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A preliminary seismic tomographic image of Deception Island Volcano

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Deception Island (62º59' S, 60º41' W) is an active volcano located in Bransfield Strait between the Antarctic Peninsula and the main South Shetland Islands. The volcano has a basal diameter of 30 km and rises 1500 m from the seafloor to a maximum height of over 500 m above sea level. The 15-km-diameter emerged island is horseshoe-shaped with a flooded inner bay that is accessible to the ocean through a 500-m-wide passage. The island is composed of volcanic rocks which date from $<$0.75 Ma to historical eruptions (1842, 1967, 1969 and 1970). The volcano lies in a complicated tectonic setting on the South Shetland block and its origin is poorly understood. The island is situated north of the main axis of the Bransfield Strait, a tensional structure interpreted as an active back-arc basin, but its geochemistry and seismic activity appear to be influenced by arc volcanism that once strongly affected the South Shetland Islands.

In January 2005 an extensive seismic survey took place in and around the island, with the participation of researchers from Spain, the United States, Italy, Ireland, Mexico, Argentina and Germany. The main objective of the experiment was to collect a high quality data set that could be used to obtain two- and three-dimensional P-wave tomographic images of the volcano. A total of 119 land seismic stations and 14 ocean bottom seismometers were deployed for two rounds of shooting and recorded more than 5000 airgun shots that were distributed within the caldera and around the island. The initial dataset used for the three-dimensional seismic tomography comprises more than 90,000 P-wave travel times that were determined using both automatic and manual first-arrival picking procedures. The inversion code makes use of accurate ray tracing procedure and comprehensive topography's information.

A preliminary three-dimensional P-wave inversion of the automatically-picked travel

times resolves structure down to 4 km depth. The tomographic image is characterized by low seismic velocities beneath the caldera floor and regions of anomalously high and low velocity around the margins of the caldera. We will present the results of additional tomographic inversions and resolution tests and will relate the observed anomalies to the distribution of recent eruptions and models for the origin of the caldera.