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

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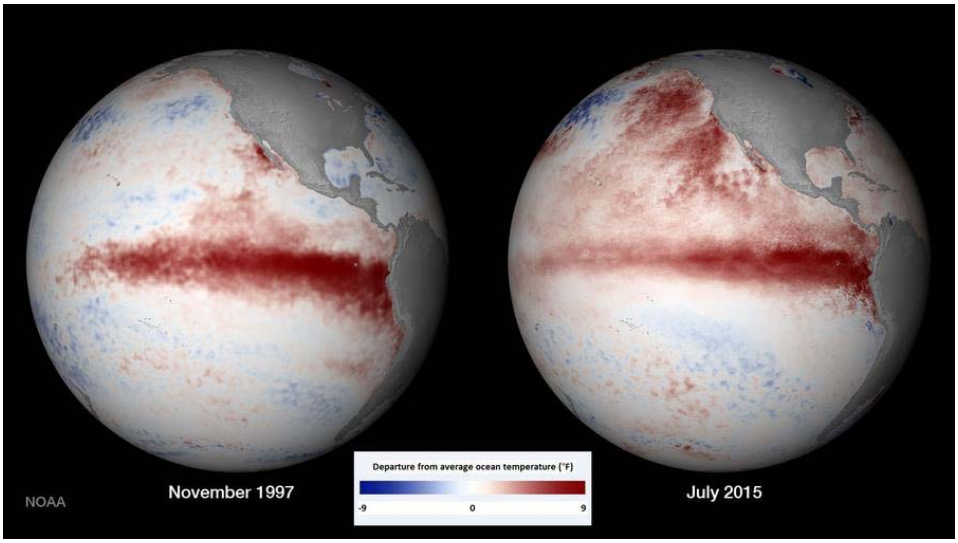
El Niño- What you always wanted to know but were afraid to ask



Departures of sea surface temperatures from long term average for 1997 and 2015, showing similar warm water concentration off South America

"Developing El Niño could be strongest on record!" may be good news, but is also a rather ominous warning, and to be honest, we just don't know which it is yet.

El Niño to some of us may be a relatively new concept to add to our bucket list of potential disasters. Historic records reveal that the fishermen of Peru and Ecuador recognized the appearance of unusually warm water in the adjacent Pacific as far back as the 1600s. Geologic evidence from the sediment records indicates El Niño events have been around even longer.

South American fishermen as well as the fertilizer industry were painfully aware of these events because of the impact on their livelihoods. The bad news started with the intrusion of warm water into the coastal zone, which shut down the upwelling of the nutrient rich subsurface water. Without the fertilizers, the plankton didn't bloom, which broke up the food chain. The fish left town, and the coastal birds that fed on the normally plentiful fish also took off and failed to leave their nitrate and

phosphate rich guano on the coastal rocks. Fishing and fertilizer industries ground to a halt every two to seven years.

The term El Niño came from *The Little Boy*, or *Christ Child*, because these ecological and economic disasters usually hit about Christmas time. Ocean and atmospheric scientists today often use the term ENSO instead of El Niño, which is short for El Niño Southern Oscillation, because of the fluctuations in the temperature of the ocean and atmosphere across the entire Equatorial Pacific.

In “normal” years, although it’s not clear what normal is any longer, the trade winds blow towards the equator from the northeast and southeast. These winds push the warm surface water in the equatorial region towards the western Pacific, to the area near The Philippines and New Guinea. Some of this warm water moves north and circulates clockwise around the North Pacific as the Kuroshio Current, which transitions to the North Pacific Current, and then finally becomes our offshore California Current.

The rest of the warm equatorial water turns south and completes a counterclockwise journey around the South Pacific as the East Australian Current, the Antarctic Circumpolar Current, and finally the Peru Current, which flows north along the coast of South America.

Now, here is the mystery that no one has yet figured out. Every two to seven years the trade winds die down, all of that warm water in the western Pacific reverses its direction and flows back towards the coast of South America, producing an El Niño. Why? We don’t know why.

But it’s the size of this pool of warm surface water and its temperature, how much warmer it is than normal, that are the key indicators of the strength of an El Niño. Comparisons have been made between the large 1997-98 event and the conditions existing now in the tropical Pacific. All forecasts are projecting that the 2015 event will be among the strongest El Niños in the, admittedly short (1950-2105), historic oceanographic monitoring record.

Warmer ocean water means higher evaporation rates and more atmospheric moisture. This increases the probability for more precipitation overall during the winter, which adds to the potential for extreme rainfall, more so in southern California. This may help alleviate the drought, but can also lead to flooding and mudslides, which have been all too common during past large El Niños.

This monitoring and the week by week tracking and prognosis is only possible because the federal government, through NOAA (the National Oceanic and Atmospheric Administration- which is now led by Kathryn Sullivan, a UCSC graduate in Earth Sciences and a former space shuttle astronaut), has invested in the satellites, ships and buoys that are keeping constant track of the temperature of the Pacific Ocean like a doctor on constant duty.