School of Ocean and Earth Science and Technology
University of Hawai'i at Mānoa
1680 East West Road, POST Bldg., Rm 401 • Honolulu, HI 96822
Web: http://iprc.soest.hawaii.edu

NEWS RELEASE:
January 9, 2008

Contacts:
Shang-Ping Xie: (808) 956-6758; xie@hawaii.edu
Gisela Speidel: (808) 956-9252; gspeidel@hawaii.edu

Mapping High Sea Winds from Space

Wouldn't maps be useful that show where gales are common over the ocean? They would come in handy, for instance, for setting shipping routes, selecting oil rig placements, planning wind farms, or preventing coastal erosion. Yet understandably, ships avoid places where they expect to hit high winds, and detailed, exact maps of sea winds have not been available. The advent of satellites is changing that. Satellites carry instruments called *scatterometers* that scan surface winds uniformly over the ocean. Scatterometers now make the drawing of such maps possible, and a paper published in the latest *Bulletin of the American Meteorological Society* describes just such a map.

The authors of the paper, Takeaki Sampe and Shang-Ping Xie at the International Pacific Research Center of University of Hawaii, took advantage of a wind-speed data set from the NASA QuikSCAT satellite. They gathered and examined carefully seven years of satellite data, and have charted the occurrence of sea winds over 44 miles per hour, that is, gale winds or higher on the Beaufort scale.

Cape Farewell in Greenland is the place visited most often by strong storms, according to their study. It tops the windiest place on the yearly average, with sea winds over 44 mph more than 16% of the time; and it also tops the winter list, with such winds blowing more than 25% of the time. Indeed, where tall coastlines or where high mountains meet the ocean, the two scientists found that winds often accelerate. Such regions were responsible for half of the top 10 entries, and include such places as the Gulf of Lyon in the Mediterranean, where the mistral shoots down from the Alps.

High winds draw tremendous heat out of the ocean, leaving behind cold, salty water that sinks to the bottom. The cold, salty water off Greenland and that flowing out at the bottom of the Mediterranean are thought to be crucial for driving the deep global ocean circulation, the so-called *conveyor belt*. Changes in the strength and vigor of this conveyor belt have been implicated in the sudden switch between warmer and colder climates in the past, with temperature changes of up to 10°C over the North Atlantic and Europe.

Among other regions favoring high sea winds, according to the study, are the Gulf Stream and the Kuroshio. When the warm Gulf Stream and Kuroshio in the Pacific flow northward into cold ocean regions, they form cold-warm fronts. These ocean fronts anchor storm tracks and are regions favorable for high winds, particularly in winter. What has surprised the scientists is that wind speed varies greatly along these fronts. Along these warm, meandering currents, they found the strong winds much more often on the warmer side than on the colder side just a few hundred miles away.

more

The high-wind map shows, for example, a calm spot in the midst of the stormy North Atlantic, southeast of Newfoundland, just over cold waters bordered by warm currents. During winter, this calm region registers winds above 44 mph only 2% of the time whereas not far away on a warm meander of the Gulf Stream, the frequency shoots up eight times to 16%. This observation gives climate scientists important clues about how sharp differences in the surface temperature of the ocean affects the atmosphere. They believe that warm ocean temperatures at such a front create an unstable atmosphere that sucks down strong winds from aloft.

Another surprise is that tracks of typhoons and hurricanes, the most powerful storms on Earth, leave little imprint on the frequency of high winds. The reason is that, although hurricanes pack devastatingly strong winds, they happen much less often than midlatitude storms.

High winds are important for climate. Besides affecting heat flux and deep water formation, they are important for air-sea gas exchange - including the greenhouse gas CO_2 - and ocean mixing. High winds spawn life by pumping up nutrients from deep water on which planktons feed.

As much as this new high-wind map has its uses and has revealed phenomena important for climate research, the map is still not precise enough for many purposes. The current scatterometers do not measure accurately wind speeds above 60 mph, and do not differentiate hurricanes of different category strength. The instruments do not see oceans within 25 km off the coast because of the scattering of radar waves by land surfaces.

NASA is studying plans to build the next generation of scatterometers. These would have a resolution of 5 km and have greatly improved sensitivity to winds above 60 mph. The increased resolution would allow the instruments to map winds closer to the coast, enabling more coastal applications such as mapping the impact of coastal mountains. Moreover, the improved accuracy would permit forecasters to determine better the strength of very intense storms, including hurricanes.

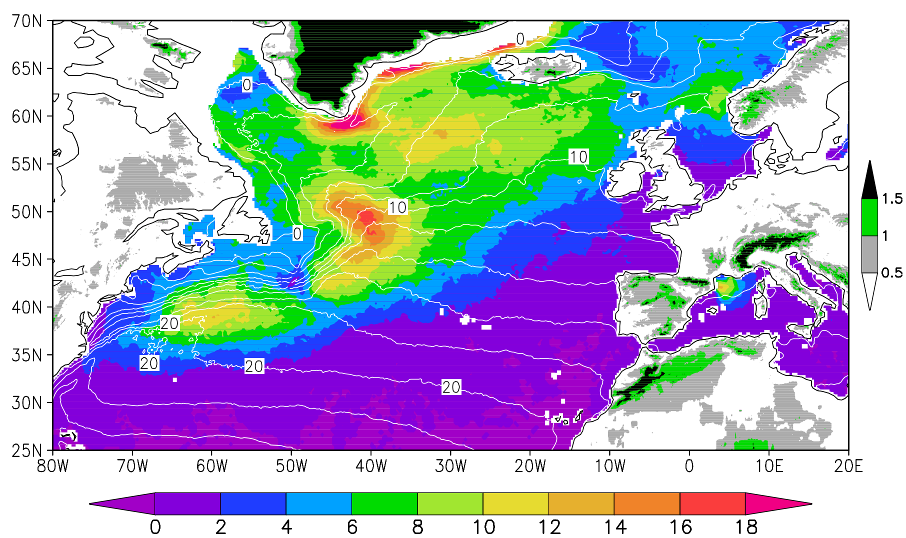

Figure Caption: *2000–2006 QuikSCAT winter climatology of the frequency of winds higher than 20 m/s or 44 mph (color in %), and AVHRR sea-surface temperature (white contours at intervals of 2°C). Topography higher than 500, 1000, 1500 m is shown in gray, green, and black, respectively.*

more

The International Pacific Research Center (IPRC) of the School of Ocean and Earth Science and Technology (SOEST) at the University of Hawai`i at Mānoa, 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.