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6 December 1989

Dr. D. Allan Bromley
Science Adviser to the U.S. President
Executive Offices of the President
Washington, DC 20500

Dear Dr. Bromley:

In an article in the 20 November 1989 issue of *Newsweek*, John Sununu referred to the new climate-change modeling research by Washington and Meehl (1989) at the National Center for Atmospheric Research (NCAR). (Another editorial, also on 20 November, in *The Wall Street Journal*, incorrectly quoted results from the same research.) When I saw the *Newsweek* article, I telegraphed Dr. Sununu and invited him to call me if he wanted more information on our experiments. In our ensuing telephone discussions about the state of climate modeling and our research, he suggested that I contact you directly.

My purpose in writing you, therefore, is to correct the media statements and to clarify the conclusions to be drawn from the model results at NCAR. Our modeling group is one of the few research groups that has successfully coupled a global atmospheric model to a global dynamical ocean model. The ocean model is driven by heat fluxes to and from the atmosphere, by wind forcing, and by salinity differences caused by atmospheric precipitation and evaporation. Although the coupled model can experience many problems from lack of constraints, its advantage is that it can be used to examine climate sensitivity to a gradual increase of carbon dioxide in addition to an instantaneous doubling of carbon dioxide.

The Wall Street Journal's editorial says that we have "cut in half" our estimates of climate change. This assumption is erroneous for the following reasons. In previous climate-change experiments, we used a simple, mixed-layer upper ocean with a thickness of 50 m. Although such an ocean model does not include vertical or horizontal heat transport mechanisms and other important ocean processes (such as mixing with intermediate and deep ocean layers), it does include some important aspects of the seasonal heat storage in the upper oceans, that is, heat is stored in summer and released in winter. The GISS model used by James Hansen is an example of a simple, mixed-layer model with a specified poleward flux of heat from the tropics.

Because of the prohibitive expense in running our new model with a dynamical ocean to equilibrium, we cannot say exactly what the new equilibrium would be, but it certainly would be larger than the value quoted in *Newsweek*. In fact, we have run it farther than reported in the referenced article and it continues to show globally averaged warming in the oceans and atmosphere. Our research and that of NOAA's Geophysical Fluid Dynamics Laboratory have revealed new insights into global warming. Previous studies indicated that land and ocean areas usually warm, but our recent studies show, for the first time, that some ocean regions actually cool. In our experiments with a gradual increase of carbon dioxide, the lands are warmer and in certain regions the North Atlantic and North Pacific Oceans are cooler—a pattern similar to that observed by Karoly (1989). Although our coupled dynamical models are not precise enough for climate prediction, they yield behavior patterns heretofore unseen in other model studies with simple oceans, and this behavior is only one part of a myriad of climate

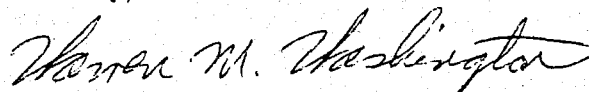
system interactions we are beginning to explore. The simplified picture of using some globally averaged warming number is not meaningful for the observations or for the models. The large-scale regional patterns that appear are likely to be quite complex with a great deal of natural variability.

The *Wall Street Journal* editorial also recommended that George Bush, John Sununu, Bill Reilly, Congress, and the governors gather together on C-SPAN to hear top climate modelers discuss and "settle" the issues surrounding the greenhouse effect. We do not believe that this is the best method of dealing with scientific uncertainties. Rather, we should consider the recommendations to be made in 1990 by the Intergovernmental Panel on Climate Change (IPCC)—a study involving worldwide experts on climate change. We at NCAR are participating in this IPCC study, as well as in intercomparisons of models under the Department of Energy's Carbon Dioxide Program. Both efforts are extremely critical to our understanding of what the models are really telling us.

Your statements to the press and public indicate that you are an advocate of global-change research. We urge your continued support. Climate modelers must continue to refine the uncertain aspects of physical processes, such as clouds, and to improve resolution.

If you would like more information, please call me at (303) 497-1321; my FAX number is (303) 497-1137.

Sincerely,



Warren M. Washington, Director
Climate & Global Dynamics Division

Enclosures

cc: John Sununu
Nancy Maynard
Richard Anthes
Peter Gilman
Ari Patrinos
Michael Riches
Robert Serafin
Deborah Stirling

References:

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Washington, W.M. and G.M. Meehl, 1989: Climate sensitivity due to increased CO₂: experiments with a coupled atmosphere and ocean general circulation model. *Climate Dynamics*, 4, 1-38.