Geophysical Research Abstracts
Vol. 14, EGU2012-2960, 2012
EGU General Assembly 2012

Crustal and Slab Related Seismicity in the Northern Chilean Coastal Cordillera

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The focus of this study is the high- resolution localization of more than 800 earthquakes in the Northern Chilean Salar Grande region at about 21°S within the Andean Costal Cordillera. The events have been recorded by a temporary local network in 2010. We find, that seismicity is not only related to the Nazca slab but also occurs widely scattered within the overlying continental crust. Our highly resolved locations with typical uncertainties below 200 meters image two distinct seismogenic zones at the top and deeper within the mantle of the Nazca slab, as well as the prominent Atacama Fault Zone. The latter could eventually penetrate the entire crust, possibly joining the subduction interface at a depth of about 40 kilometers. In our further investigation, we have applied a waveform cross-correlation approach by which we were able to identify clusters of similar events with respect to location and source mechanism. Within these clusters we took advantage of waveform similarity to further decrease location uncertainties. Most of the crustal seismicity clusters locate on a subvertical planar structure beneath the surface traces of the Atacama Fault Zone, which extends from close to the surface down to the slab. This could indicate that seismicity in the forearc is not only caused by subduction- related deformation, but also by fluid processes. The irregular spatial distribution of the Nazca slab related clusters may be a consequence of topographic variations within the downgoing slab.