RESEARCH SPOTLIGHT

Highlighting exciting new research from AGU journals

PAGE 184

Coastal cooling and marine productivity increasing off Peru

The upwelling system off Peru is of environmental and economic importance due to its high fish productivity. It has been suggested that global warming may be leading to increasing temperature differences between the coast and the ocean, causing increases in alongshore wind stress and coastal upwelling in this zone. Upwelling brings nutrients from deep waters toward the surface, increasing biological productivity.

To confirm reported trends of increasing coastal cooling and rising biological productivity, *Gutiérrez et al.* analyzed sediment records spanning the past 150 years as well as instrumental records from the main upwelling zone off Peru. They found that sea surface temperatures have been declining since the 1950s in the main upwelling zone. The cooling trend is likely linked to increased upwelling in spring, during which there is enhanced biological productivity. (*Geophysical Research Letters*, doi:10.1029/2010GL046324, 2011) —ET

This sediment core, retrieved off Pisco, Peruvian margin, was used to study trends in coastal cooling and biological productivity. The sediments accumulated in the upper block (25 centimeters) correspond to the past approximately 130 years.

Model suggests path to ending the ongoing Haitian cholera epidemic

Since early November 2010 a deadly cholera epidemic has been spreading across the Caribbean nation of Haiti, killing thousands of people and infecting hundreds of thousands. While infection rates are being actively monitored, health organizations have been left without a clear understanding of exactly how the disease has spread across Haiti. Cholera can spread through exposure to contaminated water, and the disease travels over long distances if an infected individual moves around the country. Using representations of these two predominant dispersion mechanisms, along with information on the size of the susceptible population, the number of infected individuals, and the aquatic concentration of the cholera-causing bacteria for more than 500 communities, *Bertuzzo et al.* designed a model that was able to accurately reproduce the progression of the Haitian cholera epidemic.

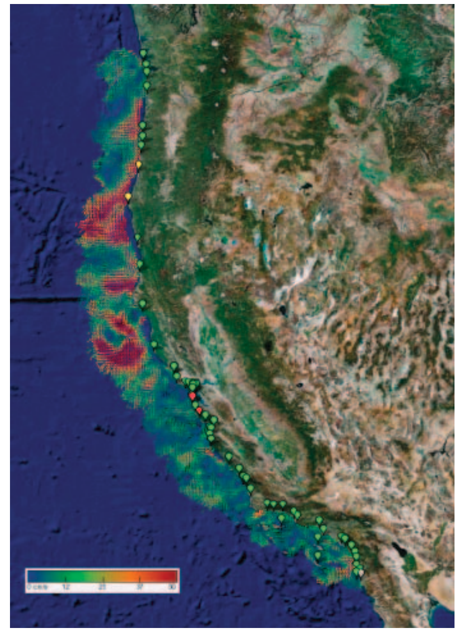
The authors' prediction for further spreading of the disease—made in late December 2010 and supported by more recent data—was that the infection rate would begin to taper off in early January. They forecast that the bulk of the cases would occur near the seat of the epidemic, in the Artibonite department, as well as in and around the Haitian capital, Port-au-Prince, in the Ouest department.

Because the researchers' model is able to differentiate between the two major avenues of cholera transmission—by surface water and by infected individuals—the scientists are able to assess how interventions that target these two mechanisms might be used to stem the progression of the disease. The authors argue that at this stage of the epidemic, emphasis should be placed on ensuring clean food and drinking water rather than on pursuing less effective vaccination campaigns. The authors suggest that reducing in 1 month the exposure to contaminated food and water by 40% could severely limit the perpetuation of the epidemic. (*Geophysical Research Letters*, doi:10.1029/2011GL046823, 2011) —CS

Mapping U.S. West Coast surface circulation

A network of high-frequency radar systems designed for mapping ocean surface currents now provides unprecedented detail of coastal ocean dynamics along the U.S. West Coast, according to *Kim et al*. The network has grown over the past decade from a few radars to what is now considered the largest network of its kind in the world, providing nearly complete coverage of currents along approximately 2500 kilometers of shoreline. With an ability to resolve kilometer-scale currents out to approximately 150 kilometers offshore, the technology has been used for local oceanographic studies in addition to applied applications for supporting oil spill response, search and rescue, fisheries, and coastal discharge assessment.

Using observations collected by a centralized data assembly center, the authors present a multiyear synthesis of the dynamics of the surface currents off the U.S. West Coast. The surface circulation is governed by a complex combination of factors including tides, winds, Earth's rotation, synoptic ocean signals, and interactions of these forces.



A map of surface currents off the U.S. West Coast created using data from a network of high-frequncy radar systems. The colored dots along the coast indicate the existing radar stations that report hourly surface currents.

The researchers report on the geographic differences of these dynamics and illustrate how the high-frequency radar system is able to characterize phenomena such as the seasonal transition of alongshore surface circulation, submesoscale eddies, and coastally trapped waves. The researchers envision that the network will continue to provide valuable real-time monitoring of the U.S. West Coast as well as long-term, science-quality records of ocean climate signals. (*Journal of Geophysical Research-Oceans*, doi:10.1029/2010JC006669, 2011) —ET

Modeling saturation overshoot in porous media

Infiltration of water into soils or porous rocks often follows unpredictable, preferential flow paths, also known as fingers. These fingers are caused by a condition called saturation overshoot, where the water content in the finger tip is greater than the water content in the finger tail. Why this happens has puzzled researchers, as overshoot cannot occur in traditional models. *DiCarlo et al.* used modeling and experiments to bridge the pore-level and continuum-scale physics behind saturation overshoot. Their model predicts the types of soils and initial conditions that are susceptible to overshoot and preferential flow. (*Water Resources Research,* doi:10.1029/2010WR009879, 2011) —ET

Determining the underlying pattern of Arctic snowfall

Across the Arctic terrain, more than a hundred bright orange markers dot the landscape, sticking up from the fallen snow. The fiberglass poles, standing 1.5 meters high and spaced 100 meters apart, allow *Sturm and Wagner* to track snow depth over their 1-square-kilometer research area in Alaska. These depth measurements may be simple, but trying to turn them into a prediction of future snowfall distribution is far more difficult. A rough estimate of the amount of snow expected in an area can be estimated from weather models, but the smaller-scale distribution of snow across the landscape is often dictated by interactions among wind, topography, and vegetation, factors that models have difficulty simulating.

Matthew Sturm

Springtime over the Nulato Hills in southwest Alaska. The shallow areas of snow have melted, making it easy to observe the areas where deep snow lay during the winter, revealing the essential snow distribution pattern.

Fortunately, topography and vegetation tend not to change drastically from year to year. The authors used this fact, along with data from 14 annual spring snow depth distribution surveys, to produce a map of the underlying pattern of snowfall in their study area. The researchers find that while the magnitude of the snowfall depth changed with the weather, the distribution was remarkably consistent. They used this depth distribution pattern, along with only three snow depth measurements, to reproduce the snowfall coverage for an independent winter; their reproduction was accurate to within a few centimeters, similar to the accuracy of weather-driven models. Further, the researchers used their snowfall distribution map to optimize a weather-driven model, increasing its predictive accuracy by up to 60%. (*Water Resources Research,* doi:10.1029/2010WR009434, 2010) —CS

—Colin Schultz and Ernie Tretkoff, Staff Writers