

## PRESIDENT'S MESSAGE

By Al Tucker



### CLIMATE CHANGE AND THE CHESAPEAKE BAY

In this issue we address some of the key challenges facing us with climate change. Climate change is associated with global warming, and a hotter planet implies that the Greenland Glaciers and the Antarctic ice cap will melt, causing the seas to rise and inundate the coastal areas with several tens of feet of water. Fortunately, this climate change scenario is not imminent, but for the sake of future generations we should not ignore it.

There is a great deal of uncertainty associated with future projections. Those of you who have watched the recent hurricane predictions are familiar with the cone of uncertainty that gets larger as the time horizon is extended. There is a high degree of agreement among models in the near future, but they tend to diverge as the time horizon is extended. Yet, the average of the models tends to be fairly accurate. Just by looking out the window, we are all pretty good weather prognosticators when it comes to the next hour. But we rely on the weather forecaster, if we are going to have a picnic.

However, the impacts of climate change are far more subtle, almost imperceptible, and seem to defy our ability to realize the changes that have occurred. These effects may be far more devastating and costly than we realize. When we try to understand the impacts of climate change, we are overwhelmed by the flood of information about seemingly unrelated effects that reach deeply into everyday lives. How do we make sense of it? How will it affect us? And then what should we do? To answer these questions, I will look closer to home, to the Chesapeake Bay, and hopefully relate some of the observed and projected consequences that are related to climate change. I underline "some" since there are a large number of them. I will choose those that I perceive to have the most impact, especially those that hit us in the pocketbook.

Over a century ago, a Swede, Svante Arrhenius, anticipated global warming. He was trying to understand what caused the ice ages. His calculations presage what more sophisticated calculations today estimate. He predicted that, if the carbon dioxide doubled its present value, the average temperature on earth would increase by 9-11°F. Since Arrhenius' time, atmospheric carbon dioxide has increased by factor of 1.3 and the global average temperature has increased by only 1.4°F. The average temperature of the Arctic, though, has increased more rapidly, by almost 5°F, closer to what Arrhenius predicted.

Since we live in the mid latitudes, these observations are not perceptible on an everyday basis. By 2050 the expected number of 95°F days here in Maryland will increase by about 15, but the number of freezing days will drop by 30 days. This is because the average nighttime temperature increase is the main contributing factor of the 3.5°F increase of the daily average for Maryland over the last century<sup>i</sup>. Since this occurs when we are asleep, it escapes our perception. As Arrhenius postulated, the increase in carbon dioxide acts like a blanket at night by keeping the heat trapped. This heat is being trapped by the ocean, causing water to expand in volume, increasing sea level by an imperceptible eighth of an inch per year. In the past 85 years, Anne Arundel County has seen about a foot of sea level rise. Up to now, thermal expansion of the ocean has been the major contributor to the rise. But even this relatively small increase leads to nuisance flooding at high tides. The surprise – of the top ten US areas with nuisance flooding, Annapolis holds the record with the largest number of days – 40. For most of us that is an inconvenience, but for downtown shopkeepers it is an increasing threat and an economic cost.

So how does this change affect us? A general perception exists that climate change has not impacted us economically. Whereas climate scientists have long agreed on the physical impacts of global warming, climate economists have not really contributed much about economic impacts. In a recent paper<sup>ii</sup>, more than 50% of the climate economists surveyed thought that agriculture, fishing, forestry, real estate, insurance and health services would be impacted negatively. Only 40% felt that the negative impacts are occurring now, but more than 90% felt that climate change will damage the global economy by mid-century.

As we have learned from our most recent hurricanes and tsunamis, it is the storm surge that causes the damage and loss of life. An imperceptibly small increase in sea level becomes amplified along shorelines and within embayments and tributaries. Locally, our most recent experience with storm surge was in 2003 with Hurricane Isabel. The peak storm surge reached over 8 ft. in the Bay. In Anne Arundel County, FEMA estimated the total damage to be \$651M (2017 dollars). The Naval Academy infrastructure was severely damaged, and the Annapolis Maritime Museum was under 6 ft. of water. Two of the largest wastewater treatment plants in Prince Georges County lost power, resulting in 96M gallons of wastewater being dumped into the Patuxent River. Subsequent storm surge projections for the Bay for a Category 4 storm hitting the Carolinas indicate that we can expect up to a 14-18 ft. surge in the upper reaches of the Bay. For a storm surge of 6 ft. in Anne Arundel County, 13,000 people, 6,000 homes with a value of \$3.4B and 2 hazardous waste sites will be at risk. The likelihood of such a storm hitting us is projected to be between 10 - 19% by 2030 and 25 - 84% by 2050. From a mathematical viewpoint this is not a negligible risk. This year three Category 4 storms struck the US, so the risk of one striking our region is real. In fact, NOAA just released figures for the increase in billion dollar (or more) weather related disasters. From 1980 to 2007, we averaged 4 events per year; since 2007 we have averaged 11 per year<sup>iii</sup>. (Note: these figures do not include the recent hurricanes with estimated costs of over \$21B.)

What should we do? We should determine the personal level of risk we face and what we can tolerate. Then, for each individual situation, develop a plan for adapting to the most probable outcome. The question is not "if" but "when" it will happen.

To find how you will be affected, the website: [riskfinder.org](http://riskfinder.org) presents an interactive map that shows you how a storm surge could impact you. In 2011 Anne Arundel County did a very good analysis<sup>iv</sup> of the areas in the county to show the impact of storm surges. From there you can assess your own personal level of risk. If you live in Eastport, another very good assessment<sup>v</sup> will show you the impacts

there. Since these reports have been done, very little action has been taken to lessen damage from storm surge in our vulnerable communities. I presume the reason is the costs associated with their implementation.

In 2007, the Maryland Climate Change Commission<sup>vi</sup> (MCCC) was established by executive order. In 2015, the General Assembly codified its mission into law to advise the Assembly and the Governor “on ways to mitigate the causes of, prepare for, and adapt to the consequences of climate change”. The best line of defense in the future, of course, is mitigation, that is, eliminating the causes, namely greenhouse gases. Maryland along with eight other Northeast states formed the Regional Greenhouse Gas Initiative. Since 2005 this effort has reduced greenhouse gases by 40% in these states.

Everyone needs to consider limiting their carbon footprint. The MCCC has produced a series of guides for individuals, businesses, and local governments for mitigation and adaptation practices<sup>vii</sup>. Maryland has been a leader in climate change planning and mitigation. Adaptation, though, remains the purview of local governments

Even with an abrupt cessation of carbon dioxide emissions, it will take centuries for the planet's ecosystems to rebalance. So every little bit of reduction that each of us can contribute counts and will help reduce the uncertainty facing future generations.

<sup>i</sup> Rising temperatures in the last century. Except for western Maryland, the state has warmed more than most of the nation. Source: EPA, Climate Change Indicators in the United States.

<sup>ii</sup> “Expert Consensus on the Economics of Climate Change”, Institute for Policy Integrity, New York University School of Law, (Dec. 2015)

<sup>iii</sup> Billion-Dollar Weather and Climate Disasters: Table of Events, [noaa.gov/billions/events/US/1980-2017](http://noaa.gov/billions/events/US/1980-2017)

<sup>iv</sup> Sea Level Rise Strategic Plan Anne Arundel County, [AASLRStrategicPlan\\_final.pdf](http://AASLRStrategicPlan_final.pdf)

<sup>v</sup> Flood And Inundation Mitigation Strategies City Of Annapolis, Maryland Eastport Area, [http://dnr.maryland.gov/ccs/Publication/Annapolis\\_FIMS\\_eastport.pdf](http://dnr.maryland.gov/ccs/Publication/Annapolis_FIMS_eastport.pdf)

<sup>vi</sup> Maryland Climate Change Commission; [MDClimateChangeCommission](http://MDClimateChangeCommission)

<sup>vii</sup> Maryland Climate Change Guides: [climatechange.maryland.gov/what-can-you-do/](http://climatechange.maryland.gov/what-can-you-do/)

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