

Features of geyser's eruptive activity in broadband seismic records (Valley of Geysers, Kamchatka)

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Valley of Geysers on Kamchatka Peninsula is one of the world's major geyser areas, in a league with Yellowstone, El Tatio in Chile, Waiotapu on New Zealand's North Island, and Iceland. We use seismic method for detection of possible hidden feature of geyser's eruptive activity in Valley of Geysers in Kamchatka.

A geyser is a spring characterized by intermittent discharge of water ejected turbulently and accompanied by a vapor phase (steam). The reasons of geyser periodicity and specifics of the activity for every particular geyser are not completely clear yet. So almost for all known geysers it is necessary to develop the personal model.

We obtained broadband seismic records of geyser generated signals in Valley of Geysers hydrothermal field by 24-bit digital output broadband seismometers GURALP CMG-6TD (0.033-50 Hz). Three geysers were surveyed: the fountain type Big and Giant geysers and the cone type Pearl geyser. Seismometers were set as close as possible to the geyser's surface vent (usually at the distance near 3 m).

For the large Big and Pearl geysers low-frequency seismic response on geyser's eruption was detected. Seismometers showed surface deformation caused by water-steam burst from the vent (or geyser eruption) with the period about 10-12 min. It was shown, that eruptions of the Big geyser are not constant at different frequency bands. Some eruptions are weaker than other in low-frequency band (lesser than 0.01 Hz), but approximately similar for the range 20-50 Hz. It means possible deep variations of thermal supply.

The most important result is the detection of hidden underground geyser in the area of the Giant geyser. Its deep activity is recorded by seismic and mass position channels as very stable quasi-periodic oscillations with period 16-18 min. It caused quasi-harmonic displacements of surface with amplitude about 5-6 mm. Earlier the existents of the underground geyser was assumed due to observation of intense bursts with such periodicity during boiling-effusion mode before every eruption. So the supposed underground geyser was accounted as the main heat provider and the principal cause of the Giant geyser eruptions. We named this deep quasi-periodic source of seismic signal (underground geyser) Heart of Giant.