Time variation of seismic amplitude corresponding to tidal forces at the vicinity of hydrothermal vents of Wakamiko Caldera

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We deployed an OBS (ocean bottom seismograph, N1) several meters from hydrothermal vents on the floor of Wakamiko Caldera in Kagoshima Bay, southwest Japan, from August 30 through October 11, 2007. In the following observation, from October 26 through December 14, 2007, another OBS (N2) was deployed at the position which left eastward about 430m from N1 to compare the observed data. As soon as N1 was put into the sea water from the vessel, we confirmed many bubbles around the sea surface from the sea-bottom hydrothermal vents. No bubble was seen at the time of N2 deployment. Although no volcanic earthquake (A-type earthquake) beneath the caldera was observed in the two periods, we clearly found quasi-steady tidal modulation of the average amplitude observed by only N1 seismograph.

From the observed data, we calculated root mean squares of the velocity amplitude (RMSA) in every 1 minute to compare the time variation between the 3 components of two OBS stations.

The average RMSA of N1 was significantly lager than the one of N2 4-5 times for each component. As a result of comparing the time variation of RMSA for 30 days between the two OBSs, the features that RMSA fluctuated in semidiurnal period were recognized only at N1. If the large difference between the two OBSs is considered, there seems to be the high possibility of recording the vibration (tremor) originated by activity of the hydrothermal vents.

It is considered that there is the relation on the semidiurnal variation with the earth tide. Therefore, we compared the RMSA of N1 to variation of the tidal level observed at Kagoshima Tidal Gauge (JMA) and the vertical component of theoretical tidal forces of the Moon and the Sun using the calculation program of Nakai (1977). It is clear that the semidiurnal variation of the RMSA is good agreement with the theoretical tidal forces. The maximum of the observed RMSA correspond to the maximum of the theoretical tidal forces in time domain. Because the observed semidiurnal variation have appeared throughout the observation period, the RMSA variation may be quasi-steady. The observed phenomena indicates that the change of the tidal forces which equally works in solid and fluid on the earth gives the effect in activity of the sea-bottom hydrothermal vents.