
[EJ] Evening Poster | S (Solid Earth Sciences) | S-CG Complex & General

[S-CG57] Dynamics in mobile belts

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The dynamic behaviours of mobile belts are expressed across a wide range of time scales, from the seismic and volcanic events that impact society during our lifetimes, to orogeny and the formation of large-scale fault systems which can take place over millions of years. Deformation occurs on length scales from microscopic fracture and flow to macroscopic deformation to plate-scale tectonics. To gain a physical understanding of the dynamics of mobile belts, we must determine the relationships between deformation and the driving stresses due to plate motion and other causes, which are connected through the rheological properties of the materials. To understand the full physical system, an integration of geophysics, geomorphology, and geology is necessary, as is the integration of observational, theoretical and experimental approaches. In addition, because rheological properties are greatly affected by fluids in the crust and fluid chemical reactions, petrological and geochemical approaches are also important. After the 2011 great Tohoku-oki earthquake, large-scale changes in seismic activity and regional scale crustal deformation were observed, making present-day Japan a unique natural laboratory for the study of the dynamics of mobile belts. This session welcomes presentations from different disciplines, such as seismology, geodesy, tectonic geomorphology, structural geology, petrology, and geofluids, as well as interdisciplinary studies, that relate to the dynamic behaviour of mobile belts.

[SCG57-P13] A resonance frequency map of Japan: Does the crust resonate?

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A medium with a certain length usually has a resonance frequency. If this is true, the crust as an outermost layer of the Earth may have a resonance frequency. For a medium with a wave velocity of V_s and a length of L , the fundamental mode of the resonance frequency is $V_s/(2L)$. The Earth's crust has the thickness of approximately 30 km and the S-wave velocity of 3 km/s, thus the resonance frequency becomes 0.05 Hz. Such a low frequency oscillation is excited only by a megathrust, so the resonance of the crust does not appear usually.

We analyze the oscillation after the Tohoku-Oki earthquakes to test occurrence of the resonance of the crust. We use the 300s data recorded by velocity type seismometers (1 Hz) after the arrival of the S-wave, correct the instrument response, and then calculate the power spectra. Some spectra show peaks in the frequency range between 0.01-0.1 Hz. We pick the peaks up, when the peak values exceed the twice of the fitting line between 0.01-1 Hz, and plot the frequencies at the peaks in the map.

The appearance of the peak frequency between 0.01-0.1 Hz depends on oscillation direction. In up-down direction, the peak signal is observed in most of Japan except for the East Tohoku and Kyushu regions. The East Tohoku region may be too close and the Kyushu region is too far from the source region to distinguish the resonance signals. The peak signals also appear in the East-West horizontal oscillation but the appeared

region is restricted comparing to that in the up-down direction. In the North-South direction, the region further restricted. This may be because the shape of the source region of the Tohoku-Oki earthquake elongates in the North-South direction, which generates difference in the typical frequency components of the originally excited wave by the earthquake in East-West and North-South directions.

The widely observed peak frequencies in up-down direction are approximately 0.05Hz. We thus consider that these peaks show the resonance of the crust. Interestingly, the peak frequencies are slightly slower on the Median Tectonic line, suggesting that the resonance frequency represents the heterogeneities in wave velocity or thickness variety of the crust.

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