ÉCOLE DOCTORALE SCIENCES DE LA TERRE

Subject offered for a contract starting in October 2014

SUBJECT TITTLE:
Seismological study of the Kamchatka peninsular

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Host lab/ Team : **IPGP- Seismology – UMR7154**

Financing: Doctoral contract with or without assignment

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The goal of this PhD project is to study the structure and the seismicity of the Kamchatka peninsular with the data of the seismological network operated by the Russian Geophysical Survey.

Kamchatka is a geologically very active region whose tectonic history reflects the long-term interaction of three major plates: Eurasia, North America, and Pacific. Present-day most active structures in the area are: the Kuril-Kamchatka subduction zone, the Kamchatka-Aleutian triple junction, and two active volcanic belts. The present day configuration of the plate boundaries and the volcanic activity are likely affected by the subduction of the Meiji seamount, the oldest known part of the Hawaii–Emperor Seamount chain originated from the Hawaiian plume.

The Pacific plate subducts beneath Kamchatka with a convergence rate of ~ 8 cm per year resulting in a very strong seismic activity and in occurrence of very strong and tsunamigenic earthquakes such as the 1952 Kamchatka earthquake that was one of five strongest ever recorder seismic events. Also, one of the strongest deep-focus earthquakes, the 2013 Okhotsk-Sea event occurred in this subduction zone. While a large part of present-day seismicity is concentrated in the well-defined Benioff zone, there is a clear geological evidence that the location of the subduction zone jumped ~200 km to the East a few Myr ago because of the accretion of an island arc, implying a strong modification of the regional plate boundary configuration. Therefore, the present-day seismic activity, especially north of the Kamchatka-Aleutian junction, may partially reflect the structures remained from the previous plate configuration.

Kamchatka is a continental arc with several very active volcanic systems. An example is the Kliuchevskoy volcanic that occupies an area with an average diameter of ~70 km and is composed of 13 closely located large stratovolcanoes with strongly varying composition. The origin of this cluster of high volcanic activity is likely related to the interaction of the edge of the subducting Pacific plate with the hot asthenosphere and also to the subduction of the plume-generated Hawaii–Emperor Seamount chain. Another peculiar feature of Kamchatka arc is existence of two parallel active volcanic belts. The Eastern volcanic belt is clearly connected to the present-day subduction while the origin of the Sredinny range volcanoes remains debated.

Knowledge about the structure and the seismic activity in Kamchatka can help us to understand how the modern continental crust is forming by processes of tectonic accretion and volcanism in active convergent margins. New opportunities for better characterizing the Kamchatka peninsular structure exist with the data of the seismological network operated by the Kamchatkan Brunch of the Russian Geological Survey. This network has been recently densified and upgraded with installation of broad-band stations operating in continuous mode. In this PhD project, we propose to analyze this data with modern seismological methods (e.g., noise-based seismic tomography and monitoring) to obtain new information about the structure and dynamics of the crust and the upper mantle at a regional scale and more locally in vicinity of the Aleutian-Kamchatka junction and the Kliuchevskoy volcanic group.

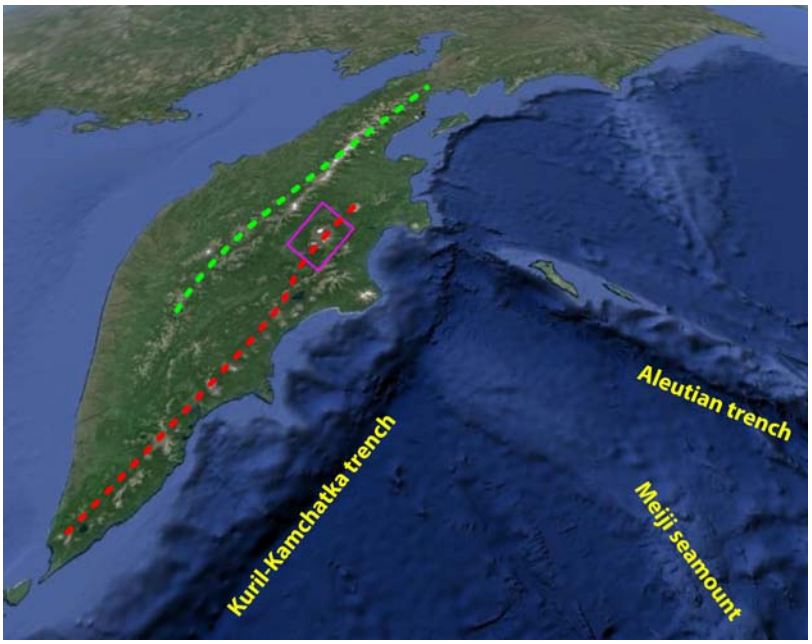

Figure showing main tectonic features of Kamchatka. Dashed lines delineate the Eastern Volcanic Belt (red) and the Sredinny Range Volcanic Belt (green). Magenta rectangle indicates location of the Kliuchevskoy volcanic group.