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ASSIMILATION AND INITIALIZATION OF DATA FOR TROPICAL WEATHER PREDICTION

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LONG TERM GOALS

Goals of this research are to improve seasonal and longer predictions of large scale tropical systems such as monsoons and ENSO related phenomena. Achievement of these goals requires development of a coupled ocean-atmosphere model and improvement of the model assimilation scheme. The full system utilized for the long term predictions includes a low-resolution global spectral model and an assimilation scheme used for proper coupling of the atmosphere and ocean models (LaRow, 1998).

OBJECTIVES

The objective of this work is to determine the impact of physical initialization (Krishnamurti, 1991) in a climate assimilation scheme developed for seasonal prediction. Improvements in the initial state of the atmosphere and ocean components with proper diabatic forcing will improve the atmosphere and ocean circulation and the longer time scale signals in both the ocean and atmosphere thermal structure. These signals may enhance the three month climate predictions of large scale tropical rainfall and development of ENSO events. This work is supported by the ONR Marine Meteorology Program.

APPROACH

An assimilation phase, which includes physical initialization of rain rates is applied for six months prior to three month simulations. The global model is fully coupled during the assimilation to impart the atmospheric signal into the ocean as well as to bring the two systems into a harmonic balance. Multiple initial states are selected in advance of the initial integration time, making up an ensemble initial state which is used to generate an ensemble prediction. The ensemble is necessary to reduce random errors, increasing confidence in the results. Ensemble forecasts are generated with and without physical initialization assimilation schemes for four separate seasons to determine the impact of the physical initialization.

WORK COMPLETED

Preliminary work completed includes collection of data and testing of the assimilation scheme with physical initialization in the climate system. Initial stages of the assimilation have been completed. Forecast periods of interest are the summer and winter seasons of 1987 and 1988, in which a strong ENSO event was observed. The full two and a half years of data necessary for the assimilation phase has been obtained and the model has been advanced as a coupled assimilation system through November 1986. The next phase consists of four consecutive six month coupled assimilations, culminating in the ensemble prediction discussed above.

RESULTS

This research is in its adolescent stages, yet preliminary investigations suggest that physical initialization in the climate assimilation scheme aids in generating a more consistent diabatic forcing with observed rainfall. Associated cloud patterns also properly locate upper and lower level radiative heat sources and sinks, which combined with the diabatic forcing alters the large scale tropical circulation in both the atmosphere and ocean.

IMPACT

This work will illustrate the utility of physical initialization for long-range prediction. Hence, it offers an option for others to follow within an assimilation scheme for climate simulations. Furthermore, the large number of ensemble members with and without the physical initialization may shed light on the role of diabatic forcing over an extended period of time.

TRANSITIONS

The development of the long time assimilation can be refined to be more efficient, as the current system involves a large amount of computational time. Furthermore, the current scheme may be advanced to include satellite estimates of surface winds and available sub-surface ocean data. The inclusion of these fields may vastly improve the initial state of the ocean, and hence improve the ocean's impact on the atmospheric prediction.

REFERENCES

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