The TUCAN Broadband Seismic Experiment: Imaging the Central America Subduction Factory

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The “Subduction Factory” processes the solids and volatiles entering oceanic trenches and produces volcanic arcs, deep earthquakes, and long-term modifications to the deep earth. Central America exhibits some of the global extremes in the factory operation: in the Nicaragua volcanic arc, fluxes of geochemical tracers associated with subducting sediment are among the highest on the planet, while in the adjacent Costa Rica arc, many of the same tracers are weak to absent. For this reason, the MARGINS Program has selected Central America as one of two focus areas for its Subduction Factory initiative. In advancing understanding of the Subduction Factory, seismic imaging of the downgoing plate, mantle wedge and upper-plate crust form a primary data set for understanding the cycling of volatiles and production of melt. To accomplish this, we deployed in July-August of 2004 the TUCAN seismic array (Tomography and other things Under Costa Rica And Nicaragua) of 48 broadband PASSCAL seismographs, operating until early 2006. The array includes two dense transects across the arc at 10 km spacing, in both Costa Rica and in Nicaragua, accompanied by distributed stations sampling arc and backarc along strike over 450 km. From the array data, we have begun applying a wide variety of imaging strategies to constrain structure from both teleseismic signals and signals from earthquakes within the downgoing slab. Overall, the data recovery and quality has been outstanding, with recovery of 90-95%. Analysis of these data and integration with parallel geochemical studies of arc lavas appear sufficient to characterize subduction here as well as any place on the planet.