2012 State of the Climate

A report released by the American Meteorological Society (AMS), which was compiled by 384 scientists from 52 countries and peer-reviewed with scientists from NOAA's National Climatic Data Center in Asheville, NC, serving as lead editors... Read more

Notes from the EDITOR

By Pablo González[1]

Undoubtedly, the ***State of the Climate in 2012*** report provides valuable information and analysis to help decision- and policy-makers understand changes in the so-called essential climate variables (ECVs) –as defined originally by the Global Climate Observing System (GCOS) program in 2003 and updated in 2010, the impact of these changes and their drivers and/or contributors. Yet, one must understand its limitations given by the data and the actual complexity of Climate itself. For instance, as the authors explain in the introduction of this report, less than half of the ECVs are "fully monitored". In other words, less than half of the ECVs are observed and analyzed across much of the world, and with sufficient long-term data collections to make long-term projections. The remaining variables are "partially monitored" or not even included in the analysis.

And perhaps above any consideration and as obvious as it may be, we must bear in mind that, by definition and as per paleoclimatology, 'change' is an inherent property of Climate. And Climate is a complex process about which, in spite of the advancements in technology and science, we still don't know much. As I was writing these notes, I came across an article, published on August 14th 2013 in The Herald World, on the findings of researchers at the University of Paul Sabatier in Toulouse, in France, who have evidence of a cold, dry spell that lasted hundreds of year and may have driven the collapse of Eastern Mediterranean civilizations in the 13th century BC.

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So, in reading this report one must take a close look at definitions, terminology and context. One must also understand the limitation that exists and will remain for years to come, as datasets for many of these variables extend only few decades back, since they only became available with the advent of satellite imagery and other remote sensing systems.

Just to take one single variable, 'sea ice' time series analysis is limited to satellite records that began only 34 years ago, according to the report. If we now consider multi-decadal oscillations that affect these variables, then these datasets may tell us very little or mislead our analysis, as long-term changes may be masked within multi-decadal oscillations.

In the next few issues of Disasters This Week, we will look into some specifics of this report, starting with 'global sea level rise' in this issue.

So, what is 'sea level'? How do we measure 'sea level' and 'sea level rise'? And finally, what is 'global sea level' and how do we measure 'global sea level rise'?

Let's start from the basics. Sea level is the elevation of the ocean surface referred to the Geoid, which in turn is defined by the equipotential surface of the Earth's gravity. This equipotential surface corresponds to the mean sea level (MSL), assuming that the oceans and atmosphere are in equilibrium and at rest relative to the rotating Earth, and no external forces are being applied. And as the Earth's gravity varies according to the location, the Geoid is of an irregular shape, where sea level is a local measurement referred to the local vertical or plumb line.

We then measure the Local Mean Sea level (LMSL), which is the altitude of the sea –in a given location or point, with respect to a land benchmark or fixed point, averaged over a period of time –such as a month or a year, long enough to weed out fluctuations caused by waves and tides. In addition, these measurements must be corrected by vertical movements of the land or terrestrial tides, which are not necessarily synchronized with ocean tides. And to make matters more complicated, the melting of ice sheets cause additional vertical movements that must be taken into account.

Sea level rise can then be measured by comparing LMSL readings in a time series, long enough not to be distorted by any oscillation. And by definition and the considerations presented above, sea level rise must be measured locally, as it varies by location.

So, what is 'global sea level'? The ***State of the Climate in 2012*** report that covers 258 pages includes only two references to 'global sea level'; and no one defines it. It is not defined either by the Intergovernmental Panel on Climate Change (IPCC) –at least until its last assessment report, but we can infer from the allusions in the report that refers to the surface that coincides with the Geoid. And 'global sea level rise' would be the expected rise of this equipotential surface if the exceeding water –from the melting of ice caps and glaciers and increasing rainfall, were to be distributed equally around it. But, we now know that any exceeding water will not be distributed equally, making 'global sea level rise' a theoretical simplification of the problem.

In the end, the observed increase in sea level at an average rate of 3.2+- 0.4 mm per year over the past two decades may mean impending catastrophic effects for some communities along coastal lines in small islands or continental shores, and good news for others in those areas where land will gain over the sea as water levels drop; or may be no news at all.

But while we continue to learn more about Climate to mitigate the potential adverse effects, we must place ourselves in the worst case scenario, reduce exposure of vulnerable communities and infrastructure, and plan and develop minimizing our intrusion into coastal zones so as to preserve our beaches and natural barriers to storm surge and wind storms, abnormal tides and even extreme events within historical records.

As the ***State of the Climate in 2012*** report clearly indicates, one thing that we are certain about is that "the increase of coastal populations and infrastructure increases vulnerability to high wind and storm surge inundation." And I would add that we have plenty and irrefutable evidence of the catastrophic consequences of the intrusion of populations, with their infrastructure –housing, board walks, restaurants and shops, amusement parks, roads, power lines, and more, into coastal areas. That is why regardless the anthropogenic contributions to Climate and the efforts we may make to mitigate those contributions; we must reduce our vulnerability and mitigate the hazards associated with natural phenomena in coastal areas.