



Groundwater level variations in the seismo-active region of western Bohemia in the years 2005-2010

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The western part of the Bohemian Massif (Vogtland/West-Bohemia region at the Czech-German border) is characterized by relatively frequent intraplate earthquake swarms and by other manifestations of present-day geodynamic activity. Seismically, the most active part of the region lies in the western part of the Krušné hory Mountains (Ore Mts., Erzgebirge) at the Czech-German border. In this contribution we analyze variations in the groundwater level in four hydrological wells in the region during the years 2000–2010. Two wells (denoted as NK-1 and NK-2) are situated in the epicentral region of Nový Kostel. The third well (HM-1) is located near the town of Krásno (27 km SE from the Nový Kostel). The last one (S-4) is set in the area of the Spa at Lázně Kynžvart (28 km SSE from the Nový Kostel). Groundwater levels in the wells NK-1, NK-2 and HM-1 have been measured since June 2000 and the wells are drilled to a depth of 23 m. Additional measurements in the well S-4 started in November 2006 and the well depth is 97 m.

All four wells display distinct seasonal variations in the groundwater level with the maximum heights usually in spring. This spring culmination is associated with snow melting, as the maximum precipitation usually appears later in summer. The time interval included the 2000 and 2008 earthquake swarm when all the wells displayed a noticeable drop in the water level. We interpret this anomaly as a co-seismic phenomenon. The decrease was distinct even in the distant wells HM-1 and S-4.

The variations in the groundwater level during 2008 swarm in the NK-1 well are moderate and relatively smooth, without noticeable relations to the variations in seismic activity. The level in the NK-2 well varies more. Several drops in the water level can even be observed prior to the intervals of increased seismic activity, in particular before October 6, 12 and 28. Nevertheless, the measurements in the NK-2 are disturbed by pumping of water in a nearby house. The variations in the groundwater level during 2008 swarm in the distant wells HM-1 and S-4 are surprisingly similar. Small rises can be recognized before some periods of increased seismic activity, e.g., before October 6, 8 and 28. We interpret this behaviour as a possible precursory phenomenon. Attention should also be paid to the “oscillatory” course during the main phase of the earthquake swarm between October 9 and 14.

In general, one should expect much greater variations in the epicentral area than at distant localities. However, such a property has not been observed, the amplitudes of the variations being comparable in all wells. This probably indicates that the NK-1 and NK-2 wells are not hydrologically linked with the seismo-active fault at depth. Note that also the concentrations of carbon dioxide and radon in soil gas of the epicentral area did not display significant relations to the 2008 earthquake swarm. These controversies lead us to formulate the preliminary hypothesis that the Mariánské Lázně fault probably does not represent the true outcrop of the deep seismo-active fault. This means that the NK-1 and NK-2 wells are not close to this outcrop. For this reason, we do not recommend drilling a deep borehole in the Nový Kostel area for scientific or geothermal purposes, although such proposals have been discussed in recent years.