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Ranger 2 and acoustic modem for Oregon State University heat flow probe

**Overview**

The heat flow probe consists of a weight stand, lance, data logger, power, and telemetry system (Figure 1). Offset from the lance is a thermistor string with a dozen or so thermistors (temperature sensors) and a heating wire. The probe is deployed from an oceanographic vessel using a trawl wire and winch and a crane or A-frame. Water depths range from 1 to 6 km. After the probe lance and sensors penetrate the seafloor, the measurement consists of two parts: a thermal gradient measurement (temperature as a function of depth) and a thermal conductivity measurement (based on the decay of a heat pulse from the heater wire). Both measurements are based on time series of temperature measurements, with data collected typically every 1-10 s.

In practice the probe is lowered to about 100 m off the seafloor, the probe is then quickly lowered such that the lance and thermistor string is inserted into the sediment. The system is designed so that the weight stand is at the seafloor when measurements are made, although the weight stand will sometimes penetrate the seafloor (at least partly). A complete set of measurements for each penetration lasts about 15 minutes. The lance and thermistor string is then pulled out of the sediment, lifted off the seafloor 100 m or so, the ship is moved to a new position (100’s m to a few km) the probe catches up to the ship, and the process is repeated to create transects of heat flow values.

**Ranger 2 and Acoustic telemetry**

The ranger 2 beacon will be attached to the weight stand and will provide the probe’s position (range and azimuth) for precision location of each measurement. The acoustic modem will be located at the top of the weight stand. Data from the heat flow probe is logged to solid state memory and, every 10 to 15 s, a partial data record is telemetered to the ship for real-time display and assessment of probe operation.

Current plan is to transmit this data string related to the heat flow probe (separate from navigation):

DateTime, V, tilt, P, TBW, T01, T02, T03, T04

Where,

DateTime = date and time (format = YY-MM-DD hh:mm:ss,', ')

V = voltage (f5.2,', ')

Tilt = probe tilt in degrees from vertical (f5.2,', ')

P = depth calculated by probe electronics from external pressure sensor, in m (f9.3', ')

TBW = temperature of bottom water (f7.3,', ')

T01 to T04 = selected temperature sensor values (f7.3,' ') – this is a subset of data collected, with sensor selection pre-programmed prior to probe deployment.

-LF/NL at end of data string

We will likely use the 2nd serial port for the acoustic telemetry in ‘fire and forget’ mode. On the ship, the heat flow data will be monitored to ensure the probe is working correctly, and analyzed for preliminary heat flow values in near-real time that may influence on the fly survey decisions. The navigation data will go to one computer/screen and the serial data from the probe will go to a different computer/screen for storage and display.

A picture containing text, water, outdoor, boat

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