



**SHORELINES – March 2007**  
As presented to the *Island Review Magazine*

### **“Global Warming & Rising Seas”**

On February 2<sup>nd</sup>, the Intergovernmental Panel on Climate Change (IPCC) released the first phase of a new report assessing past, present, and future trends regarding global climate and sea-level elevations. The entire report will be released in four phases over the remainder of the year and is essentially a wholesale update of the group’s 2001 report. The IPCC, founded in 1988 by the World Meteorological Organization and the United Nations Environment Program, is considered as the preeminent objective source of information related to global climate change, and the 2007 report will include input from over 2,500 scientists from around the world. This is the IPCC’s fourth assessment report since their formation.

“Global warming” is on the tip of everyone’s tongue lately and is obviously an important phenomenon impacting barrier islands like Bogue Banks and others along the gentle sloping southeast Atlantic coastal plain because increasing temperature causes a rise of sea level due primarily to the melting of continental ice packs (or glaciers). While the mechanisms behind global warming are complex and multifaceted, the root cause is often correlated to greenhouse gases that essentially allow the sun’s radiation to penetrate the Earth’s atmosphere but trap this same radiation near the Earth’s surface. The emissions of greenhouse gases such as carbon dioxide from human activities including industrial processes, fossil fuel combustion, and changes in land use have exacerbated this “greenhouse effect.”

As intimated above, although greenhouse gases are considered as the main vehicle behind warming climate and sea-level rise, the forces shaping climate and sea-level oscillations can be extraordinarily complex and inter-related. Factors such as dust from volcanic eruptions and air pollution, oceanic currents, solar activity, water evaporation from oceans, expansion and contraction of seawater, tectonic activity, land subsidence, isostatic rebound of land, and a host of other variables can impact climate and/or sea-level response. This leads us to two important terms regarding sea level – relative vs. eustatic. **Eustatic sea level** is the portion of sea level movement (rise or fall) only attributable to the melting or uptake of water in the world’s glaciers. **Relative Sea Level** on the other hand, is the measurement of the sea surface incorporating glacial melt/uptake and other dynamics such as land movements and sediment supply. So for instance, in area where mountain building is occurring, the land may be rising at a rate close to that of eustatic sea level. Thus the relative sea-level surface is balanced and the rate of movement is close to zero. Conversely, in areas where land is subsiding (sinking), sea level may be considered “rising” at an enhanced rate because eustatic sea level is rising **and** the land is sinking – a double whammy if you will.

With all of this as a backdrop, the 2007 IPCC report forecasts a continued trend of warming climate, shrinking Arctic ice and glaciers, and rising sea levels to the year 2100. The human (or anthropogenic) input to these events will always be difficult to “tease” out of the data, and continues to be a source political acrimony. However, the IPCC report



concludes 21<sup>st</sup> century carbon dioxide emissions (greenhouse gas) will contribute to warming and sea-level rise for more than a millennium because of the timescales required for removal of this gas from the atmosphere. The report also claims there is greater than a 90% probability that human activities, led by burning fossil fuels, are to blame for warming since 1950, compared to a 66% probability published in the 2001 report.

The "good news" in the report lies in the central projection of six models, which indicate a rise of sea level this century between 7 and 23 inches (18 and 59 cm) compared to a far wider range presented in the IPCC's 2001 report of 4 to 35 inches (9 to 88 cm). This reduction in range is attributed to improvements in the models compared to the 2001 report. This still keeps the average estimated sea-level rise figure near the plus foot and a half mark at the year 2100. Averaged over the next 90 years, this places the annual sea-level rise rate at close to 0.02 foot per year, which sounds unassuming, but needs to be given serious consideration in long-term planning efforts along gently-sloping coastal areas.

In even the shorter term, there still appears to be some disagreement that warmer climate is fueling more intense hurricanes and possibly a higher number of hurricanes, which ultimately could have the biggest impact to Carteret County and the N.C. coastal plain for the remainder of this decade. However, the 2007 IPCC Report predicts that it is likely (greater than a 66% probability) that there is link between the current rise in global temperature and hurricane intensity.

Not to complicate matters and confuse reports, but the Environmental Protection Agency is also currently leading a multi-bureau report aimed to document the impacts rising sea levels will have to barrier islands and estuaries along the New York to North Carolina coastal corridor. The report will investigate the impacts of sea-level rise at three intervals - 9.8 inch (25 cm), 19.7 (50 cm), and 39.4 inch (100 cm). There will be no climate or sea-level predictions contained in this report – just the impacts to the Mid-Atlantic coast at these three elevation intervals. This Mid-Atlantic report is part of a larger effort conducted by the U.S. Climate Change Science Program, which was launched in February 2002 under a new cabinet-level organization designed to improve government wide management of climate science and climate-related technology. The Mid-Atlantic Report will be one of 21 deliverables and could be completed by September 2007 with public hearings/input sessions scheduled beforehand – one tentatively scheduled in Tyrell County, N.C. The Shore Protection Office sits on an advisory committee to this report.

And finally, one could postulate that all this discussion regarding warming climate and rising seas warrants a chronological perspective to place much of our current state of affairs in context. This presents a perfect opportunity to discuss the Holocene, the Younger Dryas, Medieval Warming Period, Little Ice Age, and other peculiar terms next month!