A REDUCED SPHERICAL TRANSFORM FOR THE NCEP SEASONAL FORECAST GLOBAL SPECTRAL ATMOSPHERIC MODEL

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A reduced sperical tranformation (RST) is applied to the NCEP atmospheric global spectral model for seasonal forecast. It is the same concept as the reduced Gaussian grid (Williamson and Rosinski, 2000). The magnitude of the associated Legendre coefficient has a scalene right triangle pattern, which provides the basis of the RST.

The proposed RST computes fewer latitudinal waves and Lengendre tranformations than the right-angle trapezoid pattern used by all reduced-Gaussian-grid global spectral models (see Fig. 1). In order to ensure reproducibility by model restart and to avoid modification of the model preprocessor and postprocessor, we use a nearest-point-replacement method for preparation of the surface data between a full Gaussian grid for fully spherical transform (FST) and reduced Gaussian grids for RST after initial interpolation.

The advantages of scalene right triangular transformations are that they save an extra 50% of computational resources over the trapezoid Legendre transformations, and scalene transformations are easier to load balance for massive-parallel-processor computing.

A comparison without model physics, between scalene RST, trapezoid RST, and FST indicates that they have negligible differences up to 15 days and acceptable differences up to one month. And when the comparison includes model physics, the results show negligible differences up to 7 days, but the chaotic nature of the system, known as internal variability, produces significant differences among RSTs and FST in monthly integrations. Nevertheless, the seasonally averaged results from 10 years of AMIP-type runs show that the runs using RST and FST are similar. The results indicate that they have the same model climatology (see Fig. 2). From these experiments, this scalene RST (as compared with the FST) can be used for short-range as well as seasonal or climate prediction.

REFERENCES

Williamson, D. L. and J. M. Rosinski, 2000: Accuracy of reduced-grid calculations. *Q. J. R. Meteorol. Soc.*, 126, 1619-1640.

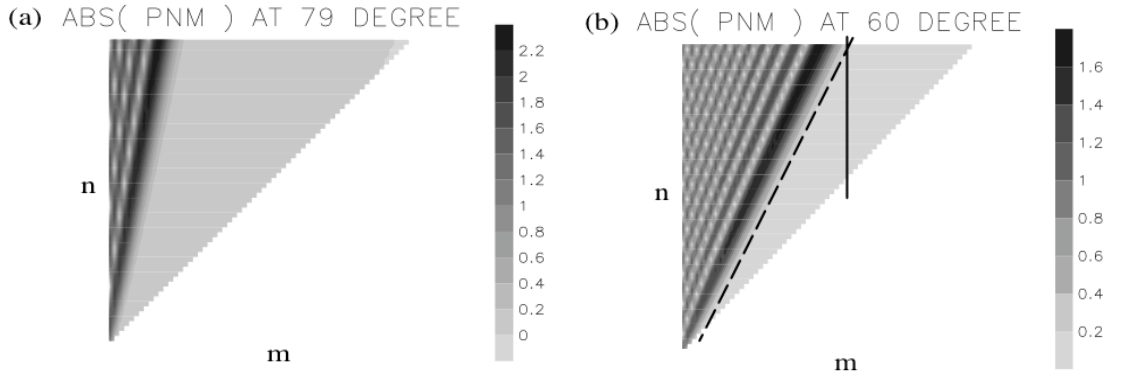

Fig. 1. The absolute amplitude of the associated Legendre function for T62 at latitudes of (a) 79 and (b) 60 N. The solid line (Fig 1(b)) indicates the trapezoidal truncation and the dashed line indicates the scalene triangular truncation.

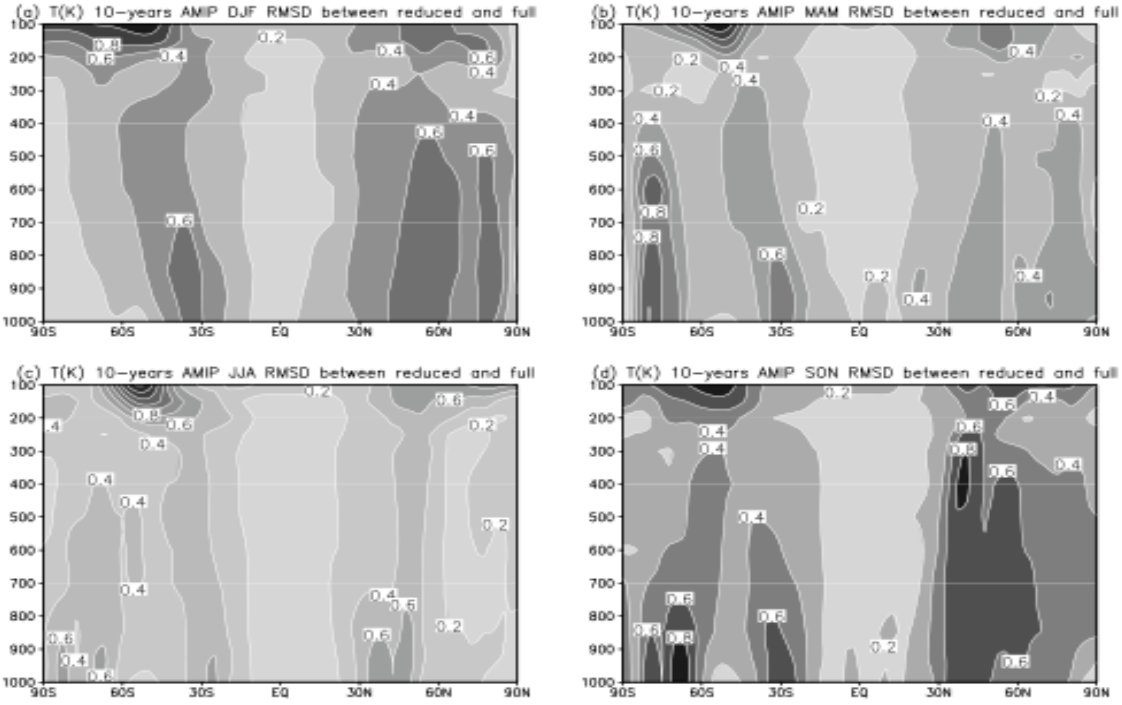

Fig 2. Root Mean Square Difference (RMSD) of 10-year zonal seasonal-mean temperature between reduced and full spherical transforms, plotted for (a) winter, (b) spring, (c) summer, and (d) fall, with contour interval of 0.2 K.