15.1 The Atmospheric Model Intercomparison Project (AMIP): Progress and Plans

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1. INTRODUCTION

In this paper we illustrate one of several AMIP results presented at the AMS 13th Symposium on Global Change and Variations. Specifically, we take a look at an approach to track AGCM performance and improvement.

2. RESULTS

A diagram (Fig. 1) may be used to summarize how model performance has changed over the last decade. Composite "median" model results were computed based on the AMIP output of a subset of 14 AMIP simulations performed between 1992 and 1996. A more recent "median" model result was obtained from newer versions of the same subset of AMIP models (1997-2001). Statistical comparisons between several simulated and observed fields were made, and the results are displayed in the diagram as fully described in Taylor (2001, J. Geophys. Res., 106, 7183-7192). The tail of each arrow indicates the statistics for the older median model, and the head the newer median model. The fields analyzed were: 500 hPa geopotential height (Z_{500}), precipitable water (PRW), 200 hPa zonal and meridional wind (U_{200} and V_{200}), zonal and meridional components of surface wind stress over the oceans (tauu and tauv), mean sea level pressure (PSL), precipitation (P), cloud fraction (CLT), 200 hPa temperature (T_{200}), and surface sensible heat flux (SH).

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The statistics shown are the correlation coefficient between the observed and simulated field (related to the azimuthal angle), the root-mean-square (RMS) difference between the two fields (proportional to the distance to the point on the x-axis marked observed), and the ratio of the standard deviation (SD) of the simulated field to that observed (proportional to the radial distance). The dimensional statistics (RMS error and SD) are normalized by the observed SD.

A model may be judged to have improved if the correlation increases, the arrow points toward the observed point (indicating a reduction in RMS error), and the arrow moves toward the dotted arc (i.e., the simulated SD moves toward the observed).

The composite "median" model result was calculated from the subset of model results available from both ca. 1993 and ca. 2000. For each model, monthly mean output was considered. For each of the 120 mean months (1979-1988) and each grid cell, the median result from the 14 models was selected. This set of values comprises the composite "median" model. A similar result would be obtained by taking the mean over the monthly mean fields simulated by the 14 models, but in this case outliers would have more influence. The statistics shown in the figure are the so-called space-time statistics for seasonal data, weighted by the area of each grid cell. In the case of the RMS error, for example, the sum of the squared difference runs over all grid cells (weighted by the grid-cell area) and also over all 40 seasons.

Simulated fields were compared to reanalysis (ERA), with the following exceptions: Precipitation was compared to the Xie-Arkin data set, cloud fraction was compared to the ISCCP data, and sensible heat was compared to the UWM/COADS climatology. Efforts are underway to incorporate observational uncertainties into these and other PCMDI performance summaries.

3. CONCLUSIONS

The impression given by the diagram is that general improvement has occurred over the past decade. This conclusion applies to the median model, but further analysis demonstrates that many individual models have also improved. This summary is limited in that only a dozen fields were considered and only global seasonal statistics are computed. Interannual variability simulated by the models or the performance in individual geographical regions might not show analogous improvement, but the global-scale climatological statistics are encouraging.

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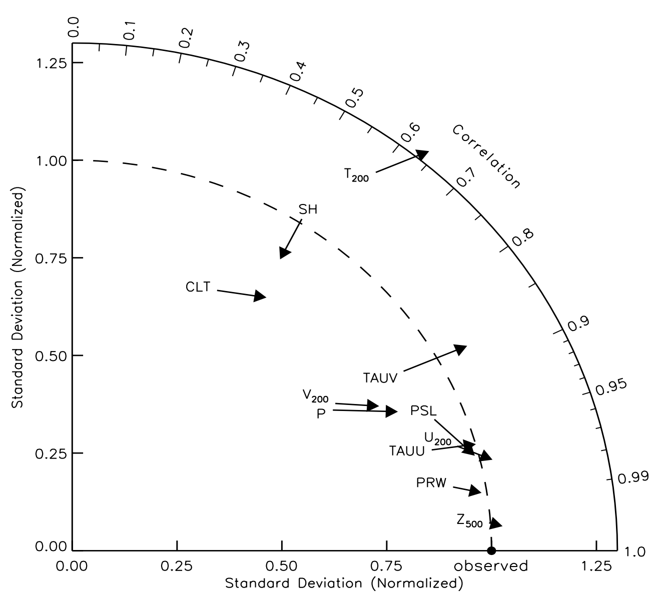

Fig. 1: Change in Median Model Performance