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Sent: Monday, February 02, 2009 9:07 AM  
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Subject: Re: FW: BrainstormingIdeasDraft

Pat,

Barry Heimlich suggests the use of a LIDAR-based model for "all of Broward County and projections of likely impacts of sea level rise at 1 foot intervals from 1 to 5 feet". In his recent presentation, Hal Wanless offered far more dire estimates. At one point during the latter part of his presentation, Hal Wanless stated that sea level would/could rise as much as 7 - 9 ft.

Who are the authors for this projected rise in sea level of 5 to 9 ft (e.g., peer-reviewed citations)? The Intergovernmental Panel on Climate Change currently estimates that temperature will increase between 1.1 and 6.4 °C and sea-level will rise between 18 and 59 cm during the 21st century ( 0.59 to 1.9 ft).

I've not had time to conduct a thorough literature review, but would like to reference a statement available in a USGS document  
<http://woodshole.er.usgs.gov/pubs/of2007-1278/html/sealevel.html>

*"With the anticipated acceleration in the rate of global sea-level rise (e.g., IPCC 2001; 2007), local rates of relative sea-level rise will also accelerate. The Fourth Assessment Report (FAR) of the IPCC has predicted that sea level will rise by 10-59 cm over the next century (Meehl and others, 2007), which is a somewhat smaller rise and range than reported in the Third Assessment Report (TAR; IPCC, 2001; estimate 11-88 cm) (Church and others, 2001). Recent criticisms of the FAR estimates of future sea-level changes (Rahmstorf, 2007; Rahmstorf and others, 2007; Hansen and others, 2007) argue that these estimates are conservative and do not incorporate adequately the potential contributions of land-based ice melt from Greenland and western Antarctica to global sea level. The IPCC assessment concludes that the science regarding future acceleration in ice melt and its contribution to sea-level rise is not yet sufficient to include in their sea-level projections."*

I've briefly examined the papers by Rahmstorf, 2007 and Rahmstorf and others, 2007 that were published in Science. The authors suggest a rate of 3.3 +/- 0.4 mm/yr, observing that the rate of sea level rise for the past 20 years of reconstructed sea level is 25% faster than any 20 year period in a 115 year segment they've examined. At the same time, they caution that the interval they've examined is so short that internal decadal climate variability could be the cause of their

observed discrepancy and note that it would be premature to conclude this increased rate to continue at this upper limit.

James Hanson's paper (published in Environmental Research Letters) is an interesting discussion of issues related to sea level rise. However, his article falls more within the realm of advocacy rather than something based on his most recent set of published data. Whereas advocacy is certainly appropriate for policy makers and elected officials, I wonder if it would be preferable for this Subcommittee to cast any discussion on sea level rise within some form of decision-making framework simply to avoid issues related to advocacy. Certainly, there are credible issues to be considered without having to embellish the potential for adverse impact even if only associated with a less dramatic 1-2 ft sea level rise.

A 100 yr rise in sea level based on historical records would increase present levels somewhere in the order of .74 to .78 ft. (assuming rates of 2.39mm/yr  $\pm$ 0.22 and 2.27mm/yr  $\pm$ 0.09 for Miami and Key West, respectively). Although Rahmstorf et al (2007) have suggested that the IPCC may have underestimated the change for sea level, it may be prudent to consider Rahmstorf et al.'s estimates as an outlier (55 to 129 cm or .6 to 4.2 ft). Conversely, Rahmstorf et al considered the possibility that the higher rate of rise would settle back to a more constant rate, estimating a 38 cm sea level rise between 1990-2100 or 1.2 ft).

It is also useful to note that Holgate et al (2007) published a comment in Science regarding Rahmstorf et al.'s estimates. Although they agreed that there is considerable uncertainty in future projections of sea-level rise and that model predictions appeared to underestimate current observations, they state that Rahmstorf's projections were far too simplistic and his estimates failed to contribute to understanding the uncertainty of nonlinear climate change relationships.

A second brief point -- I have similar concern regarding any proposed use of a static elevation model to project future landscape impacts such as has been used by Peter Harlem at FIU. I may be incorrect, but I've heard this is the approach embraced by the Miami Climate Change Task Force. Does one assume sea level rise will occur in a "static environment" or should one more appropriately assume that ecosystem, hydrologic, and even anthropogenic (e.g, water management) response is dynamic? A static model (in which a rising sea overtops coastal structures) can certainly be used to frighten the public, but a dynamic model will offer a far more realistic perspective on the potential impact of sea level rise.

A word of caution with respect to Lidar data acquisition. Ground-truthing datasets is a critical part of the process. As part of our surface- and ground-water modeling activities, we've recently discovered issues with a Lidar dataset near the Turkey Point area in Miami-Dade County between US1 and Card Sound Road. If one were to accept this dataset on a face value basis, Lidar datasets project that

wetland areas (that actually need to be rehydrated) are as much 1/2 meter below sea level. Obviously, this isn't correct. But let's raise sea level one foot and with the click of the ARCINFO mouse, a good part of Miami-Dade County magically transforms into New Orleans during Hurricane Katrina.

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