



High resolution maps of scattering loss and intrinsic absorption of short-period s-waves in the lithosphere of Japan on the basis of the multiple lapse time window analysis of hi-net data

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Propagation of short period S-waves through the crust is strongly controlled by scattering and intrinsic absorption, and the total attenuation is caused by scattering loss and intrinsic absorption. High resolution maps of Japan of both seismic S-wave attenuation parameters are obtained by using the Multiple Lapse Time Window Analysis (MLTWA) with data provided by the Hi-net seismic network (about 772 borehole-type high sensitivity seismic stations with an average spacing of 20km). The MLTWA is based on the hypothesis of multiple isotropic scattering in a medium with the homogeneous distribution of scattering mean free path and intrinsic absorption. Although these hypotheses are very simple, the results are very informative on the characteristics of each region, and show the usefulness of studying the properties of scattered seismic waves in the understanding of the properties of the crust. To elaborate our maps we have processed information of about 135,000 events and have obtained about 190,000 useful seismic envelopes. The maps show strong regional variation of the parameters. The variations depend mainly on the tectonic setting of each region and volcanism mechanisms. Scattering loss is high in the volcanic arc of Hokkaido Island and in the volcanic arc of Tohoku area for the 1-2Hz band. High value of scattering loss is also observed in some regions of Central Japan. In Chugoku, an interesting, frequency dependent behaviour is observed and strong values of scattering loss are observed for the frequency bands of 4-8Hz, 8-16Hz and 16-32Hz. This behaviour is also observed for the so called "Kinki spot". Lowest values of scattering loss in Japan are in Shikoku for all the frequency bands in contrast with the higher values in Kyushu Island. Intrinsic absorption follows a different behaviour. High levels of intrinsic absorption are observed in the north of Hokkaido Island. In Tohoku area, it is possible to distinguish between a west side which shows strong absorption and an east side with lower absorption. In the 1-2 Hz band the volcanic front can also be noticed as a high absorption area. High absorption is observed in Central Japan, although it shows important frequency dependence. The "Kinki spot" is also a noticeable region of high absorption. Higher absorption in Kyushu than in Chugoku and Shikoku regions for the 2-4Hz and 4-8Hz band is observed. We have also computed coda decay using the same data set. We observe a clear correspondence between intrinsic absorption and coda decay. Then, in our maps, the volcanic arcs of Japan clearly show up, mainly for the lower frequency bands. For higher frequency bands, high absorption and/or scattering regions have been detected. Under those regions, low velocity anomalies have been previously detected by other authors by means of velocity tomography. Those anomalies have been interpreted in terms of the upflow of fluids such as partially melted magma and water from the dehydration of the subducting Pacific plate. Finally, the MLTWA is a method that allows characterizing the properties of the lithosphere in a simple manner in accordance with other studies.