MEASURED AND BSR-DERIVED HEAT FLOW IN AN AREA OF GAS VENTING IN LAKE BAIKAL

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Recently gas venting sites associated with hydrate occurrences and destabilization, have been discovered on the bottom of Lake Baikal. The mapping of local BSR and heat flow variations in that area offered the opportunity to study the measured versus BSR-derived heat flow in detail and in relation with processes of hydrate destabilization.
A BSR-derived heat flow map for the southern and central Baikal shows an overall good agreement with the existing probe data, but at individual stations deviations up to 50 % occur in both senses. Near the venting sites in the southern Baikal basin strong fluctuations in the BSR depth and heat flow are known to exist. We present new shallow heat flow and BSR data from a small study area including the venting sites. We used the 2 m long GEOS-T thermoprobe for the in-situ measurement of thermal gradients and conductivities. The BSR derived heat flow values have been calculated assuming a thermal conductivity/depth relationship as described by Golmshtok et al. (1997). The following geothermal features have been recognized: (1) Measured heat flow in the study area averages to 75 mW/m², which is slightly higher compared to the common background heat flow values for Baikal (50-70mW/m²). At the venting site heat flow increases to a maximum of 110-160 mW/m². The shape of the anomaly is typical for the focused upflow of warm fluids, but the intensity suggests a relatively cold seepage. (2) In general there is a good correlation between the heat flow and changes in BSR depth is. However, everywhere along the profiles the measured data is higher compared to the BSR derived heat flow values. (3) Along the venting site the correlation is very good. Measured values vary between 55 to 90 mW/m², and difference with BSR heat flow is only about 5%. (4) Southeast of the venting sites the measured thermal gradient variations correlate better with BSR depth changes than the heat flow. Here, measured heat flow (60-80 mW/m²) is up to 40% larger than estimates from BSR depth. In fact, the BSR-derived heat flow shows a regional low in this area and is the most anomalous.
The observations suggest that in the vicinity of the venting sites the thermal conditions in the sediments, both near the surface and near the gas hydrate stability zone, are disturbed as a result of processes of heat and fluid flow destabilizing the hydrates.