Multi-scale seismic tomography of the Merapi-Merbabu volcanic complex, Indonesia

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Merapi-Merbabu volcanic complex is the most active volcano located on Java Island, Indonesia, where the Indian plate subducts beneath Eurasian plate. We present a preliminary study of a multi-scale seismic tomography of the substructures of the volcanic complex. The main objective of our study is to image the feeding paths of the volcanic complex at an intermediate scale by using the data from the dense network (about 5 km spacing) constituted by 53 stations of the French-Indonesian DOMERAPI experiment complemented by the data of the German-Indonesian MERAMEX project (134 stations) and of the Indonesia Tsunami Early Warning System (InaTEWS) located in the vicinity of the complex. The inversion was performed using the INSIGHT algorithm, which follows a non-linear least squares approach based on a stochastic description of data and model. In total, 1883 events and 41846 phases (26647 P and 15199 S) have been processed, and a two-scale approach was adopted. The model obtained at regional scale is consistent with the previous studies. We selected the most reliable regional model as a prior model for the local tomography performed with a variant of the INSIGHT code. The algorithm of this code is based on the fact that inverting differences of data when transporting the errors in probability is equivalent to inverting initial data while introducing specific correlation terms in the data covariance matrix. The local tomography provides images of the substructure of the volcanic complex with a sufficiently good resolution to allow identification of a probable magma chamber at about 20 km.