

Woods Hole Oceanographic Institution
Upper Ocean Processes Group

Technical Note

Floating Sea Surface Temperature Measurements

November 1996

Accurate measurements of the sea surface temperature (SST) are essential for estimating air-sea heat fluxes from a buoy. Although bulk SST observations have long been made from buoys, the demands of recent climate research programs for better air-sea fluxes have called for a closer look at near surface temperature variability and the diurnal warm layer.

The Upper Ocean Processes (UOP) Group has successfully made near-surface measurements from buoy hull mounted and drifting near-surface temperature arrays in the Pacific warm pool and the Arabian Sea. Although temperature gradients of nearly 3°C in the top 2.5 meters have been observed under low winds and high solar insolation some difficulties remain in interpreting these observations. These temperature sensors are fixed to a surface buoy and will follow the motions of the buoy. The absolute measurement depth is, thus, uncertain under varying wave-current conditions and mooring tensions and the sensors can only be placed within about 25 cm of the surface without coming out of the water. The temperature sensors are mounted on a sub-surface structure attached to the surface buoy. Such appendages introduce some asymmetry to the buoy shape and tend to behave like a vane, orienting the sensors down current. Flow past the buoy can create turbulence and mixing at the surface and the effect on the surface temperature structure downstream is unknown.

To address several of the problems associated with making very near-

surface temperature measurements, the UOP Group has designed a surface following float that can be attached to a surface buoy. It provides a miniature platform from which sea surface temperature measurements can be made.

The surface following float is made of syntactic foam which is an attractive material since it is buoyant and can be either machined or molded to nearly any desired shape. The UOP float consists of two cylindrical pieces, 15.2 cm in diameter, that have been molded to clamp around a commercially available temperature logger. When deployed, the float is free to travel vertically with each passing wave along three guide rods that are secured to the main mooring buoy. The physical size of the float has been tuned to the weight of the temperature logger so as to keep the sensor at approximately 2 cm below the ocean surface.

Internally recording instruments with built-in temperature sensors eliminate some of the problems associated with remote sensors that are cabled to a logger. Electrical conductors in cables have been known to fail due to fish bite, as well as due to excessive cable flexing when deployed in the dynamic surface environment. Fortunately there are several stand-alone sea temperature measuring devices on the market which with pre- and post-deployment calibrations

can provide a reliable and accurate temperature measurement.

Currently the temperature measurements are being made by a WaDaR Model TL-HA-DW Temperature Logger. The manufacturer's specifications for this instrument claim an accuracy of $\pm .008^\circ \text{C}$ and a resolution of $.0014^\circ \text{C}$. Although the float is designed around the WaDaR instrument, any of the other similar instruments that are available could be accommodated with slight modifications to the float.

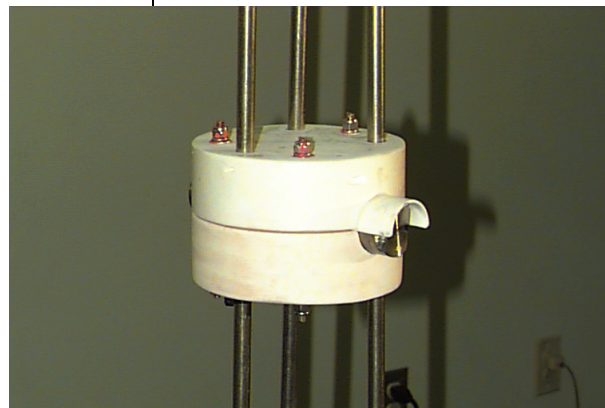


Figure 1: SST float with temperature logger and guide rods.

A simple shield protects the sensor end of the temperature logger from direct sunlight. Figure 1 is a photograph of the SST float with temperature logger and guide rods. This particular float was molded using two-part syntactic foam provided by Flo-tation Technologies, Inc., of Biddeford, Maine.

The SST float and instrument were recently tested with a surlyn foam buoy that was suspended in the boat well at the Woods Hole Oceano-

graphic Institution. Despite marine growth found on the buoy, the guide rods remained clean during the several week summer trial. The wiping action of the float as it moved up and down along the guides seemed to prevent marine growth from accumulating. Fouling of the rods will certainly have a detrimental affect on the surface following capabilities of this sensor system. An antifouling coating will be applied to the float and logger, but any application to the guide rods would presumably be short lived due to wear.

At-sea tests of this sea surface temperature measuring system are planned to take place on the two

UOP Group surface moorings that will be deployed in the tropical Pacific as part of the Pan American Climate Study (PACS). These buoys will also carry the standard fixed sub-surface structure that has been used successfully in the past to support six temperature measuring instruments between .25 and 2.5 meters depth. The floating SST package will be located on the opposite side of the buoy from the larger fixed structure so that the vane-like action of the fixed structure will orient the SST float up-current and into the flow. The data from all the near surface measurements will be used to evaluate the performance of the float-

ing SST measuring system.

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This article was written by Rick Trask, who is a Research Specialist in the Physical Oceanography Department and a member of the Upper Ocean Processes Group at the Woods Hole Oceanographic Institution.

Note: Previous issues of the UOP Technical Note can be found on our homepage at <http://uop.whoi.edu>

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Upper Ocean Processes Group
Woods Hole Oceanographic Institution
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