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Oceanic Thermal Response to Strong Atmospheric Forcing I. Characteristics of Forcing Events

Russell L. Elsberry and Norman T. Camp

Naval Postgraduate School, Monterey, Calif. 93940

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ABSTRACT

Long time series of meteorological data from Ocean Weather Ships P, V and N in the North Pacific Ocean are used to test the hypothesis that significant oceanic thermal response during September to December occurs in association with limited periods of strong atmospheric forcing. The 3 h forcing is expressed according to recent mixed layer theory in terms of u_*^3 , where u_* is the atmospheric friction velocity, and the upward surface heat flux. About 13% of the largest u_*^3 values contribute 50% of the total u_*^3 , even though the total input is quite different at the three stations. Although the thermal forcing is less skewed, a significant fraction of this flux occurs during a relatively small fraction of the time. Synoptic time scale forcing events are defined as sustained periods of forcing exceeding the long-term mean fluxes for the corresponding period. Between 68 and 77% of the total u_*^3 occurred during the roughly one-third of the time associated with the synoptic forcing events defined in terms of u_*^3 . Like-wise a significant fraction of the September–December sea surface temperature change occurred during these events. Both the time and magnitude of the strong atmospheric forcing events can have a significant effect on the September–December evolution of the upper ocean thermal structure.

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Headquarters: 45 Beacon Street Boston, MA 02108-3693

DC Office: 1120 G Street, NW, Suite 800 Washington DC, 20005-3826

amsinfo@ametsoc.org Phone: 617-227-2425 Fax: 617-742-8718

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