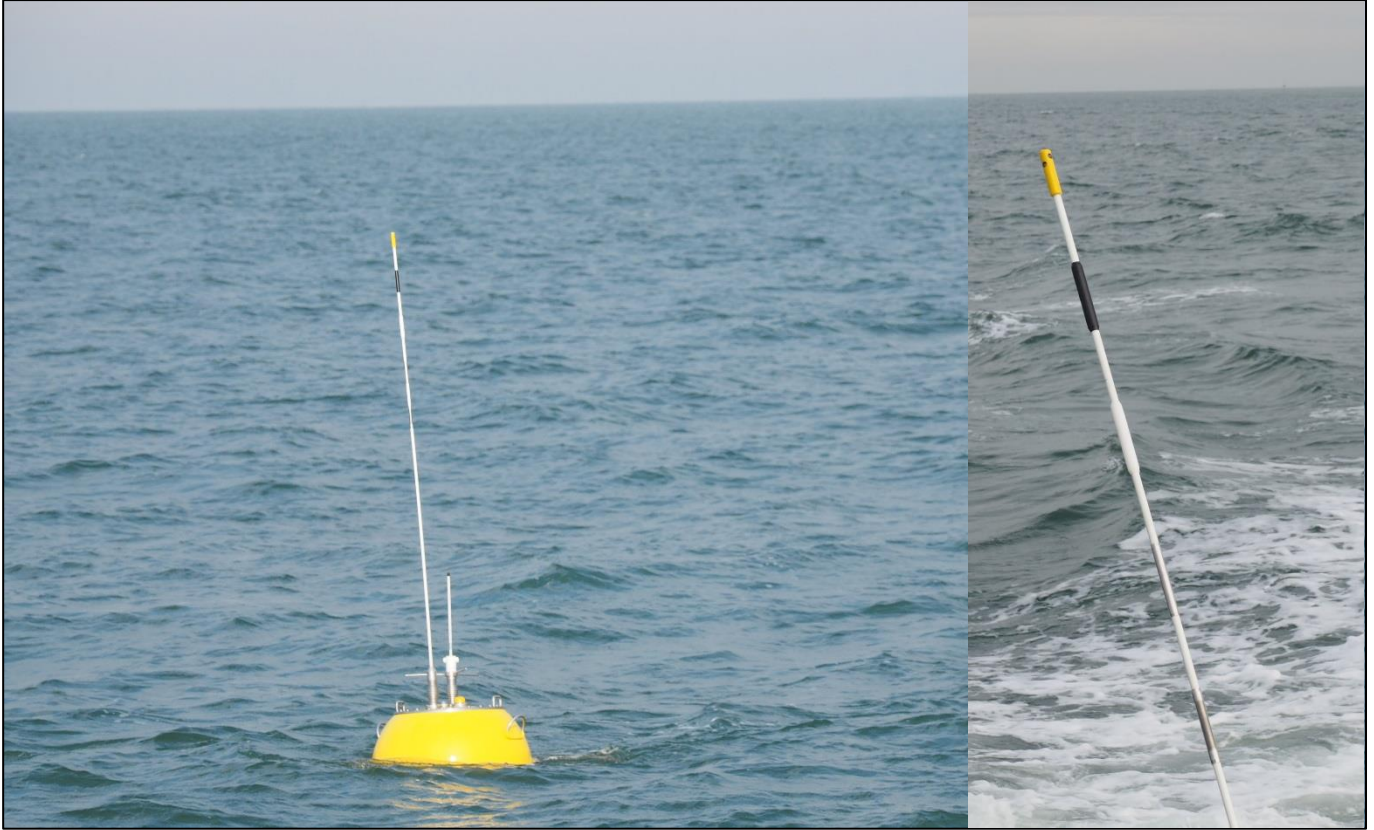




Compact Air Temperature sensor

Datawell - Oceanographic Instruments

The Datawell Waverider Air Temperature Sensor



The Compact Air Temperature sensor (CAT4) is a meteorological air temperature sensor integrated in the HF-antenna of the Directional Waverider. It consists of four individual sensors that have different radiative properties and will therefore measure different temperatures. The actual air temperature is derived from these different temperatures. External influences that might affect the measurements, such as evaporative cooling, are detected for validation.

Correction for absorption of radiation

Absorption of solar radiation by an object will increase its temperature. At equilibrium the absorbed energy equals the lost energy to the passing, colder, air. For small objects, and wind velocities as can be

expected at sea, the temperature increase is proportional to the radiation intensity and the absorption coefficient of the material. By measuring the temperature of two mechanically equivalent objects with different absorption coefficients for solar radiation, the temperature of a hypothetical sensor protected against solar radiation can be calculated. When no other disturbing phenomena are present this last temperature is the air temperature. On the Waverider this concept is implemented by incorporating two thermistors in the HF-antenna, one covered with a polymer having a low coefficient of absorption for solar radiation (white), and the other one covered with a polymer having a high coefficient of absorption for solar radiation (black).



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Correction for emission of radiation

Thermal emission from the sensor to the cold sky takes place in the far infrared, nicely distinct from the maximum power peak of the solar radiation. The correction method for this emission is similar to the correction for absorption. Two materials are selected that have different emission coefficients. The materials used for the correction of absorption have high emission coefficients. A distinct material with a low emission coefficient (stainless steel) is added to compensate for the heat loss due to emission.

Exposed accuracy

Applying the aforementioned corrections yields calculated temperature data within $\pm 0.5^{\circ}\text{C}$ accuracy, as long as the data are validated. When a solar-induced error is detected temperature data will be within $\pm 1^{\circ}\text{C}$ accuracy. When evaporation is detected measurement accuracy cannot be guaranteed.



Air temperature sensor	Range	$-20^{\circ}\text{C} - +70^{\circ}\text{C}$
	Resolution	0.01°C
	Thermistor accuracy	$\pm 0.1^{\circ}\text{C}$
	Exposed accuracy	$\pm 0.5^{\circ}\text{C}$ ($\pm 1^{\circ}\text{C}$ when solar induced error detected)
	Measurement interval	5 min.
	Measuring height	2 m above sea surface
	Life expectancy	Designed to last 10 years
	Maintenance Interval	Recommended yearly