

Topic:	Sea Level Rise Adaptation; Coastal Protection
Resource Type:	Regulations
State:	Florida
Jurisdiction Type:	Municipal
Municipality:	County of Miami-Dade
Year (adopted, written, etc.):	2008
Community Type – applicable to:	Urban; Suburban
Title:	County of Miami-Dade Science & Technology Committee Climate Change Advisory Task Force Statement
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Abstract

In July 2006, the Miami-Dade County Board of Commissioners passed an ordinance creating the Miami Dade Climate Change Advisory Task Force to provide technical assistance and advice to the Board of County Commissioners concerning mitigation and adaptation measures in response to the impacts of global climate change. The Task Force consists of twenty-five appointed members representing various sectors of the Miami-Dade community including government agencies and educational institutions.

The Science and Technology Committee is one of six committees established to focus on specific areas of climate change mitigation and adaptation. In September 2007, the Committee published a statement documenting the “very real threat” to the county’s near future posed by accelerated sea level rise. The Committee projected a rise of at least 1.5 feet in the next 50 years, with a total rise of at least three to five feet by 2100. They emphasized the urgency “of reconsidering nearly every aspect of the county’s management, zoning, infrastructure, and planning,” and recommended establishing sea level rise scenarios reflecting future rise to help determine what must be done to preserve habitability and what infrastructure will “need to yield to the rising sea.” This analysis called for documentation of infrastructure elevations, areas susceptible to erosion and pollution, drainage and storm-surge risks, and water supplies from across the country’s various departments.

Resource

Editor’s Note: The text below contains the relevant provision of the Science Committee assessment excerpted from the “Second Report and Initial Recommendations,” presented to the Miami-Dade Board of County Commissioners in April 2008 by the Miami-Dade Climate Change Advisory Task Force. The remaining provisions of these sections have been omitted due to length.

STATEMENT ON SEA LEVEL IN THE COMING CENTURY

Science and Technology Committee Miami-Dade County Climate Change Task Force.
January 17, 2008

Significant sea level rise is a very real threat to the near future for Miami-Dade County.

Background: Over the past 2,500 years south Florida has experienced an average rate of relative sea level rise¹ of about 1.5 inches per century^a. Over this time our sandy, mangrove and muddy coastlines were mostly stable or expanding seawards. The broad coastal wetlands and historically stable sandy coastlines of south Florida are a product of this prolonged period of very gradual sea level rise.

Since 1932, south Florida has had about a 9 inch relative rise of sea level^b. This is a rate of one foot per century and is about 8 times the average rate over the past 2,500 years. Much of this accelerated rise is the result of warming (and expansion) of water in the western North Atlantic Ocean in response to global warming. Our coastal and shallow- marine environments are now evolving in response to the stresses of this rising sea level.

Evaluation: The 2001 report of the United Nations sponsored Intergovernmental Panel on Climate Change (IPCC) projected an additional sea level rise over the coming century of 1-3 feet (median level rise of 2 feet.). The 2007 IPCC report projected a somewhat lower level, but it did not incorporate the significantly accelerated melting being observed in the Greenland Ice Sheet (apparently because the results had not yet been published in peer-reviewed science journals). As a result, the IPCC report, which should be the guidance for the future, underestimates the amount of sea level rise that is likely to occur in this century.

Since 2000, rapid changes have been occurring to the Greenland Ice Sheet - changes that were projected to begin at the end of this century. Over this past decade, there has also been rapid loss of multiyear pack ice in the Arctic Ocean, a phenomenon not projected to occur until 2070. Simply put, climate and glacial scientists now see that models failed to predict the rapidity and quickness with which these critical changes would occur.

Both the Arctic Ocean and Greenland Ice Sheet have important 'positive feedback' effects that are driving these accelerated changes. Positive feedbacks are secondary effects that further reinforce and accelerate the primary changes. For the Greenland Ice Sheet, (a) summer melt water on the lower elevation margins of the ice sheet is forming surface pools on the ice which absorb incoming solar energy, thus accelerating melting; (b) the melted surface water is flushing down to the bottom through fractures and dissolved moulins (vertical holes) in the ice sheet, forming a lubricated layer over the rock which is dramatically accelerating the rate of the ice sheet breakup and movement towards the sea; and (c) as the ice sheet margins melt and move towards the sea, the elevations on the ice sheet are lowering, placing the surface in yet warmer conditions.

Melt effects are expanding northwards on both coasts of Greenland. Even the very northern portions of Greenland have seen increased melting over the past decade.

Field observations from this summer in western Greenland have documented amazing acceleration of marginal glaciers. The Illulissat Icefjord, located 150 miles north of the Arctic Circle, is an outlet for about 7% of the Greenland Sheet. This marginal glacier had been receding in response to increased marginal glacier melt. Beginning in 2002, the ice has surged seaward and is presently moving seaward at over 9 miles per year with additional pulses as high as 3.1 miles in 90 minutes! Melt waters seeping down through the ice sheet have created a 1,600 foot thick layer of water on which the interior ice sheet is now floating, fracturing, and surging to the sea. Acceleration of melting of the Greenland ice sheet is the critical factor to the rise of global sea level in the coming century.

The Arctic Ocean has historically been sufficiently blocked with thick floating pack ice that navigation through the 'Northwest Passage' has remained elusive until recently. The pack ice is floating on the water of the Arctic Ocean and its melting would not in itself change sea level (like a melting ice cube in your glass). However, the white pack ice surface reflects nearly all incoming solar energy back into the air and space. Melting of the pack ice leaves areas of open water which absorb nearly 90 percent of the incoming solar energy. This warms the water, which further accelerates the rate of melting in the Arctic summer and reduces cooling in winter. Historically, the pack ice covering much of the Arctic Ocean through the summer was made of large solid masses of ice that were 4-5 years old, thickening each year. In the past decade, the pack ice has become increasingly younger and thinner. Most of the pack ice this summer is only 1-2 years old. It is thin, highly fragmented and contains many open water areas. As of mid September, this year's summer melt has left 30% less pack ice than the previous record low (in 2005). The large open water areas were 9 degrees Fahrenheit warmer than normal. Melting will continue until at least mid September. The pack ice is now so thin and fragmented that it could potentially float out of the Arctic into the Atlantic.

Climate projections had talked of the possibility of a summer ice-free Arctic Ocean in 40- 80 years. Now it looks like that may happen within a decade if recent trends continue. As the pack ice diminishes over the Arctic Ocean, the adjacent land will warm, vast areas of tundra permafrost will melt releasing potentially catastrophic amounts of methane to the atmosphere², and melting of the Greenland Ice Sheet will even further accelerate.

In short, the recent changes occurring in the Arctic and Greenland mean that global warming and sea level rise will happen much more rapidly than had been only recently projected. Even recent model projections of future ice melt for Greenland by 2040 have already happened in 2007.

In the Antarctic, there is no inherent reason why the impacts of warming should follow the pattern of the Arctic Ocean. The Arctic is an ocean surrounded by land, whereas the Antarctic is a continent surrounded by ocean. Nevertheless, there has been a gradual loss of pack ice through the last half of the twentieth century, but a slight expansion in the past decade (as anticipated by climate models); about a 12% increase in the flow rate of 300 glaciers around the margin of Antarctica between 1993 and 2003; and a significant increase in summer snow melt in both marginal and interior areas of the ice sheet since 2005. Antarctica is a critical unknown to future projections; however, it is showing

distinctive early signatures of accelerated ice release.

Projection: A further 2-foot sea level rise by the end of the century, as projected in the 2001 IPCC report, would make life in south Florida very difficult for everyone. Spring high tides would be +4.5 to 5 feet above present mean sea level; storm surges would be higher; barrier islands, fill islands and low-lying mainland areas would be frequently flooded; salt water intrusion would restrict available freshwater resources; drainage would be more sluggish; Turkey Point would be an offshore island; and so on.

Unfortunately, it looks as though sea level in the coming century will rise significantly more than two feet. With what is happening in the Arctic and Greenland, many respected scientists⁴ 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 by the end of the century, possibly significantly more (calculations used are provided at end of statement). Spring high tides would be at +6 to +8 feet. 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.

The projected rises will just be the beginning of further significant releases from Greenland and possibly Antarctica⁵. Hopefully, the IPCC will quickly revisit the question of sea level rise and provide a more valid and meaningful projection; however, to date, that is not planned until about 2012. When they revisit the current estimates, we expect it will be at least in the 3-5 foot range for this century.

Developed Miami-Dade County as we know it will significantly change with a 3-4 foot sea level rise. Spring high tides would be at about + 6 to 7 feet; freshwater resources would be gone; the Everglades would be inundated on the west side of Miami-Dade County; the barrier islands would be largely inundated; storm surges would be devastating; landfill sites would be exposed to erosion contaminating marine and coastal environments. Freshwater and coastal mangrove wetlands will not keep up with or offset sea level rises of two feet per century or greater. With a five foot rise (spring tides at nearly +8 feet), Miami-Dade County will be extremely diminished.

Reality for Our Future: Miami-Dade County, like all other coastal and low-lying counties, is now facing much more challenging decisions than ever imagined. We will work to provide more carefully documented projections, but we hope you see the urgency of reconsidering nearly every aspect of the county's management, zoning, infrastructure, and planning.

One urgent effort is to look at what Miami-Dade County will need to do to remain inhabitable and functional at benchmarks of a further 1, 2, 3, 4 and 5 foot rise in sea level – and at what point portions of the county will need to yield to the rising sea. This will require a detailed documentation of the elevations of infrastructure elements and roadways; susceptibility of coastal, wetland and artificial fill areas to erosion; defining areas of potential pollution and contamination release; determining changing drainage and storm surge risks; assessing structural viability of buildings and levees with changing groundwater levels and saline water intrusion; looking at the future of fresh potable water

sources; defining the modifications necessary to maintain connectivity of roadways; and many other aspects.

It should be pointed out that the highly porous limestone and sand substrate of Miami-Dade County (which at present permits excellent drainage) will limit the effectiveness of widespread use of levees and dikes to wall off the encroaching sea.

Respectfully submitted,

Science and Technology Committee