INTERNATIONAL PACIFIC RESEARCH CENTER

IN THE SCHOOL OF OCEAN AND EARTH SCIENCE AND TECHNOLOGY AT THE UNIVERSITY OF HAWAI'I at MĀNOA

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What is El Niño *Taimasa*?

PROJECTIONS OF EXTREME SEA LEVEL VARIABILITY DUE TO EL NIÑO TAIMASA, Oral presentation Session #:079 Rising Sea Level: Contributions and Future Projections; Date: 2/26/2014; Time: 12:00; Location: 313 B; http://www.sgmeet.com/osm2014/viewabstract.asp?AbstractID=15569

During very strong El Niño events, sea level drops abruptly in the tropical western Pacific and tides remain below normal for up to a year, especially around Samoa. The Samoans call the wet stench of coral die-offs arising from the low sea levels *taimasa* (pronounced [kai' ma'sa]). Studying the climate effects of this particular variation of El Niño and how it may change in the future is a team of scientists at the International Pacific Research Center, University of Hawai'i at Mānoa and at the University of New South Wales, Australia.

Two El Niño *Taimasa* events have occurred in recent history: 1982/83 and 1997/98. El Niño *Taimasa* differs from other strong El Niño events, such as those in 1986/87 and 2009/10, according to Matthew Widlansky, postdoctoral fellow at the International Pacific Research Center, who spearheaded the study.

Flat-top Porites coral on a shallow reef near American Samoa. Coral heads are fully submerged under normal conditions. During El Niño *Taimasa*, tops of large flat coral on the reef are exposed to air at low tide. Image courtesy of the National Park of American Samoa.

"We noticed from tide gauge measurements that toward the end of these very strong El Niño events, when sea levels around Guam quickly returned to normal, that tide gauges near Samoa actually continued to drop," recalls Widlansky.

During such strong El Niño, moreover, the summer rainband over Samoa, called the South Pacific Convergence Zone, collapses toward the equator. These shifts in rainfall cause droughts south of Samoa and sometimes trigger more tropical cyclones to the east near Tahiti.

Using statistical procedures to tease apart the causes of the sea-level seesaw between the North and South Pacific, the scientists found that it is associated to the well-known southward shift of weak trade winds during the termination of El Niño, which in turn is associated with the development of the summer rainband.

Looking into the future with the help of computer climate models, the scientists are now studying how El Nino *Taimasa* will change with further warming of the planet. Their analyses show, however, that sea-level drops could be predictable seasons ahead, which may help island communities prepare before the next *taimasa*.

Abstract

PROJECTIONS OF EXTREME SEA LEVEL VARIABILITY DUE TO EL NIÑO TAIMASA

During strong El Niño events, sea level drops around some tropical western Pacific islands by up to 20–30 cm. Such extreme events (referred to as 'taimasa' in Samoa) expose shallow reefs, thereby damaging associated coastal ecosystems and contributing to the formation of 'flat topped coral heads' often referred to as microatolls. We show that during the termination of strong El Niño events, a southward movement

of weak trade winds prolongs extreme low sea levels in the southwestern Pacific. Whereas future sea levels are likely to gradually rise, recent modeling evidence suggests that the frequency of strong El Niño events (which alter local trade winds and sea level) is very likely to increase with greenhouse warming. Such changes could exacerbate El Niño-related sea level drops, especially in the tropical southwestern Pacific. Using present-generation coupled climate models forced with increasing greenhouse-gas concentrations, we assess how the interplay between global mean sea level rise, on one hand, and more frequent interannual sea level drops, on the other, will affect shallow reef ecosystems.

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The International Pacific Research Center (IPRC) of the School of Ocean and Earth Science and Technology (SOEST) at the University of Hawaii at Manoa, is a climate research center founded to gain greater understanding of the climate system and the nature and causes of climate variation in the Asia-Pacific region and how global climate changes may affect the region. Established under the "U.S.-Japan Common Agenda for Cooperation in Global Perspective" in October 1997, the IPRC is a collaborative effort between agencies in Japan and the United States.