Pitfalls in Marine Heat Flow Probe Data Acquisition and Interpretations: Examples from the Gulf of Mexico

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ABSTRACT

A marine heat flow probe measures the geothermal gradient and thermal conductivity of the uppermost 3- to 5-m section of the seafloor sediment *in situ*. Multiplication of the two measurements yields the conductive heat flow escaping from the seafloor. The methodology has been gaining popularity among researchers involved in deep-water exploration, primarily because it is far more economical than making geothermal measurements in boreholes. The present study discusses some pitfalls in applying probe measurements, using some examples from the Gulf of Mexico. The most important issue in probe data acquisition is long-term stability of bottom-water temperature. High-quality water column temperature data obtained in the last three decades in the north-central Gulf have been reviewed in the present study. They show that water below ~1,900-m depth is in a stable, adiabatic condition, well suited for probe measurements. Another important issue is comparison between deep sedimentary temperatures measured in boreholes and those estimated from basin models constrained by probe data. Previous studies have shown that the geothermal heat flow determined from probe measurements made in stable bottom conditions agree well with that determined from borehole data obtained nearby. If researchers find significant discrepancy, there are three possibilities as to the cause other than faulty probe measurements. First, the borehole temperature data have not been properly corrected for disturbance associated with drilling. Second, the basin model used does not account for all the factors influencing the geothermal regime. Third, some of the model parameters, especially thermal conductivities of the strata, are poorly estimated.