



Foreshocks and aftershocks of Pisagua 2014 earthquake: time and space evolution of megathrust event.

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The 2014 Pisagua earthquake of magnitude 8.2 is the first case in Chile where a foreshock sequence was clearly recorded by a local network, as well all the complete sequence including the mainshock and its aftershocks. The seismicity of the last year before the mainshock include numerous clusters close to the epicentral zone (Ruiz et al; 2014) but it was on 16th March that this activity became stronger with the Mw 6.7 precursory event taking place in front of Iquique coast at 12 km depth. The Pisagua earthquake arrived on 1st April 2015 breaking almost 120 km N-S and two days after a 7.6 aftershock occurred in the south of the rupture, enlarging the zone affected by this sequence.

In this work, we analyse the foreshocks and aftershock sequence of Pisagua earthquake, from the spatial and time evolution for a total of 15.764 events that were recorded from the 1st March to 31st May 2015. This event catalogue was obtained from the automatic analyse of seismic raw data of more than 50 stations installed in the north of Chile and the south of Peru. We used the STA/LTA algorithm for the detection of P and S arrival times on the vertical components and then a method of back propagation in a 1D velocity model for the event association and preliminary location of its hypocenters following the algorithm outlined by Rietbrock et al. (2012). These results were then improved by locating with NonLinLoc software using a regional velocity model. We selected the larger events to analyse its moment tensor solution by a full waveform inversion using ISOLA software.

In order to understand the process of nucleation and propagation of the Pisagua earthquake, we also analysed the evolution in time of the seismicity of the three months of data. The zone where the precursory events took place was strongly activated two weeks before the mainshock and remained very active until the end of the analysed period with an important quantity of the seismicity located in the upper plate and having variations in its focal mechanisms.

The evolution of the Pisagua sequence point out a rupture by steps, that we suggest to be related to the properties of the upper plate, as well as along in the subduction interface. The spatial distribution of seismicity was compared to the inter-seismic coupling of previous studies, the regional bathymetry and the slip distribution of both the mainshock and the Magnitude 7.6 event. The results show an important relation between the low coupling zones and the areas lacking large magnitude events