Japan Geoscience Union Meeting 2011
(May 22-27 2011 at Makuhari, Chiba, Japan)

SSS031-P03 Room:Convention Hall Time:May 23 14:00-16:30

How do waves attenuate under urban areas?: Insight from the Tokyo Metropolitan Seismic Observation network (MeSO-net).

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The Tokyo Metroploitan area is instituted inside the 4 km deep Kanto sedimentary basin and is under-plated by both the Philippine and the Pacific sea plates. The material properties of the complex subduction zone beneath the Tokyo Metropolitan can be estimated by the seismic attenuation Q of seismic waves observed at local seismic stations. The waveform data used in this study are recorded at the dense seismic array of the Metropolitan Seismic Observation network (MeSO-net). The station network is distributed on five lines with an average spacing of 3 km and in an area with a spacing of 5 km in the central part of Kanto plane. The MeSO-net stations are equipped with a three-component accelerometer at a bottom of a 20-m-deep borehole, signals from which are digitized at a sampling rate of 200 Hz with a dynamic range of 135 dB. The attenuation of seismic waves along their path is represented by the t$*$ attenuation operator that can be obtained by fitting the observed P wave amplitude spectrum to a theoretical spectrum using an omega square source model. In order to accurately fit the spectral decay of the signal, only earthquakes that are recorded with intensity greater than 1 in the Japan Meteorological Agency intensity scale are selected. A grid search method is applied to determine the t$*$ values by matching the observed and theoretical spectra. The apparent corner frequency of the signal at each station is constrained before fitting for the t$*$. The t$*$ data where then inverted to estimate a 3D Qp structure under the Tokyo Metropolitan area, using a layered initial Q model. Two different model where tested, one model with a homogeneous Q 600 structure and one model with the top layer at 0 km representing the Kanto Basin set to 100, with all the grids below that layer to 600. The poor station/event distribution has as result a Q structure greatly depended on the initial model and ray paths. For the homogeneous initial model the Q below the kanto basin is estimated to an average 340, and failed to resolve to probable low Q values inside the basin. For the layered Q model it is estimated approximately at 500 below the Kanto basin. In addition, a notable amplification of the spectrum in the 6 ? 18 hz range can also be observed in the data of several MeSO-net stations, which suggests that is not a minor local effect but a possible characteristic of the Kanto basin.

Keywords: attenuation, tomography, MeSO-net