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Heat Balance of the Upper Ocean under Light Winds

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ABSTRACT

Measurements of the components of the heat balance of the upper 30 m of the ocean were made in the Bermuda area in August and September 1974. The quantities measured included surface downwelling and underwater downwelling and upwelling irradiance, surface net irradiance, heat content, and the bulk meteorological variables.

Under conditions of light winds, one or more layers of 1 to 10 m thickness form and persist at the surface. In some cases the bottom of the layers have sufficiently high Richardson numbers so that no vertical transport occurs through them, vastly simplifying the measurements and interpretation of their heat balance. These data illustrate several such cases. The net flux of heat from the layer at the surface is usually much larger than the bulk formulas predict in these light wind cases. When the winds are calm and the sea glassy, total heat fluxes of several kilowatts per square meter occur for several hours in the afternoon. This has been observed previously in the Sargasso Sea.

Generally twice during the day, the heat content of the upper ocean has an extremum, usually after sunrise and somewhat before sunset. At these times the net heat flow out of a layer is equal to the irradiance absorbed in the layer providing a simple determination of surface fluxes from irradiance measurements. These measurements show this feature clearly.

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