Technology That Measures Sea Level, Helps Predict El Niño Events, Improved By New Modeling, UNH Scientist, Colleagues Report

Contact: David Sims
603-862-5369
Institute for the Study of Earth, Oceans, and Space

April 11, 2006

DURHAM, N.H. -- A paper published today in the American Geophysical Union's Journal of Geophysical Research-Oceans shows a method to recover valuable data from the primary tool used for measuring global sea level – satellite radar altimetry. Altimeter data are used, among other benefits, to monitor and predict the occurrence of events such as El Niño and La Niña – a coupled ocean-atmosphere phenomena that can alter global weather patterns.

Some six percent of global altimetry measurements are typically discarded because the instrument can't get accurate readings in areas of ocean calm or "slicks" caused by a lack of wind and waves, or by surface films created by blooms of phytoplankton or oil spills. Because millions of altimeter measurements are made per year, that six percent translates into a huge amount of unused data.

The improvement comes from a modeling technique developed by scientists that should enhance and expand the number of altimeter measurements that NASA can collect – using the Jason-1 satellite – from the equatorial Pacific Ocean where El Niño events originate. Jason-1, launched in 2001, is a joint NASA/Centre National d'Études Spatiales or CNE (the French government space agency) mission.

Says co-author Doug Vandemark, a radar engineer/oceanographer and research professor at the University of New Hampshire's Institute for the Study of Earth, Oceans, and Space (EOS), "Every year our altimeters make something like 10 million ocean measurements so being able to recover at least a portion of that six percent gives us better information on sea-surface height. The percentage is much higher than six for calmer equatorial regions such as the Pacific, which tells us about where the bulge of water is that controls the El Niño."

Picture the Pacific Ocean as a big bathtub. A bulge in the western end – created by warm water and winds – can set off an El Niño event by creating a wave that propagates very quickly along the equator from Asia towards the Americas, eventually inducing large water temperature changes along the coasts of South and North America. When the bulge makes its inevitable and slower return back, that's a La Niña event.

Says the JGR paper's lead author, Jean Tournadre of Laboratoire d'Océanographie Saptiale, Institut Français de Recherche pour l'Exploitation de la Mer, "Satellite altimetry has become a standard tool for ocean modeling and climatology studies." He adds, "Altimeters provide precise measurements of sea-surface topography, the significant wave height, and the small-scale roughness of the sea surface." Indeed, a radar altimeter can measure sea height down

to one centimeter.

Altimetry works by sending 1,800 separate radar pulses per second down towards Earth from a height of some 800 kilometers and recording how long their echoes take to bounce back. The authors' work with what Vandemark calls "the problematic subset of echoes from very smooth ocean areas" suggests that altimeters may now be able to estimate the spatial extent of these smooth areas as well and to recover more sea level estimates.

Vandemark notes that having more accurate equatorial Pacific Ocean measurements "provides agencies like NASA and NOAA more measurements for El Niño prediction and tracking." NOAA, the National Oceanic and Atmospheric Administration, is responsible for forecasting El Niño events, just as its National Weather Service is responsible for weather forecasting and warnings.

Radar altimetry has been around for only 15 years and in that time has revolutionized the study of the ocean. Among its other scientific uses, altimetry is also used to monitor the ocean's circulation patterns, glaciers, predict the strength of hurricanes, and measure river and lake levels worldwide.

To learn more about ocean surface topography from space, visit http://sealevel.jpl.nasa.gov.