DOE/ER/60314--10

DE92 011602

TASK 3: Analysis of General Circulation Model Results and Comparison with Regional Climatic Data

Section A: Review of Work Completed in the Past Year

(i) Interannual variability in climate

(a) Southern Oscillation; Its origin within the atmosphere

On time scales of greater than one year the variabi?:ty of weather and climate on a large part of the Earth is dominated by the Southern Oscillation. While current theories of this phenomenon have clarified the role of the interaction between the ocean and the atmosphere in maintaining this oscillation it has so far been unclear whether the Southern Oscillation originates in the ocean, in the atmosphere or during the interaction between the ocean and the atmosphere. In this study we compared simulations of climate in two global circulation models: the coupled OSU GCM in which the atmosphere and ocean interact dynamically and the slab OSU GCM in which the ocean is represented by a static layer. The multi-year simulations of global climate with the two models were carried out without any imposed conditions on the nature of the interannual variability. The results show that the slab model generates the signal of the Southern Oscillation in atmospheric pressure during the northern spring season but the signal is not propagated to other seasons. The coupled model manifests the Southern Oscillation in other seasons and in several climatic variables in which it is found in nature. This result shows that the impulse of the ENSO phenomenon is generated by interactions within the atmosphere and subsequently modulated by interactions with the ocean.

This work has been reported in the following paper that has been submitted for publication:

"Genesis of the Southern Oscillation within the Atmosphere: Illustration with General Circulation Models" by S. Hameed, K. R. Sperber and R. D. Cess.

(b) Origin of the Chandler wobble in the atmosphere

The agent that generates and maintains the 14-month Chandler wobble of the solid earth about its rotation axis has remained unresolved for a century with first the atmosphere, later earthquakes, and more recently the earth's fluid core proposed as candidates. We have found that surface air pressure calculated in the coupled ocean-atmosphere OSU general circulation model displays a 14.7 month signal, whose amplitude is similar to that found by Maksimov

(1960) in station data; we identify it as the atmospheric Chandler wobble. This result indicates that changes in atmospheric mass distribution excite and maintain the wobble of the solid earth, and that neither earthquakes nor the fluid core are significant contributors. Another result is that in the GCM the amplitude of the wobble at high latitudes is a substantial fraction of the annual cycle, and thus is an important factor in climate formation as Maksimov (1960) suggested.

This work has been reported in the following paper that has been recently submitted for publication:

"Simulation of the 14-Month Chandler Wobble in a Global Climate Model" by S. Hameed and R. G. Currie.

Section B: Proposed Research on General Circulation Models for the Next Year

(i) Interannual variability of climate

(a) Southern Oscillation: studies aimed at elucidating its mechanism

We plan to carry out further analyses of the ENSO phenomenon in the OSU GCM with the purpose of understanding the processes that comprise it. A detailed analysis of simulated oceanic currents will be undertaken and compared with observations. The currents in the Pacific Ocean in different phases of the Southern oscillation will be ex-

RECENT ACCOMPLISHMENTS ATTRIBUTED TO DOE GRANT #DEFG0285ER60314

Published

1. Evidence of Quasi-Biennial Oscillations in a General Circulation Model, R. G. Currie and S. Hameed, Geophysical Research Letters, 15, 649-65, July 1988.
2. Variations in United States Sunshine: 1908-84, I. Pittalwala and S. Hameed, Solar 88 Technical Papers, Proceedings of the 1988 Annual Meeting of the American Solar Energy Society, pp. 257-262, American Solar Energy Soc., Boulder, CO.
3. Exploratory studies of cloud radiative forcing with a general circulation model, Robert D. Cess, Tellus, 39A, 1987.
4. Diurnal Variability of the Planetary Albedo: An Appraisal with Satellite Measurements and General Circulation Models, G. L. Potter, R. D. Cess, P. Minnis, E. F. Harrison and V. Ramanathan, Journal of Climate, Vol. 1, No. 3, 1988.
5. A Methodology for Understanding and Intercomparing Atmospheric Climate Feedback Processes in General Circulation Models, Robert D. Cess and Gerald L. Potter, Journal of Geophysical Research, 93, 1988.

Submitted

1. Simulation of the 14-Month Chandler Wobble in a Global Climate Model, Sultan Hameed and Robert G. Currie, submitted to Geophysical Letters, October 1988.
2. Genesis of the Southern Oscillation Within the Atmosphere: Illustration with General Circulation Models, Sultan Hameed, Kenneth R. Sperber and Robert D. Cess, submitted to Nature, August, 1988.
3. Sensitivity of Secular Trends in Precipitation Data to Observational Errors, Robert G. Currie and Sultan Hameed, submitted to Journal of Climate, November, 1988.

In Press

1. An Investigation of the Instrumental Effects on the Historical Sunshine Record of the United States, Sultan Hameed and Iqbal Pittalwala, Journal of Climate.

Accepted for Publication

1. Time Series Analysis of Proxy Precipitation Records at Twenty Six Locations in North-East China from 1470-1979, Lisa A. Knipl and Sultan Hameed, Journal of Climate.

Draft Form

1. Intercomparison and Interpretation of Climate Feedback Processes in Ten Atmospheric General Circulation Models, R. D. Cess, G. L. Potter, G. J. Boer, J. P. Blanchet, S. J. Ghan, K. E. Taylor, J. F. B. Mitchell, D. A. Randall, E. Roeckner, U. Schlese, M. E. Schlesinger, W. M. Washington, R. T. Wetherald, and I. Yagai.

END

DATE FILMED

6/01/92