

**Our Ocean Backyard — *Santa Cruz Sentinel* columns by Gary Griggs, Director, Institute of Marine Sciences, UC Santa Cruz.**

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**Weather, Climate and Coastlines**

The 100+ degree temperatures of Monday and Tuesday around Santa Cruz County might have made global warming believers out of a few people. It's important to understand the difference between weather and climate, however. A few very hot days don't make a case for global warming any more than a few freezing days or a heavy winter of snow in the Sierras argue against it.

Climate is what we predict and weather is what we get. Climate is long-term and is about average temperatures and rainfall over large areas and how they change over time. Weather is short-term and local and can vary widely from long-term climate patterns or trends.

We can't just look at any one-day or week or one small area, but need to keep the longer-term picture and trends in mind as we try to determine just what is happening to Earth's climate, if anything.

The slow gradual rise in sea level that I wrote about in the last several columns, which has been going on for hundreds of years, and that has begun to accelerate over the past 20 years, is one of those trends we should take notice of.

This year, the U.S. has been running a distinct fever, with NOAA's National Climate Data Center reporting that the lower 48 states had had their warmest January to August period on record. June broke or tied 3,215 high-temperature records across the United States. July was the hottest month ever recorded in the continental U.S. with an average of 77.6 degrees Fahrenheit. As of September, 64% of the U.S. was experiencing drought, with August and September comparable to the worst months of the 1930s dust bowl.

These climatic signals are being recorded along coastlines as well. Tropical Storm Debby caused Florida to have its wettest June on record. In August, Hurricane Isaac caused storm surges of up to 15 feet in some places and contributed to Louisiana and Mississippi experiencing their second wettest August on record. Isaac also gave Florida its wettest summer on record.

Many temperature and rainfall records in the U.S. go back a century or more, so when we read that a month was the hottest or wettest on record, and we see this occurring more and more frequently, it's a pretty good indication that there is some significant climate change underway.

The warming trend has impacted the Arctic in a significant way as well. Satellite data indicate that the Arctic sea ice extent in September shrunk to its smallest area since satellite observations began 33 years ago. The minimum ice coverage this year was almost 300,000 square miles smaller than the previous minimum set in September 2007. This is an area almost twice as large as the entire state of California.

As long as the atmosphere continues to warm, sea level will continue to rise because more polar and glacial ice will melt and because the oceans expand as they warm. There is absolutely nothing we can do about this over the short term. It's a long-term and complex issue but we need to start making some decisions now.

Over the next several decades, however, sea level rise most likely won't be our greatest shoreline concern in California. The National Research Council report projects a rise of somewhere between 3 and 9 inches along the California coast by 2030. During a large El Niño event such as 1982-83 or 1997-98, however, sea level can be elevated up to 12 inches for a month or longer. Combined with high tides and large storm waves, it is a repeat of an El Niño like we experienced in one of those winters that will be the most damaging to the coastline in the near term.

However, as sea level continues to rise, and in all likelihood, rise at a more rapid rate, these storm waves and high tides will reach higher and extend farther inland with each additional increment of sea level rise.

Future coastal damages and losses can only be reduced by taking two steps, neither of them easy or immediate: 1] mitigating the warming of the Earth and the resulting rise in sea level by reducing greenhouse gas emissions dramatically, and 2] developing adaptation plans for coastal infrastructure and development based on the risks of particular areas.

The first is the most difficult, simply because it involves the entire planet, and because we really only have one atmosphere and one ocean. Progress to date has been minimal at best. The 2nd is a local issue, how will each city, county or region

deal with a rising sea? Santa Cruz has now completed both a Climate Change Vulnerability Study and an Adaptation Plan, so is on the right course.