Geophysical Research Abstracts
Vol. 19, EGU2017-4791, 2017
EGU General Assembly 2017

Offshore-aftershock sequence of the Mw 8.1 2014 Iquique earthquake

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On 1 April 2014, a Mw 8.1 earthquake ruptured a portion of the subduction zone in northern Chile offshore Iquique between 19.5°S to 21°S. A large earthquake had been expected in the subduction zone off northern Chile, because it had not ruptured in a megathrust earthquake since a M ∼8.8 event in 1877. The 2014 earthquake did only affect the northern region of the 1877 rupture and left an unbroken segment to the South. In December 2014 we deployed an offshore network of 15 ocean-bottom-seismometers (OBS) between 19°S and 22°S using the Chilean Navy ship OPV Toro, covering the aftershock zone of the 2014 Iquique event and the un-ruptured offshore domain in the South. The network was recovered in November 2015 with RV SONNE.

We present the distribution of 752 aftershocks based on three months data (01/12/2014 until 28/02/2015) of this ongoing project. The observed seismicity allows to constrain the structure of the marine forearc and we relate the seismicity distribution to the background seismicity, bathymetry and regional tectonics. Hypocentral parameters of the microseismicity are based on a minimum 1-D velocity model with station corrections. Most of the seismicity occurs updip of the coseismic peak slip of the 2014 event between 19.5 and 21°S. The spatial distribution of seismicity is irregular: Seismicity in seismogenic depths is highly concentrated forming well-defined clusters. Almost no faulting is observed in the outer rise and the majority of events is located ∼30 km eastwards of the trench. The overriding crust is active with smaller magnitude events (M<4). The downgoing Wadati-Benioff zone is readily identifiable as an east dipping structure. The observed seismicity pattern suggest that fore-arc activity includes both aftershock activity along the plate interface and hence along the rupture plane of the 2014 Iquique earthquake and upper plate seismicity.