Dear Colleagues,

On 11 March 2011 Japan was struck by the magnitude 8.9 earthquake, one of the most powerful earthquakes ever recorded by Japanese seismologists or elsewhere. The TV images and videos of the destructions caused by the earthquake and the subsequent tsunami are shocking. This is a time of great trial for the Japanese nation. Today our hearts are with Japanese people who lost their relatives and friends, lost their houses and property. We wish the country a rapid recovery from the earthquake/tsunami disaster.

Japan is a well-known earthquake-prone region and seismologically is among most well-studied areas of the Earth. As scientists dealing with natural hazards, we can ask: was an event of such a magnitude expected to occur near Honshu? The answer is negative. Neither the world's most dense network of seismic stations nor the most dense network of GPS stations in the country alerted to this great earthquake. No earthquake prediction was issued in this case, although the alert on the increased probability of magnitude 8 (and higher) earthquake was issued less than a year ago (and communicated to many seismologists around the world), but has been withdrawn in the beginning of this year (Fig. 1, courtesy of V. Kossobokov).

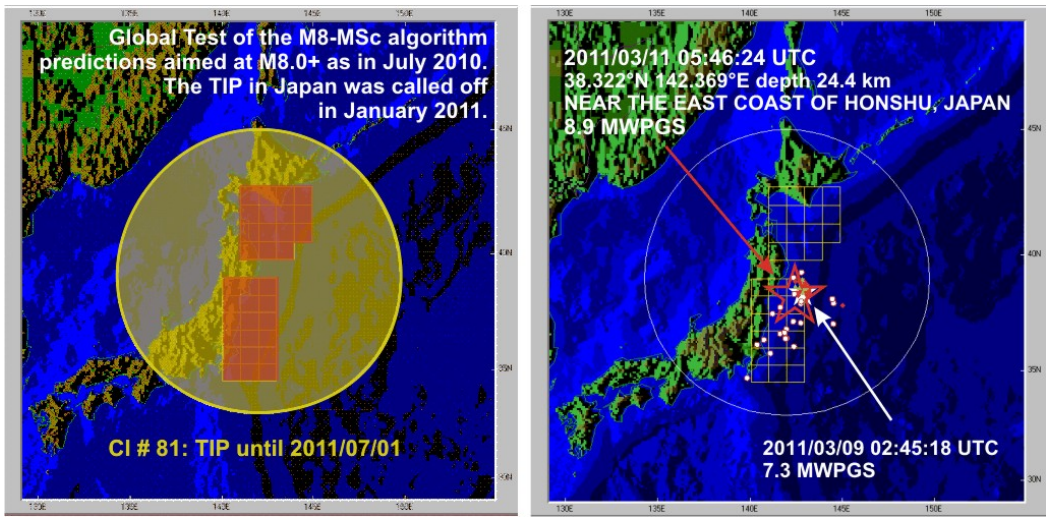

Fig. 1

Based on long-term observations, almost all seismologists were thinking that the largest earthquake in this region could be of magnitude 8. Looking at the seismic hazard map of the region (Fig. 2, courtesy of USGS) and the earthquake shake map (Fig. 3, courtesy of USGS), the answer of the question above becomes quite obvious: nobody expected an 8.9 earthquake in the region. The existing probabilistic seismic hazard assessments (PSHA) evidently suffer from the neglect of scenario-based hazard assessments, especially those associated with extreme events (PSHA failed to correctly evaluate the ground acceleration in the case of the Sichuan earthquake in 2008, Haiti earthquake in 2010, and many others).

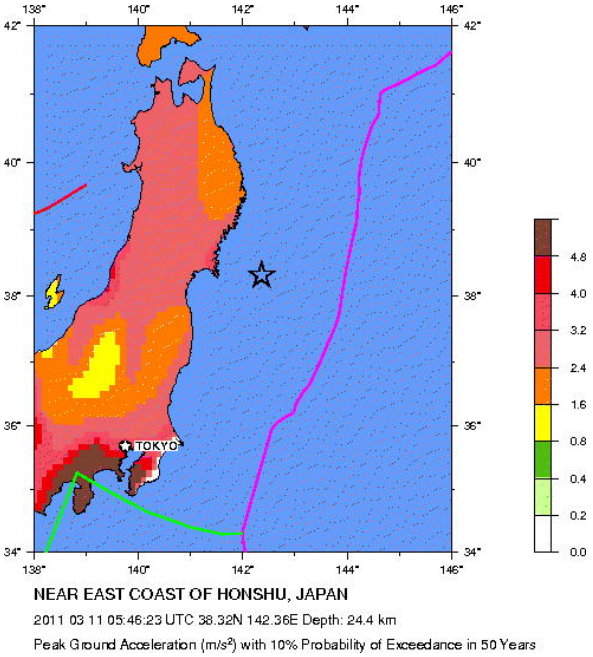

Fig. 2

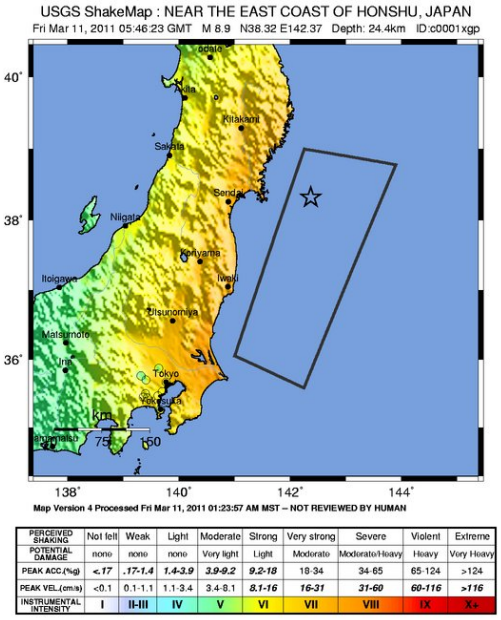

Fig. 3

The 11th March earthquake in Japan belongs to the class of extreme (high magnitude and low probability) natural events. Hence, only proper seismic hazard analysis, which should combine the best of probabilistic and deterministic seismic hazard assessments with earthquake forecasting (low probability of event's occurrence in the time-space-magnitude window) and prediction (higher probability of event's occurrence in the same window), together with permanent geodetic measurements along fault zones (onshore and off-shore), electromagnetic and other geophysical measurements and earthquake-simulation modeling could perhaps bring scientists to better assessment of potential risks in the region and help policy-makers to mitigate possible disasters.

Compared to the 2010 Haiti earthquake disaster, the disaster in Japan is of different nature. The Haiti earthquake would be not listed as a disaster if preventive measures had been implemented in advance of the event. For example, the giant M8.8 earthquake in Chile just a few months after the Haiti earthquake did not become a great disaster, because fifty years ago, after the most powerful (magnitude 9.5) earthquake in the country, the government has implemented new seismic code and switched to proper building construction. Because of preventive management of natural disasters by the Japanese government and proper science education of the population by Japanese scientists, the country met the great release of the Earth's stress rather well prepared, even though the event of 11th March was not expected to have such a huge magnitude.

Humans will never be able to prevent the occurrences of natural phenomena entirely. The case of the recent disaster in Japan has shown us again that the mitigation of disasters is an important and vital measure, which should be taken by every nation living with risks of natural hazards.

Alik Ismail-Zadeh
Chair of the AGU Natural Hazards Focus Group