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Geometry and dynamics of the magmatic feeding system beneath the Klyuchevskoy Volcanic Group (Kamchatka, Russia) revealed by detailed study of seismovolcanic tremor sources based on KISS experiment data

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Virtual

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Abstract:
The Klyuchevskoy Volcanic Group (KVG) located in Kamchatka, Russia is a one of the World's most active clusters of subduction volcanoes. In order to investigate its structure and very intense seismovolcanic activity, an international collaboration designed the KISS experiment operating a dense temporary seismic network between August 2015 and July 2016. During this period, the main volcano of KVG – Kyuchevskoy entered into eruption in the spring 2016. The preparation and eruptive periods have been characterized by a large number of volcanic earthquakes and tremors.

In this study, we analyze seismovolcanic tremors based on three different seismic network based approaches. The first method detects seismovolcanic signals based on stability in time of the single-station intercomponent cross-correlation function. Then we applied two methods in which we respectively compute the width of the network covariance matrix eigenvalue distribution and perform the 3-D backprojection of the interstation cross correlations to calculate the network response function. We apply a 3-D network-based method to locate the dominant seismovolcanic tremor sources by focusing on the cross-correlations extracted from the first eigenvector filtered covariance matrix. We use outputs of the 3 detection methods to evaluate the robustness of the obtained locations and end up with a catalog of seismovolcanic tremor sources.

Our results show that most of tremor sources are located just below the Klyuchevskoy volcano in a narrow zone vertically extended from the surface to the crust-mantle boundary. We also detect several tremor sources located along the SW-NE extended structure, in particular, beneath the active Tolbachik volcano. A very important characteristic of the inferred spatiotemporal pattern of tremor source distribution is their highly intermittent behavior characterized by burst of activities rapidly switching between deep and shallow locations which may be due to rapid pressure transfers between deep and shallow parts of the magmatic system.

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