EXPERT REPORT
OF
DR. HAROLD R. WANLESS

Professor of Geological Sciences
University of Miami

Kelsey Cascadia Rose Juliana; Xiuhtezcatl Tonatiuh M.,
through his Guardian Tamara Roske-Martinez; et al.,
Plaintiffs,

v.

The United States of America; Donald Trump,
in his official capacity as President of the United States; et al.,
Defendants.

IN THE UNITED STATES DISTRICT COURT
DISTRICT OF OREGON

(Case No.: 6:15-cv-01517-TC)

Prepared for Plaintiffs and Attorneys for Plaintiffs:

Julia A. Olson
JuliaAOlson@gmail.com
Wild Earth Advocates
1216 Lincoln Street
Eugene, OR 97401
Tel: (415) 786-4825

Philip L. Gregory
pgregory@gregorylawgroup.com
Gregory Law Group
1250 Godetia Drive
Redwood City, CA 94062
Tel: (650) 278-2957

TABLE OF CONTENTS

TABLE OF ACRONYMS AND ABBREVIATIONS

C:	Celsius
CCATF:	Miami-Dade County Climate Change Advisory Task Force
CO_2:	carbon dioxide
EPA:	United States Environmental Protection Agency
F:	Fahrenheit
ft:	feet
GMSL:	global mean sea level
IPCC:	Intergovernmental Panel on Climate Change
LiDAR:	Light Detection and Ranging
m:	meters
NAO:	North Atlantic Oscillation
NOAA:	National Oceanic and Atmospheric Administration
ppm:	parts per million
SFWMD:	South Florida Water Management District
SLR:	sea level rise
USGCRP:	United States Global Change Research Program

INTRODUCTION

I, Harold Rogers Wanless, have been retained by Plaintiffs in the above-captioned matter to provide expert testimony regarding how human-caused CO_2 emissions are causing sea level rise, which results in some of the injuries and constitutional violations alleged in the Complaint in this case. I discuss the paleoclimate record and fluctuations in sea level rise, and how human-caused climate change, ocean warming, and polar ice melt are accelerating sea level rise. I also describe the very real harms the Plaintiffs face associated with sea level rise, particularly as young people. I have also been asked to opine on the urgency of stopping additional greenhouse gas emissions in order to arrest the even more significant consequences of sea level rise. To render my opinions in this report, I have relied upon my extensive qualifications and 46 years of experience in the fields of geology, marine geology, and the paleo-sea level record. I have also reviewed a number of documents identified at the end of this report.

The opinions expressed in this report are my own and are based on the data and facts available to me at the time of writing. All opinions expressed herein are to a reasonable degree of scientific certainty and historical accuracy, unless otherwise specifically stated. Should additional relevant or pertinent information become available, I reserve the right to supplement the discussion and findings in this expert report in this action.

This report contains my opinions, conclusions and the reasons therefore. My professional and educational experience is summarized in my curriculum vitae attached to this declaration as **Exhibit A**. My curriculum vitae also contains a list of publications I authored within the last ten years and more. I have not provided testimony within the preceding four years as an expert at trial or by deposition. My report contains citations to all documents that I have used or considered in forming my opinions, listed in **Exhibit B**.

In preparing my expert report and testifying at trial, I am deferring my expert witness fees charged to the Plaintiffs given the financial circumstances of these young Plaintiffs. If a party seeks discovery under Federal Rule 26(b), I will charge my reasonable fee of $250 per hour for the time spent in addressing that party's discovery.

EXECUTIVE SUMMARY

Geologic evidence reveals that, following the last ice age 18,000 years ago, sea level rose over 128 meters (420 feet), to near its present level, but it did not do so slowly and steadily. Rather it rose in a series of rapid 1m to 10m "pulses" over a short timeframe of just a century or so, each in response to a pulse of rapid disintegration of some ice sheet sector. This is also how ice melt and sea level rise will occur in the future, and means that anthropogenic warming and loss of glacial ice is having and will have grave implications for the future of coastal cities and people around the world.

The geologic evidence for repeated rapid pulses of sea level rise during the past 18,000 years can only be explained by repeated pulses of disintegration of ice sheet sectors. This occurred throughout the rapid and slower phases of increasing global temperatures in response to naturally increasing CO_2 levels from 180 to 280 ppm over that 18,000 years.

Since the beginning of the industrial revolution, the burning of fossil fuels has very rapidly increased atmospheric CO_2 levels another 125 ppm. We now have global air temperatures at almost 1°C warmer than at the beginning of the Industrial Revolution and an ocean that has absorbed over 93 percent of the atmospheric heat produced by buildup of these anthropogenic greenhouse gases. This warmed ocean and atmosphere is now accelerating melt of the Ice Sheets of Greenland and Antarctica.

Ice melt acceleration and associated sea level rise is occurring faster than any of the climate models predict, including those used by the Intergovernmental Panel on Climate Change (IPCC) for sea level rise projections, because the models have not included, and still do not include, many of the numerous accelerating feedbacks in ice melt anticipated by the paleo record and that are now being observed in real time. These accelerating feedbacks that are accelerating ice melt and sea level rise are the real time display of the onset of a new pulse of rapid sea level rise. This pulse of rise has been triggered by the atmospheric and ocean warming resulting from the extremely rapid buildup of CO_2 in the atmosphere from our burning of fossil fuels.

Sea level rise impacts are exacerbated by increasingly intense storms that bring storm surges and heavy rains, worsening the flooding that stems from sea level rise alone. Although the precise timing and landfall of an individual storm event cannot be specifically attributed to human-induced global warming, scientists can now calculate that powerful storms are more likely and made worse from the additional heat and water vapor in the atmosphere and heat in the oceans due to the increasing concentration of atmospheric CO_2. In addition, storm surges are acting at higher sea levels. Simply put, warmer ocean temperatures provide more energy to fuel storms. Increasingly destructive storms and rainfall events are not off in the future, they are here now.

For Plaintiffs like Levi, who lives on a low-lying barrier reef island off of the southeastern seaboard, sea level rise and storm surges will make his home uninhabitable within decades, and eventually inundate it permanently with seawater.

QUALIFICATIONS

I am a Professor in the Department of Geological Sciences where I was also Chair for the previous 19 years and was Cooper Fellow of the College of Arts and Sciences at the University of Miami from 2010 to 2013. My office is located in Coral Gables, Florida. I am a Registered Professional Geologist in the State of Florida #985.

My father, Dr. Harold Rollin Wanless, was a sedimentary geologist who extensively studied the rocks of Paleozoic Pennsylvania Period and was one of the first to publish on the cyclical nature of sedimentation during Pennsylvanian Period resulting from sea level rises and falls in response to repetitive glaciations. As a child, I grew up immersed in the history of the “rocks” of the Pennsylvanian Period and the ancient stories they told of dramatic and repetitive fluctuations of sea level on scales from hundreds to millions of years. Those early beginnings led me to my own deep study of geology and the paleo-sea level record, and ultimately human-induced climate change and resulting modern-day sea level rise.

I received an A.B. degree in Geology from Princeton University in 1964; a M.S. degree in Marine Geology and Geophysics from the University of Miami in 1967; and a Ph.D. degree in Earth and

Planetary Sciences from the John Hopkins University in 1973. My Master's Thesis was on the Holocene sediments that have accumulated in the Biscayne Bay region over the past 7,000 years and the character and role of sea level rise and storm and biological processes in defining the nature of these sediments. During my time as a Master's student, I worked for my Advisor, Dr. A. Conrad Neumann, on developing a sea level curve for south Florida, the Bahamas and Bermuda using core boring samples from freshwater peat deposits that formed close to sea level elevation. My Ph.D. dissertation was on the Paleozoic Cambrian strata in the Grand Canyon, Arizona, where small-scale sedimentary cyclic sequences were deposited in response to natural cycles of sea level fluctuation operating a half billion years ago.

Since 1971, I have had 46 years of experience as a geologist and marine geologist on the faculty at the University of Miami. My research specialty is coastal and shallow marine sedimentology, modern and ancient, with a focus on documenting and understanding the role of sea level dynamics and storm processes in creating and modifying coastal and shallow marine environments. Much of my research, and that of my students, has focused on determining the fine-scale sea level history over the past 7,000 years and the associated response of coastal and shallow marine environments. This research has focused on the South Florida-Bahamas-Caicos region. Our research has been funded from a variety of sources, including the National Science Foundation, the Department of the Interior (National Park Service), the Department of Commerce (Sea Grant and National Oceanic and Atmospheric Administration), Miami-Dade County Department of Environmental Resource Management, petroleum companies (including Exxon, for whom I received research funding through much of the 1980s), and development companies. I have been publishing on past sea level trends in the juried literature since 1976 and have been projecting future trends since 1982 (Wanless, 1976; Wanless, 1982; Wanless and Parkinson, 1989; Dominguez and Wanless, 1991; Wanless, Parkinson, and Tedesco, 1994; Science Committee, 2008; Technical Ad Hoc Work Group, 2011 and 2015).

Since 1981, I have been using our knowledge of past environments to look to the future. My students and I have been documenting the changes in south Florida coastal environments in response to both accelerated sea level rise occurring since 1930 and major (category 4 and 5) hurricanes. Through this research, we have studied the coastal and low wetland environments bordering Biscayne Bay, Florida Bay, southwest Florida from Cape Sable to Everglades City, and the 10,000 islands. We focus our research on coral and oyster reefs, coastal lagoons and estuaries, coastal sandy beaches and barrier islands, saline mangrove wetlands, low-lying freshwater wetlands near the coast, as well as the adjacent fresh-water Everglades and low-lying upland. To put it simply, the scientific study of islands, mangroves, sand, mud, reefs, and rocks gives us a clear window into historic sea level rise and, combined with other scientific tools, allows us to better project sea level rise into the future.

As polar ice sheet melt has significantly accelerated on both Greenland and Antarctica since about the 1990s, I have been active in working with other scientists, communities, Miami-Dade County, the State of Florida and Federal agencies in using new research data from myself and others to project future sea level rise both globally and regionally and to determine the impact it will have on low-lying coastal environments, coastal communities, agriculture, and industry. This includes an evaluation of the changing anthropogenic effects on coastal and shallow marine environments with rising sea level (Science Committee, 2008; Technical Ad Hoc Work Group, 2011 and 2015).

I was an active member of, and invited speaker at, the Miami-Dade County Climate Change Advisory Task Force (CCATF), comprised of 25 members, appointed by the Commissioners, Mayor, and County Manager. Throughout its existence, I served as the Chair of CCATF's Science Committee and drafted their reports. From 2006–2011, the CCATF served as an advisory board to the Board of County Commissioners and was charged with identifying potential future climate change impacts to Miami-Dade County, while providing recommendations regarding realistic and necessary mitigation and adaptation measures to respond to climate change.

Miami-Dade County has officially recognized and relied upon my expertise and peer-reviewed research on climate change and sea level rise as evidenced through County review and adoption of CCATF recommendations, which was based in part upon my peer-reviewed research, as well my position as the Chair of CCATF's Science Committee.

In 2010, the Southeast Florida Regional Planning Council initiated efforts to create a four county "Regional Compact," an agreed-upon statement of climate change and anticipated sea level rise. I was part of the committees that used the peer-reviewed scientific literature and our expertise to write reports on anticipated sea level rise for the Compact. These reports are incorporated into the overall "Regional Compact" Documents (Technical Ad Hoc Work Group, 2011 and 2015).

The South Florida Water Management District ("SFWMD") has previously relied upon and cited to my peer-reviewed research in assessing sea level rise implications for South Florida. (SFWMD, "*Preliminary Estimate of Impacts of Sea Level Rise on The Regional Water Resources of Southeastern Florida*;" SFWMD, "*Estimated Impacts of Sea Level Rise on Florida's East Coast.*")

U.S. Army Corps of Engineers personnel acknowledged and cited to my research regarding sea level rise in a presentation entitled "Climate Change Concerns for Everglades Restoration Planning," which was presented at the Planning Community of Practice Conference 2008.

I have twice been an invited speaker to the State of Florida legislature to present evidence for anticipated sea level rise and implications to South Florida coastal environments and the Everglades (2007). I have been an invited speaker to the Council on Environmental Quality at the White House, addressing sea level rise and the urgent need to shift the Mississippi River outlet back onto the continental shelf to help save the Mississippi River Delta (2009).

I am familiar with the findings of the U.S. Global Change Research Program ("USGCRP") and the 2014 Report entitled "Global Climate Change Impacts in the United States: A State of Knowledge Report from the U.S. Global Change Research Program" as well as the 2017 USGCRP National Climate Assessment. I am also familiar with the broad body of scientific literature on climate change and sea level rise.

EXPERT OPINION

I. The Paleoclimate Record and Fluctuations in Sea Level Rise

Earth has different orbital cycles that affect global temperatures. One of the three Milankovitch Cycles is a ~100,000 year cycle of Earth's eccentricity, or the shape of its orbit around the sun, which fluctuates between a more circular to a more oval orbit. This cycle, which affects polar cooling and warming is primarily responsible for driving Earth in and out of glacial periods over the past million years. A second cycle, obliquity, is how the Earth's axis is tilted toward the sun, which varies between 21.5 and 24.5 degrees every ~40,000 years. The third, precession, are ~19,000 and ~21,000 year cycles, which changes the wobble of the Earth as it moves around the sun and determines whether the poles are tilted towards the sun or are sideways to the sun when closest in the orbit. **Figure 1** below depicts these cycles.

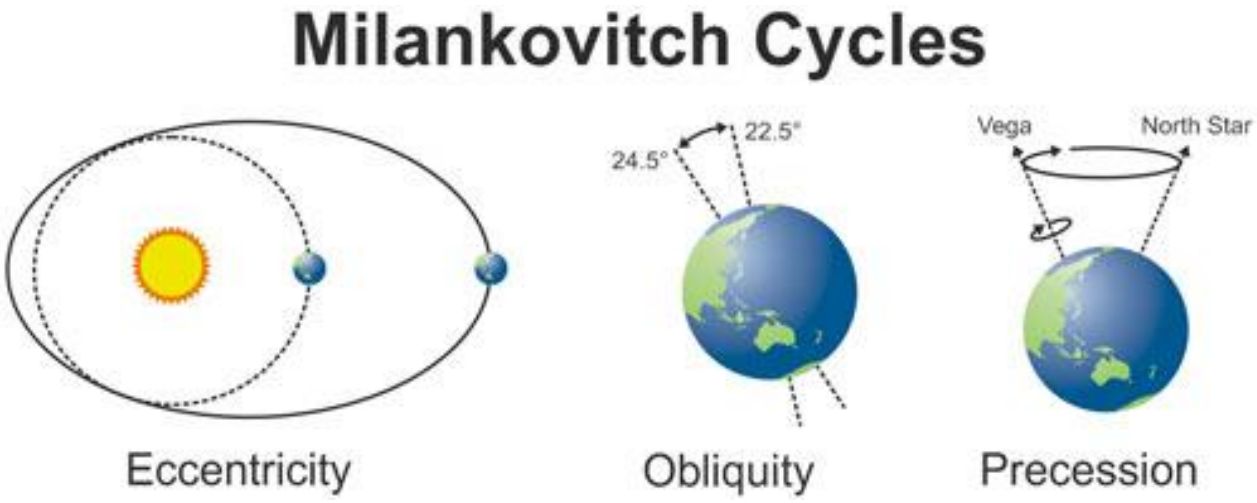


Figure 1. The Earth's orbital cycles that affect global temperatures.

These natural cycles of how Earth presents herself to the Sun result in slight differences in illumination and warming/cooling which trigger slight changes in productivity and surficial rock and soil weathering, which in turn result in changes in CO_2 and warming. By studying historic CO_2 levels through ice cores and deep ocean sampling, the scientific community has established with high confidence the close correlation between atmospheric CO_2 levels and temperature change across geologic time.

During the most recent period of the Holocene (past 12,000 years) when human civilization developed, Earth's optimum presentation to the sun occurred about 6,500 years ago, which was the warmest period of the Holocene before human-caused climate change began occurring. During that time, atmospheric CO_2 levels were ~280 ppm. As the Earth's orbit moved away from the optimum presentation, a natural, slow and slight cooling would have naturally occurred, and has been clearly documented for the 1,000 years prior to the beginning of the industrial revolution (Mann, 1994). This natural cooling has since become overshadowed by increasing human-caused

greenhouse gas emissions, predominantly CO_2. Since about 1950, human inputs of CO_2 have become the primary and dominating control of climate (Mann et al., 1995).

In contrast to the Holocene, 120,000 years ago during the warmest interglacial period, known as the Eemian, atmospheric CO_2 levels were at 280–300 ppm, temperatures were only slightly warmer than today and sea level rise was 26 feet higher than it is today (because of greater ice melt from both Greenland and Antarctica than today). As shown in **Figure 2** below, the fluctuations of CO_2 from between 280–180 ppm for hundreds of thousands of years (green line) moves in parallel with the warming and cooling of Earth's atmospheric temperature (red line) and with the cyclic rise and fall of sea level (blue line) of about 100 meters (330 feet).

These 'geologically rapid' changes in climate typically occur over thousands of years. However, since the industrial revolution, human burning of fossil fuels has caused CO_2 to shoot up from 280 ppm to over 410 ppm, which is a 40% increase over preindustrial levels, and more than double the 100 ppm increase from the natural glacial to interglacial level which resulted in 100 meters (330 feet) of sea level rise. This human-driven increase has happened in a very short period of time as compared to earlier natural shifts. Based on our understanding about how increases in CO_2 drive atmospheric and oceanic warming, which in turn cause ocean expansion and polar ice melt, leading to global sea level rise, the results will be dire for humanity at current CO_2 levels, and even worse if we continue to inject even more CO_2 into the system. The last time CO_2 levels were above 400 ppm, global sea level was some 21–27 meters (70–90 feet) higher. This was over one million years ago.

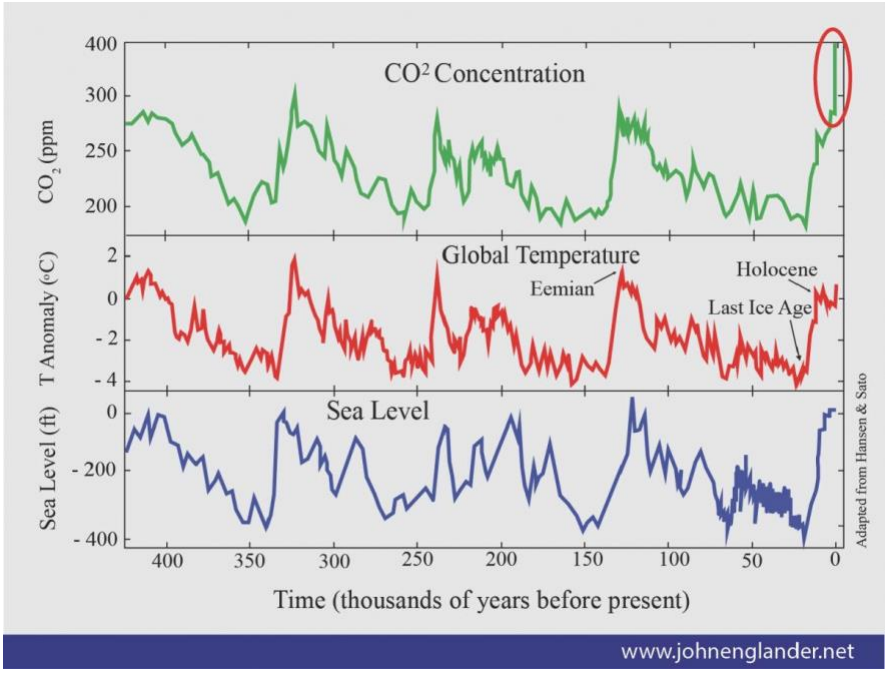


Figure 2. Graphs of 400,000 years of carbon dioxide, temperature change, and sea level. Adapted by Hansen for Englander (2013).

Figure 3 below shows the coastline of the southeastern United States, where Plaintiffs Jayden and Levi live, the last time CO_2 levels were above 400 ppm, well over a million years ago. At that

time, sea levels were about 20 meters (70 feet) higher than they are today. As you can see, sea levels that high would result in the submersion of much of the states of Florida and Louisiana, along with a vast expanse along the Gulf Coast and Eastern Seaboard. Even a sea level rise of 6 meters, which happened during the last interglacial episode approximately 125,000 years ago, would result in the total loss of the cities of Miami, FL, New Orleans, LA, and other coastal cities throughout the United States.

The increase in carbon dioxide from 280 to 410 ppm from the burning of fossil fuels has occurred more than 100 times faster than the natural increase in carbon dioxide from 180 to 280 ppm following the last ice age. The reason we have not yet seen the significantly higher sea levels that were present the last time CO_2 levels were above 400ppm is that there is simply a short time lag between the greenhouse gas buildup in the atmosphere and the heat buildup in the atmosphere, and then the heat buildup in the shallow ocean and then the heat buildup in the deeper ocean. Each one of these processes takes more time. By the 1950s, there was enough CO_2 in the atmosphere to basically control atmospheric climate. By the 1990s, the human-induced buildup of heat transferred to the oceans was enough to begin melting both the Greenland and Antarctic Ice Sheets. As the Ice Sheets are warming through atmospheric and ocean water melt-water penetration, fracturing and softening, they are accelerating their melt. We are also dramatically speeding up the rate of heat production by global warming. As you can see by where we are on the projected sea level rise rate for the future (on **Figure 6** below), we are just beginning the acceleration of sea level rise from ice melt and this will become a dominating factor later in the century. And this is why scientists are so deeply concerned. We are at a tipping point that may well spin out of control this century. That is what happened repeatedly in the past as we warmed following the last ice age 18,000 years ago.

Figure 3. Map of the south Atlantic and Gulf coasts showing the inundation that would occur with 20 meters (70 feet) of sea level rise.

A. Sea Level Rise Pulses

Through scientific study of the geologic record, we have shown that sea levels did not rise in a gradual linear manner in response to gradually increasing natural warming and carbon dioxide levels as we came out of the last glacial period. Global sea level rose from about -128 meters (-420 feet) 18,000 years ago to the present level as a series of rapid pulses of rise followed by pauses as warming initiated one pulse of ice sheet collapse after another. This is evidenced by drowned coastal deposits left across the continental shelves of the world. Through research and radiometric dating by myself and others of deposits from former coastal wetlands (especially red mangrove and salt marsh peats), reefal systems (coral and oyster), sandy barrier islands, intertidal encrusting and boring organisms (such as barnacles), we have understood for the past 30 years that there is a pattern of 1–10 meter (3.3–33.0 foot) sea level pulses of rapid coastal inundation followed by pauses, repeated rapid flooding and more pauses.

These pulses of sea level rise occur over relatively short periods of time (within a century or so) and are a reflection of a phase of rapid disintegration of some former ice sheet sector**.** Each pulse that has been documented to date was associated with a rather small increase in CO_2 as compared to the large and extremely rapid human-induced increase that has occurred since the beginning of the industrial revolution. When the sea rises slowly, barrier islands and coastal marshes can keep up and grow or gradually migrate landward and thus stay above sea level, and mature reefs would be able to grow upwards in response to increased subtidal space becoming available. But, if the rise is too rapid, it will simply overstep and drown the barrier island, the reef, or the coastal wetland and begin forming a new one shifted landward. All across the continental shelves of the world are old sandy barrier islands, reefs and coastal wetlands that were drowned out and left behind. If subsequent waves and currents permitted, these relict coastal deposits remain as testament. We can definitively establish that during certain periods the rises in sea level occurred very rapidly. This geologic evidence for rapid ice sheet disintegration, once destabilized, is the verification that the numerous reinforcing, accelerating feedbacks scientists are observing for recent ice sheet melt on Greenland and Antarctica is cause for deep concern. We most certainly are witnessing the onset of one of these rapid pulses of ice sheet disintegration and resulting sea level rise.

In the summer of 2013, I was able to witness the fact that accelerating ice melt is happening significantly faster than previously thought when flying about 50 miles onto the Greenland Ice Sheet following the deep channel of the Jacobshaven Icefjord in western Greenland. We reached an elevation on the Ice Sheet of over 2,000 meters (6,500 feet). It was like flying up a large, meandering, fractured, dry stream bed in the ice surface. The channel-like depression on the ice surface was some 150 m (500 feet) below the level of the ice sheet and was dramatically fractured from the accelerated ice melt from below and resulting fracture and flow. This was created by melt at the base of the ice sheet from deeply penetrating ‘warmed’ ocean water. As a result of the fracturing and detachment from the bottom, the forward velocity of the ice has accelerated from a couple of miles per year to over twenty. Overall, this was a spectacular, but most disturbing experience given what this means for accelerating future sea level rise.

Figure 4 below depicts the post-glacial pulses of rapid sea level rise and pauses that are well documented in the literature. These include those over the past 5,500 years that my students and I have measured in Florida and Brazil (Dominguez and Wanless, 1991; Gelsanliter, 1996;

Gelsanliter and Wanless, 1995). Others have documented earlier pulses of rapid rise, including Locker *et al*., 1996; Jarrett *et al*., 2005; Milliken *et al*., 2008; and Pretorius *et al.*, 2017.

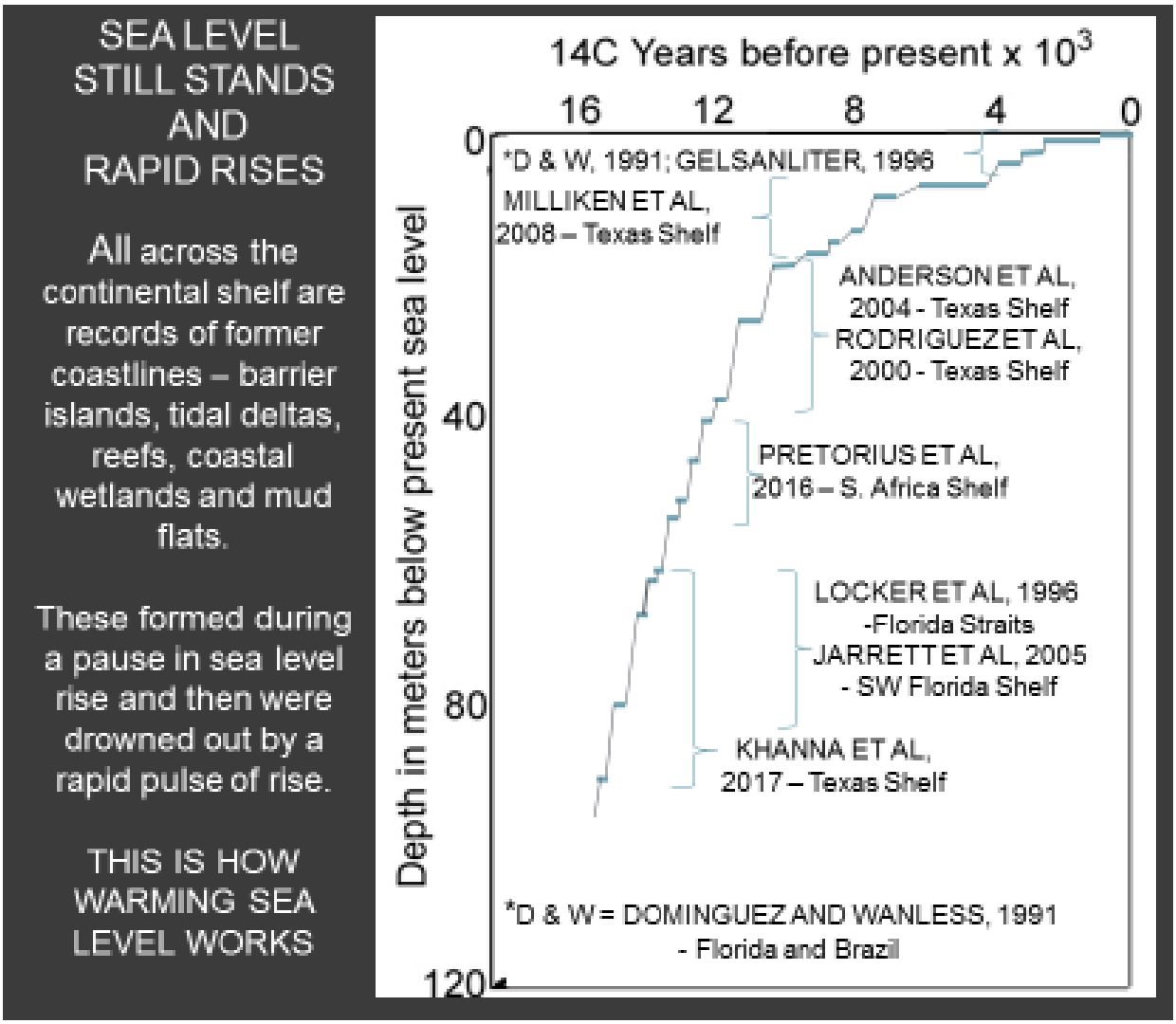


Figure 4. Reconstructed post glacial sea level history incorporating pulses of sea level rise following brief still-stands in which coastal barrier islands, tidal deltas, bay-head deltas, reefs, wetlands and tidal flats formed and were then drowned out. Age is in thousands of years before present. Each pulse of rise must represent a pulse of rapid ice sheet disintegration.

The reason for the pulses of sea level rise is the non-linear melting of ice superimposed on the thermal expansion of water and other lesser influences. James Hansen (2007) best describes this phenomenon as rapid ice sheet disintegration. Since 1990, we are now witnessing the onset of a new pulse of ice melt in both Greenland and Antarctica, which I discuss in greater detail below.

II. The Reality of Human-Caused Climate Change, Ocean Warming, and Accelerating Sea Level Rise.

Notwithstanding the natural long-term Milankovitch Cycles affecting Earth's temperatures and incoming solar radiation, the most significant effect on Earth's temperatures since the 1950s is from the increasing CO_2 levels in the atmosphere that result from humans burning fossil fuels. There is an extremely strong consensus with a high level of confidence among actively publishing climate scientists and strong scientific evidence that the climate is warming due to human activities, primarily the burning of fossil fuels such as coal, oil, and gas. Carbon dioxide emissions are the strongest human-induced climate forces, but other human-induced greenhouse gas emissions also contribute to climate change, including methane and nitrous oxide. At the beginning of the industrial revolution global CO_2 levels were ~280 ppm. They are currently above 410 ppm and increasing at greater than 3 ppm per year.

As depicted in **Figure 2** above, for the past 400,000 years, CO_2 fluctuated between 180 ppm and 280 ppm, and in concert sea level went down and up 100 meters or more. These natural changes in CO_2, temperature, and sea level occurred over thousands of years. For the first time in the paleo-record, CO_2 levels have risen by more than 125 ppm and within only 150 years. This is more than double the 180–280 ppm post-glacial CO_2 increase which drove the entire series of pulses that totaled 120 meters of sea level rise in response to warming and ice melt. There is no historical precedent for this rapidity of change that we can find in the paleo-record. The unprecedented rate and degree of human-caused CO_2 increase and warming should serve as a warning. The Earth will now respond in unprecedented, dire, and most certainly rapid ways.

Referring to the late 18th century as the beginning of the HyperAnthropocene, when the improved steam engine initiated the industrial revolution (Hills, 1993) and the exponential growth in fossil fuel combustion, Hansen et al. explain that three-quarters of human-caused warming since 1850 (~1°C) has occurred since 1975 (Hansen et al., 2016). When I was born in 1942, there were less than two billion people on the planet, and many countries were not at all industrialized. Now we have over 7.5 billion people, and also many large countries are rapidly industrializing.

The global-mean temperature has increased by more than 1.8°F (1°C) over the past century, and is projected to warm by a total of 3.6–4.8°F/2–4.8°C over the next century depending upon future emissions of greenhouse gases (IPCC, 2014).

A. Thermal Expansion of the Ocean

Very importantly, nearly all the excess atmospheric heat produced by the greenhouse gasses from burning fossil fuels has transferred to the oceans. Approximately 93.4% of the excess energy (heat) human pollution has forced on the planet has been absorbed by the oceans, with much of it penetrating to 1,000 meters or more in depth. This heat transfer is rapidly accelerating as people burn more and more fossil fuels. Over half of this excess heat from human-induced global warming has transferred to the ocean since 1997. **Figure 5** shows the distribution of global-warming energy accumulation (heat) relative to 1971 and from 1971–2010.

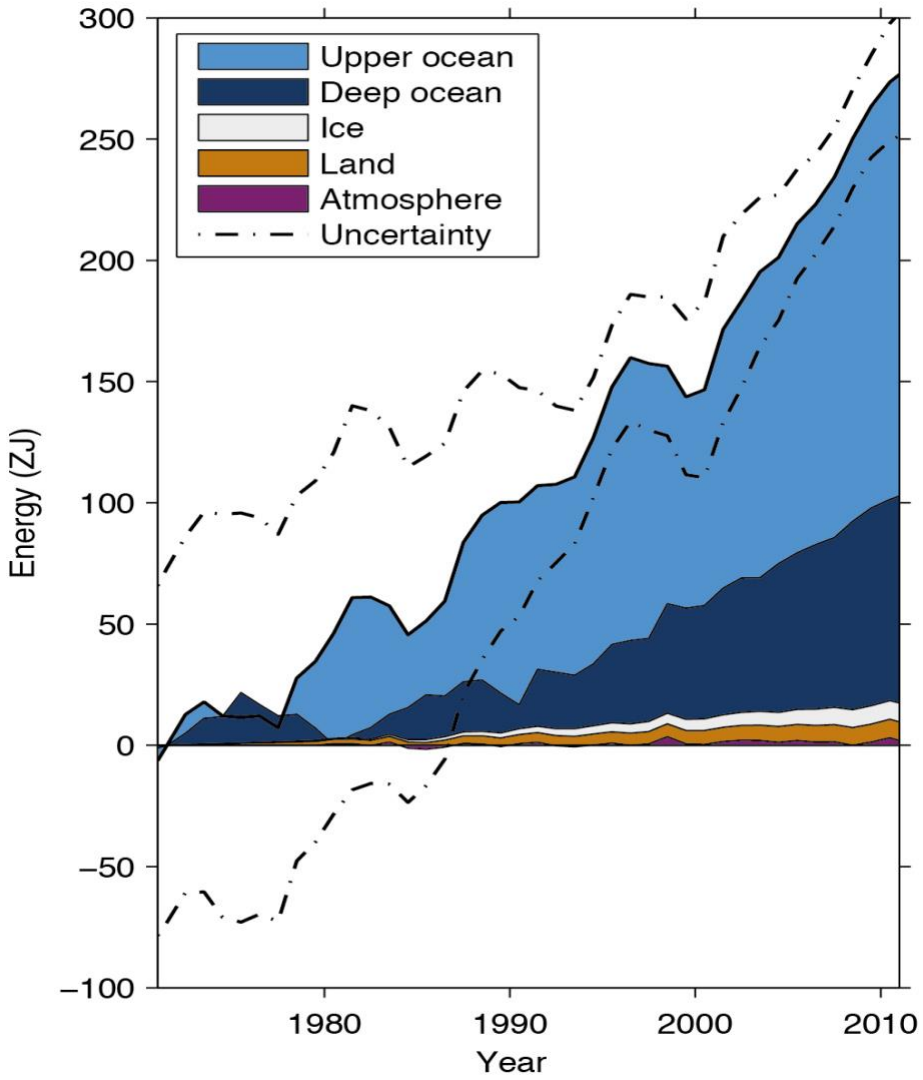


Figure 5. Plot shows the distribution of global-warming energy accumulation (heat) relative to 1971 and from 1971 to 2011 (IPCC, 2014). Half of the human-produced global warming heat has entered the ocean since 1997.

In high school physics, children are taught that water has great capacity to take in, hold, and use heat. Atmospheric warming will continue for some 30 years after we stop putting more greenhouse gasses into the atmosphere. But that warmed atmosphere will continue warming the ocean for centuries, and the accumulating heat in the oceans will persist for millennia.

The temperature of the ocean is significant for sea level rise because the density of seawater largely depends upon temperature. Because warmer water is less dense than colder water, the volume of the ocean increases even if it stays at a constant mass. Thus, thermal expansion of the ocean is one of the major contributors to sea level change. Scientists have predicted that "[i]f the upper 1,000 meters of some portion of the ocean were to warm by 1 degree Celsius, then the sea

level would increase by about 50 centimeters [1.67 feet]."[1] Ocean temperature measurements have shown that the warming of the upper ocean has contributed about 30 percent of the total sea level rise between 1971 and 2010. Ice melt from mountain glaciers, Greenland, and Antarctica accounts for most of the remaining rise.

The CO_2 addition to the atmosphere has a several thousand-year residence time and is not consumed as it warms the atmosphere and ocean. Due to that large thermal inertia, the climate will continue to warm over the next half-century, even if a reduction in fossil fuel emissions and stabilization of CO_2 concentrations occurred today, and the warmed ocean will continue to melt polar ice for centuries. Put simply, the climate has warmed and future warming is unavoidable. However, how much more climate-forcing we put into the system through CO_2 and other greenhouse gas emissions this year and in the years to follow, and how much carbon we sequester from the atmosphere through improved land management practices and active sequestration, will dictate how much additional warming will occur and whether the impacts of climate change are survivable for much of humanity and many other species living on the planet.

Global warming from the atmospheric influx of CO_2 and other greenhouse gasses leads to a number of changes in climate beyond simply an increase in ocean and land-surface temperatures. These include, but are not limited to: increased frequency and intensity of heavy rainfall events and floods, increased sea level, more intense hurricanes, higher atmospheric and oceanic temperatures, ocean acidification, loss of coastal wetlands, and destabilization of permafrost in the arctic and of methane hydrates frozen in the sediments in the Arctic Ocean bottom.

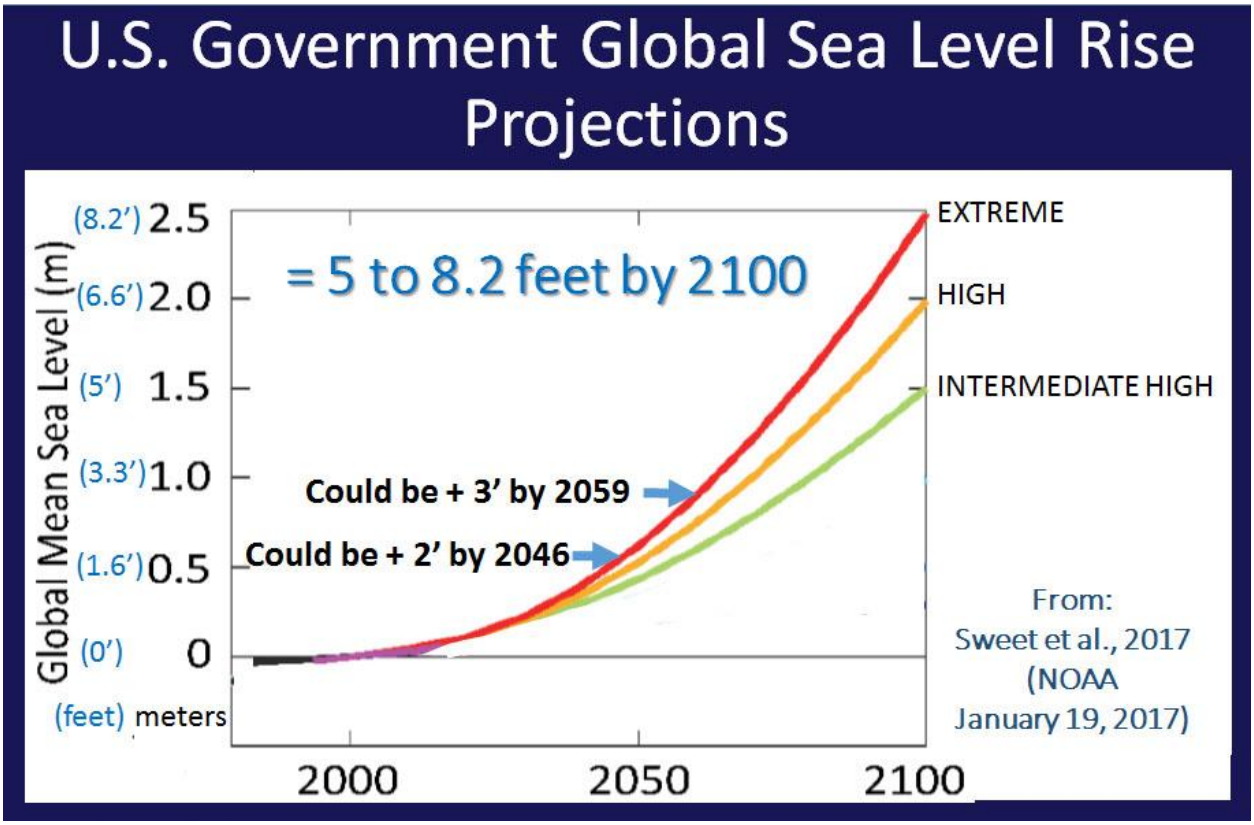
B. Sea Level Rise Projections

Global mean sea level (GMSL) has risen about 20–23 cm (8–9 inches) since the industrial revolution and 8 of those centimeters (3 inches) have occurred between 1993 and 2009 (Church and White, 2011; Hay et al., 2015; Nerem et al., 2010). Even these relatively small increases have had substantial effect on low-lying areas, like we have seen in south Florida and Louisiana. The question now is not whether the seas will continue to rise, but by how much and by when.

In 2017, the National Oceanic and Atmospheric Administration (NOAA) published the most recent United States Government sea level rise projections, once again confirming that sea level rise is a certain impact of climate change (*Global Sea Level Rise Scenarios for the United States; National Climate Assessment* (NOAA, January, 2017)). NOAA's projections, which included acceleration of ice melt from Greenland and Antarctica, included a range between 1.5–2.5 m (5–8.2 ft.) global mean sea level rise (GMSL) for 2100 (**Figure 6**). However, for certain coastlines across the U.S., the high ranges could be .3–1.0 m (1–3.3 ft.) higher than the GMSL, thereby increasing projections upwards by .3–1.0 m (1–3.3 feet). NOAA's 2017 projections are higher than the projections NOAA made just five years ago in its 2012 assessment. NOAA's 2017 projections are also higher than the conservative IPCC projections for the 4th and 5th reports. The reason for this is that the IPCC is required to use only jury refereed published articles (usually published 3–4 years after the research). The IPCC cuts off use of literature 2–3 years before report

[1] Hine, C., et al., Sea Level Rise in Florida, Science, Impacts, and Options, Univ. of Fla. Press (2016) at 41.

publication because of the need for gaining scientific consensus and public review. The sea level working group has been dominated by modelers who do not see beyond their numerical models (which cannot yet incorporate many of the accelerating ice-melt feedbacks being observed), and there is governmental political pressure on some scientists to go low on sea level projections, and the consensus agreed upon will be by definition very conservative. For all the above reasons, the IPCC has put out unreasonably low sea level rise projections in their 4th and 5th reports (2007 and 2013). NOAA's and most other projections conclude that sea level rise will continue to rise and to accelerate even more after 2100. If, for example, sea level has risen 1.5 m (5 feet) by 2100, it will be rising at a rate of 30 centimeters (one foot) per decade—and accelerating.



GMSL Scenario (meters)	2010	2020	2030	2040	2050	2060	2070	2080	2090	2100	2120	2150	2200
Low	0.03	0.06	0.09	0.13	0.16	0.19	0.22	0.25	0.28	0.30	0.34	0.37	0.39
Intermediate-Low	0.04	0.08	0.13	0.18	0.24	0.29	0.35	0.4	0.45	0.50	0.60	0.73	0.95
Intermediate	0.04	0.10	0.16	0.25	0.34	0.45	0.57	0.71	0.85	1.0	1.3	1.8	2.8
Intermediate-High	0.05	0.10	0.19	0.30	0.44	0.60	0.79	1.0	1.2	1.5	2.0	3.1	5.1
High	0.05	0.11	0.21	0.36	0.54	0.77	1.0	1.3	1.7	2.0	2.8	4.3	7.5
Extreme	0.04	0.11	0.24	0.41	0.63	0.90	1.2	1.6	2.0	2.5	3.6	5.5	9.7

Figure 6. Top: 2017 NOAA projections for sea level rise which include accelerating ice melt from ice sheet disintegration and a warming, expanding ocean (Modified from Sweet et al,

2017). Bottom: Global Mean Sea Level rise scenario heights for 19-year averages centered on decade through 2200. From Sweet *et al.*, 2017. Low, Intermediate Low and Intermediate are unrealistically low projections because they do not incorporate significant acceleration in polar ice melt.

Using NOAA's higher projections, which as discussed below are conservative, the time at which each foot of sea level rise will be reached can be anticipated by using their 'Intermediate High,' 'High,' and 'Extreme' scenarios. The Intermediate High scenario projects sea level rise incorporating a warming ocean and 'limited ice sheet loss' and some ice melt acceleration. The 'Intermediate Low' scenario only incorporates sea level rise from ocean warming, minor ice melt but no ice melt acceleration. The 'Lowest' scenario is a linear projection based on historical sea level rates derived from tide gauge measurements beginning in 1900. Neither the Lowest nor the Intermediate Low scenarios are valid scenarios to use for the future. They both fail to reproduce the observed sea level rise over the past two decades because of significant acceleration from already occurring observed ice melt.

Under NOAA's 2017 projected scenarios, there could be 60 cm (2 feet) of sea level rise by 2046 and 90 cm (3 feet) by 2059. A 2–3 foot rise of sea level will make nearly all of the barrier islands of the world uninhabitable, result in inundation of a major portion of the world's deltas, and make low-lying coastal zones like south Florida and Louisiana increasingly challenging communities in which to maintain infrastructure and welfare and to assure protection of life and property during extreme rainfall events and hurricanes.

NOAA reports that even 0.9 m (3 feet) of sea level rise would permanently inundate 2 million American's homes and communities. Two meters (6.6 feet) of sea level rise would put 6 million U.S. homes underwater (Hauer et al., 2016).

While NOAA's projection of up to 2.5 m (8.2 feet) of sea level rise by 2100 is representative of sea level projections typically made in the scientific literature based on current modeling, including the current rate of accelerated melting in the poles, it does not address other very plausible high-risk scenarios.

Importantly, sea level rise is now accelerating due primarily to the rapid loss of ice on Greenland and Antarctica. This acceleration is occurring faster than any of the climate models predict, because the models currently do not include many of the numerous accelerating feedbacks in ice melt that are now being observed and that the paleo-record documents the reality of. Although not yet in the models, these accelerating feedbacks for ice melt are a reflection of the fact that ice, when destabilized, disintegrates very rapidly resulting in significant pulses of sea level rise such as are documented throughout the past. The historic record of sea level rise clearly establishes that sea level rises in pulses. Our scientific understanding of the historic rapid pulses in sea level rise as ice sheets disintegrate is not incorporated in any U.S. government models, including NOAA's 2017 model, or any of the modeling summarized by the IPCC, the governmental body reporting on the consensus science of climate change. NOAA confirms "the GMSL exceedance probabilities for the scenarios may underestimate future rates of ice melt due to effects such as Antarctic ice sheet instability." (NOAA, 2017).

Dr. James Hansen and co-authors published a peer-reviewed paper in 2016 that attempted to take into account the rapid disintegration of ice sheets that the models have not accounted for and are not yet able to provide for in a numerical model. They used a combination of climate modeling, paleoclimate analyses, and modern observations to incorporate climate feedback processes in an effort to explain the more rapid paleoclimate changes to sea levels. Hansen *et al.* explain the broad scientific understanding that during the late-Eemian, sea level reached +6–9 m (+20–30 feet), due in substantial part from melting in Antarctica at a time when Earth was only slightly warmer than today (Dutton et al., 2015; Hansen et al., 2016). Hansen *et al.* ultimately conclude that while precise predictions of sea level rise are not possible given the uncertainties around how quickly the ice sheets will disintegrate, the authors state with a high degree of confidence that multi-meter sea level rise would become practically unavoidable, probably within 50–150 years, if current emission trends continue.

Table 1 below summarizes the observed accelerating feedbacks that are speeding up ice sheet melt on Greenland and Antarctica. Most of these are not in the modeled projections of sea level rise, and necessitate consideration that the reality will be much faster than even NOAA's most recent 2.5 meter (8.2 feet) "Extreme" projection. These accelerating feedbacks that we are now observing are the witness to the reality of a new, probably significant and rapid, pulse of ice sheet disintegration and sea level rise.

From Atmospheric Warming (mostly Greenland at Present)

1. Lowering surface elevation with melt putting surface in warmer climate belt.
2. Surface melt lakes and ponds adsorb more heat than white ice.
3. Dark dirt and soot from within ice concentrates on melting surface adsorbing more heat.
4. Surface melt water pours down moulins (melt sinkholes) to base of ice sheet lifting and detaching ice from rock substrate causing increased lateral movement and ice fracturing.
5. Resulting fracturing lets melt water into ice sheet warming interior ice making it softer and flowier (Bell et al, 2014).
6. Fracturing greatly accelerates overall melt rate as it warms throughout the ice sheet (Scambos et al., 2009).
7. Lake drainage sets up bottom flow causing tensile shock fracturing of ice and then cascading lake drainage (Christoffersen et al., 2018). This large volume of water can accelerate basal ice flow.
8. Melt water is increasing portion of the basal ice sheet that is thawed and flowier (MacGregor et al., 2016). Heat from Earth interior also plays a role in some areas.
9. Increased melt of floating Arctic pack ice creates more open water, adsorbing more heat to warm Greenland's atmosphere and adjacent ocean waters.
10. Cryoconite holes in melting ice sheet surface accelerate surface melt (Fountain et al., 2004).
11. Thick summer surface melt forms thick slush on surface that works downward melting and softening ice.
12. Surface warming has eliminated ability of firn to refreeze meltwater over much of ice sheet, accelerating meltwater production and release (Noel et al., 2017).

From Ocean Warming (Greenland and Antarctica)

13. Intensive intrusion of dense warm ocean water through glacial outlets deep beneath ice sheets causing rapid and irreversible warming (much like estuarine circulation) (Hansen et al., 2016; Kusahara and Hasumi, 2014).
14. Weight of ice produces retrograde slopes (deepening inward) making melting easier and easier inland.
15. Ice, once detached from bottom, can thin by bottom melt and by dynamic thinning (collapse along fractures much like a rack of books splaying out across a table).
16. Inward calving produces higher and higher cliffs which are very unstable above 90 meters height (DeConto and Pollard, 2016; Rignot, 2015). This can result in runaway ice cliff collapse.
17. Surface meltwater can dramatically accelerate ice fracturing of ice cliffs (called hydrofracturing) promoting rapid ice shelf collapse and breakup (Tollefson, 2016; Kopp et al., 2017b).
18. Breakup of floating Ice Shelves (like Larsen A, B, and C) removes the resisting pressure on grounded glaciers and ice sheets and the upstream ice greatly accelerate its velocity of flow to the sea, accelerating sea level rise (Reese et al., 2018).

Table 1. Observed Acceleration of Ice Sheet Melt from Atmospheric Warming (mostly Greenland at Present).

Most importantly, Kopp *et al.* (2017) strongly state that "current sea-level observations cannot exclude future extreme outcomes," especially because of hydrofracturing and ice cliff collapse effects that they project to become increasingly important as the century progresses (see also DeConto and Pollard, 2016). These processes, combined with the retrograde bathymetry inward beneath the ice sheet (Rignot, 2015), provide the opportunity and strong likelihood of runaway ice sheet collapse as the century progresses.

In my expert opinion, based on the historic record, the rapid pulses, and current rates of sea level rise acceleration, I project a 4.6 to 9.1-meter (15 to 30-foot) rise in sea level by 2100 if current trends continue, with ever greater rises and acceleration in subsequent centuries until such time as we dramatically reduce the levels of CO_2 in the atmosphere and take steps to cool the upper portion of the ocean. I am not alone in this conclusion. One of the world's eminent glaciologists, Dr. Eric Rignot, predicts that an increase in global temperatures to 1.5–2°C over pre-industrial levels, will commit the planet to sea level rise of six to nine meters, which could occur in the next 100–200 years. In addition, James Hansen has projected 5–10 meters (16–

33 feet) this century (Hansen et al., 2016). Thus, only NOAA's extreme sea level rise scenario presents anything close to approximating the real risk we face with sea level rise.

C. Accelerated Sea Level Rise

Although Florida has been subjected to basically the global rise in sea level in the past, there are two features which indicate that Florida's sea level rise is accelerating and will be significantly greater than the future global average sea level rise. First, as Greenland and Antarctica ice melt is accelerating, the gravitational attraction of that decreasing ice mass is weakening the pull of water towards these ice masses. Hsu and Velicogna (2017) estimate that this redistribution of gravitational attraction is resulting in Florida's sea level rise being 52 percent greater than the global average.

Second, it is forecast that the speed of the Florida Current and Gulf Stream will decrease through the century as less water is drawn north around Greenland to replace water that has sunk to form the deep water of the ocean conveyer belt. This Florida Current/Gulf Stream slowdown is predicted in Atlantic Ocean circulation models (Kirtman et al., 2012), and has been documented in recent observations (Park and Sweet, 2015; Rahmstorf et al., 2015). The north-flowing Florida Current is pulled to the right by the Coriolis Force of Effect, a force related to the spin of the Earth. In the northern hemisphere, the Coriolis Force acts to turn a moving water current to the right and creates a slope of the water surface, higher on the right or east side of the Florida Current. Slowdown of the Florida Current and Gulf Stream lessens the effect of the Coriolis Force on the slope of the ocean resulting in an immediate rise of water level on the western (Florida) side of the current. Presently, ocean levels are about 1 meter (3.3 feet) higher at Bimini, Bahamas, than at Miami because of the strong northward flow of the Florida Current. Because of the anticipated slowdown of the Florida Current, the Southeast Florida Regional Planning Council's "Regional Compact" has recommended adding 15 percent to future global sea level rise to account for the anticipated decreasing velocity of the Florida Current and Gulf Stream (Technical Ad Hoc Work Group, 2015).

Valle-Levinson *et al*. (2017) studying the causes for times of accelerated relative sea level rise along the Atlantic Coast through "tide gauge records reveal comparable short-lived, rapid SLR accelerations (hot spots) that have occurred repeatedly over ~1500 km stretches of the coastline during the past 95 years, with variable latitudinal position." They conclude that North Atlantic Oscillation determines the latitudinal position of these SLR hot spots, while a cumulative El Niño index is associated with their timing. The North Atlantic Oscillation (NAO) is caused by fluctuations in the difference of atmospheric pressure at sea level between the Icelandic low pressure center and the Azores high pressure center. The NAO affects the strength of the westerly winds of the North Atlantic and thus influences the speed of the Gulf Stream. The El Niños influence the strength of the easterly trade winds and thus the speed of the surface currents moving westerly across the tropical Atlantic. This control of North Atlantic circulation and current speeds and eddies in the currents affects sea level along the Atlantic coast. In the past decade, portions of the coast from Miami north to Cape Hatteras have had 5- to 10-year periods of greatly accelerated sea level rise—at rates of 9 to 20 mm per year (0.35 to 0.79 inches per year) (Wdowinski et al., 2016; and Valle-Levinson et al., 2017). These were three or more times the global average and have been, fortunately, just oscillations, though it is a view of things to come.

Just a 60- to 90-cm (2- to 3-foot) rise of sea level will make nearly all the barrier islands of the world uninhabitable, begin the inundation of a major portion of the world's deltas, and make low-lying coastal zones like Louisiana and southeast Florida increasingly challenging communities in which to maintain infrastructure and assure protection of life and property during hurricanes and other extreme events. Importantly, when governments project several feet of sea level rise by the end of the century, that rise will not be some new fixed end point of sea level at equilibrium. It represents an acceleration of sea level rise because of the ongoing accelerating ice melt. If, for example, we have 1.5 meters (5 feet) of sea level rise at the end of the century, sea level will be rising at a foot per decade and accelerating. That will make maintaining coastal infrastructure, such as port facilities, extremely difficult logistically and financially.

III. Sea Level Rise in Southern Florida and Its Barrier Islands

While climate change will be felt globally, the low-lying and heavily-populated coastline of south and central Florida, including its barrier islands, makes it extremely vulnerable to the effects of climate change, particularly sea level rise, amplified by storm surges. Hurricane storm surges will make low-lying south Florida an increasingly risky place to live. The maps in **Figure 7** below show the increased extent and depth of the category 5 Hurricane Andrew (1992) storm with a further three feet of sea level rise. Nearly the entire southern two-thirds of Miami-Dade County will be affected by a deep, powerful, violent onshore storm surge and the seaward barrier islands will be dangerously swept by a strong surge.

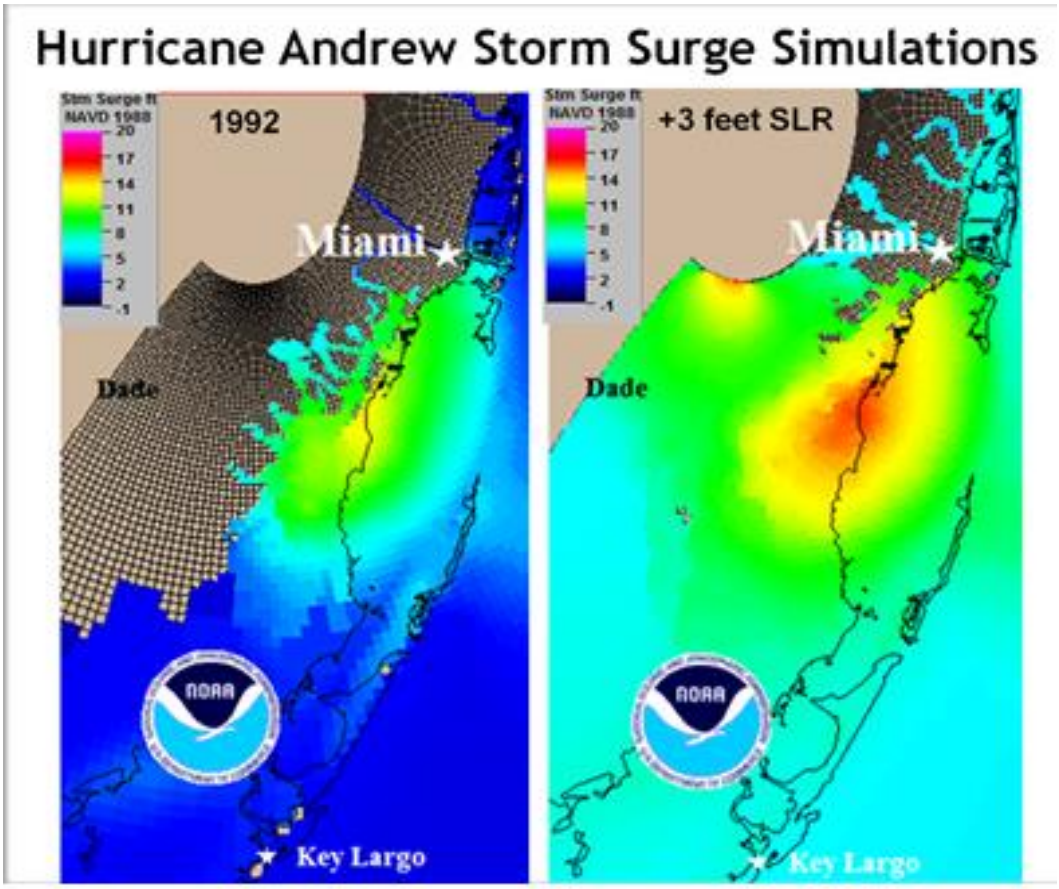


Figure 7. Left: Storm surge of category 5 Hurricane Andrew in 1992. Right: Same Hurricane Andrew storm surge with 90 cm (3 feet) of sea level rise. (Provided by Dr. Brian Soden, University of Miami).

South Florida is not significantly sinking or rising so sea level change in south Florida basically follows the global sea level change, with some potential for enhanced rises. South Florida's sea level has risen about 30 cm (12 inches) since 1930 and is currently increasing at a rate of about 3.5 cm (1.3 inches) per decade; a rate that is approximately 10 times faster than what occurred naturally over the past 2,400 years. If the current trend were to continue at the same linear rate of 1 inch per decade, the oceans along South Florida's coast would rise another 12.5 cm (5 inches) by 2060 and 25 cm (10 inches) by the end of the century. As discussed above, these scenarios are highly improbable and vastly underestimate potential sea level rise given the non-linearity we are observing and that is predicted of ice melt and resulting sea level rise.

In January 2008, the Science Committee (of which I was Chair) of the Miami-Dade Climate Change Advisory Task Force issued a projection of future sea level rise for south Florida, stating:

> With what is happening in the Arctic and Greenland, many respected scientists now see a likely sea level rise of **at least** 1.5 feet in the coming 50 years and a total of **at least** 3-5 feet [90-150 cm] by the end of the century, possibly significantly more. Spring high tides would be at +6 to +8 feet [1.8-2.4 m].

> This does not take into account the possibility of a catastrophically rapid melt of land-bound ice from Greenland, and it makes no assumptions about Antarctica. (MDC-CCATF, 2008).

Since issuing this statement, evidence for dramatically accelerating ice sheet melting has increased on both Greenland and Antarctica, again not accounted for in the modeling or in NOAA's latest sea level rise predictions. (Van den Broeke et al., 2009; Velicogna, 2009; Kerr, 2009; Jiang et al., 2010; Rignot et al., 2016, 2017).

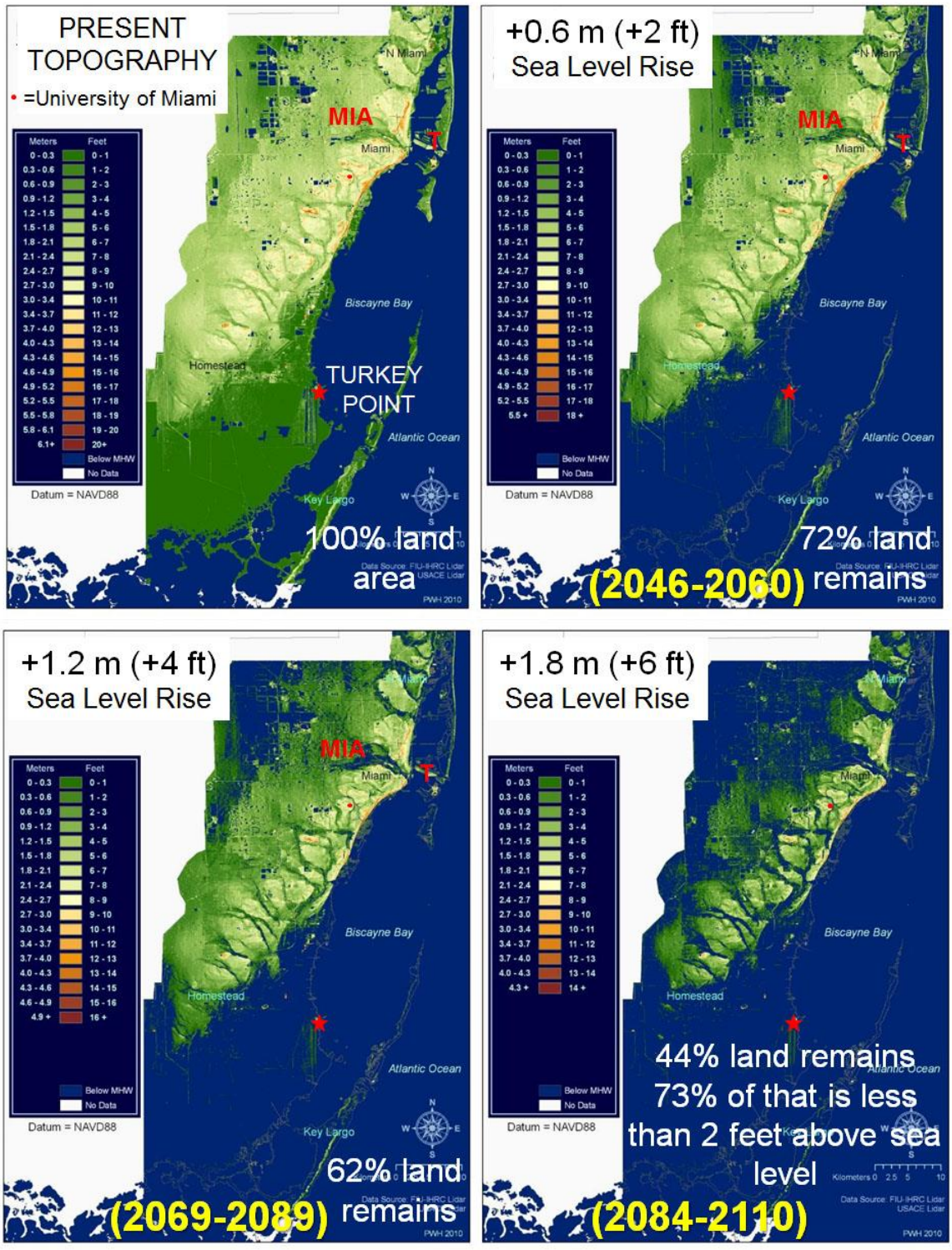
Miami is particularly at risk to the environmental impacts of sea level rise as acknowledged in the 2014 USGCRP Third National Climate Assessment:

> Large numbers of cities, roads, railways, ports, airports, oil and gas facilities, and water supplies are at low elevations and potentially vulnerable to the impacts of sea level rise. New Orleans (with roughly half of its population living below sea level), Miami, Tampa, Charleston, and Virginia Beach are among those most at risk. (Strauss et al., 2012).

Even during the summer and fall of 2017, residents in some areas such as Miami Beach, Key Biscayne, and the Bayshore Drive section of Miami experienced repetitive, serious seawater flooding their streets.

Nearly all climate and sea level assessments agree that ice melt and sea level rise is and will be accelerating well into the next century. This means that coastal cities will not be adjusting to a fixed higher sea level at the end of the century, but one that *continues to rise at an accelerating rate*. Long-term adaptation to sea level rise in low-lying areas of the United States is not realistic under current rates of warming.

Using LiDAR (Light Detection and Ranging) high-resolution elevation mapping from a plane with ground-truthing, the late Peter Harlem and I mapped Miami-Dade County to show the progressive inundation of Miami-Dade County based on U.S. government projections. These are depicted below in **Figure 8**. These LiDAR maps represent mean high tide and do not include king tide or storm surge inundation, which will be substantial. They clearly illustrate the complete and irreversible loss of land and property expected this century. With NOAA's 'Highest' sea level rise scenario (again, which is conservative), we would see 60 cm (2 feet) of sea level rise by 2046, 90 cm (3 feet) by 2059, 1.2 m (4 feet) by 2069, 180 cm (6 feet) by 2084, 2.4 m (8 feet) by 2098, and 3.0 m (10 feet) by 2110.


PRESENT TOPOGRAPHY
• =University of Miami
MIA
Miami
Biscayne Bay
Homestead
TURKEY POINT
Atlantic Ocean
Key Largo
Datum = NAVD88
100% land area
+0.6 m (+2 ft) Sea Level Rise
72% land remains
(2046-2060)
+1.2 m (+4 ft) Sea Level Rise
62% land remains
(2069-2089)
+1.8 m (+6 ft) Sea Level Rise
44% land remains
73% of that is less than 2 feet above sea level
(2084-2110)

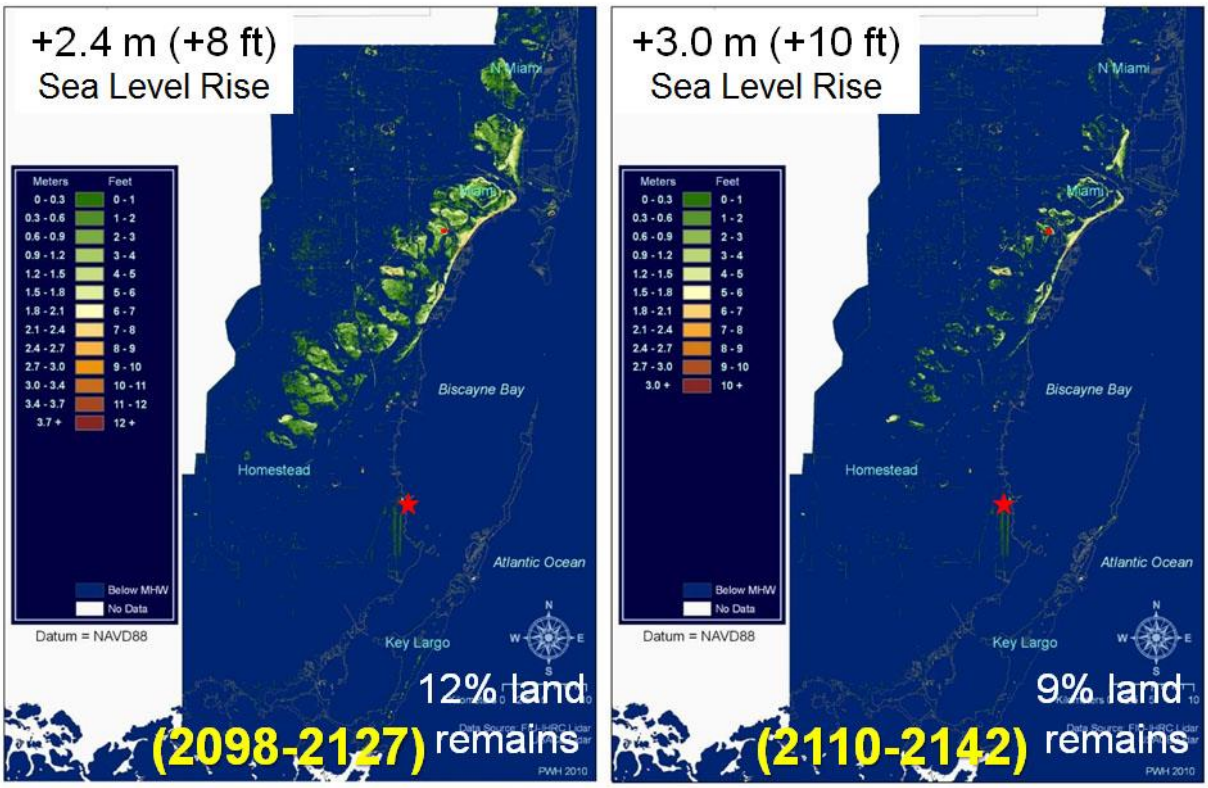


Figure 8. LiDAR elevation maps of Miami-Dade County showing areas above mean high water at present and with 0.6 m (2 feet), 1.2 m (4 feet), 1.8 m (6 feet), 2.4 m (8 feet) and 3 m (10 feet) of further sea level rise. Possible timing of these inundation levels is indicated using those U.S. Government projections that incorporate significant acceleration in polar ice melt. Maps were created by the late Dr. Peter Harlem of Florida International University using LiDAR data flown by the State of Florida. MIA= Miami International Airport; T = new tunnel to shipping/cruise port; star = Turkey Point Nuclear Power Plant.

Sandy barrier islands along tectonically passive margins, such as southeast Florida, are on a gently sloping continental shelf setting and tend to shift dramatically landward with rising sea level. In this setting, a one-foot rise in sea level will commonly result in a landward migration of a barrier island of 500 to 2,000 feet. This occurs as sand overwashes the island or is swept through inlets or to the offshore during storms.

Rising sea level will significantly change the coastal environments, interactions of land and water (including salinity), base-level elevations, tidal current patterns and strengths, and storm surge patterns and strengths. With even a two-foot rise in sea level, saltwater will intrude into Florida's southern and southeastern aquifers. For instance, saltwater intrusion is already affecting the Biscayne Aquifer, and this will become a rapidly increasing problem (Heimlich et al., 2009), diminishing and then eliminating sources of freshwater (Science Committee, 2008; Heimlich et al., 2009).

In addition to harming private and public property, rising sea level will also harm the viability of infrastructure like wastewater treatment facilities, nuclear power plants, roads, and landfills,

which will become vulnerable to disruption or destruction by storms, potentially leading to vast contamination of lands and waters as other pollutants are released. There is no planning in southern Florida for cleaning the land before inundation even though many of the waste disposal sites, sewage treatment plants, industrial sites, nuclear power plant, and superfund sites are in low-lying coastal zones. For example, with only 45 to 90 cm (1.5 to 3 feet) of further sea level rise, the Central Sewage Treatment Plant and the adjacent abandoned unlined dump of Virginia Key, Florida will be all that is left of the ocean-facing sandy barrier island. Those pollutant-filled facilities will be exposed to the full force of the oceans tides, waves and storm surges. For those areas on septic tank systems, increasingly frequent sunny day flooding will flood neighborhoods and roads with fecal pollution.

Southeastern Florida and its barrier islands will experience at least two feet of sea level rise in the next 30–50 years. This rise, combined with king tides and storm effects, will eliminate the habitability of most of Florida's barrier islands. Sweet *et al*. (2018) have taken the future frequency of high-tide floods that an area will experience for the different U.S. Government sea level rise projections (Sweet, 2017). They based 'flood' as 'when water levels exceed about 0.5 m, 0.8 m and 1.17 m above a height slightly higher (3–4%) than the local tide range," because that is when they found "minor, moderate and major flooding will occur" (Sweet et al., 2018). **Figure 9** below shows the projected future flooding frequency for those levels for New York City, Miami, and San Francisco.

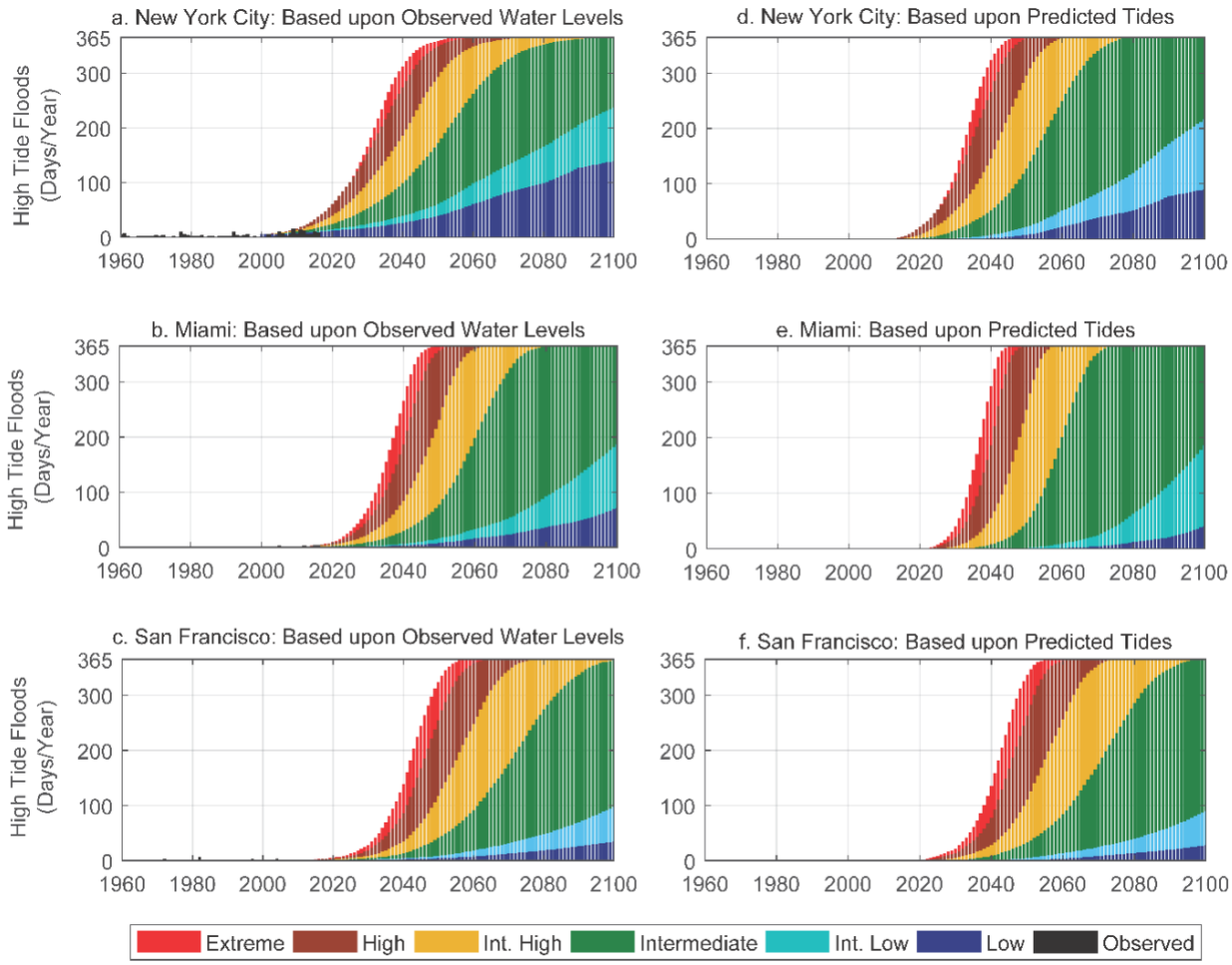


Figure 9. Projected annual frequencies of high tide flooding in response to scenarios of global sea level rise (Sweet et al., 2017) estimated at NOAA tide gauges in a) New York City (The Battery), b) Miami (Virginia Key), Florida and c) San Francisco, California considering observed patterns (combined tidal and nontidal water level components) and d), e) and f) at the same locations but assuming predicted tide forcing only. Derived high tide flood levels are 0.56m, 0.53 m and 0.57 m, respectively.

Plaintiff Levi lives in Satellite Beach on a southeastern Florida barrier island, much of which is less than 6 feet above sea level. Levi's home is at 0.9 m (3 feet) above sea level. His island is already facing sea level rise and increased inundation during storms. At 90 cm (3 feet) of sea level rise, Levi's home will be in the sea. That is likely to happen between 2065 and 2083. But long before 3 feet of sea level rise, Levi and his family will have been forced out because of increasing frequency and depth of flooding and infrastructure failure in their home and community from sunny day flood events (king tides and heavy rainfalls) and storm surges from tropical storms and hurricanes.

A. 2017 Hurricane Season and Sea Level Rise

As described above, human-induced climate change can also cause more intense hurricanes. In September 2017, we experienced this firsthand when the state of Florida was hit by Hurricane Irma as a huge category 1 to 4 storm that blanketed the state in wind damage and in heavy rains and storm surges, which caused significant flooding, even where it only reached category 1 intensity (Miami). In addition, two other hurricanes (Harvey and Maria) reached category 5 status and caused catastrophic damage in Texas, Puerto Rico (a U.S. territory) and elsewhere throughout the Caribbean.

Although the timing and landfall of storm events like these hurricanes cannot be specifically attributed to human-induced global warming, there are a number of trends predicted from global warming that contributed to the 2017 hurricane season's impacts on the United States and its territories. First, a warmer ocean fueled three category 4–5 hurricanes. Irma in particular was an unusually large storm as a category 5 storm and when it diminished in intensity, it spread out to become a spatially huge storm (much like a spinning figure skater spreading her arms). Second, the warmed ocean has a thicker warm layer than in the past, and this was especially true in the southern Gulf of Mexico where the thick warmed ocean fueled intense rain for days in and around Houston alongside Hurricane Harvey. In the past, turbulence in the upper ocean as a hurricane passed brought up cooler water from below thereby weakening the hurricane. Third, as global warming shifted the summer Jet Stream further north than in the past, its strong influence on picking up and moving on hurricanes was diminished, and hurricanes Harvey and Irma lingered on their north and northeastern passage resulting in prolonged intense rainfall (Harvey) and prolonged coastal erosion (Irma on the Atlantic Coast). Normally, as a hurricane approaches the Jet Stream, it is pulled in and swept eastward and northward. And fourth, because of the relative 30 to 75 cm (1 to 2.5) feet of relative sea level rise that the Atlantic and Gulf coasts have experienced in the past century, storm surges were more severe since they could reach higher, further inland and with more velocity than in the past without this sea level rise.

IV. Sea Level Rise and Loss of Infrastructure

As a resident of South Florida, it is truly amazing to me to watch the very aggressive building boom underway, on beaches and barrier islands, throughout downtown and in the low western areas bordering the Everglades. Even with the current, likely underestimated, projections of sea level rise by the end of the century in NOAA, 2017, it is beyond sobering to consider the risk in the present investments and safety that young people, including Plaintiffs, face.

With a further 60 cm (2 feet) of rise (possibly before 2046) most of the barrier islands (of South Florida and the world) will be abandoned and the people relocated; at the same time low places like Sweetwater and Hialeah bordering the Everglades will become more and more frequently flooded and difficult places to live, as illustrated by Hurricane Irma in September 2017. We are on a path towards losing our freshwater resources, living in a community with a failing and disconnected infrastructure, and facing increasing risk from catastrophic storm surges and from hurricanes and flooding from extreme rainfall events.

Based on what we know about sea level rise, governments should be aggressively and transparently planning for young people's future, working with elevation and infrastructure maps to determine the timing, costs and economic feasibility for maintaining a functional infrastructure, a viable insurance industry, and human health and safety. In South Florida, there are already areas that will be unlivable and properties that will be unsellable within a 30-year mortgage cycle.

On January 30, 2015, then-President Barack Obama issued Executive Order 13690, establishing a Federal Flood Risk Management Standard and a Process for Further Soliciting and Considering Stakeholder Input. This order was designed to improve the Nation's resilience to current and future flood risks, which "are anticipated to increase over time due to the effects of climate change and other threats." The sea level rise scenarios and tools set forth in the 2017 NOAA Technical Report, Global and Regional Sea Level Rise Scenarios for the United States (NOAA, 2017), referenced above, were "intended to serve as a starting point for on-the-ground coastal preparedness planning and risk management processes," including compliance with Executive Order 13690. NOAA recognized:

> In this context, there is a clear need – and a clear call from states and coastal communities (White House, 2014) – to support preparedness planning with consistent, accessible, authoritative and more locally appropriate knowledge, data, information, and tools about future changes in sea level and associated coastal risks.

I agree with that statement and have been involved in this kind of work with local governments in South Florida for the past decade, including the 4-County Compact on climate change in Southeast Florida. The lack of current federal government support for sea level rise adaptation and preparedness planning is notable. For example, on August 15, 2017, President Trump revoked Executive Order 13690. In addition, the federal Flood Insurance Rate Maps established by the Federal Emergency Management Agency to help determine the cost of the National Flood Insurance Program flood insurance rates are based on past patterns of flooding.[2] Present and future sea level rise is not factored into the Flood Insurance Rate Maps and thus the maps do not accurately communicate the risk to residents who live in coastal areas.

Nonetheless, as I explain above, no amount of preparedness or adaptation planning will make people like Levi safe from the rising seas and increasingly dangerous storm events if mitigation through urgent emission reductions is not planned for and carried out by Defendants. We cannot adapt our way out of increasingly warm oceans and the planet's ice that will melt.

V. The Loss of Coastal Wetlands

Both Florida and Louisiana are losing vast amounts of wetland because of accelerating sea level rise and poor management. In Louisiana, through the last century, a continuous line of levees was built essentially to the outlet far out on the edge of the continental shelf. This prevented both sediment and freshwater from building and maintaining the Delta. Louisiana has lost more than

[2] National Research Council, Tying Flood Insurance to Flood Risk for Low-Lying Structures in the Floodplain (2015); FEMA Technical Mapping Advisory Council Annual Report (Dec. 2016).

5,000 square kilometers of wetlands over the past century (Jankowski et al., 2017) and will lose another 10,000 to 13,500 square kilometers by the end of this century because of subsidence and sea level rise (Blum and Roberts, 2009). Blum and Roberts (2009) conclude that, because of upstream dams, there is no longer enough sediment coming down the Mississippi River to significantly offset this loss. Nearly all of the Mississippi River Delta is less than 1.5 meters (5 feet) above sea level and extremely vulnerable to the coming accelerating sea level rise as depicted in **Figure 10**, below.

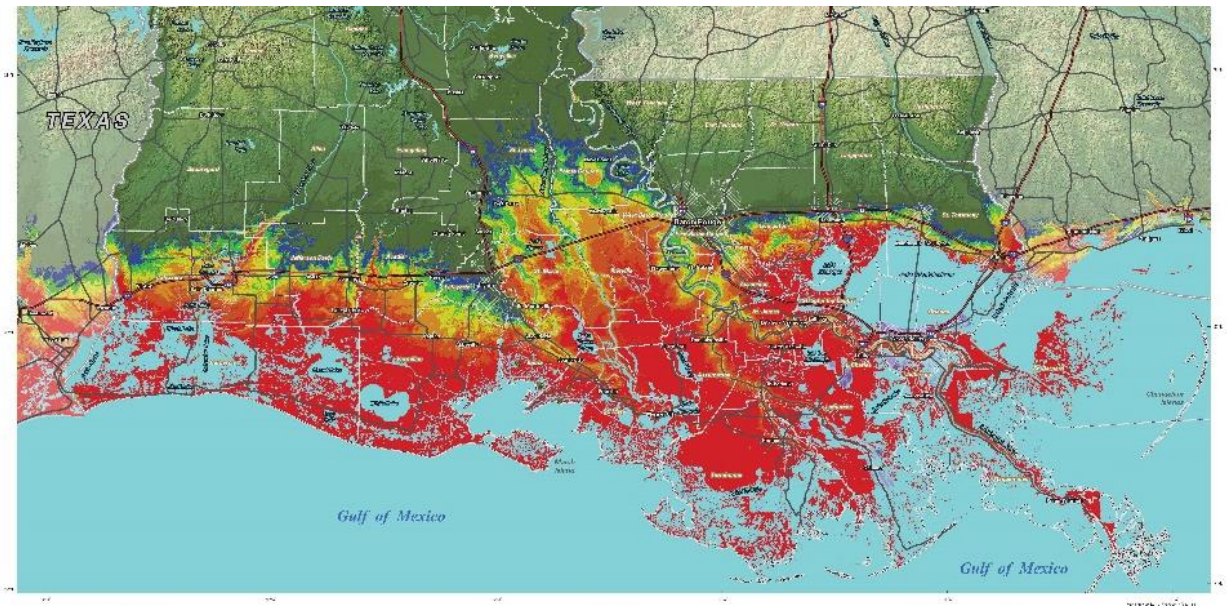


Figure 10. Low lying areas associated with the Mississippi River Delta. Red areas are less than five feet elevation; dark orange is 5 to 10 feet. The large gaps in the delta plain (G) are areas largely lost since World War II as increased blockage by levees forced deterioration. NO is New Orleans. Chenier Plain is a coast of sand beach ridges, mud and wetlands built by the western drift of sediment eroded from the main Delta and then washed to shore. Digital Elevation Data map by the U.S. Geological Survey (Kosovitch, 2008).

A part of Louisiana's wetland and coastal barrier island loss is because of subsidence brought on primarily because of the withdrawal of oil, gas, and water. Current relative sea level rise is a rate of about 12 mm per year (Jankowski, 2017) of which 3.5 mm per year is global sea level rise and 8.5 mm per year is land subsidence. That is an overall rate of relative sea level rise of 1.2 m (4 feet) per century of which 36 cm (1.2 feet) per century is global and 86 cm (2.8 feet) per century is from subsidence. Basically, no coastal sandy barrier island or coastal wetland can persist with that rate of relative sea level rise. Already the U.S. Government has had to remove 35 place names from the Louisiana Coastal Charts because they no longer exist as a result of relative sea level rise and erosion.[3] Florida is also rapidly losing coastal wetlands through a combination of rising sea levels, storm surge damage and saline intrusion.

[3] NOAA, Office of Coast Survey, Historical Geographic Place Names Removed from NOAA Charts (updated Aug. 4, 2014), at

VI. The Unprecedented Urgency of Reducing Greenhouse Gas Emissions

The U.S. government has long known that burning fossil fuels would cause global warming and ultimately sea level rise. In 1983, I attended my first meetings with EPA where they were discussing accelerating sea level rise. I have been speaking about the threat of accelerating sea level rise since 1981 and became certain by the mid-1990s that human burning of fossil fuels was the cause.

The last time in the geologic record that atmospheric CO_2 was at present levels, the seas were 21–27 meters (70–90 feet) higher (Miller et al., 2012; Dutton at al., 2015). Several recent papers, including one from the National Science Foundation, have pointed out that we now have greenhouse gas levels sufficient to cause a 21-meter (70-foot) sea level rise (Miller et al., 2012) and be sufficient to affect or displace 70 percent of the world's population (National Science Foundation, 2012).

In my expert opinion we need to return from over 400 ppm to 350 ppm as recommended by Hansen et al. (2008) and then towards 300–325 ppm to prevent further ocean warming and eventually attempt to return to the levels of the Holocene. Even if we do that, the immense heat that is now in the ocean is only very, very slowly going to revert back to the atmosphere. It's going to stay in the oceans for centuries continuing to expand the ocean and melt polar ice. And this is why we so urgently need to stop burning fossil fuels, aggressively sequester more carbon into our lands and forests, and actively reduce carbon dioxide levels in the atmosphere.

We are headed to catastrophic sea level rise a lot faster than we have anticipated. If we act now, we may not be able to save Naples, Miami, our sandy barrier islands, the Mississippi Delta coast, and other low-lying regions. But if we do not act now, we have no chance to protect Plaintiff Levi's barrier island, and we will also be heading towards losing Orlando, Baton Rouge and many other places presently above any officially projected sea level rise.

As the ocean warms, we are also causing the release of huge amounts of methane and CO_2 from permafrost and methane hydrates from the Arctic tundra and Arctic Ocean floor. This stands to become a runaway warming contributor to catastrophic warming later this century unless we rapidly stop forcing atmospheric warming. This will very significantly affect sea level rise in the future.

Already, our local governments in southern Florida must plan for 1.5–2.4 meters (5–8 feet) of sea level rise by century's end according to the U.S. Government projections. Although I consider 4.6–9.1 m (15–30 feet) by century's end to be more likely, 1.5–2.5 m (5–8.2 feet) will be enough to basically eliminate habitation of south Florida's barrier islands and low mainland areas.

---

https://historicalcharts.noaa.gov/pdfs/HistoricalPlacenames_Louisiana.pdf; Meredith Westington, NOAA, Office of Coast Survey, *Geographic Names Disappear from Charts, But Not from History*, at https://noaacoastsurvey.wordpress.com/2014/03/21/geographic-names-disappear-from-charts/ ("Some of these places have appeared on NOAA's nautical charts of Louisiana since the 1800s, so their removal raises concerns about a loss of cultural identity on the landscape.").

At times, the hard facts of science do not convey the grave danger we face, particularly when the consequences of invisible CO_2 pollution are locked in long before we physically see them. I express the urgency in this way: As we continue burning fossil fuels today, tomorrow, next month and into next year, a significant portion of the resulting CO_2 pollution is going to remain in the atmosphere for 4,000 years. Every ton of fossil fuels the U.S. government grants private companies permission to extract, when burned, adds more heat and energy to the oceans, and our oceans will hold that heat for hundreds to thousands of years, leading to more and more ice melt.

For hundreds of thousands of years, CO_2 has fluctuated up and down about 100 ppm, between 180–280 ppm, during which time sea level has been going up and down by about 100 meters in response. In the flash of time since the industrial revolution, we have tipped the CO_2 scale over 410 ppm, an increase of 130 ppm, and that rapidly warming atmosphere has already heated the ocean enough to initiate rapid melting of the ice on both Greenland and Antarctica and to initiate destabilization of the Arctic Pack Ice, permafrost, and methane hydrates. It is important to note that the natural 100 ppm rise, from 180 to 280 ppm, occurred over about a 12,000 year period. The human induced CO_2 increase of 130 ppm, from 280 to 410 ppm, has occurred in the last 120 years. This is a rate about 100 times faster than the natural geologically very rapid rate of climate change. Note that, although the industrial revolution began in the 1700s, it was not until the 20th century that burning of fossil fuels had a significant impact on climate. In 1900, only about 500 metric tons of carbon were introduced into the atmosphere by burning fossil fuels per year. By 1950, this had increased to about 1,800 metric tons per year, and by the year 2000 humans were introducing over 6,600 metric tons of carbon per year—a 13-fold increase. Progressive global industrialization and population growth have turned burning fossil fuels from a small influence to an overwhelming control on climate.

To stay at this high level for long or to further increase atmospheric CO_2 levels will wreak havoc on our oceans, our coastal lands within 100 feet of sea level, our arid areas, human civilization, and the productivity and diversity of life on earth.

Dr. Hansen et al., concluded their 2016 paper, "Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling, and modern observations that 2°C global warming could be dangerous," by saying:

> We understand that in a system that is out of equilibrium, a system in which the equilibrium is difficult to restore rapidly, a system in which major components such as the ocean and ice sheets have great inertia but are beginning to change, the existence of such amplifying feedbacks presents a situation of great concern. There is a significant possibility, a real danger, that we will hand young people and future generations a climate system that is practically out of their control. We conclude that the message our climate science delivers to society, policymakers, and the public alike is this: we have a global emergency. Fossil fuel CO_2 emissions should be reduced as rapidly as practical.
>
> Social disruption and economic consequences of such large sea level rise, and the attendant increases in storms and climate extremes, could be devastating (Hansen, 2016).

Along similar lines, NOAA concludes that a strategy for decisions and planning processes where *long-term* risk management is paramount is to:

> Define a scientifically plausible upper-bound (which might be thought of as a worst-case or extreme scenario) as the amount of sea level rise that, while low probability, cannot be ruled out over the time horizon being considered. Use this upper-bound scenario as a guide for overall system risk and long-term adaptation strategies (NOAA, 2017, p. 34).

Given all of the above, it is my opinion, stated to a reasonable degree of scientific certainty, that these Plaintiffs face ongoing long-term harm, and any delay in massive reductions of greenhouse gas emissions will only increase the very dangerous situation they already face. For Plaintiff Levi, it may very well be too late to save his barrier island from the rising seas over the course of the century, but to have any reasonable possibility of avoiding irreversible harm to his home island and State, we must aggressively work to limit any additional warming of the oceans and slow the risk of rising ocean levels.

In my expert opinion, we are in the danger zone in southern Florida, and any delay in a judicial remedy for Plaintiff Levi poses clear and irreversible harm to his interests and his future. However, it is not just Plaintiff Levi and his island that are at risk. All of the children of the barrier islands, deltas, and low-lying coastal zone of the Atlantic and Gulf coasts are at risk of inheriting a life of migration further inland. And even on soft-cliffed shorelines, such as are found in portions of California, Oregon, Washington and Hawaii, very significant coastal erosion will occur as ocean waves and currents attack these weak cliffs at a higher level.

In closing, I am sometimes asked by adults about how I give hope to young people given the dire projections for their future. I tell them "I hope *you* are listening." It does a disservice to young people for adults in positions of power and governmental leadership to sugarcoat or deny the very real irreversible harms that are already occurring and are now committed to because of warming already realized. Without transparent and honest planning to urgently mitigate climate change, we are betraying young people and all citizens. We cannot have government disregard for this or have planning regarding our citizen's survivability behind closed doors. The purpose of government is not to do business with and for the coal, oil and gas industry and others who benefit in the short-term by ignoring this serious problem, to the detriment of the broad public interest and certainly the public interest in protecting our children. The public interest is fundamentally harmed by ongoing fossil fuel combustion, which urgently needs reparation.

CONCLUSION

As a geologist and marine geologist with 46 years of experience, and with over 100 peer reviewed publications, largely concerning sea level rise and coastal environmental evolution, it is my expert opinion that young people, including the Plaintiffs, are experiencing sea level rise from already occurring observed and measured ocean warming and polar ice sheet melt. This sea level rise is happening faster than the climate models predict because the models do not include many of the numerous accelerating feedbacks in ice melt that are now being observed consistent with the paleo-record. If we continue to inject even more CO_2 into the atmosphere, the results will be even

more dire for these Plaintiffs and future generations. The fact of the matter is that we have warmed the atmospheric and oceanic climate and future atmospheric warming is unavoidable for some 30 years after we stop putting further greenhouse gases into the atmosphere. However, how much more climate forcing humans put into the system through CO_2 and other greenhouse gas emissions in the near-term, and how much carbon we sequester, will dictate the severity of the warming and whether these young Plaintiffs and future generations can thrive, or even survive.

The need to move quickly to stop using the burning fossil fuels as our primary energy source is in large part because, through scientific study of the geologic record, we have learned that sea levels did not rise in a sluggish, gradual linear manner in response to gradually increasing natural warming and carbon dioxide levels as we came out of the last glacial period. Rather, global sea level rose to the present level as a series of rapid pulses of rise, followed by pauses as warming initiated one pulse of ice sheet collapse after another. These historical pulses of sea level rise each caused a 1- to 10-meter rise over a relatively short period of time (within a century or so) and each reflects the rapid disintegration of some ice sheet sector.

We are most likely witnessing the onset of one of these rapid pulses of sea level rise, this time in response to human-induced CO_2 build up and warming. Through the 20th Century, atmospheric warming progressively warmed the oceans causing their expansion, and this was the reason for an initial increase in the rate of global sea level rise to some 2.3 mm/year, a rate some 8 times that of the past 2,000 years. Then in the 1990s, these warmed ocean waters initiated ice sheet melt of Greenland and Antarctica, and this is dramatically accelerating. Current models only incorporate a few of the 15 or so accelerating feedbacks that have been documented to be accelerating polar ice melt. It is these accelerating feedbacks, which are the current visual display of the nature of pulses of ice melt and resulting sea level rise that characterized the paleo-sea level record in the 18,000 years following the past ice age. All of the accelerating feedbacks recently documented are features of ice melt that are anticipated to maintain ice melt acceleration and sea level rise acceleration through this century and beyond.

For the first time in Earth's climate record, human-induced climate change has caused CO_2 levels to rise more than 125 ppm in a period of only 150 years, some 100 times faster than the increase following the last ice age. This pace and extent of CO_2 increase and associated warming is unprecedented and should serve as an emergency warning that the Earth will now respond in dire ways, including very significant sea level rise above and beyond what has already been experienced. The last time CO_2 levels were above 400 ppm, over one million years ago, sea level was some 21–27 m (70-90 feet) higher than today (Miller et al., 2012; Dutton at al., 2015). That is where we are headed.

Specifically, I project near certainty of a sea level rise of 1.5–2.5 m (4.1 to 8.2 feet) by 2100 and a strong likelihood that this could be 4.5–9 m (15–30 feet) by 2100 if current trends continue, with ever greater rises and acceleration in subsequent centuries until such time as we aggressively begin to dramatically reduce the levels of CO_2 in the atmosphere and take steps to cool the upper portion of the world's ocean. This amount of sea level rise, combined with other factors, such as hurricane storm surges, would make many parts of the coastal United States uninhabitable. Given the pulses of sea level rise documented in the paleo climate record, this amount of future sea level rise is likely to occur in a relatively short timeframe, making adaptation difficult or impossible.

To protect these Plaintiffs and future generations from the serious and significant harms associated with sea level rise, I recommend that the Federal Defendants be ordered to drastically reduce greenhouse gas emissions and initiative massive carbon sequestration efforts. The prescription set forth by Hansen, et al. in 2013 and 2016, i.e. achieving atmospheric CO_2 concentrations of at most 350 ppm before 2100, should be required. Our children and theirs and future civilization deserve much better than we are presently doing.

Signed this 4th day of April, 2018 in Miami, Florida.

Dr. Harold R. Wanless

EXHIBIT A: CURRICULUM VITAE

UNIVERSITY OF MIAMI
Curriculum Vitae

1. **Date:** March 2018

PERSONAL

2. **Name:** Harold R. Wanless

3. **Home (cell) Phone:** (305) 798-6735

4. **Office Phone:** (305) 284-4253 or 284-2697, FAX 284-4258
E-mail: hwanless@miami.edu
Department Office (305) 284-4253, FAX 284-4258

5. **Home Address:** 1231 Genoa St. Coral Gables, FL 33134

6. **Academic Rank:** Professor

7. **Primary Department:** Department of Geological Sciences, School of Arts and Sciences, University of Miami, P.O. Box 249176, Coral Gables, Florida 33124

Secondary Department: Division of Marine Geology and Geophysics, Rosenstiel School of Marine and Atmospheric Sciences, University of Miami

8. **Citizenship:** U.S.

9. **Date of Birth:** 14 February 1942

HIGHER EDUCATION

10. **Institutional:**

Johns Hopkins University; Ph.D. 1973 (Dr. L.A. Hardie, Dissertation Advisor)

University of Miami: M.S. 1968 (Dr. A. Conrad Neumann, Thesis Advisor)

Princeton University: A.B. 1964 (Dr. A.G. Fischer, Thesis Advisor)

11. **Non Institutional:** NONE

12. **Certification:** Registered Professional Geologist, State of Florida, #985, 1989 to present.

EXPERIENCE

13. **Academic:**

Geological Assistant; Scripps Institution (for Dr. Francis P. Shepard); 1962-63

Geological Assistant; University of Illinois (for Dr. Harold R. Wanless); 1964

Research Assistant; University of Miami (for Dr. A. Conrad Neumann); 1965-67

Graduate Fellow; Johns Hopkins University; 1967-71

Research Scientist; University of Miami; 1971-73

Assistant Professor; University of Miami; 1973-81

Associate Professor; University of Miami; 1981-1993

Professor, University of Miami; 1993-present

Chairman, Department of Geological Sciences, University of Miami 1998-2017

Elected Interim Director, Institute for Interdisciplinary Tropical Science, University of Miami, 2003-2004

Cooper Fellow of the College of Arts and Sciences, University of Miami, 2010-2013.

14. **Non-Academic Employment:** Private consultant: petroleum, coastal and environmental, forensic and educational, climate change and sea level rise.

15. **Military:** NONE

PUBLICATIONS

16. **Books and Monographs Published:**

Wanless, H.R., Tedesco, L.P., Rossinsky, V., Jr., and Dravis, J.J., 1989. Carbonate Environments and Sequences of Caicos Platform with an Introductory Evaluation of South Florida. Am. Geophysical Union, 28th Internatl. Geol. Congress Field Trip Guidebook T374, American Geophysical Union, Washington D.C., 75 p.

Wanless, H.R., Tedesco, L.P., Risi, J.A., Bischof, B.G., Gelsanliter, S., 1995, The Role of Storm Processes on the Growth and Evolution of Coastal and Shallow Marine Sedimentary Environments in South Florida, 1st SEPM Congress on Sedimentary Geology, Field Trip Guidebook, 179 p.

Martini, I.P., and Wanless, H.R., Editors, 2014. *Sedimentary Coastal Zones from High to Low Latitudes: Similarities and Differences*, The Geological Society Special Publication SP388, University of London Press. London, 600 p.

17. **Juried or Refereed Journal Articles and Exhibitions:**

1970 (with R.N. Ginsburg, O.P. Bricker and P. Garrett). Exposure index and sedimentary structures of a Bahama tidal flat. Discussion paper, Geol. Soc. America Abstract with Program. 2(7):744-745.

1972 (with E. Bonatti and O. Joensuu) Geological observations in the submarine caldera of Santorin (Aegean Sea). Rapp. Comm. Int. Mer. Medit. 20(4): 569-570.

1974 "Mangrove sedimentation in geologic perspective." In Environments of South Florida: Present and Past. P. 190-200. Edited by P. Gleason. Miami: Miami Geological Society.

1975 "Carbonate tidal flats of the Grand Canyon Cambrian." In Tidal Deposits: A Casebook of Recent Examples and Fossil Counterparts. P. 269-277. Edited by R.N. Ginsburg. New York: Springer-Verlag.

"Intracoastal sedimentation." In New Concepts of Continental Margin Sedimentation. P. 221-239. Edited by D.J. Stanley. New York: Wiley Interscience.

1976 Geologic setting and recent sediments of the Biscayne Bay region, Florida. In Biscayne Bay: Past, Present and Future. P. 1-32. Edited by A. Thorhaug and A. Volker. University of Miami, Sea Grant Special Report, No. 5, 315p.

Man's impact on sedimentary environments and processes. In Biscayne Bay: Past, Present and Future. P. 287-300. Edited by A. Thorhaug and A. Volker. University of Miami, Sea Grant Special Report, No. 5, 315p.

(with H.J. Teas and R.E. Chardon) Effects of man on shore vegetation of Biscayne Bay. In Biscayne Bay: Past, Present and Future. P. 133-156. Edited by A. Thorhaug and A. Volker. University of Miami, Sea Grant Special Report, No. 5, 315p.

1979 Limestone response to stress: solution and dolomitization. Jour. Sed. Petrology 49(2): 437-462.

1981 Wanless, H.R., E.A. Burton and J.J. Dravis. Hydrodynamics of carbonate fecal pellets. Jour. Sed. Petrology 51(1): 27-36.

Fining upwards sedimentary sequences generated in seagrass beds. Jour. Sed. Petrology 51(2): 445-454.

Limestone response to stress: solution and dolomitization. In Diagenesis of Carbonate Rocks: Cement-Porosity Relationships. No. 10, p. 251-276. Edited by G.M. Friedman. and S.A. Ali. Soc. Econ. Paleontologists Mineralogists Reprint Series.

1982 Limestone response to stress: pressure solution and dolomitization-reply. Jour. Sed. Petrology 52(1): 328-332.

Burial diagenesis in limestones. In Sediment Diagenesis. Edited by A. Parker and B.W. Sellwood. Proceedings of NATO Advanced Study Institute, John Wiley and Sons.

Sea level is rising - so what? Jour. Sed. Petrology 52(4): 1051-1054.

1984 Styles of pressure dissolution, In Stylolites and Associated Phenomena: Relevance to Hydrocarbon Reservoirs. P. 81-105. Abu Dhabi National Reservoir Research Foundation Special Publication, Abu Dhabi, U.A.E., 304p.

Wanless, H.R., Rossinsky, V., Jr., and McPherson, B.F. Sedimentologic History of the Loxahatchee River Estuary, Florida, U.S.G.S. - Water Resource Investigations Report 84-4120, 58p.

Pilkey, O.N., Sharma, D.G., Wanless, H.R., and others. Living with the East Florida Shore, Duke University Press, Durham, N.C., 200p.

1988 Wanless, H.R., L.P. Tedesco and K.M. Tyrrell. Production of subtidal tubular and surficial tempestites by Hurricane Kate, Caicos Platform, British West Indies. Jour. Sed. Petrology. 58(4): 739-750.

Wanless, H.R., K.M. Tyrrell, L.P. Tedesco and J.J. Dravis. Tidal-flat sedimentation from Hurricane Kate, Caicos Platform, British West Indies, Jour. Sed. Petrology, 58(4): 724-738.

1989 Wanless, H.R. and M.G. Tagett. Origin and dynamic evolution of carbonate mudbanks in Florida Bay. Bull. Mar. Sci., Symposium on Florida Bay, 44(1): 454-489.

Tedesco, L.P. and Wanless, H.R., Role of burrow excavation and infilling in creating the preserved depositional fabric of Pennsylvanian phylloid mounds of southeastern Kansas: in Sequence Stratigraphic Interpretations and Modeling of Cyclothems, W.L. Watney, J.A. French and E.K. Franseen (eds.), Kansas Geological Society 41st Annual Field Trip, p. 179-192.

Wanless, H.R., and Parkinson, R.W., 1989. Late Holocene sealevel history of southern Florida: control on coastal stability. In Tanner W.F. (ed.), Coastal sediment mobility. Proc., Eighth symposium on Coastal Sedimentology, Fla. State Univ., Tallahassee, Fl, p. 197-213.

1991 Dominguez, J.M.L., and Wanless, H.R. Facies architecture of a falling sea-level strandplain, Doce River coast, Brazil, in: D.J.P. Swift and G.F. Oertel (Eds.), International Association of Sedimentologists, Spec. Publ. #14, p. 259-289.

Rossinsky, V., Jr., and Wanless, H.R. Topographic and vegetative controls on calcrete formation, Turks and Caicos Islands, British West Indies. Jour. Sedimentary Petrology, v. 62, p. 84-98.

Tedesco, L.P., and Wanless, H.R. Generation of sedimentary fabrics and facies by repetitive excavation and storm infilling of burrow networks: Palaios (Ichnofabric Theme Issue) v. 6, p. 326-343.

Wanless, H.R. Observational foundation for sequence modeling. E.K. Franceen, W.L. Watney, C.G.St.C. Kendall, and W. Ross (eds.) Sedimentary Modeling: Computer simulations and methods for improved parameter definition, Kansas Geological Survey Bull. 233, p. 42-62.

1992 Rossinsky, V. Jr., and Wanless, H.R. Topographic and vegetative controls on calcrete formation, Turks and Caicos Islands, British West Indies. Jour. Sedimentary Petrology, v. 62, p. 84-98.

Rossinsky, V. Jr., Wanless, H.R. and Swart, P.K. Penetrative calcretes and their stratigraphic implications. Geology, v. 20, p. 331-334.

1993 Wanless, H.R., and Tedesco, L.P. Comparison of oolitic sand bodies generated by tidal versus wind-wave agitation, *in* B.D. Keith and C.W. Zuppann (Eds.) Mississippian oolites and modern analogs, American Association of Petroleum Geologists Studies in Geology #35, Amer. Asoc. Petroleum Geologists, Tulsa, OK, p. 199-225.

Wanless, H.R., and Tedesco, L.P. Depositional and early diagenetic controls on texture and fabric of carbonate mudbanks, south Florida, *in* R. Rezak and D.L. Lavoie (Eds.) Carbonate Microfabrics, Frontiers in Sedimentary Geology. Springer-Verlag, NY, p. 41-63.

Rossinsky, V. Jr., Wanless, H.R. and Swart, P.K. Penetrative calcretes and their stratigraphic implications, Reply #1. Geology, vol 21, no. 2, p. 186-187.

Rossinsky, V. Jr., Wanless, H.R. and Swart, P.K. Penetrative calcretes and their stratigraphic implications, Reply #2. Geology, vol. 21 no. 6, p. 573-574.

1994 Smith III, T.J., Robblee, M.B., Wanless, H.R., and Doyle, T.W. Mangroves, hurricanes, and lightning strikes. Bioscience, vol. 44, p. 256-262.

Tilmont, J.T., Curry, R., Jones, R., Szmant, A., Zieman, J.C., Flora, M., Robblee, M.B., Smith, D., Snow, R.W., and Wanless, H.R. Hurricane Andrew's effect on marine resources. Bioscience, vol. 44, no. 4, p. 230-237.

Wanless, H.R., Parkinson, R., and Tedesco, L.P. Sea level control on stability of Everglades wetlands, *in* Proceedings of Everglades Modeling Symposium. St. Lucie Press, FL, p. 199-223.

1995 Risi, J.A., Wanless, H.R., Tedesco, L.P., and Gelsanliter, Catastrophic sedimentation from Hurricane Andrew along the southwest Florida coast. J. Coastal Res., v. 21, p. 82-102.

Tedesco, L.P., and Wanless, H.R. Growth and borrow-transformation of carbonate banks: comparison of modern skeletal banks of south Florida and Pennsylvanian phylloid banks of south-eastern Kansas, USA. Spec. Publs. Int. Assoc. Sedimentologists, No. 23, p. 495-521.

1995 Tedesco, L.P. Wanless, H.R., Scusa, L.A., Risi, J.A., and Gelsanliter, S. Impact of Hurricane Andrew on south Florida's sandy coastlines. J. Coastal Res. v. 21, p. 59-82.

1995 Wanless, H.R., Tedesco, L.P., Cottrell, DJ.., Tagett, M.G., and Warzeski, E.R. Origin and growth of carbonate mud banks in south Florida. Spec. Publs. Int. Assoc. Sedimentologists, No. 23, p. 439-473.

Wanless, H.R., Tedesco, L.P., Risi, J.A., Bischof, B.G., and Gelsanliter, S., 1995. The Role of Storm Processes on the Growth and Evolution of Coastal and Shallow Marine Sedimentary Environments in South Florida, Field Trip Guide, The 1st SEPM Congress on Sedimentary Geology, St. Petersburg, FL, 179p.

2000 Kang, Woo-Jun, Trefry, J.H., Nelsen, T.A., and Wanless, H. Direct atmospheric inputs versus runoff fluxes of Hg to the Lower Everglades and Florida Bay. Environmental Science and Technology (16 msp., 2 tables, 4 figs.).

2001 Browder, J.A., and Wanless, H.R. Biscayne Bay Partnership Initiative Science Team Co-Chair's report, *in: Biscayne Bay Partnership Initiative Survey Team Final Reports*, Biscayne Bay Partnership Initiative, Ft. Lauderdale, Fl, p. 75-108.

Wanless, H.R. Geology, Sedimentology, Climate and Sea Level, *in: Biscayne Bay Partnership Initiative Survey Team Final Reports*, Biscayne Bay Partnership Initiative, Ft. Lauderdale, Fl, p. 109-133.

Thorhaug, A., Browder, J., Wanless, H.R., and others. Habitat and Species of Concern, *in: Biscayne Bay Partnership Initiative Survey Team Final Reports*, Biscayne Bay Partnership Initiative, Ft. Lauderdale, Fl, p. 175-217.

2002 Nelsen, T.A., Wanless, H.R., Trefry, J.H., Alvarez-Zarikian, C., Hood, T., Blackwelder, P., Swart, P., Tedesco, L.P., Kang, W-J., Metz, S., Garte, G., Feathersonte, C., Souch, C., Pachut, J.F., O'Neal, M., and Ellis, G. Linkages between the south Florida peninsula and coastal zone: a sediment-based history of natural and anthropogenic influences., *in* (Porter, J.W. and Porter, K.G., eds.) *The Everglades, Florida Bay, and Coral Reefs of the Florida Keys: An Ecosystem Sourcebook*, CRC Press, Boca Raton, p. *415-449.*

2004 Wanless, H.R. Keep it clean and do the research. *Groundwater*, April 2004; and reply to discussion in *Groundwater*, October 2004.

2005 Davis, S.M., Childers, D.L., Lorenz, J.J., Wanless, H.R., and Hopkins, T.E., A conceptual model of ecological interactions in the mangrove estuaries of the Florida Everglades, *Wetlands*, 25 (4)27: 832-842.

2007 Wanless, H.R., and Maier, K.L., Evaluation of beach nourishment sands adjacent to reefal settings, southeast Florida, *Southeastern Geology*, V. 45, No. 1, p. 25-42.

2008: Dravis, J.J., and Wanless, H.R., Caicos platform models of Quaternary carbonate deposition controlled by stronger easterly Trade Winds – applications to petroleum exploration. *In* Morgan, W., and Harris, P. (eds.), *Developing Models and Analogs for Isolated Carbonate Platform – Holocene and Pleistocene Carbonates of Caicos Platform, British West Indies, SEPM Core Workshop 22*, Society of Sedimentary Geology, 10 ms pages and 4 figures.

Van Ee, N., and Wanless, H.R., Ooids and Grapestone- A Significant Source of Mud on Caicos Platform. *In* Morgan, W., and Harris, P. (eds.), *Developing Models and Analogs for Isolated Carbonate Platform – Holocene and Pleistocene Carbonates of Caicos Platform, British West Indies, SEPM Core Workshop 22*, Society of Sedimentary Geology, 13 ms pages and 1 figure.

Wanless, H.R., and Dravis, J.J., Pleistocene Reefal and Oolitic Core Sequences from West Caicos, Caicos Platform, *In* Morgan, W., and Harris, P. (eds.), *Developing Models and Analogs for Isolated Carbonate Platform – Holocene and Pleistocene Carbonates of Caicos Platform, British West Indies, SEPM Core Workshop 22*, Society of Sedimentary Geology, p. 171-177.

2009 Wanless, H.R., and Dravis, J.J. Role of Storms and Prevailing Energy in Defining Sediment Body Geometry, Composition, and Texture on Caicos Platform, *In* Morgan, W., and Harris, P. (eds.), *Developing Models and Analogs for Isolated Carbonate Platform – Holocene and Pleistocene Carbonates of Caicos Platform, British West Indies, SEPM Core Workshop 22*, Society of Sedimentary Geology, p. 13-20.

Vlaswinkel, B.M., and Wanless, H.R. Rapid recycling of organic-rich carbonates during transgression: a complex coastal system in southwest Florida. *In* Swart, P., Eberli, G., and McKenzie, J., (eds.) *Perspectives in Sedimentary Geology: A tribute to the Career of R.N. Ginsburg*, International Association of Sedimentologists Special Publication, Wiley-Blackwell, p. 91-112.

Wanless, H.R. A History of Poor Economic and Environmental Renourishment Decisions in Broward County, Florida., in Kelley, J.T., Pilkey, O.H., and Cooper, J.A.G., eds., America's Most Vulnerable Communities: Geological Society of America Special Paper 460, p. 111-119. Doi:10.1130/2009.2460 (07).

Wanless, H.R. Layering – what does it mean? *In* Swart, P., Eberli, G., and McKenzie, J., (eds.) *Perspectives in Sedimentary Geology: A tribute to the Career of R.N. Ginsburg*, International Association of Sedimentologists Special Publication, Wiley-Blackwell, p. 297-304.

2011 Wanless, H.R., with Gassman, N.J., Soden, B., Landersand , G., Obeysekera, J., Park, J., and Van Leer, J. Southeast Florida Regional Climate Change Compact Technical Ad hoc Work Group. April 2011. A Unified Sea Level Rise Projection for Southeast Florida. A document prepared for the Southeast Florida Regional Climate Change Compact Steering Committee. 27 p.

2014 Wanless, H.R., and Van Leer, J. A tsunami sculpted beach, Sermermiut Beach, Jacobshaven Icefjord World heritage Site, south of Ilulissat, western Greenland.

http://coastalcare.org/2014/08/a-tsunami-sculpted-beach-sermermiut-beach-jacobshaven-icefjord-world-heritage-site-south-of-ilulissat-western-greenland-by-harold-r-wanless-and-john-c-van-leer/

2015 Southeast Florida Regional Climate Change Compact Sea Level Rise Work Group (Compact). October 2015. *Unified Sea Level Rise Projection for Southeast Florida.* A document prepared for the Southeast Florida Regional Climate Change Compact Steering Committee. 35 p.

2016 Wanless, H.R. The coming reality of sea level rise: Too fast too soon. Paper and recorded discussion and consensus statements of 2-day presentation in St. Petersburg, FL on October 2-3, 2015. Pages 16-27, *in* ISGP Climate Change Program (ICCP): "Sea Level Rise: What's Our Next Move?", Institute on Science for Global Policy, Publishers, Washington DC. 73 p.; ISBN: 978-09861007-5-8.

Wanless, H.R. The coming reality of sea level rise along the New Jersey Coast: Too fast too soon. Paper and recorded discussion and consensus statements of 2-day presentation in Toms River, NJ on November 20-21. Pages 11-22 , *in* ISGP Climate Change Program (ICCP): "The Shore's Future: Living with Storms and Sea Level Rise." Institute on Science for Global Policy, Publishers, Washington DC. 73 p.; ISBN: ISBN: 978-09861007-4-1.

2017 Dravis, J., and Wanless, H.R., Accepted for Publication. The Impact of Stronger Easterly Trade Winds on Carbonate Plays - Relationships Developed from Caicos Platform, Southeastern Bahamas. *Marine and Petroleum Geology*. 24 manuscript pages plus 23 pages of figures with captions.

18. **Other Works and Publications:**

1969 Sediments of Biscayne Bay - distribution and depositional history. Technical report 69-2, Inst. Marine Sciences, University of Miami, Miami, Florida, 260pp.

Sedimentary structure and zonation on tidal levees, Andros Island, Bahamas. Amer. Assoc. Petrol. Geol. Bull. 53(3): 748.

1970 Influence of pre-existing bedrock topography on bars of lime mud and sand. Biscayne Bay, Florida. Amer. Assoc. Petrol. Geol. Bull. 54(5): 875.

1971 Carbonate tidal flats of the Grand Canyon Cambrian. Geol. Soc. America Abstract with Program. 3(7): 743.

1973 Preliminary report on the sediments and sedimentary processes in natural and artificial waterways, Marco Island, Florida. Report 22 to Deltona Corp., December. 15 pp. and 6 figures.

Cambrian of the Grand Canyon - a re-evaluation. Amer. Assoc. Petrol. Geol. Bull. 57(4): 810-811.

Microstylolites, bedding, and dolomitization. Amer. Assoc. Petrol. Geol. Bull. 57(4): 811.

1974 Fining-upwards sequences generated by seagrass beds. Geol. Soc. America Abstract with Program. 6(7): 999.

"Intracoastal sedimentation." In The New Concepts of Continental Margin Sedimentation II. P. 391-429. Edited by D.J. Stanley. Falls Church, Va.: Amer. Geol. Inst.

Concepts in carbonate sedimentation: A problem oriented field excursion on the origin of carbonate sand and mudbanks - Biscayne Bay, Florida. Amer. Geol. Inst. Mimeo. 15 pp.

Sediments and sedimentary processes in natural and artificial waterways, Marco Island area, Florida. Scientific report UM-RSMAS, No. 74032, Univ. Miami, Miami, Florida. 127 pp.

1975 (with J. Dravis) "Characterization of carbonate sand fraction from MAFLA Areas I, II, and III." In Final Report on the Baseline Environmental Survey of the MAFLA Lease Areas CY 1974. St. Petersburg: State University System of Florida, Inst. Ocy. BLM Contract No. 08550-CT4-11. 191 pp.

(with E. Barron and J. Rine) Sediments and sedimentation in inland waterways, Marco Island, Florida. Progress report to Deltona Corp. 48 pp.

Sedimentary dynamics and significance of seagrass beds. Florida Scientist 38(Suppl.1): 20.

1976 (with J.M. Rine) Timing, character and preservability of sedimentation events in low-energy coastal environments, southwest Florida, Amer. Assoc. Petrol. Geol. Bull. 60(4): 731.

Carbonate Sediment Constituents and Molluscan Lithotopes on the MAFLA Continental Shelf. Final Report to the Bureau of Land Management. 280 p.

Sedimentary dynamics and significance of seagrass beds. Geol. Soc. America Abstracts with Programs 8(6): 1160.

1978 Limestone Response to Stress: Neomorphism, Solution and Dolomitization. P. 6 of abstracts. 6th Meeting of Carbonate Sedimentologists, Liverpool, England, Jan. 3-7, 1978.

Storm generated stratigraphy of carbonate mud banks, South Florida. Geol. Soc. America Abstracts with Programs 10(7): 512.

1979 Role of physical sedimentation in carbonate bank growth. Amer. Assoc. Petrol. Geol. Bull. 63(3): 547.

1981 Environments and dynamics of clastic sediment dispersal across the Cambrian of the Grand Canyon. Amer. Assoc. Petrol. Geol. - Soc. Econ. Paleontologists Mineralogists Ann. Mtg., San Francisco.

1982 Diagenetic fabric and structures in Ordovician slope limestones. Amer. Assoc. Petrol. Geol. Bull. 66(5): 640.

1983 Turbidity in Biscayne Bay. Annual Report to Dade County and Sea Grant, 226 p.

1984 (with J. Dravis) Comparison of two Holocene Tidal Flats - Andros Island, Bahamas, and Caicos, British West Indies. Am. Assoc. Petrol. Geol. Bull. 68(4): 537.

(with D. Cottrell, R. Parkinson and E. Burton) Sources and Circulation of Turbidity, Biscayne Bay, Florida. Final report to Sea Grant and Dade County, 499 p.

1985 (with J. Dravis and G.S. Grabowski, Jr.) Exposed Pleistocene platform margin reef sequence, West Caicos Island, British West Indies. Soc. Econ. Paleontologists Mineralogists Ann. Midyear Mtg., Abstracts, 2: 25-26.

1986 Transgressive and regressive stromatolites. Stromatolite symposium. Abstracts Soc. Econ. Paleontologists Mineralogists Ann. Midyear Mtg., Raleigh, 3: 114.

(with V. Rossinsky) Coastal accretion on leeward margins of carbonate platforms, Turks and Caicos Islands, British West Indies. Amer. Assoc. Petrol. Geol. Bull. 70: 660.

(with M. Tagett) Burrow-generated false facies and phantom sequences. Amer. Assoc. Petrol. Geol. Bull. 70: 660.

Tagett, M.G. and H.R. Wanless. Gradients in carbonate mudbank stratigraphy and dynamics: Florida Bay, South Florida. Abstracts Soc. Econ. Paleontologists Mineralogists Ann. Midyear Mtg., Raleigh, 3: 108.

Tedesco, L.P., H.R. Wanless and K.M. Tyrrell. Tabular and tubular tempestites from Hurricane Kate, Caicos Platform, British West Indies. Abstracts Soc. Econ. Paleontologists Mineralogists Ann. Midyear Mtg., Raleigh, 3: 108.

1987 Wanless, H.R., K.M. Tyrrell, and L.P. Tedesco. Hurricane-dominated tidal flats, Caicos Platform, British West Indies. Amer. Assoc. Petrol. Geol. Bull. 71: 200.

Waltz, M., V. Rossinsky, and H.R. Wanless. Repetitive reef to ooid sequences near the leeward margin of Caicos Platform, British West Indies, Am. Assoc. Petrol. Geologists Bull., 71: 200.

Wanless, H.R. Key Biscayne's "mangrove reef", a reflection of barrier island and sea level history. in Maurrasse, F.J-M.R. (Ed.), Symposium on south Florida geology. Miami Geological Society Mem. 3, p. 16.

Wanless, H.R., and Tagett, M.G. Origin and dynamic evolution of carbonate mudbanks in Florida Bay, Florida Bay Symposium, Univ. Miami/Everglades National Park, June 1987.

Wanless, H.R., and Tedesco, L.P. Burrow-generated sedimentary sequences: An example from the Glen Rose Formation, Lower Cretaceous, Austin, Texas: Soc. Econ. Paleontologists Mineralogists Midyear Mtg., Austin, IV: 88-89.

1988 Rossinsky, V. Jr., and H.R. Wanless. Penetrative Calcretes: Origin and stratigraphic pitfalls: Geol. Soc. America, Ann. Mtg., Denver, Abstracts with Programs 20(7): 329.

Tedesco, L.P. and Wanless, H.R. Paleoenvironmental reconstruction of Paleozoic mud mounds: A reinterpretation based on modern burrow infill fabrics: Geol. Soc. America, Ann. Mtg., Denver, Abstracts with Programs, 20(7): A211.

Wanless, H.R. and Tedesco, L.P., Sand Biographies: Sea Frontiers, 34, p. 224-231.

1989 Tedesco, L.P. and Wanless, H.R., Biogenic generation, transformation and destruction of sedimentary facies: 28th International Geological Congress, Washington, D.C., Abstracts, v. 3, p. 224-225.

Wanless, H.R., Tedesco, L.P., Dravis, J.J., and Emerson, J.D., Alternate models of Bahamian platform carbonate sedimentation: Caicos Platform, British West Indies: 28th International Geological Congress, Washington, D.C., Abstracts, v. 3, p. 331-332.

Wanless, H.R., Tedesco, L.P., and Dravis, J.J., An expanded model for ooid form and genesis: Caicos Platform, British West Indies: Am. Assoc. Petrol. Geol. Bull., v. 73, p. 1041.

Wanless, H.R., Observational Foundation for and Scaling Limitation to Sequence Modeling, in Sedimentary Modeling: Computer Simulation of Depositional Sequences; Franceen, E.D. and Watney, W.L. (eds.) Kansas Geological Survey Subsurface Geology Series 12, p. 7.

Wanless, H.R. and Parkinson, R., Late Holocene Sea Level History of south Florida: Control on coastal stablitiy: Geol. Soc. America, Ann. Mtg. Abstracts, St. Louis, p. A35.

Tedesco, L.P. and Wanless, H.R., The depositional sequences of phylloid mounds: a reappraisal: Geol. Soc. America Ann. Mtg., Abstracts, St. Louis, p. A292.

Browne, K.M., Wanless, H.R., Swart, P., Rossinsky, V., and Tyrrell, K.M., Dolomite cementation and sediment dissolution in association with ponded brines, Caicos, B.W.I.: Geol. Soc. America Ann. Mtg., Abstracts, St. Louis, p. A220.

1990 Tedesco, L.P. and Wanless, H.R. Role of burrow excavation and infilling in creating the preserved depositional fabric of the core facies of modern and Paleozoic mud mounds: 13th International Sedimentological Congress, Abstracts of Posters, Nottingham, England, p. 214.

Tedesco, L.P. and Wanless, H.R. Biogenic generation, transformation and destruction of sedimentary facies by excavation and catastrophic infilling of burrow networks: 13th International Sedimentological Congress, Abstracts for Papers, Nottingham, England, p. 546.

Wanless, H.R. Late Holocene sealevel history of south Florida: control on coastal Stability. Navigating the Nineties, Florida Coastal, Management Conference, Clearwater, FL, Sept, 1990.

Wanless, H.R., Cottrell, D.J., Tagett, M.G., Tedesco, L.P., and Warzeski, E.R. Origin and growth of carbonate mud banks in south Florida: a reevaluation: 13th International Sedimentological Congress, Abstracts for Papers, Nottingham, England, p. 588.

Wanless, H.R., and Tedesco, L.P. Comparative facies analysis of oolitic sand bodies generated by tide versus wind agitation, Geol Soc. America Ann Mtg. Abstracts, Dallas, TX, p. A131-132.

Wanless, H.R. and Tedesco, L.P. Ooids: an expanded model for petrologic form, genesis and sediment body geometry: 13th International Sedimentological Congress, Nottingham, England, p. 587-588.

1991 Tedesco, L.P., Aller, R.C., and Wanless, H.R., 210-Bp chronology of sequences affected by burrow excavation and infilling: examples from shallow marine carbonate sediment sequences, Holocene south Florida and Caicos Platform, BWI. Geol Soc. America, Ann. Natl. Meeting, San Diego, 1991.

Tedesco, L.P., and Wanless, H.R. Fabric selective dolomitization and porosity enhancement in fine-grained shelf and bank facies. International Symposium on the Exploration and Development of Low Permeability Oil and Gas Reservoirs, Abstracts; Xian, China, 2 p.

Wanless, H.R. Porosity and permeability destruction and enhancement in limestones during burial and tectonic stresses. International Symposium on the Exploration and Development of Low Permeability Oil and Gas Reservoirs, Abstrasts; Xian, China, 2 p.

Wanless, H.R., and Tedesco, L.P., A re-evaluation of Mississippian mud mounds based on their internal stratigraphy. Geol Soc. America, Ann. Natl. Meeting, San Diego, 1991.

1992 Frederick, B.C., Gelsanliter, S., Risi, J.A., and Wanless, H.R. Historical evolution of the southwest Florida coastline and its effect on the adjacent marine environments. 1992 Symposium on Florida Keys Regional Ecosystem, Abstracts. Univ. Miami and NOAA, p. 11.

Tedesco, L.P., and Wanless, H.R. Variability of ooid grain form and internal microstructure: a response to energy level of the formational environment. Geological Society of America, 1992 Annual Meeting, Abstracts with Programs, Cincinnati, p. A350-A351.

Wanless, H.R. Progress Report 1. Dynamics and Historical Evolution of the Mangrove/Marsh Fringe Belt of Southwest Florida, in Response to Sea-level History, Biogenic Processes, Storm Influences and Climatic Fluctuations. 3p. Plus 3 Appendicies, to Everglades National Park.

Wanless, H.R., and Tedesco, L.P., Paleoenvironmental setting of Paleozoic mud mounds. Geological Society of America, 1992 Annual Meeting, Abstracts with Programs, Cincinnati, p. A141-A142.

Wanless, H.R., Tedesco, L.P., Hine, A.F., and Dravis, J.J. Facies geometries of shallowing-upwards sequences associated with leeward-margin sediment wedges, Caicos Platform, British West Indies. American Assoc. Petroleum Geologists 1992 Annual Convention, Program with Abstracts, Calgary, p. 137.

Wanless, H.R., Tedesco, L.P., Cottrell, D., and Tagett, M.G. Holocene environmental history of carbonate banks in Florida Bay and Biscayne Bay, south Florida. 1992 Symposium on Florida Keys Regional Ecosystem, Abstracts. Univ. Miami and NOAA, p. 68.

1993 Risi, J.A., and Wanless, H.R. Physical modifications to the shallow marine environments of south Florida by Hurricane Andrew. Geological Society of America southeast Section Meeting. Tallahassee, April, 1993.

Gelsanliter, S., and Wanless, H.R. Modifications to the mangrove environment and coastlines of south Florida as a result of Hurricane Andrew. Geological Society of America southeast Section Meeting. Tallahassee, April, 1993.

Tedesco, L.P., Wanless, H.R., and Scusa, L. Impact of Hurricane Andrew on sandy coastlines and shallow marine banks of south Florida. Geological Society of America southeast Section Meeting. Tallahassee, April, 1993.

Wanless, H.R., Frederick, B., Gelsanliter, S., and Risi, J.A. First Annual Report. Dynamics and Historical Evolution of the Mangrove/Marsh Fringe Belt of Southwest Florida, in Response to Sea-level History, Biogenic Processes, Storm Influences and Climatic Fluctuations. 28p. Plus 6 Appendices, to Everglades National Park.

Wanless, H.R., and Tedesco, L.P. Wind transport and damage by Hurricane Andrew. Geological Society of America southeast Section Meeting. Tallahassee, April, 1993.

1994 Wanless, H.R., Frederick, B., Gelsanliter, S., and Risi, J.A. Semi-annual Research Report, June 1993 to February 1994.Dynamics and Historical Evolution of the Mangrove/Marsh Fringe Belt of Southwest Florida, in Response to Sea-level History, Biogenic Processes, Storm Influences and Climatic Fluctuations. 15p. Plus 3 Appendicies, to Everglades National Park and National Biological Survey.

Wanless, H.R. Investigators [2nd] Annual Report. Dynamics and Historical Evolution of the Mangrove/Marsh Fringe Belt of Southwest Florida, in Response to Sea-level History, Biogenic Processes, Storm Influences and Climatic Fluctuations. 5p. To Everglades National Park and National Biological Survey.

Wanless, H.R., Tedesco, L.P., Risi, J.A. 11-Month Progress Report, Post Hurricane Sediment Redistribution and Benthic Community Response and Evolution Within Biscayne Bay, the Coral Reef Platform and the Southwest Florida Coast. 26p, plus Figures and 5 Appendices (October 15). To Biscayne and Everglades National Parks

1995 Gelsanliter, S., and Wanless, H.R. Evidence for high-frequency sea-level oscillations during the late Holocene: implications for modeling sediment body initiation and evolution. Amer. Assic. Petrol. Geologists Ann. Natl. Mtg., Program and Abstracts., p. 32a.

Tedesco, L.P., and Wanless, H.R. Redefined paleoenvironmental interpretation of Mississippian oolites. Amer. Assoc. Petrol. Geologists Ann. Natl. Mtg., Program and Abstracts., p. 94a.

Gelsanliter, S., and Wanless, H.R., High-frequency sea-level oscillations in the late Holocene of south Florida: a dominating control on facies initiation and dynamics. 1st SEPM Congress on Sedimentary Geology, Congress Program and Abstracts, Vol. 1, St. Pete Beach, Fl, p. 58.

Risi, J.A., Hurricane event and post-event sedimentation: taphonomy and geologic signature. 1st SEPM Congress on Sedimentary Geology, Congress Program and Abstracts, Vol. 1, St. Pete Beach, Fl, p. 105.

Wanless, H.R., Gelsanliter, S., Bischof, B., and Bossung, J. Research Progress Report. Dynamics and Historical Evolution of the Mangrove/Marsh Fringe Belt of Southwest Florida, in

Response to Sea-level History, Biogenic Processes, Storm Influences and Climatic Fluctuations. 9p. To Everglades National Park and National Biological Survey.

Wanless, H.R., Tedesco, L.P., Smith, T., Bischof, B., and Risi, J.A. Controls on mangrove community recovery or evolution following major hurricanes. 1st SEPM Congress on Sedimentary Geology, Congress Program and Abstracts, Vol. 1, St. Pete Beach, Fl, p. 126.

Wanless, H.R., Nelsen, T.A., Tedesco, L.P., Trefry, J.H., Blackwelder, P.L., and Risi, J.A., Documenting the styles of sedimentation and contained historical sedimentary record in shallow marine environments in and adjacent to Florida Bay, south Florida. Florida Bay Science Conference, Gainesville, FL, September, 1995 (3 p.).

Wanless, H.R., Tedesco, L.P., Bischof, B., Risi, A. and Smith, T., Post-Event subsidence: a dominating control on mangrove community evolution following major hurricanes. Geol. Soc. America, Abstracts with Programs, 1995 Annual Meeting, Vol. 27, No. 6, p. A-452.

Wanless, H.R., Tedesco, L.P., Risi, J.A. 17-Month Progress Report, Post Hurricane Sediment Redistribution and Benthic Community Response and Evolution Within Biscayne Bay, the Coral Reef Platform and the Southwest Florida Coast. Figures and 8 Appendices (July 5). To Biscayne and Everglades National Parks

Wanless, H.R., Tedesco, L.P., Risi, J.A. 23-Month Progress Report, Post Hurricane Sediment Redistribution and Benthic Community Response and Evolution Within Biscayne Bay, the Coral Reef Platform and the Southwest Florida Coast. 15p, plus Figures and 9 Appendices (November 20). To Biscayne and Everglades National Parks

1996 Tedesco, L.P., Risi, J.A., Wanless, H.R., and Hernly, F.V., The evolution of shallow marine environments of south Florida following Hurricane Andrew., Geol. Soc. America 1996 Annual Meeting, Abstracts with Programs, p. A-274.

Wanless, H.R., Bischof, B. Gelsanliter, S., Frederick, B., and Risi, J.A. Final Report. Dynamics and Hirtorical Evolution of the Mangrove/Marsh Fringe Belt of Southwest Florida, in Response to Sea-level History, Biogenic Processes, Storm Influences and Climatic Fluctuations. 12p. To Everglades National Park and National Biological Survey.

Wanless, H.R., Gelsanliter, S., and Herman, K., Sea-level control on carbonate, clastic and organic sediment body initiation and evolution. 30th International Geological Congress, Abstracts Beijing, Peoples Republic of China. Vol. 2, p. 209.

Wanless, H.R., Gelsanliter, S., and Herman, K., Sea-level control on carbonate, clastic and organic sediment body initiation and evolution. Geol. Soc. America

1996 Annual Meeting, Abstracts with Programs, p. A-275.

Wanless, H.R., Tedesco, L.P., and Dravis, J.J., Facies geometry of shallowing upwards sequences associated with leeward-margin sediment wedges, Caicos Platform, British West Indies. 30th International Geological Congress, Abstracts Beijing, Peoples Republic of China. Vol. 2, p. 208.

Wanless, H.R., Tedesco, L.P., Risi, J.A. 29-Month Progress Report, Post Hurricane Sediment Redistribution and Benthic Community Response and Evolution Within Biscayne Bay, the Coral

Reef Platform and the Southwest Florida Coast. Figures and 8 Appendices (June 15). To Biscayne and Everglades National Parks

Wanless, H.R., Tedesco, L.P., Risi, J.A., and Smith, T., Post-event subsidence: a dominating control on mangrove community evolution following major hurricanes. 30th International Geological Congress, Abstracts Beijing, Peoples Republic of China. Vol. 2, p. 150.

Nelsen, , T., Zetwo, M, Wanless, H., Risi, A., Blackwelder, P., Swart, P., Alvarez-Zarikian, C., Hood, T., Trefrey, J., Kang, W-J., Metz, S., Trocine, R., Tedesco, L., Capps, M., O'neal, M. The sediment record as a monitor of the natural and anthropogenic changes in the lower Everglades/Florida Bay ecosystem. NOAA Report, 4 p..

Nelsen, , T., Zetwo, M, Wanless, H., Risi, A., Blackwelder, P., Swart, P., Alvarez-Zarikian, C., Hood, T., Trefrey, J., Kang, W-J., Metz, S., Trocine, R., Tedesco, L., Capps, M., O'Neal, M. The sediment record as a monitor of the natural and anthropogenic changes in the lower Everglades/Florida Bay ecosystem: a high resolution study. Program and Abstracts, 1996 Florida Bay Science Conference (Florida Sea Grant), Key Largo, Florida, p. 62-65.

1997 Tedesco, L.P. and Wanless, H.R. Stability of coastal wetlands of south Florida: the role of sea level and major hurricanes. Estuarine Research Federation Annual Convention, Rhode Island, Abstr. p. 81.

Wanless, H. R., Risi, J.A., Tedesco, L.P., and Nelsen, T.A., Occurrence and character of stratification in mudbanks in south Florida. Geological Society of America Abstracts with Programs, p. A-111.

1998 Wanless, H.R., Nelsen, T, Trefry, J., Blackwelder, P., Swart, P., Risi, A., Hood, T., Alvarez-Zarikan, C., Kang, W-J., Metz, S., Tedesco, L.P., and O'Neal, M. Mud Banks of south Florida: Stratification Type and the contained paleoenvironmental record. in: Paleoecology and ecosystem history of Florida Bay and the lower Everglades. Proceedings of Workshop held January 22-23 and sponsored by the Florida bay Program Management Committee.

Hood, T., Alvarex-Zarikian, C., Blackwelder, P., Nelsen, T., Wanless, H.R., and Trefry, J. Paleoecological reconstruction in the lower Everglades/Florida Aby Environments using ostracods and benthic foraminifera. in: Paleoecology and ecosystem history of Florida Bay and the lower Everglades. Proceedings of workshop held January 22-23 and sponsored by the Florida bay Program Management Committee.

Tedesco, L.P., O'Neal, Pachut, J.F., and Wanless, H.R. Application of surface pollen zonation to sequences of southwestern Florida: pitfalls, lessons and utility of hte pollen record. in: Paleoecology and ecosystem history of Florida Bay and the lower Everglades. Proceedings of Workshop held January 22-23 and sponsored by the Florida bay Program Management Committee.

Wanless, H.R. A summary of what we know and need to know. in: Paleoecology and ecosystem history of Florida Bay and the lower Everglades. Proceedings of Workshop held January 22-23 and sponsored by the Florida bay Program Management Committee.

1999 Dravis, J.J., and Wanless, H.R. Application of the Caicos Platform Model to exploration: trade

wind controls on carbonate distribution. 1999 AAPG Annual Convention, San Antonio, TX.

Wanless, H.R., Tedesco, L.P. and Hall, R.E. Historical changes in mangrove, seagrass and calcareous algal communities in south Florida. 1999 Florida Bay and Adjacent Marine Systems Science Conference, Key Largo, FL November 5, 1999.

Tedesco, L.P., Souch, C., Pachut, J., Arthur, J.A., Wanless, H.R., Blackwelder, P., Hood, T., Alvarez-Zarikian, C., Trefry, J., Kang, W.J., Metz, S., and Nelsen, T.A. The Signature of Hurricane Sedimentation in the Lower Everglades/Florida Bay Ecosystem: Recognition of Sedimentologic, Geochemical and Microfaunal Indicators. 1999 Florida Bay and Adjacent Marine Systems Science Conference, Key Largo, FL November 5, 1999.

Nelsen, T.A., Garte, G., Featherstone, C., Blackwelder, P., Hood, T., Alvarez-Zarikian, C., Swart, P., Wanless, H.R., Tedesco, L.P., Souch, C., Pachut, J., and Arthur, J.Understanding Long-Term Rainfall, Freshwater Flow and Salinity Patterns with Concomitant Responses of Benthic Microfauna, Stable Isotopes, and Pollen in Oyster and Florida Bays. 1999 Florida Bay and Adjacent Marine Systems Science Conference, Key Largo, FL November 5, 1999.

2000 "The Interaction of Hurricanes Events and Sea Level in the Dynamics and Evolution of Tropical Coastal and Shallow Marine Environments." NOAA/Office of Atmospheric Research, Senior Research Council Meeting and Symposium on Hurricane Research, Miami, FL, February 8, 2000.

Wanless, H.R., Tedesco, L.P., and Hall, R.E., Mapping south Florida in 2100: rapid transgression of coastal wetlands. Geological Society of America, 2000 Abstracts with Programs, 34th Annual Meeting, North-Central Section, Indianapolis, p.A-66.

Wanless, H.R., and Tedesco, L.P., "Storm Events as Initiators of Coastal Evolution in Times of Rising Sea Level" The Coastal Society 17th Conference - Coasts at the Millennium Session on "Temporal and Spacial Scaling in Coastal Science: Insights into Natural and Anthropogenic Processes" Corvallis, OR

Wanless, H.R., Oleck, P., Tedesco, L.P., Hall, B.E. Next 100 Years of Evolution of the Greater Everglades Ecosystem in Response to Anticipated Sea Level Rise: Nature, Extent and Causes. Greater Everglades Ecosystem Restoration Science Conference, Naples, Fl., December, 2000. p. 174-176.

2001 Wanless, H.R., "Aquifer Storage and Recovery: lessons from failing injection wells." The Everglades Coalition annual meeting, Stewart, Fl., January 2001.

Wanless, H.R., "Geological Controls on Fate of Pharmaceuticals in Surface and Ground Waters", Oral and written presentation at the Center for Disease Control meeting on 'Fate of Pharmaceuticals in Surface and Ground Waters, October, 2001, Atlanta, Ga. Transcript in review.

Thorhaug, A., and Wanless, H.R., "The role of Hurricanes, Tornados and gale force winds in seagrass distribution in Subtropical and Tropical Nearshore Waters." Abstr. Botany, 2000.

Wanless, H.R., "Florida Geology and ASR's" Summit Meeting of Legal Environmental Assistance Fund, Orlando, March, 2002, 9p.

Vlaswinkel, B.M., Wanless, H., Robertson, W., Zhang, K and Leatherman, S., 2001. Airborne Laser Altimetry: the potential of first and last stop detection in mangrove swamps. Poster for MTS/IEEE Oceans 2001 Conference, Honolulu.

2002 Wanless, H.R. "Sediment Stability in Tropical Carbonate and Organic Environments". U.S. Army Corps of Engineers sponsored *Sediment Stability Workshop*, New Orleans, LA. 41p. PowerPoint.

Controlling Influences on Sediment Stability of Coastal and Shallow Marine Carbonate Mud and Organic Substrates, South Florida and the Bahamas. U.S. Army Corps of Engineers sponsored *Sediment Stability Workshop*, New Orleans, LA. 17p.
Dravis, J.J., and Wanless, H.R., "Stratigraphy and Controls on Development of Isolated Carbonate Platforms." American Association of Petroleum Geologists Annual National Meeting, Houston, TX. March 2002.

Wanless, H.R., and Manne, T., 2002. Caicos Platform Sand Resources Evaluation: Sediment Thickness and Character. Report to Shoreline Foundation and Turks and Caicos Government, May, 2002, 30p.

Wanless, H.R., "An Evaluation of Cape Sable Canals, Everglades National Park, Florida." Submitted to Everglades National Park., March, 2002; 20p. report and 62 p. PowerPoint.

Wanless, H.R., "The Nature of Transgression: Cape Sable, Florida." Geological Society of America, Annual Meeting & Exposition Abstracts with Programs. p. 206-207.

Tedesco, L.P., and Wanless, H.R. H.M.S. Fowey Project: Biscayne National Park Submerged Site Stabilization, Sedimentology/Seagrass Dynamics/Bioturbation. National Park Service (22 p., 11 figs.).

2003 Wanless, H.R., "Aquifer Injection and Storage Wells – Opportunity of Disaster?". National Groundwater Association, 2003 Annual Meeting.

Vlaswinkel, B.M., Wanless, H.R. and Rankey, E.C. Changing land- and seascape environments at Cape Sable, a coastal wetland complex in South Florida. Geophysical Research Abstracts, Vol. 5, 07245.

2004 Vlaswinkel, B. and Wanless, H.R. Wetland and tidal channel evolution affecting critical habitats at Cape Sable, Everglades National Park, Florida. Abstract with Programs, First National Conference on Ecosystem Restoration, Florida, p. 452.

Vlaswinkel, B., Wanless, H., and Rankey, E. Processes and dynamic evolution of a rapidly changing, low energy carbonate coastal system, Southwest Florida. Abstract with Programs, 23rd IAS Meeting of Sedimentology, Coimbra, Portugal, p. 284.

Jackson, K.L,. and Wanless, H.R. Shift of Everglades Discharge in Response to Late Holocene Coastal Buildup, southwest Florida/ Geological Society of America, Annual Meeting and Exposition Abstracts with Programs, Vol. 36 (5), p. 192.

2005 Wanless, H.R., and Vlaswinkel, B.M. Coastal Landscape and Channel Evolution Affecting Critical Habitats at Cape Sable, Everglades National Park, Florida. Final Report of Research Project to Everglades National Park, 197 p.

Wanless, H.R., Vlaswinkel, B.M., and Jackson, K.L. Transgressive recycling produces organic-rich carbonate muds. American Association of Petroleum Geologists Annual National Meeting, Calgary, Alberta, June.

Wanless, H.R. Layering – what does it mean? Geological Society of America, Annual Meeting & Exposition Abstracts with Programs. Paper 179-3, vol. 37, no. 7, p.400(also online as recorded session (http://gsa.confex.com/gsa/2005AM/finalprogram/abstract_90897.htm)

Wanless, H.R., and Vlaswinkel, B.M. 2005. "Coastal Landscape, Wetland and Tidal Channel Evolution Affecting Critical Habitats of Cape Sable, Everglades National Park, Florida." Final Report to National Park Service, Department of Interior, 196p.

Wanless, H.R., and Gonzales, C., "Detection, Mapping, and Characterization of Groundwater Discharges to Biscayne Bay" Final Report to State of Florida, Biscayne Bay Regional Restoration Coordination Team, as sub-contract with National Oceanic and Atmospheric Administration through CIMAS. With Dr. John R. Proni, NOAA, AMOL., 11p.

2006 Wanless, H.R. with others. Final report and Findings from Technical Group, Envisioning the Future of the Gulf Coast Conference, New Orleans. By America's Wetland: Campaign to Save Coastal Louisiana, 11p.

Wanless, H.R., and Vlaswinkel, B.M., Composite shallowing sequences generated within overall highstands. Geological Society of America Annual National Meeting, Abstracts with Programs, p.477, Philadelphia, PA.

2007 Wanless, H.R., Integrated Fine-Scale Temporal and Spatial Controls on Carbonate Sedimentation (Abstract). SEPM Research Symposium - Changing Paradigms in Carbonates, American Association of Petroleum Geologists/ SEPM Annual Meeting, Long Beach, CA.

Wanless, H.R., A history of poor economic and environmental renourishment decisions in Broward County, Florida (Abstract). Symposium on Endangered Beaches, Geological Society of America Annual National Meeting, Denver, October, 2007.

Wanless, H.R., Water sources and "re" sources and potential losses: south Florida's diminishing freshwater future. *Partnering with Water and Sewer Agencies: The Key to Future Development* , Lormen Educational Services, Eau Claire, WI, p. 491-504.

Wanless, H.R., Leatherman, S., and Committee. Statement on Sea Level Rise in the Coming Century. Science and Technology Committee, Miami-Dade County Climate Change Task Force. September 20, 2007; revised with full citations and notes, January 18, 2008.

2008 Dravis, J.J., and Wanless, H.R. Caicos Platform models of Quaternary carbonate deposition controlled by stronger easterly Trade Winds – applications to petroleum exploration. American Association of Petroleum Geologists Annual Convention and Exhibition, Abstracts Volume, San Antonio, TX, P. 47.

Van Ee, N., and Wanless, H.R. Ooids and grapestone – a significant source of carbonate mud. American Association of Petroleum Geologists Annual Convention and Exhibition, Abstracts Volume, San Antonio, TX, P. 205.

Wanless, H.R., and Smith, L., How N.H. Voters Can Help Save Florida. *The Keene Sentinel*, P. 6, January 3, 2008.

Wanless, H.R. Role of Storms and Prevailing Energy in Defining Sediment Body Geometry, composition and texture from Caicos Platform. American Association of Petroleum Geologists Annual Convention and Exhibition, Abstracts Volume, San Antonio, TX, P. 211.

Wanless, H.R. Pleistocene reefal and oolitic core sequences from West Caicos, Caicos Platform. American Association of Petroleum Geologists Annual Convention and Exhibition, Abstracts Volume, San Antonio, TX, P. 211.

2009 Wanless, H.R. Sea Level Rise on the Southern Florida Coast: Past, Present, and Future Trends. Rethinking Protected Areas in a Changing World, The 2009 George Wright Society Biennial Conference on Parks, Protected Areas, and Cultural Sites, Program and Abstracts. Portland, Oregon. P. 60.

2010 Wanless, H.R., and Harlem, P. Accelerating sea level rise – projections and implications. 2010 Geological Society of America Annual Meeting and Exposition; Abstracts with Programs, p. 489.

2011 Wanless, H.R., and Harlem, P. Accelerating sea level rise – projections and implications. Sea Level Rise Adaptation in the Florida Keys: Conserving Terrestrial and Intertidal Natural Areas and Native Species. May 10th – 12th, 2011, Hawks Cay Resort, Florida Keys

2012 Wanless, H.R. Carbonate Depositional Systems in the Context of Previous, Current, and Anticipated Global Change, in Gerace Symposium on Rapid Pulses of Sea Level Rise and Their Effect on Past, Present, and Future Coastal Environments and Sequences. 2 page Abstract in Abstract Volume.

Wanless, H.R. Pulses of Rapid Sea Level Rise: Their Effect on Past, Present and Future Coastal Environments and Sequences. Invited presentation in session on 'Rapid Sea Level Rise and Its Impacts: Past, Present and Future.' Geological Society of America Annual National Meeting and Exposition Abstracts with Programs, Vol. 44. No. 7, p 53.

"Role of Storms, Oceanic Swells, Prevailing Energy and Sea Level in Defining Sediment Body Geometry, Composition and Texture on Caicos Platform, Turks and Caicos Islands." Keynote Presentation in session on 'New Insights on the Geology, Karst, and Paleontology of Carbonate Systems of the Bahamian Archipelago.' Geological Society of America Annual National Meeting and Exposition Abstracts with Programs, Vol. 44. No. 7, p 67.

2013 "Pulses of Rapid Sea Level Rise – Past, Present and Future", Penrose/Chapman Conference on Coastal Processes and Environments Under Sea-Level Rise and Changing Climate: Science to Inform Management, jointly sponsored by the Geological Society of America and the American Geophysical Union. Abstracts. Galveston, TX. April 15-19, 2013.

"Need for Orderly Planning for Barrier Island Inundation", in Session 107, The Sandy Beaches of Atlantis: Success Stories and Cautionary Tales for Coastal Development. Geological Society of America Annual National Meeting and Exposition Abstracts with Programs, Vol. 45. No. 7, p 273.

2014 "The Coming Reality of Sea Level Rise: Too Fast Too Soon", Illustrated Abstract for National League of Cities Conference. September 20, 2014.

"The Coming Reality of Sea Level Rise: Too Fast Too Soon", Illustrated Abstract for Best Practices Conference, Miami-Dade County League of Cities, Miami, FL. October 24, 2014.

2015 "Thriving *Acropora* in Caicos – a Refugia?" Invited presentation GSA 193-11in session T148 on.' Geological Society of America Annual National Meeting and Exposition Abstracts with Programs, Baltimore, MD, Vol. 47, No. 7, p. 489-490.

"The Coming Reality of Sea Level Rise: Too Fast Too Soon." A 4-10 page illustrated summary of the seriousness and urgency of climate change and sea level rise; revised and updated monthly and provided at all my invited lectures, interviews and other events.

2016 "The Coming Reality of Sea Level Rise: Too Fast Too Soon." A 4-10 page illustrated summary of the seriousness and urgency of climate change and sea level rise; revised and updated monthly and provided as handout at all my invited lectures, interviews and other events.

"Anaerobic Bottom Waters Need Not Be Deep." Geological Society of America Annual National Meeting, Abstracts with Programs V. 48, No. 7. Session T296. Carbonate Sediments Session. Paper 12. https://gsa.confex.com/gsa/2016AM/webprogram/Paper283809.html

2017 "The Coming Reality of Sea Level Rise: Too Fast Too Soon." A 10-12 page illustrated summary of the seriousness and urgency of climate change and sea level rise; revised and updated for each lecture/event and provided as handout at all my invited lectures, interviews and other events.

Book Reviews:

1980 The North-West European Shelf Seas: The Sea Bed and the Sea in Motion. I. Geology and Sedimentology. (F.T. Banner, and M.B. Collins, and K.S. Massie, Eds.), Bull. Mar. Sci., 30(3): 746.

1981 Barrier Islands from the Gulf of St. Lawrence to the Gulf of Mexico. (S.P. Leatherman, Ed.), Academic Press, New York.

1983 "Tempestites", review of Cyclic and Event Stratification, 1980, G. Einsele and A. Seilacher, Eds., Science, v. 220, #4564: 296-297.

1987 An Introduction to Carbonate Sediments and Rocks (Terence P. Scoffin), Bull. Mar. Sci. 41(3): 909-910.

19. **Other Works Accepted for Publication:**

Refereed Articles Accepted and in Press:

Tedesco, L.P., and Wanless, H.R. Fabric selective dolomitization and porosity enhancement in fine-grained shelf and bank facies. Proceedings of the International Symposium on the Exploration and Development of Low Permeability Oil and Gas Reservoirs, Xian, China [12 msp, 12 figs.; in English and Chinese].

Wanless, H.R. Porosity and permeability destruction and enhancement in limestones during burial and tectonic stresses. Proceedings of the International Symposium on the Exploration and Development of Low Permeability Oil and Gas Reservoirs, Xian, China [19 msp., 15 figs.; in English and Chinese].

PROFESSIONAL

20. **Funded Research Performed**, H.R. Wanless, Principal Investigator. (Since 1978):

Role and Record of Storms on Sedimentation in Subtropical Lagoons, National Science Foundation (Geology), 1978-1980.

Pressure Solution and Dolomitization, National Science Foundation (Geology), 1978-1980.

Sedimentation History of Loxahatchee River Estuary, Florida. U.S.G.S., 1981-1982.

Sources and Circulation of Turbidity in Biscayne Bay, Florida. Dade County, 1982-1984.

Sources and Circulation of Turbidity in Biscayne Bay, Florida. Sea Grant, 1982-1984.

Limestone Diagenesis and Porosity Modification Associated with Exposure Surfaces: Influence of Climate, Depositional Fabric and Topography, Exxon Production Research Co., Tenneco Oil Co., and Union Oil of California, 1985-1986.

Effect of Hurricane Kate on Carbonate Sedimentation, Caicos Platform, B.W.I. National Science Foundation (Surficial Processes) 1986.

Carbonate Mud Mound Facies Evolution. Champlain Oil, 1987.

Carbonate Facies on Caicos Platform. Union Oil of Calif., and ARCO, 1987, 1988 and 1989.

Facies Generation, Transformation and Destruction by Repetitive Excavation and Infilling of Burrow Networks, National Science Foundation, 1990-1991.

Carbonate Facies and Shallow Seismic Signature on Caicos Platform. Texaco, BP and UNICAL, 1991.

Dynamics and Historical Evolution of the Mangrove/Marsh Fringe, Southwest Florida, in Response to Sea-level History, Biogenic Processes, Storm Influences, and Climatic Fluctuations. Department of Interior, National Park Service, June, 1992 to June, 1996.

Post-Hurricane Sediment Redistribution and Benthic Community Response and Evolution within Bicayne Bay, the Coral Reef Platform and the Southwest Florida Coast. Department of Interior, National Park Service, November 1993 to October 1996.

Sediment Dynamics and Substrate Characterization Legare Anchorage, Mid-Reef-Tract Shelf, Biscayne National Park. National Park Service, April 1995 to December 1995.

Historical Changes in the Coastal and Shallow Marine Environments in and Proximal to Florida Bay, Florida: a Retrospective analysis using sedimentologic parameters. Department of Commerce, National Oceanic and Atmospheric Administration, April 1994 to June 2001.

Project SUCCEED: School University Community Coalition for Excellence in Education. Co-geology leader, working with members of Biology, Chemistry and Physics to develop an integrated curriculum for middle school science and for undergraduate education majors. U.S. Department of Education (5 years: 2000-2004; discontinued participation 2002)

Experimental coral/coralline algae transplanting on carbonate banks in Biscayne Bay. Oil Spill Research Fund, subcontract of sea grass planting program (April 2001-April 2002).

"Coastal landscape, wetland and tidal channel evolution affecting critical habitats of Cape Sable, Everglades National Park, Florida." National Park Service, August 2002-June 2005.

"Detection, Mapping, and Characterization of Groundwater Discharges to Biscayne Bay" State of Florida, Biscayne Bay Regional Restoration Coordination Team, as sub-contract with National Oceanic and Atmospheric Administration through CIMAS. With Dr. John R. Proni, NOAA, AMOL. March 2003- December 2004

21. **Editorial Responsibilities:**

Reviewer for numerous journals.

Co-Chair Biscayne Bay Initiative Science Survey Team, responsible for preparation of

Synthesis, critical issues and recommendation to the Florida Legislature, 1999-2001.

Invited member of Core Group for evaluating and prioritizing research and monitoring research (RECOVER) associated with the Comprehensive Everglades Restoration Plan 2004-2005.

National Science Foundation Panel on the Coastal SEES Program (SEES a new program within NSF's "Science, Engineering and Education for Sustainability." – 2012 - 2015.

22. **Professional and Honorary Organizations:**

Society of Economic Paleontologists and Mineralogists
International Association of Sedimentologists
Gulf Coast Section; Society of Economic Paleontologists and Mineralogists
Geological Society of America, elected Fellow
American Association of Petroleum Geologists
Board of Directors: The Conservancy, Inc. (Collier County) (1983-1987)
Miami Geological Society
Board of Directors, CLEO Institute, Miami, (2011-present)

23. **Honors and Awards:**

1976 American Association of Petroleum Geologists General Chairman's Award for Best Paper in Poster Session at 61st Annual Meeting in New Orleans.

1980 Best paper for 1979 in Journal of Sedimentary Petrology. ("Limestone Response to Stress: Pressure Solution and Dolomitization") from the Society of Economic Paleontologists and Mineralogists. Presented at May 1981, San Francisco Mtg.

1986 Society of Economic Paleontologists Mineralogists Excellence of Presentation: AAPG-SEPM Annual National Meeting, Atlanta. "Burrow-Generated False Facies and Phantom Sequences." Presented at June 1987, Los Angeles Mtg.

1993 Awarded Undergraduate Course Enhancement Grant, College of Arts and Sciences, University of Miami.

2001 Earth Trustee, Presented at the United Nations by the Earth Society, March 21, 2001.

2002 Environmental Leadership Award for 2001, Sierra Club, Miami Group.

2004 Honorary Member Board of Directors, Montgomery Botanical Center, Miami-Dade County.

2007 Sabbatical, Spring 2007 – College of Arts and Sciences, University of Miami.

2010-2013 Cooper Fellow, College of Arts and Sciences, University of Miami.

2011. Named by Poder Hispanic Magazine as one of the 100 Most Influential Persons in Miami.

2012. Named by Poder Hispanic Magazine as one of The Most Influential People in Miami.

Keynote Speaker and honoree at Gerace Geology Symposium, San Salvador, Bahamas, June, 2012.

Keynote Speaker at Bahamian Symposium, Geological Society of America Annual National Meeting, Charlotte, NC, November, 2012.

Inducted into CLEO Leadership Circle, CLEO Institute (Department of Geological Sciences also received award for Sponsoring 'Empowering Capable Climate Communicators' climate training series), December, 2012.

2013 Written up as a "Gables Great" in an article entitled 'Dr. Hal Wanless Easily Mixes Science and Fun' in ***Coral Gables News***, January 8-12, 2013.

2015 "Founders Award." Earth Web Foundation, Orlando, Earth Day 2015 (April 18).

2016 Featured in "10 by 10" in ***Malibu Magazine***, April 2016.

Named one of ***Politico Magazine's*** 50 plus 'thinkers, doers and visionaries who are transforming American Politics in 2016.'

Lifetime Achievement Award for leadership work with youth and climate change, Adams Foundation.

24. **Post-Doctoral fellowships:** NONE

25a. **Other Professional Activities - Invited Lectures** (see #18 for papers presented at scientific meetings and symposiums):

1981 Sediment Diagenesis, a NATO Advanced Study Institute at Reading University, U.K., 12-25 July, 1981. Specific Topic: "Late Stage Diagenesis in Carbonates".

"Dynamics of Carbonate Sedimentation in Florida Bay". Invited lecture at Univ. of South Florida, October, 1981.

1982 "Modern Carbonate Sedimentation and Early Diagenesis". Invited lecture and field study, University of Kansas, March, 1982.

"Sea Level Rise: Evidence and Implications". TV Channel 17, Miami, March, 1982.

"Sea Level Rise: Evidence and Implications". Invited Lecturer at Florida Department of Environmental Regulation, Tallahassee, Florida, March, 1982.

"How Biscayne Bay Works". Invited Lecturer and Techn. Coordinator, October, 1982, RSMAS and Dade County sponsor.

1983 Invited Lecture series, University of Tubingen, West Germany, I. "Pressure Dissolution"; II. "Facies Reconstruction of the Cambrian of Grand Canyon", November, 1983.

"Styles of Pressure Dissolution", Abu Dhabi Reservoir Research Foundation, Abu Dhabi, U.A.E., November, 1983.

1984 "Understanding and Managing Florida's Estuaries", Keynote speaker at St. Lucie Estuary Coordinating Conference, Jensen Beach, Fl., March, 1984.

"Biscayne Bay Problems and Solutions". Baynanza Symposium RSMAS, October, 1984.

1985 "Environmental Implications of Sea Level Rise". The Conservancy, January, 1985.

1986 "Storm Sedimentation and Burrow Dynamics". Department of Geology, Cambridge University, February, 1986.

"Coastal Dynamics and Trends: A Necessary Background for Beach and Shore Management". Keynote speaker, 1986 Coastal Management Conference-Florida's Coastal Future: The Challenge Remains. State of Florida. Department of Environmental Regulation, Miami Beach, September, 1986.

"The Geology of Hurricanes", Distinguished Lecture Series, in celebration of the 60th Anniversary of the University of Miami, October, 1986.

"Hurricanes and Sea Level Rise; Effect on Coastal Environments", Fairchild Tropical Gardens, Annual Mtg. Native Plant Society, October, 1986.

"Influence of Sea Level Rise on Coastal Mangrove Communities", Naples City Council, December, 1986.

1987 "Biogenic Facies Destruction, Modification and Generation", Champlain Oil Co., Denver, June, 1987.

1988 "Will Our Rising Sea Level Cause Disaster in South Florida?" American Littoral Society, South Florida Chapter, Key Biscayne, Florida, March 1988.

Evolution of Coastal Environments in Response to Increased Rate of Sea Level Rise", Admirals of the Fleet of Florida, October, 1988.

"The Role of Excavating Burrowers in Generating, Transforming and Destroying Sedimentary Facies", Kansas Geological Survey and University of Kansas, October, 1988.

1990 Invited Lecture series, National Taiwan University, Taipei, Republic of China, I. "New Models of Carbonate Platform Sedimentation"; II. "Burrow Generation and Modification of Sedimentary Facies", March, 1990.

Invited Lectures series, East China Petroleum University of Beijing, Peoples Republic of China, I. "New Models of Carbonate Platform Sedimentations"; II. "New Models of Ooid Sedimentation"; III. "Carbonate Reefs and Leeward Margin Evolution"; IV. "New Models of Carbonate Tidal Flat Sedimentation"; V. "Seagrass/Crinoid Influence on Sedimentation"; VI. "Origin and Growth of Modern Carbonate Mud Mounds"; VII. "Porosity Evolution During Karst and Calcrete Development"; VIII. "Holocene Evaperite and Dolomite Sedimentation"; IX. "Cambrian Cyclic Sedimentation"; X. "Pressure Dissolution and Dolomitization in Carbonate Rocks", April, 1990.

"New Models of Carbonate Platform Sedimentation", Chengdu College of Geology, Chengdu, Sichian, Peoples Republic of China, April, 1990.

Invited Lectures series, Changying Petroleum Exploration Gen. Co. of China National Petroleum Corp., Qinayang, Gansu, Peoples Republic of China; I. "New Models for Ooid Sedimentation"; II. "Reefs and Leeward Margin Evolutions"; III. "Carbonate Tidal Flat and Evaperite sedimentation and Holocene Dolomitization"; IV. "Origin and Facies Development of Modern Carbonate Mud Mounds"; V. "Porosity Evolution During Karst and Calcrete Development"; VI. "Pressure Dissolution and Dolomitization in Carbonate rocks", April, 1990.

Invited Lectures series, East China Petroleum University at Dangyang, Shengdong, Peoples Republic of China, I. "New Models of Ooid Sedimentation"; II. "Reefs and Leeward Margins Evolution of Carbonate Platforms"; III. "Carbonate Tidal Flat Sedimentation"; IV. "Origin and Facies Development of Modern Carbonate Mud Mounds"; V. "Pressure Dissolution and Dolomitization in Carbonate Rocks", April, 1990.

"Observations of Changing Sea Levels and Storms on Coastal Environments", Astronaut Office Colloquium on Earth: a Changing Planet, Johnson Space Center, Houston, Texas, July 25, 1990

"New Models of Carbonate Platform Sedimentation". Royal Dutch Shell, Den Hague, The Netherlands, August 1990.

"New Models of Carbonate Platform Sedimentation". British Petroleum, London, August, 1990.

"Biscayne Bay's Response to Urbanization and Rising Sea Level", Baynanza 90 and Sierra Club, Miami, FL, Oct., 1990.

"Sea Level and Hurricanes: Their Effects on Our Coastal Environments". RSMAS School Council Staff Seminar Series, December, 1990

1991 "Porosity and Permeability destruction and Enhancement in Limestones during Burial and Tectonic Stresses." International Symposium on the Exploration and Development of Low Permeability Oil and Gas Reservoirs, Xian, China, May, 1991.

"Differentiating Porosity Development Resulting from Karst Versus Late-stage burial Dissolution in Limestones", Changying Petroleum Exploration Co. of China National Petroleum Corp., Qinayang, Gansu, China, June, 1991.

"Origin and Evolution of Holocene Sedimentary Environments in Florida Bay". Indiana University Purdue University at Indianapolis, Indiana, November, 1991.

1992 "Plio-Pleistocene stratigraphy of Caicos Platform based on high-resolution Seismic profiles and core borings." Texaco Research and Exploration, Houston, February, 1992.

"Recommendations for the Future Management of Key Biscayne's Beaches and Coastline," Village of Key Biscayne Public Lecture Series in Conjunction With Master Plan Development, April 1992.

"Hurricane Andrew: the Geological Implications." Special evening symposium at the 1992 Annual Meeting of the Geological Society of America, Cincinnati. Organizer and one of four speakers.

"Physical and Biological Effects of Hurricane Andrew: a Summary. Hurricane Andrew Session of the 1992 Symposium on Florida Keys Regional Ecosystem. NOAA and University of Miami, RSMAS Conveners, Miami, November, 1992.

1993 "Hurricane Andrew: the Short and Long Term Impacts." Sigma XI Lecture series, Tallahassee, April 1993.

1994 "The Impact of Hurricane Andrew on the Terrestrial, Wetland, Coastal and Shallow Marine Environments of Florida" Environmental Lecture Series, The Conservancy, Inc., Naples, FL; February, 1994.

"Sea Level Rise and Mangrove Forests" Department of Environmental Protection Coastal Zone Resource Management Workshop, Rookery Bay National Estuarine Research Reserve, Naples, FL; February, 1994.

1995 "Coastal changes resulting form Hurricanes and Global Warming" NOVA University, September, 1995

"Geology of Western Cuba" Miami Geological Society, September, 1995.

“How Hurricanes and Sea-Level Rise Are Changing Our Coastal Environments” Science Expo ‘95, Univ. Miami, September, 1995.

1996 “Land from the Sea: the Geological Origins of south Florida;” Lecture #2 of the Miami Centennial Celebration Lecture Series, January, 1996.

Past and Future Sea-Level Rise.

1997 "The Geologic Wonders of Newfoundland," Miami Geological Society, February, 1997.

"Hurricanes and Sea-Level Rise: Effectors of Coastal Evolution," Florida Tech, Melbourne, FL, February, 1997.

"Anticipated Sea Level Change and Effects" and Panelist at 'Impacts of Climate Change in South Florida's Growing Urban Area' a regional teleconference in conjunction with 'President Clinton Speaks Out on Climate Change', Florida international University, October, 1997.

"Beach Dynamics and Coastal response to Sea Level Rise an Hurricane Events," Rookery Bay National Estuarine Research Reserve, November, 1997

1998 "Geological History, Evolution of Modern Environments and Processes Controlling the Coastal Systems of Southwest Florida". A lecture and field seminar for Faculty of the Keck Consortium of Undergraduate Geoscience Departments. Naples, FL January 7-10, 1998.

"Mud Banks of South Florida: Stratification Type and the Contained Paleoenvironmental Record." Workshop on Paleoecology and Ecosystem History of Florida Bay and the Lower Everglades. Sponsored by the Florida bay Program Management Committee, Key Largo, January, 1998.

"A Summary and Perspective on What We Know and need to Know" Workshop on Paleoecology and Ecosystem History of Florida Bay and the Lower Everglades. Sponsored by the Florida Bay Program Management Committee, Key Largo, January, 1998.

(poster) Stratification types of Florida Bay. Workshop on Paleoecology and Ecosystem History pf Florida Bay and the Lower Everglades. Sponsored by the Florida bay Program Management Committee, Key Largo, January, 1998.

"Natural and Geological Wonders of Newfoundland." Miami Geological Society, February 28, 1998.

"Geological Influences on the Big Cypress Basin." Workshop II of the Big Cypress Basin Science Plan Steering Committee, Department of Environmental Protection. February 26, 1998.

"The Impact on Florida of Global Warming." 1st Orlando Earth Day Symposium, sponsored by Orange County Medical Society Environmental Committee., Orlando Regional Medical Center, April 25, 1998.

1999 "The Geologic Dynamics of Everglades National Park." Everglades National Park Interpreter's Training Workshop. January, 1999.

"Life as a Geoscientist." Centennial Middle School, Miami-Dade County, April, 1999.

"The Future of South Florida." Friends of the Everglades, April 1999

"South Florida in the Face Of Global Warming." Miami Marine Council. Coral Gables, FL, May, 1999.

"Sea Level Rise Adaptation Options for South Florida." Environmmental Protection Agency Conference: *Climate Change: What Does It Mean for South Florida?* Miami, FL, May 26, 1999.

"Sea Level Rise Adaptation for the Florida Keys." Environmental Protection Agency Conference: *Climate Change: What Does It Mean for the Florida Keys?* Marathon, FL, May 27, 1999.

"Harold Rollin Wanless – a Son's View." 8th International Carboniferous Congress, Session on Cyclothems dedicated to Harold R. Wanless. Calgary, Alberta, Canada, August 18, 1999.

"The origin and dynamics of intertidal sand and mud flats." Rookery Bay National Marine Estuarine Reserve Conference on biodiversity of intertidal environments, Naples, FL, November 1999

"South Florida Environments in the Face of Rising Sea Level." Sierra Club, Miami Chapter, Coral Gables, FL, November, 1999.

2000 "South Florida-- the Next 100 Years." South Florida Audubon Society, January, 2000

"Evolution of Biscayne Bay -- Past and Future." Biscayne Bay Partnership Initiative, Science Survey Team Working Session, Miami, FL, January 28, 2000

2001 "Aquifer Storage and Recovery: lessons from failing injection wells." Everglades Coalition Annual Meeting invited breakfast speaker, Stewart, Fl. January 2001.

"The Evolution of the Florida Keys and Reefs over the next 100 years in the face of global warming." John Pennecamp State Park, Key Largo, Fl. February 2001

The Risk of Injection Wells and impure ASRs." LEAF meeting on Aquifer Storage and Recovery, Winter Park, Fl. May 2001.

"You're a Scientist Now – Don't Believe a Word You Hear." INQUIRY, University of Miami, November, 2001.

"The Risks to South Florida over the next 100 Years from Global Warming: Need for Council Action." South Florida Regional Planning Council, Hollywood, Fl. December 3, 2001

"The Risks to South Florida over the next 100 Years from Global Warming: need for Coalition Action." Florida Gold Coast Clean Cities Coalition meeting, Hollywood, Fl. December 3, 2001.

2002 "Aquifer Storage and Recovery" – a panel on questions and feasibility. The Everglades Coalition annual meeting, Ft. Lauderdale, Fl., January 2002.

"Biscayne Bay in the Face of Global Warming" National Park Service Discovery Series Lectures, Miami, FL, April 2002.

Wanless, H.R. "Sediment Stability in Tropical Carbonate and Organic Environments". U.S. Army Corps of Engineers sponsored *Sediment Stability Workshop*, New Orleans, LA, Jan 22-24, 2002. (Invited presenter and panelist)

Wanless, H.R., "An Evaluation of Cape Sable Canals, Everglades National Park, Florida." Invited presentation to Superintendent and staff, Everglades National Park, October, 2002.

Wanless, H.R., "Rapid Ecosystem and Coastscape Evolution of South Florida, in response to Sea Level Rise, Hurricane Events, and Human Stresses", National Oceanic and Atmospheric

Administration, National Ocean Service, Coastal Oceans Division. Rockville, MD, (with synchronous feed to regional centers), October 2002.

Wanless, H.R., "The Nature of Transgression: Cape Sable, Florida." Geological Society of America Annual National Meeting, Denver, October, 2002

2003 "Inundation of South Florida: Past, Present and Future." Invited paper at 13th South West Florida Water Research Conference: The Rising Tide: Emerging Coastal Issues, Gulf Coast University, November 2003.

"Aquifer Injection and Storage Wells – Opportunity or Disaster?" invited paper at the National Groundwater Association meeting: Groundwater in Coastal Zones, Availability, Sustainability and Protection, Orlando, December, 2003.

2005 South Florida Coastal Response to anticipated Sea level Rise" invited presenter and panelist, Everglades Coalition Annual Meeting, Naples, January, 2005.

"With Global Warming – Comes the Sea" invited lecturer and panelist, 11th Annual Public interest and Environmental Conference, University of Florida, Gainesville, FL, February, 2005

"Regional Impacts of Climate Change: Hurricanes and Sea Level Rise" and panelist South Florida Parks and Preserves, Climate Friendly Parks Workshop, Environmental Protection Agency and National Park Service. Everglades National Park, Florida, June, 2005

"Welcome to the Tropics: Where the Canadian Rockies Were Made" Canmore Geoscience Museum Open House, Canmore, Alberta, June, 2005.

2006 Climate Change Workshop, Florida Atlantic University, January, 2006.

"Impact of Climate Change on South Florida" on *Topical Currents* on WLRN Radio, January 19. 2006.

"Coastal Systems and Climate Change – It is real – It is Now – Change Your Ways – Change Your Plans" South Florida Association of Environmental Professionals Conference on Global Climate Change: Implications for South Florida's Future, Florida, January 20, 2006.

"The Everglades in the Next 100 Years" and panelist discussing 'Global Warming's Threats to Florida's Everglades, Economy and Way of Life.' Everglades Restoration: Are We Making Progress? Everglades Coalition 21sat Annual Conference, Stuart, FL, January, 2006.

"Providing Water for a Viable Everglades Restoration" and Panelist discussing 'Deep Concern for ASR Wells and Everglades Restoration.' Everglades Restoration: Are We Making Progress? Everglades Coalition 21sat Annual Conference, Stuart, FL, January, 2006.

"Towards Effective Everglades Restoration and south Florida Resource Management" 5th Annual Environmental Ethics Conference, Ft. Lauderdale, Florida, February 17, 2006.

"Beach Renourishment is Becoming an Economic and Environmental Disaster in Florida" Invited workshop with Regional Environmental Protection Agency heads preliminary to a regional workshop and new regulations. Palm Beach, Florida, February 22, 2006.

"How We Know Global Warming is Human Induced and Real" League of Women Voters, Broward County, Florida, February 25, 2006.

"With Warming Comes the Sea – Global Warming's Effect on South Florida", Broward County Audubon Society, Ft. Lauderdale, FL. April 20, 2006.

"We have Made a Mess of Earth and Earth is Responding" Earth Day Miami. Miami, FL April 22, 2006

"Saving America's Wetland's – Alternatives for Action" A presentation to the State of Louisiana'a Governor's office based on recommendation of an international workshop held in April in Louisiana. New Orleans, LA. June 1, 2006.

"Anticipating and Managing Climate Change – a Conservation View", The Nature Conservancy annual Florida Meeting St. Petersburg Beach. September 17, 1006.

"Global Warming and its Implications for Managing South Florida" Broward County Water Advisory Board, Ft. Lauderdale, September 21, 2006

"Global Warming and Coastal Architecture" University of Miami, November 11, 2006

"Anticipating and Managing Global Warming in Florida – A Conservation View", to the Florida Board of Directors, The Nature Conservancy./ November 16, 2006.

2007 "Global Warming: Its Effect on Southeast Florida" VisionBROWARD Leadership Community Forum, Ft. Lauderdale, FL. February 9, 2007

"Rising Sea Level and its Anticipated Effect on Southwest Florida" Gulf Coast Alliance Workshop on Water. Rookery Bay, Naples, FL, February 20, 2007.

"Comes the Sea – Global Warming's Anticipated Effect on South Florida" Miami Rotary Club, Miami, FL, February 22, 2007.

"Comes the Sea – Global Warming and Sea Level in South Florida" Dade Native Plant Society, Fairchild Gardens, September 25, 2007.

"Water Resources and 'Re'Sources and Potential Losses – South Florida's Diminishing Freshwater Future" Legal Symposium - Partnering With Water and Sewer Agencies: The Key to Future Development in Florida, Miami, October 26, 2007.

"Florida's Diminishing Coastal Future" Florida Legislature, Energy and Environmental Council – Symposium on the Science and Economics of Climate Change, Tallahassee, November 6, 2007.

"Florida's Diminishing Coastal Future" Symposium on Global Warming in honor of Dr. Jack Parker, Florida International University, November 29, 2007.

"Florida's Diminishing Coastal Future" South Florida Association of Environmental Professionals, Workshop and Symposium for Wetland Professionals in South Florida, Miami, November 29, 2007.

2008 "Rising Seas: Will the Everglades and Coastal Areas Survive?" Keynote Address, Everglades Coalition Annual Conference, Captiva, FL, January 12, 2008.

"Rising Seas: Will the Everglades and Coastal Areas Survive?" Miami-Dade College, sponsored by Earth and Environmental Ethics Institute, Miami, January 31, 2008.

"Comes the Sea" Global Warming Teach-In, University of Miami, January 31, 2008.

"Rising Seas: Will the Everglades Survive?" Climate Change Discussion/Mini-Workshop, Greater Everglades Ecosystem Restoration, Florida Atlantic University, February 6, 2008.

"Managing the Everglades in a Time of Rapidly Rising Sea Level" State of Florida Legislative Committee on Everglades Restoration, Tallahassee, February 18, 2008.

"Rising Sea Level and Implications for Future Development in Miami-Dade County." Hold The Line Meeting, South Miami, Florida. February 20, 2008.

"Rising Seas: Realities for our South Florida Coastlines." Climate Protection and Greenhouse Gas reduction Workshop for Local Governments, Palm Beach, FL, February 21, 2008.

"Rising Seas: Realities for Our South Florida Coastlines." Kiwanis Club of Coral Gables, FL, March 11, 2008.

"Rising Seas: Realities for the Everglades and Our South Florida Coastlines." Ecosystem Science Seminar, University of Miami, FL, March 19, 2008.

"Sea Level Rise in South Florida." Faiths United for Sustainable Energy (FUSE), Beth Ann Synagogue, Miami Beach, FL, March 31, 2008.

"Comes the Sea: Earth's Changing Coastal Future." Quantum Leap – 1st Annual Meeting of the Climate Group, Miami, FL, April 1, 2008.

"Rising Seas: A Challenge to the Everglades' Survival – Realities and What We Have to Do."

Friends of the Everglades – Founder's Day Celebration, April 13, 2008.

"Key Biscayne – Past, Present and Future." Key Biscayne / RSMAS Lecture Series, Key Biscayne, FL, April 15, 2008.

"Comes the Sea: South Florida in the Face of Global Warming." Friends of Forest Hill Environmental Academy – 8th Annual Nicolas Megrath Dinner, Palm Beach, FL, April 17, 2008.

"Statement on Sea Level in the Coming Century" from the Science Committee of the Miami-Dade County Climate Change Advisory Task Force for the Board of County Commissioners, Miami, FL, April 22, 2008.

"Comes the Sea: Earth's Changing Coastal Future." Scripps Howard Institute on the Environment (a National Workshop for Journalists), Florida Atlantic University, Jupiter Campus, May 12, 2008.

"Implications of Rising Sea Level on Everglades Restoration." American Geophysical Union Annual Meeting, Ft. Lauderdale, FL, May 28, 2008.

"Comes the Sea: Earth's Changing Coastal Future." One-on-one presentation and discussion with Presidential Candidate and U.S. Senator John McCain and Florida Governor Charlie Crist, in the Everglades, FL, June 6, 2008.

"Ocean Effects of Rising Sea Level on Coastal Environments." Florida Wildlife – on the Front Line of Climate Change, Orlando, FL, October 1, 2008.

"Comes the Sea: Earth's Changing Coastal Future." University of Miami URB 201 – Metropolitan Miami, Coral Gables, FL, September 9, 2008.

"Climate Change and Sea Level Rise – Impacts on Florida in the Coming Century." Florida Shore and Beach Preservation Association Annual Meeting, Captiva Island, FL, September 12, 2008.

"Ocean Effects of Rising Sea Level on Coastal Environments – Biscayne Bay." Miami, FL, October 10, 2008.

"In Future of the Environment and the Nation: A Forum on Sustainability." A Dialogue for Democracy, University of Miami, Coral Gables, FL, October 22, 2008.

"Ocean Effects of Rising Sea Level on Coastal Environments." University of Miami Oceans and Human Health Graduate Course, RSMAS, Miami, FL, November 3, 2008.

"Rising Seas: Realities for the Southwest Coast of Florida." A Sustainable Southwest Florida: Creating a vision. Ft. Myers, FL, November 6, 2008.

"Rising Seas: Realities for the Coming Century." University of Miami ECS201 (Contemporary Environmental Issues), Coral Gables, FL, November 13, 2008.

"Rising Seas: Coastal Realities for the Coming Century." University of Miami, RSM-581 (Carbon and Climate), Virginia Key, FL, November 21, 2008.

"South Florida and Global Warming." Miami-Dade County League of Cities Dinner Meeting, Miami, FL, December 3, 2008.

2009 "Climate Change and Sea Level Rise – The Coming Century." Broward County Climate Change Task Force, Ft. Lauderdale, Florida. January 22, 2009.

"Effects of Rising Sea Level on the Florida Keys and Reef Tract." Federal Regional Management Meeting. Marathon, Florida. January 27, 2009.

"Climate Change and Sea Level Rise – the Coming Century." Gumbo Limbo Eco Center Evening Lecture Series, Boca Raton, Florida. January 27, 2009.

"Climate Change and Sea Level Rise – the Coming Century." Miami-Dade College, Kendall Campus, Miami, Florida. February 5, 2009.

"Climate Change and Sea Level Rise – the Coming Century." Space Coast Climate Change Initiative, Melbourne, Florida. February 9, 2009.

Climate and Ecosystem workshop, invited panelist. Washington D. C. February 17-19, 2009.

Beach Restoration Panelist. Ocean Awareness Week. University of Miami, Coral Gables, Florida. February 24, 2009.

"Sea Level Rise on the Southern Florida Coast: Past, Present, and Future Trends." In Session: Navigating Terra Incognita: New Management Strategies in an Era of Climate Change II • Confronting Climate Change in Everglades and South Florida. Rethinking Protected Areas in a Changing World, The 2009 George Wright Society Biennial Conference on Parks, Protected Areas, and Cultural Sites, Program and Abstracts. Portland, Oregon. March 3, 2009, P. 60.

"Climate Change and Sea Level Rise – the Coming Century." EPH 541, Environmental Health, University of Miami Medical School, Miami, Florida. March 24, 2009.

"Effects of Sea Level Rise in South Florida in the Coming Century." The Impact of Climate Change on South Florida. Florida Atlantic University. April 3, 2009.

"Climate Change and Sea Level Rise – the Coming Century." Gateway To Green Symposium, Parrot Jungle venue, Miami, Florida. April 8, 2009.

"Climate Change and Sea Level Rise – the Coming Century." City of Plantation Climate Change Task Force, Plantation, Florida. April 15, 2009.

"Climate Change and Sea Level Rise – the Coming Century." Broward County Directors and Managers Quarterly Meeting, Ft. Lauderdale, Florida. April 17, 2009

"The Influence of Sea Level Change on Florida's Ecology." Florida Native Plant Society, 29th Annual Conference. West Palm Beach, Florida. May 23, 2009

"Rising Sea Level and Florida's Tenuous Future." PCB 3352 – Issues in Human Ecology with a focus on South Florida. Florida Atlantic University, Davie Campus, Florida. October 5, 2009.

"Accelerating Predictions for Rising Sea Level: Florida's Tenuous Future." Southeast Coastal and Ocean Stewardship Workshop: Challenges in a Changing Environment. Mandarin Oriental Hotel, Miami, Florida. November 2, 2009.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Oxbow Eco-Center Lecture Series. Port St. Lucie, Florida. November 7, 2009.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Executive Committee, South Florida Builders Association. Miami-Dade Water and Sewer building, Miami, Florida. November 12, 2009.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Harbor Branch Evening Lecture Series, Ft. Pierce, Florida. November 18, 2009.

"Coral Gables, A Jewel From the Sea – Will It Return?" Coral Gables Museum, Coral Gables, Florida. November 7, 2009.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Managing Climate Change with Sustainable Initiatives. Lee County, Florida. December 4, 2009.

"Be Bold or Start Packing up the Shop – Recommendation to move the Mississippi River Outlet from the Scientists of the 'Envisioning the Future of the Gulf Coast Workshop." White House Council on Environmental Quality, Washington D.C., December 1, 2009.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Florida Natural Resources Leadership Institute. Preparing for Sea Level Rise: Local Government Planning and Community Management, Deauville Hotel, Miami Beach, Florida, December 10, 2009.

2010 "Sea Level Rise and the Everglades Through the Century: the Need for More Proactive Management of the Everglades." Global Climate Change and the Changing Role of Everglades Restoration. Everglades Coalition Conference, Palm Beach Gardens, Florida. January 8, 2010.

"Rapid Sea Level Rise Steps Are the Norm in Post-glacial Rise." Predicting Climate of the Coming Decades: Paleo-perspective on decadal variability. Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, Florida. January 13, 2010.

"Capstone Address - Summary of Challenges and Opportunities." Keeping out Heads Above Water: Surviving the Challenges of Sea Level Rise in Florida. Archbold Biological Station, Lake Placid, Florida. January 13, 2010.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future". Dagny Johnson Key Largo Hammock Botanical State Park Lecture Series, John Pennecamp Coral Reef State Park, Key Largo, Florida, January 27, 2010.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." ECS 310 – Sustainable Living (but maybe not in south Florida. University of Miami, Coral Gables, Florida. January 28, 2010.

"Sea Level Rise in the Coming Century – How Much and How Do We Prepare?" NOAA sponsored Community Conversations on Climate Change and Sea Level Rise, Ft. Lauderdale, Florida. February 27, 2010.

"Anticipated Global Warming and Sea Level Rise – What They Mean for Your Career Opportunities?" ULecture Series, University of Miami. April 7, 2010

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." FNS 199 – Global Warming. University of Miami, Coral Gables, Florida. April 13, 2010.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Science Café Series: Eat, Think and be Merry, Bookstore in the Grove, Coconut Grove, Florida, April 19, 2010

"Accelerating Sea Level Rise and Florida's tenuous Coastal Future," University of Florida Everglades conference at FIU North Campus. May 18, 2010

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." US State Department International Visitor Leadership Program, Sustainable Development and Environmental Projections to Chinese Delegation, August 11, 2010.

"Recovery of An *Acropora* Reef Following Hurricane Ike Devastation, SE Caicos Platform." 2nd Annual NCORE University-wide Coral Reef Forum, University of Miami, Virginia Key, Florida. August 23, 2010

"Emergence of Modern reefs and Their Dynamics in Times of Major Sea Level Fluctuations – Past and Future. Graduate Marine Biology and Fisheries course in Reef Systems, RSMAS, University of Miami, August 26, 2010.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." ESC Sustainability program, RSMAS, Coral Gables, Florida. September 13, 2010.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Distinguished Lecturer Series, Florida Atlantic University, September 17, 2010.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Osher Lifelong Learning, University of Miami, Coral Gables, Florida. September 21, 2010.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Lecture Series, RSMAS, University of Miami, Florida. November 10, 2010.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." MSC 220 – Global Climate Change, University of Miami, Coral Gables, Florida. November 23, 2010.

With Peter Harlem: "Accelerating Sea-Level Rise – Projections and Implications. Geotopics, Division of Marine Geology and Geophysics, RSMAS, University of Miami, Florida. November 29, 2010.

2011 "Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." ECS 310 Sustainable Living, University of Miami, Coral Gables, Florida. January 27, 2011.

"Accelerating Sea Level Rise and Earth's Tenuous Coastal Future." Distinguished Lecrure Series, NOVA Southeast University, Ft. Lauderdale, FL, February 8, 2011.

"Accelerating Sea Level Rise and Earth's Tenuous Coastal Future." Distinguished Lecture Series, Indian River State College Institute for Lifelong Learning, Vero Beach, Florida, February 10, 2011.

"Accelerating Sea Level Rise and Earth's Tenuous Coastal Future." Distinguished Lecture Series, Indian River State College Institute for Lifelong Learning, Stuart, Florida, February 10, 2011.

"Accelerating Sea Level Rise and Earth's Tenuous Coastal Future." University of Florida Natural Resources Leadership Institute, Homestead, Florida, February, 11, 2011.

"Accelerating Sea Level Rise and Earth's Tenuous Coastal Future." Graduate course in Global Warming and Environmental Health, Miller School of Medicine, University of Miami, Miami, Florida, February 21, 2011.

"Accelerating Sea Level Rise and Earth's Tenuous Coastal Future." Empowering Capable Climate Communicators Training Series, College of Arts and Sciences, University of Miami, March 5, 2011.

"Accelerating Sea Level Rise: Projections and Implications." Climate Change Professional Fellows Program, Florida International University, March 28, 2011.

"Accelerating Sea Level Rise: Projections and Implications." Climate Change Communication, Florida Atlantic University, Gumbo Limbo Nature Center, April 5, 2011

"Accelerating sea level rise – projections and implications (poster and talk). Sea Level Rise Adaptation in the Florida Keys: Conserving Terrestrial and Intertidal Natural Areas and Native Species. Hawks Cay Resort, Florida Keys. March 11, 2011.

"Rapidly Accelerating Sea Level Rise and Earth's Tenuous Coastal Future." Miami-Dade College, downtown campus, in conjunction with 24-hour presentation on Extreme Events. September 15, 2011.

"Accelerating Sea Level Rise: Projections and Implications." CLEO Institute, Vizcaya. Miami. September 22, 2011.

"Rapidly Accelerating Sea Level Rise and Earth's Tenuous Coastal Future." Florida International University. Miami. October 12,2011.

"Rapid Steps of Sea Level Rise: An Ominous View into the Future." Presentation during Field Trip in conjunction with the Society of Environmental Journalists Annual National Meeting, Emergency Management Center, Miami-Dade County. October 20, 2011.

"Rapid Steps of Sea Level Rise: An Ominous View into the Future." Plenary Presentation and Panelist at Plenary Luncheon of the Society of Environmental Journalists Annual National Meeting, Intercontinental Hotel, Miami. October 22, 2011.

"Rapid Steps of Sea Level Rise: An Ominous View into the Future." CLEO Institute, Pinecrest Gardens, Miami-Dade. November 4, 2011.

"Rapid Pulses of Sea Level Rise." Earth Ethics Institute, Miami Dade College, Kendall Campus. November 29, 2011.

2012 "Accelerating, Pulsed Sea Level Rise: Dire Implications for South Florida. Sustainable Living ECS 310. University of Miami. January 31, 2012.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future." Ecology Club, Palm Beach State College, Boca Raton. February 10, 2012.

"Accelerating Sea Level Rise and Florida's Tenuous Coastal Future," University of South Florida at St Petersburg, Geography Department, April, 2012.

"Sea Level Rise and Climate Change: Your Property Value in the Balance." Friends of the Everglades 43rd annual meeting, Miami. April 15, 2012.

Keynote Speaker: "Carbonate Depositional Systems in the Context of Previous, Current, and Anticipated Global Change," in Gerace Symposium on Rapid Pulses of Sea Level Rise and Their

Effect on Past, Present, and Future Coastal Environments and Sequences, Gerace Research Center, San Salvador, Bahamas, June 14, 2012.

Gulf Coast Science Consortium Invited Workshop and presentation on Evidence for Rapid Steps of Sea level Rise: Past, Present and Future." Shell Center for Sustainability, Rice University, Houston, Texas. June 27-29, 2012.

"Evolution of the Loxahatchee River Estuary: Past–Present–Future." Friends of the Loxahatchee River, Jupiter, Florida. October 5, 2012.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." For Is Miami the Next Atlantis? Community Conversations in the Good Government Initiative, University of Miami, Coral Gables, Florida. October 9, 2012.

"Pulses of Rapid Sea Level Rise: Their Effect on Past, Present and Future Coastal Environments and Sequences." Invited presentation in session on 'Rapid Sea Level Rise and Its Impacts: Past, Present and Future.' Geological Society of America Annual National Meeting, Charlotte, NC. November 4, 2012.

"Role of Storms, Oceanic Swells, Prevailing Energy and Sea Level in Defining Sediment Body Geometry, Composition and Texture on Caicos Platform, Turks and Caicos Islands." Keynote Speaker in session on 'New Insights on the Geology, Karst, and Paleontology of Carbonate Systems of the Bahamian Archipelago.' Geological Society of America Annual National Meeting, Charlotte, NC, November 4, 2012.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." Howard Hughes Medical Institute Holiday Lectures Festival: Changing Planet: Past – Present – Future. University of Miami, Coral Gables, Florida. November 14, 2012

"The Frightening Acceleration in Ice Melt and Sea Level Rise." Howard Hughes Medical Institute Holiday Lectures Festival: Changing Planet: Past – Present – Future. Miami Dade College, Miami, Florida. December 3, 2012.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." Broward County, Climate Change Task Force, Plantation, Florida. December 12, 2012.

2013 "Statement on Anticipated Sea Level Rise." Board of County Commissioners, Miami-Dade County, Miami, Florida. January 10, 2013

"The Frightening Acceleration in Ice Melt and Sea Level Rise." City of Miami Beach Chamber of Commerce, Miami Beach, Florida. January 23, 2013.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." For Environmental History, University of Miami, Coral Gables, Florida. January 24, 2013.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." For ECS 310, Sustainable Living, University of Miami, Coral Gables, Florida. January 24, 2013.

"Dynamics of a Warming Ocean: Changing Ocean Circulation, Changing Currents." For Empowering Capable Climate Communicators 2013 I, University of Miami, Coral Gables, Florida, February 2, 2013.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." For Empowering Capable Climate Communicators 2013 I, University of Miami, Coral Gables, Florida, February 2, 2013.

"Straining the Fiber of Civilization: What We Lose If We Do Nothing." For Empowering Capable Climate Communicators 2013 I, University of Miami, Coral Gables, Florida, February 9, 2013.

"The Cyclic Drivers of Climate change and Sea Level Through Geologic Time." For Empowering Capable Climate Communicators 2013 I, University of Miami, Coral Gables, Florida, February 16, 2013.

"Dynamics of a Warming Ocean: Changing Ocean Circulation, Changing Currents." For Empowering Capable Climate Communicators 2013 I, University of Miami, Coral Gables, Florida, February 16, 2013.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." For Empowering Capable Climate Communicators 2013 I, University of Miami, Coral Gables, Florida, February 16, 2013.

"The Frightening Acceleration of Ice Melt and Sea Level Rise." for Democrats of South Dade County, Miami, Florida. February 19, 2013.

"Straining the Fiber of Civilization: What We Lose If We Do Nothing." For Empowering Capable Climate Communicators 2013 I, University of Miami, Coral Gables, Florida, February 23, 2013.

"Hurricanes and Sea Level Rise – A Deadly Combination." For GSC 107, Natural Disasters: Hollywood Versus Reality. University of Miami, Coral Gables, FL. March 5, 2013

"The Frightening Acceleration in Ice Melt and Sea Level Rise." Oceans and Human Health. Rosenstiel School of Marine and Atmospheric Science, University of Miami. Virginia Key, FL. March 25, 2013.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." Miami Beach 2100 Design Challenge: A Workshop on Sea Level Rise and Planning for resilience, Miami Urban Studies Studios, College of Architecture and the Arts, Florida International University. Miami Beach, FL. March 28, 2013.

"The Frightening Acceleration in Ice Melt and Sea Level Rise." Graduate Climate Education Program, Florida Atlantic University, Boca Raton, FL. April 4, 2013.

"Sea Level Rise and Climate Change: An Update of Dramatic Acceleration." Friends of the Everglades 44th Annual Meeting, Miami. April 14, 2013.

"Pulses of Rapid Sea Level Rise: Past, Present and Future", for Penrose/Chapman Conference: 'Record of Sea-Level Rise', Galveston TX. April 15, 2013.

"Frightening Acceleration in Ice Melt and Sea Level Rise", Rising Seas Summit ACCO, Ft. Lauderdale, FL. June 18, 2013.

"Greenland's Melt will Inundate South Florida", for ECS 310, Sustainable Living, University of Miami. September 3, 2013.

"Greenland's Melt will Inundate South Florida", for CLEO Institute Board Meeting Pinecrest, FL. September 16, 2013.

"Make the Difficult Decisions on Water Resources and Infrastructure with Sea Level Rise", for National League of Cities, Energy, Environment and Natural Resources Steering Committee, Pinecrest, FL. September 20, 2013.

"Frightening Acceleration in Ice Melt and Sea Level Rise", for Graduate Seminar, Department of biology, University of Miami, September 24, 2013.

"The Need for Orderly Planning for Inundation of Barrier Island Inundation", Geological Society of America, Denver, CO. October 28, 2013.

"The Need for Orderly Planning for Inundation of Barrier Islands and Low Coasts", for MSC 220, Climate Changes at UM, University of Miami. November 5, 2013.

"The Need for Orderly Planning for inundation of Barrier Islands and Low Coasts", for High Water Line Miami at University of Miami, November 12, 2013.

"Why is Miami Ranked as the Most Vulnerable City to Climate Change?" for Miami Dade College Climate Change Symposium, Kendall, FL. November 19, 2013.

2014 "Reinforcing Feedbacks Make Future Accelerating Ice Melt and Sea Level Rise Inevitable and Unstoppable", CLEO Institute Climate Training, Coral Gables, FL. January 23, 2014.

"The Need for Orderly Planning for inundation of Barrier Islands and Low Coasts", for ECS 310, Sustainability at UM, University of Miami, Coral Gables, FL. January 28, 2014.

"The Need for Orderly Planning for inundation of Barrier Islands and Low Coasts", 23rd Annual Southwest Florida Water Conference, Florida Gulf Coast University, Ft. Meyers, FL. January 31, 2014.

"What Sea Level Rise Should We Be Planning For?", for Energy, Climate Disruption and Sea Level Rise: New Directions in Law and Policy, Nova Southeastern University, Ft. Lauderdale, FL. February 6, 2014.

"The Need for Orderly Planning for Inundation of Barrier Islands and Low Coasts", for Climate Disruption and Sea Level Rise: New Directions in Law and Policy, Nova Southeastern University, Ft. Lauderdale, FL. February 6, 2014.

"Global Warming is a Warming Ocean", for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 8, 2014

"What Sea Level Rise Should We Be Planning For?" for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 8, 2014.

"The Beach on Key Biscayne: Problems and Solutions", for Condominium Association of Key Biscayne, Beach Club at Ocean Club, Key Biscayne, FL. February 11, 2014.

"Sea Level Rise Might Be Much Faster Than Models Are Predicting", for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 15, 2014.

"The Need for Orderly Planning for Inundation of Barrier Islands and Low Coasts", for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 15, 2014.

"Human-induced Global Warming is Causing An Acceleration in Global Sea Level Rise – This Will Have Serious Consequences for South Florida As The Century Progresses" Miami Beach Chamber of Commerce, Miami Beach, FL, March 16, 2014.

"Climate Briefing – Sea Level Rise Predictions and Possible More Severe Scenarios" Public event sponsored by CLEO Institute, Pinecrest, FL. March 24, 2014.

"This Can't Be Happening with David Lindorff", a one hour one-on-one interview with call in on the reality and rates of global warming, sea-level rise and desertification; nationally broadcast live on PRN, April 9, 2014.

"Oceans: The Future of Water – Coming To A Home Near You Sooner Than You Think." Featured Speaker - 17th Annual Earth Day Symposium, EarthWeb Foundation and Rollins College, Winter Park, FL. April 12, 2014.

"Climate Science Briefing Panel with U.S. Senator Sheldon Whitehouse." Pinecrest FL. April 25, 2014.

"Sea Level Response to Climate Change." Art Marshall Foundation Summer Intern Program, given at University of Miami, FL. June 16, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Florida League of Cities, Pinecrest, FL. August 15, 2014

"The reality of Human-Induced Climate Change." An invited presentation with four other scientists to Florida Governor Rick Scott. The Governor's Office, Tallahassee, FL. August 18, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Pinecrest Rotary Club, FL. August 19, 2014.

"Comes the Sea." Panelist and speaker following climate change movie presentation, Miami Beach Botanical Gardens, Miami Beach, FL. August 20, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Coral Gables Rotary Club, FL. September 4, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." 'BAD' (Boating, Angling and Diving) Group - Coconut Grove Yacht Club, Miami, FL. September 18, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." 'Protecting SE Florida's Oceans and Coastal Heritage', Sierra Club, Hallandale Beach, FL. September 20, 2014.

"Environmental Risks of Sea Level Rise on Miami Beach." EECOMB, Panelist and Speaker following three climate change movies. Miami Beach Botanical Gardens, Miami Beach, FL. September 20, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Coral Gables Women's Club, Coral Gables, FL. October 1, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Stag Night – Biscayne Bay Yacht Club, Miami, FL. October 14, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Best Practices Conference, Miami-Dade county League of Cities, Miami, FL. October 24, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." COSEE Florida: Water as Habtat Science Café, Wynwood (Gramps Bar), FL. October 28, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Presentation to Oxford Brooke's University, School of Architecture students and faculty. Miami, FL. November 3, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change plant life on Earth as the century progresses." University of Miami Arboretum Society, Coral Gables, FL. November 5, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Carl Sagan Day at Broward College, North Campus, Coconut Creek, FL. November 8, 2014.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." MSC 220 – Climate and Global Change, RSMAS, UM. November 20, 2014.

"The Risk We Face from Accelerating Sea Level Rise", CLEO Climate Change Symposium at Vizcaya, Miami, FL Dec. 10, 2014.

2015 "Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Biscayne Bay Regional Restoration Coordination Team, National Park service and NOAA, NOAA Marine Fisheries, Miami, FL January 14, 2015.

"The Risks of Fracking in south Florida." Miami-Dade County Commissioners meeting, Miami. FL. January 20, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Committee for Conservation at Deering Bay, Deering Bay Country Club, FL. January 20, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." ECS 310 – Sustainability, University of Miami. I on January 27 and II on January 29, 2015.

Panel discussing future of Andean Glaciers, following film presentation, ECCOMB, Miami Beach Gardens, Miami Beach, FL. February 6, 2015.

"Global Warming is a Warming Ocean", for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 21, 2015.

"What Sea Level Rise Should We Be Planning For?" for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 21, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Coral Gables Garden Club, Coral Gables, FL. February 23, 2015.

"Sea Level Rise Might Be Much Faster Than Models Are Predicting", for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 28, 2015.

"The Need for Orderly Planning for Inundation," for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 28, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." League of Women Voters of Collier County, Naples, FL. March 19, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Oceans and Human Health, RSMAS, University of Miami. March 24, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Sea Keepers and British Counsel General, RSMAS, University of Miami. April 14, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Keynote Speaker, Earth Web Foundation Annual Meeting, Orlando, FL. April 18, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." College of Arts and Sciences review Committee, University of Miami. April 23, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Southwest Florida Sea level Rise Summit. Florida Gulf Coast University, Ft. Myers, FL. May 7, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Florida Trust Annual conference, Miami, FL. May, 8, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." South Miami Rotary Club, South Miami, FL. May 12, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Western Newfoundland Environmental Program, Woody Point Newfoundland, Canada. June 30, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." ECS 310 – Sustainability. University of Miami. September 8, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Coral Gables Volsky Assembly, Coral Gables, FL. September 22, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." FSS 190 – Miami: Transformations in a Global City, University of Miami. September 22, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." CLEO Teachers Training Event, University of Miami. September 15, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." City of Coral Gables, Commission Chambers, Coral Gables, FL. September 29, 2015. (hour plus presentation posted on Community Television Network).

"The Coming Reality of Sea Level Rise: Too Fast Too Soon." Institute on Science for Global Policy, St. Petersburg College, St. Petersburg, FL. October 2-3, 2015.

"The Coming Reality of Sea Level Rise: Too Fast Too Soon." Speaker, Climate Change Workshop, Village of Pinecrest Council Chambers, FL. October 6, 2015.

"Historical Wetland Community Evolution in the Lower Everglades and Cape Sable." South Florida Water Management District, West Palm Beach, FL. October 29, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." University of Miami Citizen's Board – Lunch and Learn. Miami, FL. November 18, 2015.

"The Coming Reality of Sea Level Rise in New Jersey: Too Fast Too Soon." Institute on Science for Global Policy, Toms River, New Jersey. November 20-21, 2015.

"Changing Influences on South Florida's Beaches." ECS 310 – Sustainability. University of Miami. December 1, 2015.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Brandeis Study Group, Pinecrest, FL. December 1, 2015.

"Historical Wetland Community Evolution in the Lower Everglades and Cape Sable." ECS 310 – Sustainability. University of Miami. December 3, 2015.

"Assessment of Paris COP21.CMP11 Agreements on Sea Level Rise." French Consulate Evening on Global Ties. Center for Social Change, Miami, FL. December 11, 2015.

"Future Sea Level Rise in South Florida." Young Democrats Club. Miami, FL. December 16, 2015.

2016 "Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." South Florida Mensa. Coral Gables, FL. January 5, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Road Scholar, Miami Beach, January 11, February 1, and February 22, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." City of Miami Sea Level Rise Committee, Miami City Hall, Miami, FL. January 11, 2016.

"The Risk of Turkey Point with Sea Level Rise." CLEO Panel, Pinecrest Gardens, FL. January 19, 2016.

"Community Responsibility in the Face of Sea Level Rise." CLEO Institute Community Panel, Pinecrest, FL., January 18, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." ECS 310, Sustainability, University of Miami. January 21 and 26, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Opening Address, Northeast Florida Environmental Summit, Jacksonville, FL., January 25, 2016. See: https://www.youtube.com/watch?v=SooK37SuY_8&feature=youtu.be (7:27-36:06) and https://www.youtube.com/watch?v=aBVhJ4tQyC0&feature=youtu.be (38:38-59:42).

"How Climate Trends Will Impact Storms of the Future: Preparing Today for Later in the Century – King Tides, Storm Surges, Salt Spray and Sea Level Rise – Imminent Threats Now and Growing." Data Driven Outage Restoration for Electric Distribution 2016 Conference, Coconut Grove, FL., January 27, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Talk and Panel. Florida Interfaith Climate Action Network National Assembly, Longwood, FL., January 28-29, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." University of Miami Woman's Guild, University of Miami. February 1, 2016.

"Geologic Evolution of the Everglades from Start to Finish – The Past 5,000 years and the Next 100." Southeastern Geological Society Field Conference on the Everglades. Talk on 12th and Field Guide on 13th. Miami and the Everglades, February 12-13, 2016.

"Global Warming is a Warming Ocean", for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 20, 2016.

"What Sea Level Rise Should We Be Planning For?" for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 20, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Miami Beach as the century progresses." Harvard University Graduate School of Design Conference: 'South Florida and Sea Level – The Case of Miami Beach,' Miami Beach, FL., February 23.

"Sea Level Rise in South Florida," On-air panel with Elizabeth Kolbert of the *New Yorker* on NPR's WLRN *Topical Currents*, 1-2 PM, February 24.

"Sea Level Rise Might Be Much Faster Than Models Are Predicting", for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 27, 2016.

"The Need for Orderly Planning for Inundation," for Empowering Capable Climate Communicators, College of Arts and Sciences, University of Miami. February 27, 2016.

"Comes the Sea. Miami's Vulnerabilities: an Overview. UNESCO World Field Laboratory Symposium on Sea Level Rise and the Future of Coastal Settlements. Miami, FL. March 3, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." URB 301 – Cities in Time and Space. University of Miami. March, 15, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." The Conservancy of Southwest Florida, Naples, Earth Day, April 22, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." Earth Day with Congressional Candidate Ed Emery, Gainesville, FL, April 22, 2016.

"Changing Influences on South Florida's Beaches." University of Miami / Florida International University Architectural symposium on Beach Vulnerability, Miami Beach, May 2, 2016.

Role of Anticipated Sea Level Rise in Urban Planning." Urban Land Trust Focus on Arch Creek. Florida International University Symposium, FIU North Campus, Miami, Florida. May 24, 2016.

"Comes the Sea: Accelerating sea level rise will dramatically change life on Earth as the century progresses." NCGE (National Conference on Geographic Education), Human Geography Teacher Workshop, Keynote Speaker. Tampa, Florida, July 27, 2016.

"Comes the Sea – Miami's Vulnerabilities: an Overview." U.S. State Department International Visitor Leadership Program and Global Ties Miami. Miami, Florida, September 19, 2016.

"Historical Wetland Community Evolution, Collapse, and Migration in the Lower Everglades and Cape Sable. Florida International University Symposium on Wetland Dynamics and Saline Intrusion. Miami, Florida September 29, 2016.

"Comes the Sea - Miami's and the World's Vulnerabilities: an Overview." Villa Regina on Brickell Symposium, Miami, Florida. October 1, 2016.

"Comes the Sea." Symposium on the Current state of our Sea" in conjunction with the Smithsonian "Waterways Exhibit." The Curtiss Mansion, Miami Springs, Florida. October 6, 2016.

"Comes the Sea - Miami's and the World's Vulnerabilities: an Overview." ECS-310 Sustainability. University of Miami, Florida. October 13, 2016.

"Comes the Sea – A: The Reality of Human-Induced Climate Change; B: Causes for and Projections of Sea Level Rise; C: What This Means for Coastal Environments and Cities; and D:

What We Must Do and Opportunities for Our Students." (a 6-hour training presentation) Gulliver Schools Teacher Training Program. October 29, 2016.

"Comes the Sea – Planning for Accelerating Sea Level Rise Through This Century and Beyond." Board of Directors, The Conservancy of Southwest Florida, Naples, Florida. November 1, 2016.

"Planning for significant Sea Level Rise in Pinecrest." Village of Pinecrest Council chambers, Florida. Presentation to Mayor and citizens. November 2, 2016.

"Comes the Sea – Planning for Accelerating Sea Level Rise Through This Century and Beyond." Climate Across the Curriculum CLEO Workshop, University of Miami, Florida. November 12, 2016.

"Comes the Sea." Presentation and panel discussion as part of UM's Citizen U with Joshua Myers. Student Center, University of Miami, Florida. November 16, 2016.

"Comes the Sea – Planning for Accelerating Sea Level Rise Through This Century and Beyond." Keynote Speaker: NAIC (National Association of Insurance Companies) National Meeting: Sea Level Rise Workshop, Fontainebleau Hotel, Miami Beach, Florida. December 10, 2016.

2017 "Comes the Sea – Planning for Accelerating Sea Level Rise Through This Century and Beyond." Keynote Speaker. Now in My Back Yard. Rising Sea Level on the Florida Gulf Coast and What Can Be Done About It. South Seas Resort, Captiva Island, Florida. January 13, 2017.

"The Coming Reality of Sea Level Rise: Too Fast Too Soon – Planning for Accelerating Sea Level Rise Through This Century and Beyond." Florida Oceanographic Foundation Coastal Lecture Series, Blake Library, Stuart, Florida. January 23, 2017.

"Comes the Sea – Planning for Accelerating Sea Level Rise Through This Century and Beyond." Key Biscayne Rotary Club, Key Biscayne Yacht Club, Florida. January 27, 2017.

"Comes the Sea – The Future of south Florida Fishing with Accelerating Sea Level Rise Through This Century and Beyond." Tropical Anglers Club, Miami, Florida. January 31, 2017.

"Comes the Sea – Planning for Accelerating Sea Level Rise Through This Century and Beyond." Green Sanctuary Program: Progressive Voices Speak Out. Unitarian Congregation of Greater Naples, Florida. February 1, 2017.

"Anaerobic Bottom Waters Need Not Be Deep." Geo-Topics at Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, FL. February 6, 2017.

"Introduction," "Natural Climate Changes," "Global Warming is a Warming Ocean," "What Sea Level Rise Should We Be Planning For?" "Mapping Coastal Inundation and Infrastructure Vulnerability; Some Examples from Florida," "Sea Level Rise Will Likely Be Much Faster Than Models Are Predicting," and "The Need for Orderly Planning For Inundation." *Empowering Capable Climate Communicators Training Session.* University of Miami, Coral Gables, Florida. February 11, 2017.

"An introduction to South Florida – Planning for Accelerating Sea Level Rise Through This Century and Beyond. Opening Lecture for Community Resilience Panel. Neumann Alumni Center, University of Miami, March 9, 2017.

"Climate Change and Sea Level Rise in South Florida – Realities, Rates and Needed Responses." Lecture, Discussions, and Field Trip. Young Presidents Group. Ritz Carleton Hotel South Beach, Miami Beach, FL March 29, 2017.

"The Coming Reality of Sea Level Rise: Too Fast, Too Soon." American Institute of CPAs, Government Performance and Accountability Committee (GPAC) Meeting, Florida International University, Miami, FL. April 3, 2017.

"The Coming Reality of Sea Level Rise: Too Fast, Too Soon." Oceans and Human Health Course, Rosenstiel School of Marine and Atmospheric Science, University of Miami, Virginia Key, FL. April 4, 2017.

"The Coming Reality of Sea Level Rise: Planning for Accelerating Sea Level Rise Through This Century and Beyond." Keynote Speaker. Gulf Coast Climate Change Symposium. University of South Florida, Sarasota, Florida. April 18, 2017.

"Comes the Sea: Planning for Accelerating Sea Level Rise Through This Century and Beyond." Sierra Club Earth Day Celebration at Anne Kolb Nature Center, Hollywood, Florida, April 23, 2017.

"Comes the Sea: Planning for Accelerating Sea Level Rise Through This Century and Beyond." Code for Miami, Cambridge Innovation Center, Wynwood, Florida. April 24, 2017.

"Comes the Sea: Planning for Accelerating Sea Level Rise through This Century and Beyond: impact on Design and growth." 2017 SEGD Conference – Experience Miami, Loews Miami Beach, Florida. June 9, 2017.

"Comes the Sea: Planning for Accelerating Sea Level Rise Through This Century and Beyond." Newfoundland Climate Group, Merchant's Warehouse, Woody Point, Newfoundland, July 3, 2017.

"Comes the Sea: Planning for Accelerating Sea Level Rise Through This Century and Beyond." A morning at Burger Bob's, Coral Gables, Florida. August 15, 2017.

"Comes the Sea: Planning for Accelerating Sea Level Rise through This Century and Beyond: impact on Design and growth." Miami-Dade County Urban Development Boundary Expansion Task Force, west Miami-Dade County, Florida. November 17, 2017.

"Water Sources and 'Re' Sources and Potential Losses: South Florida's Challenging Freshwater Future" and "The Coming Reality of Sea Level Rise: Too Fast, Too Soon." The Rivers Coalition, Stuart, Florida. November 29, 2017.

25a. **Other Professional Activities** – **Symposia Organization** (see #18 for papers presented at scientific meetings and symposiums):

"Empowering Capable Climate Communicators" a Cooper Fellow climate training series involving 14 climate scientists and communicator lecturers and panelists for four full Saturdays in the spring of 2011, College of Arts and Sciences, University of Miami. There were 65 participants.

"Empowering Capable Climate Communicators 2012" a Cooper Fellow climate training series involving 14 climate scientists and communicator lecturers and panelists for four full Saturdays in the spring of 2012, College of Arts and Sciences, University of Miami. There were 70 participants.

"Empowering Capable Climate Communicators I 2013" a Cooper Fellow climate training series involving 14 climate scientists and communicator lecturers and panelists for two full Saturdays in the spring of 2013, College of Arts and Sciences, University of Miami. There were 85 participants.

"Empowering Capable Climate Communicators II 2013" a Cooper Fellow climate training series involving 14 climate scientists and communicator lecturers and panelists for two full Saturdays in the spring of 2013, College of Arts and Sciences, University of Miami. There were 120 participants.

"Empowering Capable Climate Communicators 2014" a Cooper Fellow climate training series involving 13 climate scientists and communicator lecturers and panelists for two full Saturdays in the spring of 2014, College of Arts and Sciences, University of Miami. There were 110 participants; February 8 and 15, 2014.

"Empowering Capable Climate Communicators 2015" a Cooper Fellow climate training series involving 13 climate scientists and communicator lecturers and panelists for two full Saturdays in the spring of 2015, College of Arts and Sciences, University of Miami. There were 95 participants; February 21 and 28, 2015.

"Empowering Capable Climate Communicators 2016" a Cooper Fellow climate training series involving 13 climate scientists and communicator lecturers and panelists for two full Saturdays on February 20 and 27, 2016, College of Arts and Sciences, University of Miami. There were 120 participants and 15 lecturers.

"Empowering Capable Climate Communicators 2017" a Cooper Fellow climate training series involving 7 climate scientist lecturers and panelists for one full Saturday on February 11, 2017, College of Arts and Sciences, University of Miami.

25a. **Other Professional Activities** – Provided requested professional interviews to **Newspaper, Magazine, Book, Radio, TV, video, and online organizations (list only kept since 2014)**

2014 Newspapers: Miami Herald (numerous), Washington Post, Sun Centennial, New York Times, Key Biscayne Times, other Community Newspapers.

Magazines: Time, Rolling Stone, National Geographic, Die Stern (German), a Dutch magazine, Boca Raton Magazine (link below), and others.

Radio and TV: NPR (3), Marketplace (link below), WLRN 91.3 (link below), Fox News, NBC, CBS, Huffington Post, CBC Canada One (link below), and others. Several web-based news and talks shows.

http://www.cbc.ca/radio/thesundayedition/a-christmas-concert-michael-s-essay-harold-wanless-mail-about-dying-at-age-75-cat-christmas-documentary-mail-about-refugee-policy-bob-bossin-menorah-s-hidden-history-1.2905337/coastal-florida-and-miami-are-doomed-says-scientist-

harold-wanless-1.2905344

http://www.marketplace.org/topics/sustainability/water-high-price-cheap/rising-seas-threaten-south-floridas-drinking-water

http://bocamag.com/blog/2015/03/02/is-south-florida-in-hot-water/

http://wlrn.org/post/florida-officials-ban-term-climate-change

2015 Boca Raton Magazine, Center for Investigative Reporting (Tristan Korten), Verge (Josh Dzieza), Fairchild Garden, Morad – pbu TV (Clemence de la Robertie), MSNBC (Ed Schultz), Puerto Rican Sistema TV Geo, Sun sentinel (David Flescher), Stewart News on ASRs (Scripps Howard), Perkins and Will, Agencie France Television (Frederica Nanancio), WWL First News radio New Orleans (Tommy Tucker), Progressive News Network (Karina Veaudry Internet Radio Podcast), Korean Broadcasting Service, The Nation (re Jeb Bush record), Tampa Bay Tribune, The Daly Show, ZDF German TV, Years of Living Dangerously (Jon Meyershon), Vanity Fair (David Kamp), American Prospect (Nathalie), Fabiano D'Yomato, CBC (Michael Enright – replaying previous interview), ABC (Evan Simon), CNBC (Robert Ferris), City University of NY (Ashley Dawson – book interview), Miami Herald, France 2 TV (Sabrina Buckwalter), conserve turtles.org (Gary), Dutch Freelance (Eline van Nes), Center for Urban and Community Design (Sonia Chao), New Yorker (Elizabeth Kolbert), the Weather Channel (Michael Lowery and Mark Elliott).

2016 NJTV News (Brenda Flanagan), KYW Radio (Madden), Radio Free Europe (Igor Yefimov), Orlando Sentinel (Kevin Spear), University of Amsterdam Graduate Program in Human Geography (Lars Ankum, Wessel Brocken, and Tiemen Koch), Ed Emery for Congress (training about Climate Change and effects), Weather Channel (Sam Champion), University of Buenos Aires Law Program (Claude Lutzky, Exec. Director), MIT Masters in City Planning, Urban Studies (Devon Neary), Politico Magazine (Sarah Solovitch), WLRN Topical Currents (Joseph Cooper) hour show with Elizabeth Kolbert, MSNBC (Chris Hayes), Malibu Magazine (full page coverage), FORWARD Florida Magazine (Dave Cocchiarella), Olonne sur Mer, Vendée, France (Germain Piveteau, and Emmanuel Ayet); *Ahead of the Tide* (Ariel Gudwin); CBS News (Chris Libel); Organized *Ahead of the Tide* video presentation at UM (4/11/17); MSNBC interview (Joelle Martinez); NPR Interview (Gina Jordan and Laura Coburn); Gizmo Science Tech (Maddie Stone); Muse Magazine (Corbie); Josh Dzieza; The Hokkaido Shimbun Press (Katsuhori Hashimoto); The Tokyo Shimbun (Tomonori Ishikawa); The Chunnhi Shimbun (Conrad Chaffee); Louisville Courier-Journal (James Bruggers); National Geographic (Laura Parker); CavU (recorded sea level Webinar on SLR); THEOECO.org (Steve Richards); Years of Living Dangerously (interview in advance of premier of Climate/Sea Level episode with Jack Black), Tower Theater, Miami; Distraction Magazine (Marissa Vonesh); Dutch Journalist video interview on Sea level rise on Miami Beach (Max van der Heijden); Film on sea level rise by David Able(visiting Knight Chair in Journalism Department); Sea level rise interview with Prof. Alejandre Portes, UM School of Law; Sea level rise interview with Molly Cominick, Sophie Barrows, and Danni Dikes, UM Communication Program; Sea level rise interview with Ben Travers (on 1,000 mile awareness tour of Florida);Climate Change interview (Prof Rick Van Noy, English Dept, Radford University, Virginia).

2017 Throughline Productions interview for movie on water and sea level rise in Florida (Chuck Davis and Dr. Timothy Beatley, a University of Virginia Sustainable Communities Professor); Santiva

Chronicle (reporter David Rohn interview re sea level rise presentation on Captiva Island, Florida); captivasanibel.com Community News (reporter Ashley Goodman interview re sea level presentation on sea level rise on Captiva Island, Florida); KelvinFilm (2-day film interview by Joanna Engel on Major film on worldwide adaptation to climate change including interactions with Angaangaq Angakkorsuaq an Elder representative from the Greenland Eskimos); clearpath.org (Jay Faison, clean energy advocates for republicans in Washington D.C.; Mary Ann Rozance, Toulan School of Urban Studies and Planning, Portland State University; Chris De Angelo, Huffington Post, Washington D.C.; Angilique Millan and Maria Cubas, FIU Journalism; Thomas Salme (re Italian movie producer murder conviction); BBC Inisgen Anderson at Matheson Hammock; Biscayne Times; Mary Ann Rozance, Portland State University on sea level rise adaptation; Stephanie Wakefield, New School in NYC, Anthropocene Working Group; WLRN Topical Currents on air interview on WSLR; Tom walker USF Sarasota - WSL– FM interview on sea level rise; Matt Mornick, Seattle photo-journalist on king tides and sea level rise; Lisa Aunon, PhD student on communication of environmental risk; Mario Alejandro Ariza, Journalist on socio-economic inequality of climate change in Miami; Ari Odzer, NBC 6, Trumps 1st 100 days and sea level rise and climate change; Christophe Washer, ISURU, Brussels, Lack of proper strategic thinking; Jamie Hopkins, Center for Public Integrity on electricity generation and climate change issues affecting South Florida; Rosilind Margie Donald, Columbia PhD on climate science censorship; Anne Greggis, SunSentinel; Maggie Stone, sea level rise; Mike Vogel, editor Florida Trend; Ann-Dorit Bay, with Neve Zurcher Zeitung (Swiss Daily Newspaper) political journalist; Manuela Tobias of Politifact on hurricane Harvey and climate change; Arinn campo or Wall Street Journal on Harvey and climate change; Nelson Aroque and Fai Agliarde of Newsweek; Brady of Washington Post; Geta of In These Times (Chicago); John Flesher of Associated Press on Miami-Dade Water and Sewer response to climate change; Ari Nalter, Bloomberg News on Irma, Everglades, climate change and sea level rise; Chelsea Harvey of Washington Post on Irma and Everglades; Kelly Sweet of RedRock Films on Irma and Everglades; Christa Marshall of E&E News on why not more inundation; Jeanette Francis of Australian TV video interview; Alissa Groeninger, a USF journalism graduate student on Everglades; Rosilind Margaret Donald of Columbia, video interview; Deepa Fernandez of NPR-PRI interview in Satellite Beach on Climate Change and sea level rise; Jeff Goodell; Kate Fleming; Coral Gables Planning Department on Vulnerability Assessment; Elizabeth Rush, book writer on climate change; Jamie Rush at Public Integrity .org on climate change and public officials; Oliver Milman of The Guardian on Archaeological sites and sea level rise; J. Van Leer at UM on Positive feedback for ocean cooling;

TEACHING

26a. **Courses Taught:**

ENS 103-104 - Environmental Issues of South Florida
Taught 1996, Spring 1998, Spring 1999.

ENS 492 - Field Study in Environmental Science
Taught: Spring 2000, Fall 2001, 2002

FNS 180 - Evidence for and Societal Implication of Global Change (Freshman Seminar)
Taught: 1991, 1992.

GSC 100 – Marine Geology of South Florida, part of Summer Scholar Program for High School Students.
Taught: Summer of 1998, 1999, 2000.

GSC 105 – The Global Environment
Taught: Fall 2004

GSC 110 - Physical Marine Geology (A dual enrollment course taught at MAST Academy, Dade County Public Schools)
Taught: 1993, 1996.

GSC 111 – Historical Geology
Taught: 2003, 2006

GSC 120 - Environmental Geology
Taught Spring 1993, Fall 1993, Fall, 1994, Fall 1995, Spring 1996, Fall, 1996, Spring 1997, Fall 1997, Fall 1998, Fall 1999, Fall 2000.

GSC 160 - Historical Geology: Taught Spring 1993.

GSC 230 - Reef Systems through Time:
Taught Spring 1998, 1999, 2000, 2001, 2002, 2004, 2005, 2006, 2009, 2010, 2011, 2012, 2013, 2014.

GSC 231 - Field Study of Reef Systems Through Time
Taught: Spring Break 2000, 2001. 2004, 2009, 2011, 2012, 2014, 2016.

GSC 260 – Earth Materials: Co-taught fall 2011, 2012, 2013, 2014, 2015, 2016.

GSC 350 - Stratigraphy: Taught: 1992, 1994, 1995, 1996, 1997, 1998, 2004.

GSC 360 - Depositional and Diagenetic Systems:
Taught: Spring 1999, 2000, Fall 2001, 2002, 2003, 2004, 2005, 2006, 2007, 2008, 2009 2010, 2011, 2012, 2013, 2014, 2015, 2016.

GSC 440 – Petrology
Taught with D. McNeill: Spring 2015, 2016, 2017.

GSC 450 - Sedimentology
Taught: 1988, 1989, 1990, 1992, 1993, 1994, 1995, 1996, 1997, 1998.

GSC 462 – Paleoclimatology Taught: Spring 2014, 2015, 2016, 2017.

GSC 480 – Structural Geology: Taught with D. Olson: Spring 2013.

GSC 482 (was 596) - Field Methods and Mapping:
Taught: spring 1994, 1995, 1996, 1997, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2017.

GSC 561 – Colloquium, fall (capstone course for seniors) 2004, 2005, 2006, 2007, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2016.

GSC 574; now 580-581 - Geology Summer Field Course
Taught: 1994, 1995, 1996, 1997, 1999, 2000, 2001, 2002, 2003, 2004, 2005, 2006, 2008, 2009, 2010, 2011, 2012, 2013, 2014, 2015, 2017.

GSC 574 - Geologic Studies in the Grand Canyon
Taught: 2007

GSC 575 – Coastal Processes
Taught: 2008

GSC 582(01) - Field Study of Reef Systems Through Time
Taught: Spring Break 2012, 2014, 2016

MGG 511 - Sedimentation
Taught: 1972-1991.

MGG 541 - Field Evaluation of Fossil Platforms, Margins and Basins
Taught: 1978, 1980, 1981, 1984, 1985, 1986, 1987, 1988, 1991.

MGG 558 - Geology of Florida
Taught: Fall 1979, 1982, 1983, 1985, 1986.

MGG 584, 585 - Geology of Tropical Marine Environments
Taught: Summer 1979.

MGG 672 - Basin Analysis (with others)
Taught: 1979.

MGG 683 - Sediment Diagenesis
Taught: 1977, 1982, 1984, 1987, 1989.

MGG 684 - Environments of South Florida
Taught: 1981, 1984.

MGG 685 - Sediment Dynamics
Taught: 1981, 1983, 1984, 1985.

MGG 687 - Substrate Influence on Benthic Communities

Taught: 1977, 1987.

MSC 111 – Introduction to Marine Science. Taught: Fall 2002

MAST Academy – Dual Enrollment Marine Geology 1996, 1997.

27. **Thesis and Dissertation Advising:**

Major Advisor for the Following Undergraduate Senior Thesis:

1997 Rodebaugh, Amy. Diatom Assemblages in a 100-Year Sediment Record from Whitewater Bay, South Florida.

1999 Kathrine A. Banner. Internal Architecture of Archaeocyathid Bioherms, Labrador, Canada, 64p.

1999 Andrew Zachary Krug. Environmental Zonations Within a Platform Margin Reef, Lower Head, Newfoundland.

2000 Stacy Anderson. A Paleoenvironmental Analysis of the Key Largo Limestone.

2002 Matthew Brewer. Mangroves, Storms and Sea-Level: an air photo analysis of the past 70 years of coastal evolution in the Gopher Key Region, SW Florida.

2002 Katie Inderbitzen. A Sedimentary-Exhalatory Barite Deposit and Associated Chemosynthetic Bioherm, Aguathuna Quarry, Port au Port Peninsula, Newfoundland, Canada.

2002 Lauren Moyer. Diagenesis and Tectonic history of Cambro-Ordovician Sediments in a Fore-Arc Basin, Northwestern Newfoundland.

2002 Amy Sofge. Origin of Cavities in Lower Cambrian Archaeocyathid Reefs, Southeast Labrador.

2004 Kelly Jackson. Late Holocene Evolution of the Lower Shark River Discharge in response to a high-frequency sea level oscillation, Everglades National Park, Florida

2006 Katie Murray (Magna Cum Laude), Potential Effects of Increased Scour Depth on Chum Salmon Redds in the Gray's River, Washington. November, 2006

2007 Noelle Van Ee, Analysis of abrasion susceptibility of Bahamian sands proposed for placement on south Florida's beaches, 2008

2012 Max Tenaglia, Re-evaluation of the Late Permian carbonate reef margin facies patterns, Dark Canyon, New Mexico, December 2012.

2015 William Farrell, Diagenetic and porosity evolution in Early Pennsylvanian carbonate mud mounds, New Mexico.

Zoe Smith, Fauna and diagenesis in Lower Cambrian carbonate nodules in black shale sequences.

Major Advisor of the Following Masters of Science Theses:

1976 Barron, Eric J. Suspended Sedimentation Processes, Marco Island, Florida. M.S. Thesis, University of Miami, 182p.

1976 Warzeski, E. Robert. Growth History and Sedimentary Dynamics of Caesar's Creek Bank. M.S. Thesis, University of Miami, 195p.

1977 Dravis, Jeffrey J. Holocene Sedimentary Depositional Environments on Eleuthera Bank, Bahamas. M.S. Thesis, University of Miami, 386p.

1978 Bohlke, Brenda. Clay Fabric and Geotechnical Properties Associated with Crust Zones in the Mississippi Prodelta Deposits. M.S. Thesis, University of Miami, 95p.

1979 Harlem, Peter. Aerial Photographic Interpretation of the Historical Changes in North Biscayne Bay, Florida: 1925-1976. M.S. Thesis, University of Miami, 152p.

1983 Craig, Genevieve. Holocene Carbonate Sedimentation in a Pleistocene Depression Adjacent to Key Largo. M.S. Thesis, University of Miami, 120p.

1984 Burton, Elizabeth Ann. X-ray Diffraction of Natural High and Low Mg Calcites. M.S. Thesis, University of Miami, 148p.

Rossinsky, Victor, Jr. Sedimentation and Holocene History in the Loxahatchee River Estuary, Jupiter, Florida. M.S. Thesis, University of Miami, 247p.

1988 Waltz, Michael D. The Evolution of Shallowing-Upwards Reef to Oolite Sequences at the Leeward Margin of Caicos Platform, B.W.I. M.S. Thesis, University of Miami, 98p.

1989 Tagett, Mathew G. Stratigraphy, Nucleation and Dynamic Growth History of a Holocene Mudbank Complex, Dildo Key Mudbank, Western Florida Bay. M.S. Thesis, University of Miami, 210p.

1990 Huang, Holan. Holocene Environmental History in a Marginal Marine Area of the Everglades of South Florida. M.S. Thesis, University of Miami, 131p.

1991 Emerson, James D. Surficial Carbonate Facies of the Caicos Platform, British West Indies. M.S. Thesis, University of Miami, 183p.

1993 Frederick, Bruce. The Development of the Holocene Stratigraphic Sequence Within the Broad-Lostman's River Region, Southwest Florida Coast, M.S. Thesis, University of Miami, 173p.

1995 Bischof, Barberel. Aerial Photographic Analysis of Coastal and Estuarine Mangrove System Dynamics of the Everglades National Park, Florida, in Response to Hurricanes: Implications for the Continuing Sea-level Rise. M.S. Thesis, University of Miami, 135p. Plus Figures.

1996 Gelsanliter, Sarah. Holocene Stratigraphy of the Chatham River Region, Southwest Florida; with a Reevaluation of the Late Holocene Sea-level Curve, M.S. Thesis, University of Miami, 182p.

2001 Michaels, Brian A. Holocene Stratigraphy and Geomorphic Evolution of the Cape Sable Region, Southwest Florida: Evidence for Late Holocene Sea-level Dynamics, M.S. Thesis, University of Miami, 183p.

2003 Manne, Tiina. Archaeocyath Growth Morphology as a Reflection of Bioherm Form, Cavity Development and Life Habit, Newfoundland nad Labrador, Northeastern Canada, M.S. Thesis, University of Miami, 100 p. (awarded Rosenstiel School's Dean Prize for outstanding M.S. Thesis for 2002-2003)

2006 Christina Smith (Defended and completed, April, 2006).

Major Advisor for the following Ph.D. Dissertations:

1981 Nelson, Terry. The Nature of the General and Mass Sedimentary Processes on the Outer Shelf, Slope and Upper Rise, Northeast of Wilmington Canyon. Ph.D. Dissertation, University of Miami, 303p.

1982 Perlmutter, Martin. The Role and Recognition of Storm Deposits in the Subtidal Sediments of the Ten Thousand Islands, southwest Florida. Ph.D. Dissertation, University of Miami, 230p.

1984 Figueiredo, Alberto G., Jr. Submarine Sand Ridges: Geology and Development, New Jersey, U.S.A. Ph.D. Dissertation, University of Miami, 408p.

1987 Dominguez, Jose M.L. Quaternary Sealevel Changes and the Depositional Architecture of Beach-Ridge Strandplains Along the East Coast of Brazil. Ph.D. Dissertation, University of Miami, 288p.

1987 Meeder, John F. A Depositional Model of the Tamiami Formation of Southwestern Florida. Ph.D. Dissertation, University of Miami, v. 1, 433p.; v. 2, -748p.

1987 Parkinson, Randall. Holocene Sedimentation and Coastal Response to Rising Sea Level Along Subtropical Low Energy Coast, Ten Thousand Islands, Southwest Florida. Ph.D. Dissertation, University of Miami, 224p.

1989 Cottrell, Daniel J. Holocene Evolution of the Coast and Nearshore Islands, Northeast Florida Bay, Florida. Ph.D. Dissertation, University of Miami, 194p.

1990 Rossinsky, Victor Jr. Topographic, Vegetative and Climatic Controls on the Petrography and Geochemistry of Calcretes in the Bahamas and South Florida. Ph.D. Dissertation, University of Miami, 228p.

1991 Tedesco, Lenore P. Generation of Carbonate Fabrics and Facies by Repetitive Excavation and Infilling of Burrow Networks in Recent and Ancient Sequences. Ph.D. Dissertation, University of Miami, 434p.

1993 Briggs, Kevin B. High-frequency Acoustic Scattering from Sediment Interface Roughness and Volume Inhomogeneities. Ph.D. Dissertation, University of Miami, 143 p.

1998 Risi, J. Andrew. Event Sedimentation from Hurricane Andrew Along the Southwest Florida Coast. Ph.D. Dissertation, University of Miami, 198 p.

2007 Brigitte M. Vlaswinkel. Field Results and Physical Modeling of the Sediment Dynamics of a Channeled, Peritidal Coastal System in Southwest Florida, Ph.D. Dissertation, University of Miami, 303 p.

Member of Advisory Committee for the following graduate students:

Completed: Shirley Pomponi, Mark Palmer, James Rine, Mohammed Almasi, David Beach, Bernard Pierson, Zelinda Leao, Bill Corso, Charles Evans, Sue Markley, Stuart Williams, Sach Prasad, Pamela Ried, Charles Evans, Michael Westphall, Jorge Jiminez, Kathy Browne, Joshua Feingold, Michael Grammar, David Obdura, Carrie Kievman, Ken Lindeman, Symma Finn, Tony Poiriez, Xavier Jansen, Matt Bonicotti, Emily Bowlin.

SERVICE

28. **University Committee and Administrative Responsibilities:**

RSMAS School Council 1984-1987

MGG Academic Committee 1990-1992

Chairman Search Committee for Paleoecologist, GSC 1993

Tenure Review Committee, College of Arts and Sciences, 1993-1996

Search Committee for Dean, School of Arts and Sciences, 1996-1997

Senate Committee on Rank, Salary and Terms of Employment 1997-1999

Chair, Department of Geological Sciences, September 1998-.

Interim Director, Institute for Interdisciplinary Tropical Science 2003-2004

Search Committee, Weeks Endowed Professorship 2005-2006

29. **Community Activities:**

Scoutmaster of Troop 322, Key Biscayne, Boy Scouts of America 1979-1987 and 1995-2001; asst. leader 2002-2006.

Member of Technical Advisory Committee to EPA and Munisport Dump Coalition on Munisport Toxic Waste Dump: 1989-2000.

Advisor to Key Biscayne Council and Village of Key Biscayne on shore management: 1989-1992. Member Technical Advisory Task Force on Beach Management: 1995- termination of Task Force in 1998. (including preparation of guidelines for future beach renourishment activities in 1998).

Scientific advisor to the City of Naples, Florida: on beach, lagoons and wetland management, 1978 and 1989-1990.

Judge at elementary, middle and high school science fair competitions: 1965-1995.

Advisor on Post-Hurricane Resource Inventory and Recovery Strategy to Everglades National Park, Biscayne National Park, Cape Florida Park, Dade County Parks, and coastal citizen groups and individuals.

Technical Advisor to South Florida Water Management District: 1997-present.

Mentor to Miami-Dade County High School Interns (two of which have achieved semifinalist in Westinghouse Science Talent Search), 1993-present.

Advisor on forensic geology to Miami Homicide, Miami-Dade States Attorney Office and Federal Justice Department, 1998-2000.

Co-Chair Biscayne Bay Initiative Science Survey Team, 1999-2001. Coordination and preparation of science synthesis, issues, and recommendations to State of Florida Legislature.

Invited contributor to scientific design of South Florida Management District's RECOVER (research and monitoring) design for the Comprehensive Everglades Restoration Plan, 2001-2005.

Invited Advisor to Everglades National Park, Coastal Instability on southwest coast of Everglades National Park, 2002.

Invited Advisor to Big Cypress National Preserve on Recreational Off-road Management Plan and construction of defined vehicle trails, 2002.

Invited member and leader of science evaluation group, Miami-Dade County's 'Climate Change Adaptation 'Task Force' and now Committee, a committee of the Miami-Dade County Commissioners, 2003 – 2007.

Chair of Science and Technology Committee, Miami-Dade County Climate Change Advisory Task Force of the Miami Dade County Commissioners (2007-2011).

Member of Miami-Dade County Climate Change Advisory Task Force of the Miami Dade County Commissioners (2007-2011).

Invited speaker/advisor to Florida legislative committees on the Everglades (2007).

Invited speaker to White House Council on Environmental Quality concerning relocation of Mississippi River outlet (2009).

Member, Ad Hoc Committee on Sea Level Rise, South Florida regional Planning Council, tasked with defining a projected sea level rise for 2030, 2060, 2100, and 2110 to be used by southeast Florida Counties for planning purposes – final report is published and has been adopted by the four southeast Florida Counties. Presented at a Four County Compact meeting in December, 2011. (2010-2011).

Member Science Advisory Committee Florida Beaches for Habitat Conservation Plan, Florida Fish and Wildlife Conservation Commission. 20defining habitat risks for construction and other activities in the portion of the coastal beach/dune zone that can be regulated, including changes in response to rising sea level, 2010 - present.

Coordinator and Host of "Empowering Capable Climate Communicators" and full four Saturday series of training lectures and discussions to produce qualified speakers on climate change. Done as a Cooper Fellow Series and Sponsored by the Department of Geological Sciences and the College of Arts and Sciences, University of Miami. Spring of 2011, Spring of 2012, Spring of 2013 (two sessions), Spring of 2014, and Spring of 2015.

Board of Directors, the CLEO Institute. A program for involving and training secondary school, college students and adults in climate change, locally, nationally, and globally. (2011- present).

Invited Speaker to Miami Beach Chamber of Commerce, January 2013.

Informal (non-paid) advisor to numerous coastal governments, chambers of commerce, businesses, and/or organizations in Florida on optimal response to sea level rise, including Miami Beach Chamber of Commerce, Bay Harbor Islands, Fairchild Gardens, (2014).

Member, Committee on Sea Level Rise, South Florida Regional Planning Council, tasked with revisiting and revising (upwards) projected sea level rise rates for 2045, 2060, 2100, and 2130 being used by southeast Florida Counties for planning purposes – Adopted by the four-county Compact (October 2014 - March 2015).

Stormwater Master Plan – Pinecrest (2015).

Invited presenter and advisor to cities of Coral Gables, Miami, and Pinecrest; Fairchild Gardens, community groups, service organizations, and individuals on projected rates of sea level rise and recommended solutions (2016).

EXHIBIT B: REFERENCES

Bell, R.E., Tinto, K., Das, I., Wolovick, M., Chu, W., Creyts, T.T., Frearson, N., Abdi, A., and Paden, J.D., 2014. Deformation, warming and softening of Greenland's ice by refreezing meltwater. *Nature Geoscience.* Volume 7, p. 497-503. DOI:10.1038/NGEO2179.

Blum, M.D., and Roberts, H.H., 2009. Drowning of the Mississippi Delta due to insufficient sediment supply and global sea-level rise, *Nature Geoscience,* Volume 2, p. 488–491. doi:10.1038/ngeo553.Church, J.A. and White, N.J., 2011. Sea-level rise from the late 19th to the early 21st century. *Surveys in Geophysics*, *32*(4-5), p. 585-602.

Christoffersen, P.**,** Bougamont, M., Hubbard, A., Doyle, S.H., Grigsby, S. and Pettersson, R., 2018. Cascading lake drainage on the Greenland Ice Sheet triggered by tensile shock and fracture. *Nature Communications,* Volume 9, p.1064-. doi:10.1038/s41467-018-03420-8.

DeConto, R.M., and Pollard, D., 2016. Contribution of Antarctica to past and future sea-level rise. *Nature, Volume 531*, p. 591-597, doi:10.1038/nature17145.

Dominguez, J.M.L., and Wanless, H.R., 1991. Facies architecture of a falling sea-level strandplain, Doce River coast, Brazil, in: D.J.P. Swift and G.F. Oertel (Eds.), *International Association of Sedimentologists, Spec. Publ. #14*, p. 259-289.

Dutton, A., Carlson, A.E., Long, A.J., Milne, G.A., Clark, P.U., DeConto, R., Horton, B.P., Rahmstorf, S., and Raymo, M.E., 2015. Sea-level rise due to polar ice-sheet mass loss during past warm periods. *Science,* Vol. 349, Issue 6244, aaa4019. DOI: 10.1126/science.aaa4019.

Englander, J., 2013. High *Tide On Main Street: Rising Sea Level and the Coming Coastal Crisis*, 2nd Edition. The Science Bookshelf, Boca Raton, 252 p. ISBN-13: 978-0615637952.

EPA, 2012. United States Environmental Protection Agency, *Coastal Areas Impacts and Adaptation.* http://www.epa.gov/climatechange/impacts-adaptation/coasts.html.

FEMA, 2016. *Technical Mapping Advisory Council Annual Report*.

Fountain, A., Tranter, M., Nylen, T., Lewis, K., & Mueller, D., 2004. Evolution of cryoconite holes and their contribution to meltwater runoff from glaciers in the McMurdo Dry Valleys, Antarctica. *Journal of Glaciology,* Volume *50 No.* 168, p. 35-45. doi:10.3189/172756504781830312.

Gelsanliter, S., 1996. *Holocene Stratigraphy of the Chatham River region, southwestern Florida; with a reevaluation of the Late Holocene sea-level curve.* Master's Thesis, University of Miami, Coral Gables, Florida.

Gelsanliter, S., and Wanless, H.R., 1995. High frequency sea-level oscillations in the late Holocene of South Florida: a dominating control on facies initiation and dynamics (abstr.). *First SEPM Congress on Sedimentary Geology* (St. Petersburg, FL, Program with Abstracts, p. 58.

Hansen, J.E., 2007. Scientific reticence and sea level rise. *Environ. Res. Lett.* Vol. 2 024002.

Hansen, J., M. Sato, P. Kharecha, D. Beerling, R. Berner, V. Masson-Delmotte, M. Pagani, M. Raymo, D.L. Royer, and J.C. Zachos, 2008. Target atmospheric CO_2: Where should humanity aim? *Open Atmos. Sci. J.*, **2**, 217-231, doi:10.2174/1874282300802010217.

Hansen, J., Sato, M., Hearty, P., Ruedy, R., Kelly, M., Masson-Delmotte, V., Russell, G., Tselioudis, G., Cao, J., Ringot, E., Velicogna, I., Tormey, B., Donovan, B., Knsino, E., von Achuckmannm K., Kharecha, P., Legrande, A.N., Bauer, M., and Lo, K-W., 2016. Ice melt, sea level rise and superstorms: evidence from paleoclimate data, climate modeling and modern observations that 2ºC global warming could be dangerous. *Atmospheric Chemical Physics*, Volume 16, p. 1-52. www.atmos-chem-phys.net/16/1/2016/.

Hauer, M.E., Evans, J.M. and Mishra, D.R., 2016. Millions projected to be at risk from sea-level rise in the continental United States. *Nature Climate Change*, *6*(7), p. 691-695.

Hay, C.C., Morrow, E., Kopp, R.E. and Mitrovica, J.X., 2015. Probabilistic reanalysis of twentieth-century sea-level rise. *Nature*, *517*(7535), p. 481-484.

Heimlich, B.N., Bloetscher, F., Meeroff, D. and Murley, J., 2009. *Southeast Florida's Resilient Water Resources: Adaptation to Sea Level Rise and Other Impacts of Climate Change;* Florida Atlantic University.

Hills, R.L., 1993. *Power from steam: A history of the stationary steam engine*. Cambridge University Press.

Hine, C., et al., 2016. *Sea Level Rise in Florida, Science, Impacts, and Options*. University of Florida Press.

Historical Map and Chart Collection, 2014. Historical Geographic Place Names removed from NOAA Charts, Office of Coast Survey, NOAA. www.nauticalcharts.NOAA.gov/history.

Hsu, C.-W., and Velicogna, I, 2017. Detection of sea level fingerprints derived from GRACE gravity data, *Geophys. Res. Lett.*, *44*, 8953–8961, doi:10.1002/2017GL074070.

IPCC, 2014. *Climate Change 2014 Synthesis Report; Summary for Policymakers*. A summary of three working groups of the Fifth Assessment Report of the Intergovernmental Panel on Climate Change. 31p. https://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.

Jankowski, K.I., Törnqvist, T.E., and Fernandes, A.M., 2017. Vulnerability of Louisiana's coastal wetlands to present-day rates of relative sea-level rise, *Nature Communications*, volume 8, Article number: 14792. doi:10.1038/ncomms14792.

Jarrett, B.D., Hine, A.C., Halley, R., Naar, D., Locker, S., Neumann, A.C., Twichell, D., Hu, C., Donahue, B.T., Jaap, W., Palandro, D., and Ciembronowicz, K., 2005. Strange bedfellows - A

deep-water hermatypic coral reef superimposed on a drowned barrier island; Southern Pulley Ridge, SW Florida platform margin. *Marine Geology*. 214. 295-307. 10.1016/j.margeo.2004.11.012.

Jevrejeva, S., Moore, J.C., and Grinsted, A., 2010. How will sea level respond to changes in natural and anthropogenic forcings by 2100?, *Geophysical Research Letters*, v.37, L07703, doi:10.1029/2010GL042947.

Jiang, Y., Dixon, T.H. and Wdowinski, S., 2010. Accelerating uplift in the North Atlantic region as an indicator of ice loss. *Nature Geoscience*, *3*(6), p. 404.

Karl, T.R., Melillo, J.M., and Peterson, T.C., (eds.), 2009. *Global Climate Change Impacts in the United States*, Cambridge University Press, 192 p.

Kerr, RA., 2009. Both of the world's ice sheets may be shrinking faster and faster. *Science*, V. 326, p. 217.

Khanna, P., Droxler, A.W., Nittrouer, J.A., Tunnell Jr., J.W. and Shirley, T.C., 2017. Coralgal reef morphology records punctuated sea-level rise during the last deglaciation. Nature Communication, Volume 8, Article number: 1046 doi:10.1038/s41467-017-00966-x.

Kirtman, B.P., Bitz, C., Bryan, F., Collins, W., Dennis, J., Hearn, N., KinterIII, J.L., Loft, R., Rousset, C., Siqueira, L., Stan, C., Tomas, R., and Vertenstein, M., 2012. Impact of ocean model resolution on CCSM climate simulations. *Climate Dynamics*. 39(6). 1303-1328. doi:10.1007/s00382-012-1500-3.

Kopp, R.E., DeConto, R.M., Bader, D.A., Hay, C.C., Horton, R.M., Kulp, S., Oppenheimer, M., Pollard, D., Strauss, B.H., 2017b. Evolving understanding of Antarctic ice-sheet physics and ambiguity in probabilistic sea-level projections. *Earth's Future.* DOI: 10.1002/2017EF000663. http://onlinelibrary.wiley.com/doi/10.1002/2017EF000663/abstract.

Kusahara, K., and Hasumi, H., 2014. Pathways of basal meltwater from Antarctic ice shelves: A model study. *Oceans*, Volume 119, Issue 9, p. 5690–5704. DOI: 10.1002/2014JC009915.

Locker, S.D., Hine, A.C., Tedesco, L.P., and Shinn, E.A., 1996. Magnitude and timing of episodic sea-level rise during the last deglaciation. *Geology* 24, 827–830.

MacGregor, J.A., Fahnestock, M.A., Catania, G.A., Aschwanden, A., Clow, G.D., Colgan, W.T., Gogineni, S.P., Morlighem, M., Nowicki, S.M.J., Paden, J.D., Price, S.F., and Seroussi, H., 2016. A synthesis of the basal thermal state of the Greenland Ice Sheet. *Journal of Geophysical Research, Earth Surface.* Volume 121. https://doi.org/10.1002/2015JF003803.

Mann, M.E., Bradley, R.S., and Hughes, M.K., 1994. Northern Hemisphere temperatures during the past Millennium: Inferences, uncertainties, and limitations, American Geophysical Union, *Geophysical Research Letters*, v. 26 (6), p. 759-762. doi:10.1029/1999GL900070.

Mann, M.E., Park, J., and Bradley, R. S., 1995. "Global interdecadal and century-scale climate oscillations during the past five centuries". *Nature.* 378 (6554): 266–270.

Melillo, J.M., Richmond, T.C, and Yohe, G.W., Eds., 2014: Climate Change Impacts in the United States: The Third National Climate Assessment. U.S. Global Change Research Program, 841 p. doi:10.7930/J0Z31WJ2.

Miller, K.G., Wright, J.D., Browning, J.V., Kulpecz, A., Kominz, M., Naish, T.R., Cramer, B.S., Rosenthal, Y., Peltier, W.R., and Sosdian, S., 2012. High tide of the warm Pliocene: Implications of global sea level for Antarctic deglaciation. *Geology* 40 (5): 407-410. doi.org/10.1130/G32869.1.

Milliken, K.T., Anderson, J.B., and Rodriguez, A.B., 2008. A new composite Holocene sea-level curve for the northern Gulf of Mexico, *in* Anderson, J.B., and Rodriguez, A.B., eds., *Response of Upper Gulf Coast Estuaries to Holocene Climate Change and Sea-Level Rise: Geological Society of America Special Paper* 443, p.1-11.

National Science Foundation, 2012. Global Sea Level Likely to Rise as Much as 70 Feet in Future Generations. *National Science Foundation News Release* #12-051; https://www.nsf.gov/news/news_summ.jsp?cntn_id=123545

National Research Council. 2015. *Tying Flood Insurance to Flood Risk for Low-Lying Structures in the Floodplain*.

Nerem, R.S., Chambers, D.P., Choe, C. and Mitchum, G.T., 2010. Estimating mean sea level change from the TOPEX and Jason altimeter missions. *Marine Geodesy*, *33*(S1), p. 435-446.

NOAA-OAR, 2012. 2012 *Arctic Report Card*, 11p. http://www.climatewatch.noaa.gov/article/2012/2012-arctic-report-card.

NOAA, 2012. Global Sea Level Rise Scenarios for the United States National Climate Assessment. *NOAA Technical Report OAR CPO-1*. Climate Program Office, Silver Spring MD, 27p. (done cooperatively with United States Geological Survey, Department of Defense, Environmental Protection Agency, Department of Energy, and the US Army Corps of Engineers).

NOAA, Office of Coast Survey, 2014. *Historical Geographic Place Names Removed from NOAA Charts* (updated Aug. 4, 2014). https://historicalcharts.noaa.gov/pdfs/HistoricalPlacenames_Louisiana.pdf.

NOAA (Sweet, W.V., Kopp, R.E., Weaver, C.P., Obeysekera, J., Horton, R.M., Thieler, E.R., and Zervas, C.), 2017. Global and Regional Sea Level Rise Scenarios for the United States. *NOAA Technical Report NOS CO-OPS 083*. National Ocean Service, Center for Operational Oceanographic Products and Services, Silver Spring MD, 55p. plus appendices (done cooperatively with United States Geological Survey, Environmental Protection Agency, and Rutgers University).

Noël, B., van de Berg, W.J., Lhermitte, S., Wouters, B., MachguthI. H., Howat, H., Citterio, M., Moholdt, G., Lenaerts, J.T.M., and van den Broeke, M.R., 2017. A tipping point in refreezing accelerates mass loss of Greenland's glaciers and ice caps. *Nature Communications*, 7 p., DOI: 10.1038/ncomms14730.

Park, J. and Sweet, W., 2015. Accelerated sea level rise and Florida Current transport. *Ocean Sci.*, 11, 607-615, doi:10.5194/os11-607-2015.

Pretorius, L, Green, A., and Cooper, A., 2017. Submerged shoreline preservation and ravinement during rapid postglacial sea-level rise and subsequent "slowstand", *Geological Society of America Bulletin*, v. 128, no. 7/8, p.

Rahmstorf, S., 2010. A new view on sea level rise. *Nature Reports Climate Change.* Published online: 6 April 2010 | doi:10.1038/climate.2010.29 http://www.nature.com/climate/2010/1004/full/climate.2010.29.html.

Rahmstorf, S., Feulner, G., Mann, M. E., Robinson, A., Rutherford, S., and Schaffernicht, E. J., 2015. Exceptional twentieth-century slowdown in Atlantic Ocean overturning circulation. *Nature Climate Change.* Vol. 5, p. 475–480. doi:10.1038/nclimate2554.

Reese, R., Gudmundsson, G. H., Levermann, A., and Winkelmann, R., 2018. The far reach of ice-shelf thinning in Antarctica. *Nature Climate Change.* Volume 8, Number 1, p. 53-57.

Rignot, E., 2015. 'Ice sheet systems and sea level change.' Oral presentation at American Geophysical Union meeting. https://www.youtube.com/watch?v=3p9uRxX95f4&list=PLKVXrT0KzhY7s3tXLO_mUKEqenXJxiuOc&index=6.

Rignot, E., Xu, Y., Menemenlis, D., Mouginot, J., Scheuchl, B., Li, X., Morlighem, M., Seroussi, H., den Broeke, M.V., Fenty, I. and Cai, C., 2016. Modeling of ocean-induced ice melt rates of five west Greenland glaciers over the past two decades. *Geophysical Research Letters*, *43*(12), p. 6374-6382.

Science Committee, 2008. Statement on Anticipated Sea Level Rise in the Coming Century. Science Committee, Miami-Dade County Climate change Advisory Task Force, Miami, Fl, 9 p. (Can be found on P. 28-36 of '*Second Report and initial Recommendations, Miami-Dade County Climate change Advisory Task Force*, April 2008, 101 p., at http://www.miamidade.gov/derm/library/08-10-04_CCATF_BCC_Package.pdf).

Sweet, W.V., Kopp, R.E., Weaver, C.P., Obeysekera, J., Horton, R.M., Thieler, E.R., and Zervas, C., 2017b. *Global and Regional Sea Level Rise Scenarios for the United States.* NOAA Technical report NOS CO-OPS 083, U.S. Department of Commerce, Silver Spring, Md., 75 p.

Sweet, W.V., Dusek, G., Obeysekera, J., and Marra, J.J. 2018. *Patterns and Projections of hig Tide Flooding Along the U.S. Coastline Using a Common Impact Threshold.* NOAA Technical Report NOS CO-OPS 086, U.S. Dept Commerce, Silver Spring, MD., 44 p.

Technical Ad Hoc Work Group (Nancy Gassman, Glenn Landers, Jayantha Obeysekera, Joseph Park, John Van Leer, and Harold Wanless), 2011. *A Unified Sea Level Rise Projection for Southeast Florida*. Regional Compact, Southeast Florida Regional Planning Council. 27p. http://www.broward.org/NaturalResources/ClimateChange/Documents/SE%20FL%20Sea%20Level%20Rise%20White%20Paper%20April%202011%20ADA%20FINAL.pdf.

Technical Ad Hoc Work Group (Danchuk, S., Berry, L., Enfield, D., Gassman, N., Harlem, P., Hefty, N., Heimlich, B., Jurado, J., Kivett, J., Landers, G., Murley, J., Obeysekera, J., Park, J., Steelman, M., Van Leer, J., Wanless, H.R., and Wdowinski, S.), 2015. *Unified Sea Level Rise Projection for Southeast Florida. Southeast Florida Regional Compact*, Southeast Florida Regional Planning Council. 35p. http://www.southeastfloridaclimatecompact.org/wp-content/uploads/2015/10/2015-Compact-Unified-Sea-Level-Rise-Projection.pdf.

Tollefson, J., 2016. Antarctic model raises prospect of unstoppable ice collapse. *Nature*, Vol 531, Issue 7596, p.562.

U.S. Army Corps of Engineers, 2009. Water Resource Policies and Authorities Incorporating Sea-Level Change Considerations in Civil Works Programs. *USACE Circular No. 1165-2-211*. Washington, DC, 1 July 2009. 23 p.

Valle-Levinson, A., Dutton, A., and Martin, J.B., 2017. Spatial and temporal variability of sea level rise hot spots over the eastern United States, *Geophysical Research Letters*, Vol. 44, Issue 15, p. 7876-7882. http://onlinelibrary.wiley.com/doi/10.1002/2017GL073926/abstract.

Van den Broeke, M., Bamber, J., Ettema, J., Rignot, E., Schrama, E., van den Berg, W., van Meijgaard, E., Velicogna, I, and Wouters, B., 2009. Partitioning recent Greenland mass loss. *Science*, v. 326, p. 984-986 and supporting on-line material. http://www.sciencemag.org/cgi/content/full/326/5955/984 http://www.sciencemag.org/cgi/content/full/326/5955/984/DC1

Velicogna, I., 2009. Increasing rates of ice mass loss from the Greenland and Antarctic ice Sheets revealed by GRACE. *Geophysical Research Letters*, v. 36, L19503, doi: 10.1029/2009GL040222, 4 p.

Wanless, H.R., 1976. Geologic setting and recent sediments of the Biscayne Bay region, Florida. In *Biscayne Bay: Past, Present and Future*. P. 1-32. Edited by A. Thorhaug and A. Volker. University of Miami, Sea Grant Special Report, No. 5, 315 p.

Wanless, H.R., 1982. Sea level is rising - so what? *Jour. Sed. Petrology* 52(4): 1051-1054.

Wanless, H.R., and Parkinson, R.W., 1989. Late Holocene sealevel history of southern Florida: control on coastal stability. In Tanner W.F. (ed.), *Coastal sediment mobility. Proc., Eighth symposium on Coastal Sedimentology*, Fla. State Univ., Tallahassee, Fl, p. 197-213.

Wanless, H.R., Parkinson, R., and Tedesco, L.P., 1994. Sea level control on stability of Everglades wetlands, in *Proceedings of Everglades Modeling Symposium*. St. Lucie Press, FL, p. 199-223.

Ward, P.D., 2010. *The Flooded Earth: Our Future in a World Without Ice Caps.* Basic Books Publ., New York. 272 p.

Wdowinski, S., Bray, R., Kirtman, B., and Wu, Z., 2016. Increasing flooding hazard in coastal communities due to rising sea level: Case study of Miami Beach. Florida. Ocean and Coastal Management. Volume 126. P. 1-8.

Westington, M., NOAA, Office of Coast Survey, 2014. *Geographic Names Disappear from Charts, But Not from History*. https://noaacoastsurvey.wordpress.com/2014/03/21/geographic-names-disappear-from-charts/.