Scientists explore if we're in 'age of great quakes'

Gary Robbins, San Diego Union Tribune, 4-10-11

It has been barely a month since a magnitude-9.0 earthquake and subsequent tsunami devastated Japan, killing at least 12,800 people. But scientists are already coming out with research about one of the worst natural disasters in history. Some of those findings will be released during the annual meeting of the Seismological Society of America, which gets under way today in Memphis, Tenn. The society released this snapshot of some of the research papers about Tohoku, the name given to the event. The summaries are often verbatim ....

Could the Tohoku earthquake have been predicted?

Two days before the devastating Japanese earthquake and tsunami, there were foreshocks off the Pacific coast of Tohoku. Yoshiaki Fujii of Hokkaido University notes that the daily rate of small earthquakes (equal or more than magnitude-1.0) significantly increased two days before the main quake. A large number of these foreshocks were detected in Miyagi, Iwate and Fukushima, site of the dangerously crippled nuclear power plant.

Although a major earthquake doesn't always follow these types of foreshocks, Fujii argues that they could have pointed to the need to prepare or at least go on alert for a major quake somewhere in Japan. Even with such a prediction, buildings and other infra structure would have still suffered considerable damage. But Fujii notes that an earlier warning may have allowed thousands of people to safely evacuate with their valuables and emergency goods.

Tohoku's surprising size

The 2011 Tohoku earthquake took many seismologists by surprise, because there have been few other earthquakes larger than magnitude-8.0 in the area for the past 1,200 years. But there were some signs of seismic strain for the area that may have been considered in assessing the possibility of a rare and devastating earthquake, says Hiroo Kanamori of Caltech.

In this overview of the Tohoku event, Kanamori outlines details of the earthquake based on seismic, tsunami and global positioning system data. Preliminary analyses suggest there was large ocean bottom deformation of the crust along the Japan Trench, where the Pacific Ocean basin tectonic plate collides and is pulled under the continental crust.

Are we in an age of great earthquakes?

Is the magnitude-9.0 Japan earthquake part of a larger global trend toward giant earthquakes?

Several groups of researchers have been combing through 110 years' worth of global seismic records to determine that and have arrived at different interpretations.

Richard Aster of the New Mexico Institute of Mining and Technology and colleagues looked at historical catalogs of earthquakes along with more recent estimates to create a long-term record of global seismic moments — the cumulative size of earthquakes around the world. They suggest there were relatively low rates of big earthquakes from 1907-1950 and 1967-2004. The rate of large earthquakes increased substantially from 1950-1967 and appears to be increasing again since the 2004 Sumatra-Andaman earthquake.

In a second analysis, Charles Bufe and David Perkins, both of the U.S. Geological Survey, update their

conclusions reached in a 2005 paper in which they described “megaquakes” to describe five earthquakes of magnitude-9.0.

Three of these occurred in an 11.6-year cluster between 1952 and 1964, and included the magnitude-9.5 Chile earthquake of 1960. They found significant clustering of magnitude-8.6 and larger earthquakes during 1950-1965 and documented a long period (beginning during 1965 and continuing to 2001) of significant global quiescence with no events of magnitude-8.4 or larger.

In the 2005 paper, they speculated that the 8.4 in 2001 could mark the beginning of a new global sequence of larger earthquakes. In the new paper, Bufe and Perkins discuss the significance of the current 6.3-year global cluster of great earthquakes, including the two recent megaquakes of 9 or greater.

An analysis by Andrew Michael, also of the U.S. Geological Survey, suggests that the recent increase in the rate of large earthquakes may just reflect random variation in global patterns of seismic activity. His statistical study found that the pattern of large global earthquakes can be explained as a random fluctuation, once local aftershocks of the large earthquakes are taken into account.

Big earthquakes bracketed by earthquake swarms

Earthquake swarms are episodes where an area experiences many earthquakes over a short period without an initial “main shock” of greater magnitude. Stephen Holtkamp and Michael Brudzinski of Miami University suggest that large subduction zone earthquakes, such as the 2011 Tohoku quake, are bracketed by earthquake swarms. They describe earthquake swarms from around the Pacific, and find that regions with a large gap between swarm areas are often the site of major earthquake ruptures.

They note this tendency in the 2010 Chile earthquake, as well as earthquakes in Sumatra, Peru, Alaska and Kamchatka. Although earthquake swarms are generally composed of many smaller magnitude earthquakes, they appear to indicate areas that do not accumulate large tectonic stresses, which could prevent large earthquake ruptures from continuing through the swarm area.