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Longterm monitoring of pressure, tilt and temperature at Logatchev Hydrothermal Vent Field, Mid-Atlantic Ridge

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The geophysical parameters of pressure, tilt, acceleration and temperature at the Logatchev Hydrothermal Vent Field (LHF) which is located in 3050m water depth at about 15˚N at the Mid-Atlantic Ridge, were monitored with high resolution for more than two and a half years, from May 2005 until December 2007. An autonomously operating Ocean Bottom Pressure Station (OBP; resolution of 80 Pa in the first year, improved to 8 Pa afterwards, sampling period of 2 minutes in the first year, increased to 2 seconds afterwards) and a programmable Ocean Bottom Tiltmeter (OBT; resolution 1 μrad, sampling period 6 seconds) measured local ocean-floor point motions derived from tilt and absolute pressure. In addition, vertical acceleration was measured using a MEMS accelerometer (resolution 10^{-5} m/s^2, sampling rate 1.33 Hz) within the housing of the OBT. Numerous autonomous temperature loggers (resolution 0.001˚C, sampling period 15 minutes) were installed at prominent places like mussel fields or soil fissures within the LHF. Time series are analyzed using Fourier-Transformation techniques but also using the novel approach called Empirical Mode Decomposition (EMD).

Pressure records show a modulated background noise level with increased amplitudes lasting for several days to weeks, and most likely show signals generated by local earthquakes. Bottom water temperature has transients with peak-to-peak-amplitudes of up to 0.1˚ C, which correlate for a number of events directly with earthquake signals. A comparison of pressure, tilt, acceleration and temperature data events shows that all four records are correlated. For a few of those events a direct causal link can be firmly established.

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