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Seismic swarms and fluid flow offshore Central America

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Offshore Nicaragua and Northern Costa Rica, the Cocos Plate subducts beneath the Caribbean Plate, carrying with it a large amount of fluids and volatiles. While some of these are set free at great depth beneath the volcanic arc, causing the extremely high water content observed in Nicaraguan mafic magmas (Carr et al., 2003; Kutterolf et al., 2007), some early dehydration reactions already release fluids from the subducting plate underneath the continental slope. Unlike in accretionary margins, where these fluids migrate up along the decollement towards the deformation front, fluid release at erosional margins seems to occur through fractures in the overriding plate (Ranero et al., 2008). Fluid seeps in this region have be observed at seafloor mounds, appearing as side-scan sonar backscatter anomalies or revealed by the presence of chemosynthetic communities (Sahling et al., 2008).

In the framework of the General Research Area SFB 574 "Volatiles and Fluids in Subduction Zones", a network of 20 ocean-bottom-stations was deployed offshore Sta Elena Peninsula, Northern Costa Rica, from December 2005 to June 2006. Several distinct swarms of small earthquakes were observed at the seismic stations, which occurred clustered over a time period of several days and have very similar seismic waveforms. Since a correlation of fluid-release sites with the occurrence of sporadic seismic swarms would indicate that fluid migration and fracturing is the mechanism responsible for triggering the earthquake swarms, the events are re-analysed by double-difference localisation to enhance the resolution of the earthquake locations. The results are then considered to estimate the migration velocity and direction and compare the localisations with the known mound sites.

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