Getting Used to Slow Climate And Sea Level Changes: The Danger of not Recognizing and Planning for Thresholds

Slow changes in climate such as sea level rise and increased coastal flooding carry the danger that we get used to them without knowing where the trends might be leading. Focus is often on the extreme events, while thresholds that might be reached due to the slow changes receive less attention. In Venice, for example, the population and tourists get used to the frequent flooding and it becomes part of the daily life (Fig. 1). In Hampton Roads, VA, the large rate of local sea level (LSL) rise causes an increase in frequent flooding, denoted as “nuisance flooding” (Fig. 2), and despite the growing economic impacts, the population learns to live with this “nuisance” without openly acknowledging the threshold when the “nuisance” will turn into an economic disaster. Increasingly large areas are barely above the present tidal range, and an accelerated sea level rise has the potential to increase hours of flooding per year and number of flooding events exponentially, with potentially damaging economic consequences.

As a result of learning to live with the immediate impacts of slow changes, preparations for the moment when a slow trend reaches a threshold receive less attention. Hampton Roads is an example of an area where the immediate problems caused by the high rate of LSL rise, including damages to property, increased flood insurance premiums, reduced air quality, groundwater saturation, and public health impacts, are on peoples mind more than the increased risk of major storm surges that could, and likely will, cause major disasters. A return of the 1933 flood (Fig. 3), they highest flood experienced in the region up to today, would today be more than 45 cm higher and could cause a major disaster.

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Our ability to adapt to slowly degrading situations makes us often blind for where the trend is leading us. As Robert Engelman (2013) points out, “human resilience can have its downside. By adapting too well to past environmental loss … we humans have been able to keep expanding our population, leading to ever-wider ripples and denser layers of long-term unsustainability.” The metaphor of the “boiling frog” (Fig. 4) comes to mind, and it appears like humans often behave like this frog. Newer research shows that frogs actually do not stay in the warming water if it exceeds a threshold. They leave, if they can.

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Fig. 1: As a result of a slow increase in LSL, many streets in Venice that were built well above LSL many centuries ago are experiencing may push us out of the safe operating space for humanity (Fig. 7). Focusing on mitigation of, and adaptation to, the immediate impacts may keep us from seeing the “Elephant” right in front of us.

Conclusion of the current LSL rise will increasingly impact the region. Nevertheless, the population aims to cope with the current “nuisance flooding” without acknowledging the thresholds that could soon be reached making the impacts of the frequent flooding too costly. The more people get used to the “nuisance flooding,” the less they become aware of the changing risk associated with major hurricanes or “northeasters,” which is exaggerated by the slow change in mean LSL.

The local impacts of climate change and LSL rise can also divert our attention from the “Elephant in the room” (Fig. 5), i.e. the fact that the survival of human civilization as we know it is at stake (Fig. 6). A World Bank report recently stated that “There is… no certainty that adaptation to a 4°C world is possible.” Realizing that civilization developed during the exceptionally stable Holocene, with very little changes in climate during the Past 11,300 Years. Science, 339, 1198-1201.

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REFERENCES


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Fig. 3: The 1933 flood in Hampton Roads caused by a “northeaster” would under today’s condition be far more devastating for several reasons: LSL has increased by more than 45 cm since 1933. In 1933 population in Virginia Beach and Norfolk was about 40,000, while today it is about 1 Million. Floodplains have changed and today’s dependency on roads for transportation, communication, food and water, electrical power, etc. has reduced resiliency and results exacerbate the disaster any such flooding could cause.

Fig. 4: In the 19th century, several scientists claimed that a frog would not leave a slowly heated water if the heating was slow enough. This is the basis of the often used metaphor of the “boiling frog.” However, newer research shows that frogs are smarter than that: they leave the water if there is a way out. Figure from http://en.wikipedia.org/wiki/File:BoilingFrog.png.

Fig. 5: The expected change in global temperature and other climate change will put the planet out of the stable Holocene, and into a far more variable state not conducive for a civilization as we know it. (Rockström et al., 2009). The Holocene, the time frame that civilization developed during the exceptionally stable Holocene, with very little changes in climate during the Past 11,300 Years. Science, 339, 1198-1201.

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