Abstract View

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Data Assimilation Tests with an Oceanic Mixed-Layer Model

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ABSTRACT

A data assimilation technique using a one-dimensional, ocean mixed-layer model to advance the thermal structure observations to the analysis time is tested. The effects of insertions of erroneous temperature profiles in such a model are studied for winter and summer periods. Sets of 5, 15 or 30 model-generated profiles at random times during the 15 days prior to analysis time are modified by adding errors in layer depth and temperature and in the thermocline temperature gradient. Each of the modified profiles is advanced by the mixed-layer model to the initial forecast time. This produces a series of temperature profiles that are consistent with the prediction model and with the atmospheric forcing at that time. The profiles are combined by a simple level-by-level averaging. A prediction from this averaged profile, or a similar profile after screening for extreme temperatures, is compared to a prediction from the last available observation in the set. A control run of the model provides complete 3 h verification data.

For the winter season tests, the errors in the predictions of layer depth from the last available profile are 3–5 times larger than the errors in the averaged and screened-averaged cases. During the summer, the larger errors are in surface temperature. Predictions from the averaged initial profile have typical errors of 0.25°C, whereas those from the last available profile are 3–4 times larger. Having 15 or 30 observations during a 15-day period appears to provide a relatively small improvement over a set of only five observations. It is thus concluded from these model-generated tests that the data assimilation technique will permit the long-term retention of the ocean thermal structure observations in the data base. Using the ocean mixed-layer model to combine these observations appears to be useful in the diagnosis and prediction of upper ocean thermal structure.

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