Abstract View

Volume 12, Issue 5 (May 1982)

Journal of Physical Oceanography
Article: pp. 483–494 | Abstract | PDF (935K)

GATE Air-Sea Interaction. I: Numerical Model Calculation of Local Sea-Surface Temperatures on Diurnal Time Scales Using the GATE Version III Gridded Global Data Set

P.S. Brown Jr., J.P. Pandolfo, and S.J. Thoren

The Center for the Environment and Man, Inc., Hartford, CT 06120

(Manuscript received August 3, 1981, in final form January 25, 1982)

DOI: 10.1175/1520-0485(1982)012<0483:GASIIN>2.0.CO;2

ABSTRACT

The numerical model of air-sea interaction previously described in Jacobs (1978), Pandolfo and Jacobs (1972) and Pandolfo (1969) is inserted at one horizontal grid point in the GATE III Gridded Global Data Set to calculate a model-generated, local interface temperature over a two-day interval (0000 GMT 4 September-0000 GMT 6 September 1974) of GATE Period III.

The experiment provides a preliminary demonstration of the accuracy achievable in predicting sea-surface temperature over multi-day scales with limited-domain models nested within global data sets. It also demonstrates the degree of sensitivity of the model-generated sea-surface temperature to the inclusion of parameterized convective adjustments in the oceanic and atmospheric sub-layers under the general conditions prevailing during the period studied.

Initial and boundary data were provided to the local model on a relatively coarse vertical grid and with relatively coarse (12 h) temporal resolution. Linear spatial and temporal interpolation was used to produce the higher resolution data required by the model. (A 6 min time step and grid intervals as small as 1 m were used in the experiments described in this paper.) Therefore, the nested local model provides, in this preliminary experiment, increased resolution only in the vertical and temporal dimensions. It also adds greater physical complexity to the global-scale model used in the generation of the GATE III gridded data set (and described in Miyakoda *et al.*, 1980) by coupling the atmosphere-ocean boundary layers to allow the prediction (rather than the prespecification) of sea-surface temperature, and by taking into account model-generated temporal variations in the vertical structures of the atmospheric transmissivity with regard to solar and infrared radiation.

The two-day period used for this demonstration is characterized by moderately disturbed tropical marine conditions with intermittent periods of light wind as contrasted to the generally steady trade-wind and midlatitude conditions

previously treated in the papers cited above. Nevertheless, the air-sea interaction model, when suitably refined to include parameterized convective adjustment in the, coupled air-ocean layers, again yields model-generated sea-surface temperatures which generally differ from those observed by less than the uncertainty of measurement, and with accuracy well within that estimated in Charney *et al*. (1966) as required in order to extend the temporal range of weather forecasts in numerical models of the atmosphere.

In one model run of the experiment the atmospheric convective adjustment was eliminated from the model. The result is an unrealistic accumulation of heat in the ocean surface layer. In another model run of the experiment the ocean-surface layer convective adjustment was eliminated from the model. The result is a somewhat cooler model-generated nighttime interface temperature.

Interaction between the parameterized convective processes of the coupled air-sea model layers is also evident from the results. When the parameterized atmospheric convective adjustment is omitted from the model, significant alteration of the model-generated oceanic "convection depth" takes place; conversely when the parameterized oceanic convective adjustment is omitted, there occurs a substantial alteration of the model-generated atmospheric "convective condensation level."

top