Polar Earth Observatory Network (POLENET): Investigating Links between Geodynamics and Ice Sheets in Antarctica

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POLENET International Consortium

The Polar Earth Observatory Network, or POLENET, is a recently proposed GPS/Seismic network, aimed at observing the Antarctic glaciologic and geologic system using a multidisciplinary and internationally-coordinated approach. An observatory-style backbone network of 18 co-located, continuously-recording GPS and broadband seismic sites across West Antarctica, as well as a two- to three-year GPS and seismic “International Polar Year (IPY)-only” deployment has been proposed (Figure 1). The co-location of GPS and seismic sensors provides important science synergies and significant logistical advantages. Cooperation of the GPS and seismic Principal Investigators, UNAVCO, and the Incorporated Research Institutes for Seismology (IRIS) will allow development and deployment of the next-generation power and communication systems optimized for remote operations in extreme environments.

To refine estimates of recent ice mass change of the West Antarctic Ice Sheet, we will measure isostatic rebound with GPS, constrain mantle rheology through seismic studies, and dramatically improve continental-scale rebound model predictions used to correct ice mass trends derived from satellite altimetry and time-varying gravity. Both the viscoelastic and elastic response from mass change can be modeled from continuous GPS measurements, allowing for better estimates of Antarctica’s contribution to global sea level change. Seismological investigations, integrated with results from the geodetic studies, will provide first-order constraints on geological/tectonic parameters important for understanding ice sheet dynamics in West Antarctica. New seismic data will be used to develop high-resolution seismic tomographic images, seismic receiver functions will be used to map the sediment thickness distribution beneath the ice sheet, and recordings of glacial earthquakes will help to constrain short-term slip events that are important for understanding ice sheet dynamics.