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Seiches in Lake Yellowstone: a tool to probe the Yellowstone caldera.

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As part of the NSF sponsored EarthScope initiative in North America, a substantial geodetic monitoring network was established in the Yellowstone basin consisting of real-time GPS, borehole seismometers, borehole strainmeters, MET packs, high-frequency barometers and tiltmeters. This augmentation to existing monitoring infrastructure more than trebled the number of permanent stations in the Yellowstone area and increased the available data by over an order of magnitude.

In July of 2009, strong, persistent, high Q factor, multi-day signals with approximate periods of 11.5, 13.4 and 76 minutes were observed at a PBO borehole strainmeter installed within 200 m of the West Thumb basin of Lake Yellowstone. Coincident fluctuations in the Yellowstone River Lake Outlet stream gauge gave rise to the hypothesis that this was a barometrically-induced seiche. Recent installation of tide gauges have confirmed this hypothesis and allowed for direct calibration of existing geodetic instrumentation. In addition FEM models of the Lake Yellowstone basin find excellent agreement of these periods with the fundamental modes of the system.

The spatially and temporally dense geodetic network, combined with a known time varying load, allow for the possibility of using Yellowstone lake as a tool to probe the structural and crustal properties of the caldera. Other properties of this seiche are intriguing and could also provide insight into the structure of the caldera and the interaction of the surface with the hydrothermal system; unusually high Q factor and a ubiquitous presence raise interesting questions about forcing and restoring mechanisms. This presentation will describe the current data sets available related to this line of study and current hypotheses, models and conclusions.