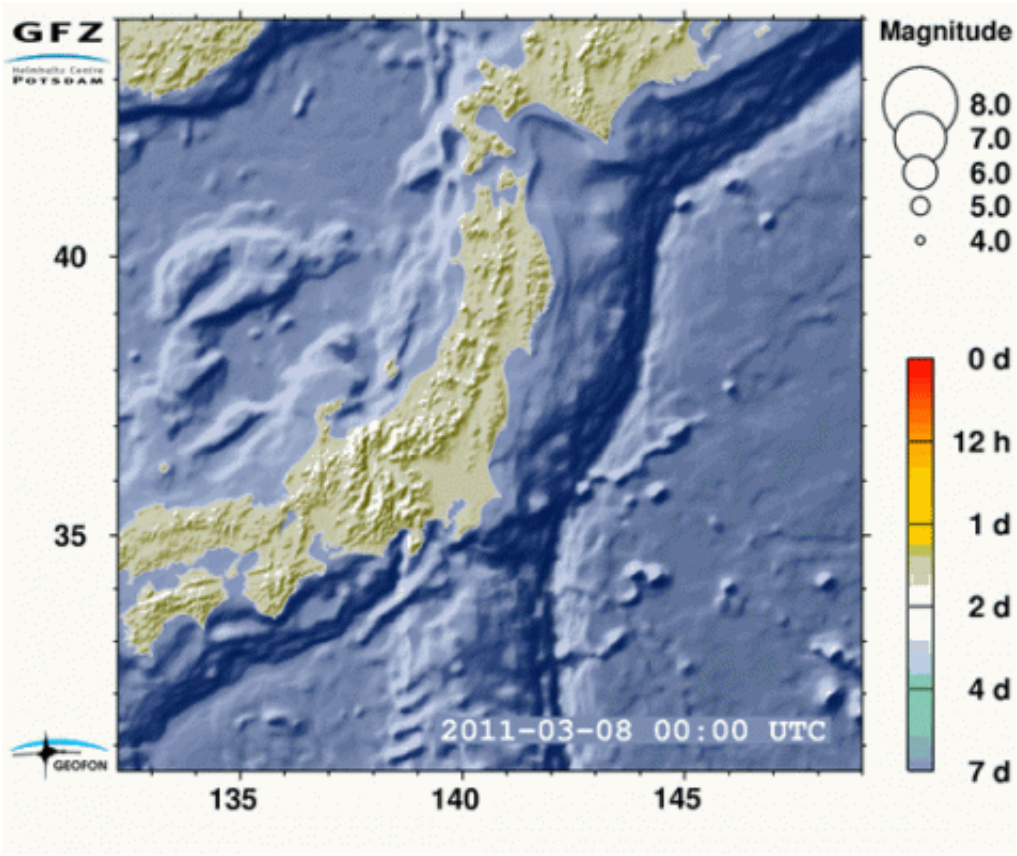
New findings on the developments of the earthquake disaster

March 16 2011



Propagation of the Honshu Tsunami

The earthquake disaster on 11 March 2011 was an event of the century not only for Japan. With a magnitude of Mw = 8.9, it was one of the strongest earthquakes ever recorded worldwide. Particularly interesting is that here, two days before, a strong foreshock with a magnitude Mw =

7.2 took place almost exactly at the breaking point of the tsunami-earthquake. The geophysicist Joachim Saul from the GFZ German Research Centre for Geosciences (Helmholtz Association) created an animation which shows the sequence of quakes since March 9.

The animated image is available above. It shows the earthquake activity in the region of Honshu, Japan, measured at the GFZ since 8 March 2011. After a seismically quiet 8th March, the morning (coordinated universal time UTC) of the March 9 began with an earthquake of magnitude 7.2 off the Japanese east coast, followed by a series of smaller aftershocks. The morning of March 11 sees the earthquake disaster that triggered the devastating tsunami. This earthquake is followed by many almost severe aftershocks, two of which almost reach the magnitude 8. In the following time period the activity slowly subsides, and is dominated today (March 16) by relatively small magnitude 5 quakes, though several earthquakes of magnitude 6 are being registered on a daily basis. The activity of aftershocks focuses mainly on the area of the March 11 earthquake. Based on the distribution of the aftershocks, the length of the fraction of the main quake can be estimated at about 400 km. Overall, 428 earthquakes in the region of Honshu were registered at the GFZ since March 9.

By analysing over 500 GPS stations, the GFZ scientists Rongjiang Wang and Thomas Walter have found that horizontal displacements of up to five meters in an eastern direction occurred at the east coast of Japan. The cause lies in the earthquake zone, i.e. at the contact interface of the Pacific plate with Japan. Computer simulations of this surface show that an offset of up to 25 meters occurred during the earthquake. Calculations of the GFZ modeling group headed by Stephan Sobolev even yielded a displacement of up to 27 meters and a vertical movement of seven meters. This caused an abrupt elevation in the deep sea, and thus triggered the tsunami. The images of the GPS displacement vectors and the computer simulations can also be found among the online

material provided by the GFZ.

Already shortly after the quake Andrey Babeyko and Stephan Sobolev of the GFZ modeled the propagation and wave heights of the tsunami in the Pacific over the first 16 hours. The tremendous force of the earthquake is highlighted here, too: in the open Pacific, relatively large wave heights of over one meter were calculated, which agrees very well with the observations. How high the tsunami is piled up on the coast is largely determined by water depth and the shape of the coastline. The GFZ material also contains an image and an animation regarding this work.

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