Science and Technology Infusion Climate Bulletin
NOAA's National Weather Service
40th NOAA Annual Climate Diagnostics and Prediction Workshop
Denver, CO, 26-29 October 2015

An Analysis of Predictability of Seasonal Atmospheric Variability Using NMME Models

Bhaskar Jha[1,2] and Arun Kumar[1]

[1]*Climate Prediction Center, NOAA/NWS/NCEP, College Park, Maryland*
[2] *Innovim LLC, Greenbelt, Maryland*

The seasonal predictability of 200-hPa height (Z200) was estimated based on North American Multi-Model Ensemble (NMME) forecast system. In this analysis, a simple procedure was adopted based on finding the minimum value of Mean Square Error (MSE) between observed and NMME forecast system (Kumar *et al.* 2007) and it was argued that the minimum MSE is a best estimate of the atmospheric seasonal internal variability.

The updated estimates of seasonal internal variability based on NMME forecast show significant reduction in MSE over tropical region as compared to Atmospheric Modeling Intercomparison Project (AMIP) and Development of European Multimodel Ensemble System for Seasonal to Interannual Prediction (DEMETER) based estimates. The top and middle panels of Fig. 1 are based on AMIP simulation and DEMETER data sets (Kumar *et al.* 2007) and bottom panel is the current estimate of seasonal internal variability based on NMME forecast. However, the amplitude of seasonal internal variability based on NMME forecast system shows little reduction over Pacific North America (PNA), Greenland region, northern and southern higher latitude compared to AMIP and DEMETER. Overall seasonal observed variability looks broadly similar over northern and southern higher latitude.

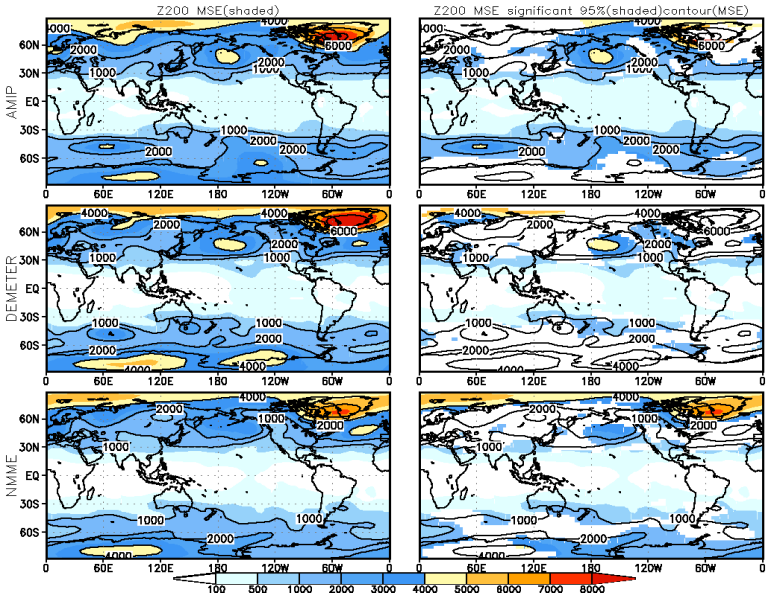

Fig. 1 The internal variance from grid-to-grid point is best estimated by the minimum value of MSE. Left panel (top) for AMIP, (middle) for DEMETER and (bottom) for NMME. The right panel is the same plot as the left panel except for shading that indicates the significance of estimated MSE at 95% level based on Monte Carlo approach.

In this work, the analysis was focused on predictability of Z200 in Northern Hemisphere winter. It is clear that the predictability should be seasonal and variable dependent, e.g. it is expected that the predictability is lower in Northern Hemisphere summer than in winter, which needs further investigation.

Last, next generation forecast system and corresponding spatial map of MSE can be used to update the spatial map of internal variability as well as the predictability. It remains to be seen how much of the internal variability estimates based on NMME forecast (Fig. 1 bottom panel), can be further improved because of improved models by higher resolution, better initial condition and larger ensemble sizes. The present estimate can be used as a benchmark that could be used to document such improvement.

This work has been submitted to *Climate Dynamics*.

Correspondence to: Bhaskar Jha, 5830 University Research Court, Climate Prediction Center, NOAA/NWS/NCEP, College Park, Maryland; E-mail: Bhaskar.Jha@noaa.gov.

Acknowledgements. This study was supported by NOAA's Climate Program Office's Modeling, Analysis, Predictions, and Projections program.

References

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