

## **Interaction between deep and shallow deformation related to the 2013 Okhotsk earthquake, Kamchatka**

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The 24/05/2013 Okhotsk earthquake ( $M=8.3$ ) took place at 600 km depth on the Kamchatka subduction zone that accommodates 8 cm/yr of westward convergence of the Pacific plate with respect to the North American plate. The extensional Okhotsk earthquake produced some 15 mm of co-seismic displacements of GPS stations on the Kamchatka peninsula, directed westward. This motion adds to the interseismic loading of the locked, shallow part of the subduction zone. A detailed analysis of the time series of 12 permanent GPS stations in the south of Kamchatka since 2005 indicates an acceleration of the interseismic displacement rates during the two years period after the earthquake. The additional few mm/yr displacements are oriented in the same sense as the co-seismic motion, and therefore also increasing the loading of the shallow part of the subduction interface. Furthermore, several seismic swarms were observed in the weeks to days before the Okhotsk earthquake, on the shallow part of the subduction interface, off the east coast of southern Kamchatka. During the swarm east of Petropavlovsk on 19-21/05/2013, four local stations at about 100 km distance from the swarm show a few mm of displacement coherent with slip on the shallow subduction zone (opposite to the co-seismic motion of the following deep event of 24/05/2013). A transient displacement related to the most intensive swarm of 26/02-09/03/2013 east of the southern tip of the peninsula is observed at the closest station (40 km), of some 15 mm pointing to the location of the swarm. The second closest station at 80 km to the north of the swarm shows 5-10 mm southward displacement. On top of this small-scale effect, a general transient ESE displacement of 5-10 mm is observed simultaneously at most of the stations up to the northernmost one analyzed, over 700 km distance. This large-scale signal could be related to a deep source or un-modeled regional loading (e.g. hydrologic loading).