Slow Slip Events and large earthquakes interactions along the Mexican subduction zone.

*Mathilde Radiguet[1], Jorge Jara[1], Ekaterina Kazachkina[1,2], Louise Maubant[1], Nathalie Cotte[1,3], Vladimir Kostoglodov[2]

1. University Grenoble Alpes, 2. Universidad Nacional Autonoma de Mexico, 3. CNRS

The Mexican subduction zone is characterized by the occurrence of recurrent slow slip events (SSEs), both in the Guerrero region, where the SSEs are among the largest observed worldwide, and in the Oaxaca region, where smaller and more frequent SSEs occur. In the past, complex interactions between slow slip events and seismic processes have been identified in that region, in particular the triggering of two thrust earthquakes by ongoing SSEs [Graham et al. 2014, Radiguet et al. 2016] and the activation of SSEs and associated tremor signals by a distant earthquake [Zigone et al. 2012].

In this study, we investigate the aseismic-seismic interactions preceding and immediately following the 2017 Mw 8.2 Tehuantepec and Mw 7.1 Puebla large intraplate earthquakes. The slab-pull mechanisms of these earthquakes differ from previously observed aseismic-seismic interactions in the region, which consisted in the triggering of nearby thrust earthquakes. However, large scale aseismic slip (decoupling) have been proposed in Chile to explain interactions between deep and shallow seismicity [Jara et al. 2017].

We look from short-term and long-term variations in seismicity and surface displacements, by analyzing the SSN (Servicio Seismologico National, Mexico) seismicity catalog and the GPS time series (IG-UNAM and TLALOCNet).

At the time-scale of a few years preceding the 2017 earthquakes, we investigate the variations in the raw and background seismicity rate by declustering the seismicity catalog using an epidemic-type aftershock sequence (ETAS). Our results reveal an increase in the background seismicity rate in the Chiapas region, which initiates in early 2015, both in at shallow (< 30km) and intermediate (> 55km) depths. We complement this observation by an analysis of the surface deformations prior to the 2017 earthquakes. Several transient slip episodes (SSEs) are detected in the GPS time series, which locally modify the interseismic coupling. So far no long-term trend in the GPS time series, that could be associated with the observed variation in the seismicity rate, has been detected.

At a shorter time scale, following the 2017 earthquake, our seismicity analysis reveals the extinction of shallow seismicity in the Guerrero region. Our geodetic analysis reveals that the Mw8.2 Tehuantepec earthquake perturbed the large ongoing SSE in Guerrero, this SSE being reactivated just after the earthquake occurrence.

We will thus present observations of aseismic and seismic interactions at different spatial and temporal scale, and discuss the possible mechanisms responsible for such interactions.

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