Approaches to Power Spectrum Estimation of Atmospheric Angular Momentum

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The location, resolution, and statistical significance of some peaks in atmospheric angular momentum (AAM) time series spectra computed using several modern spectral estimation techniques are compared and contrasted. Peaks relating to El Nine-Southern Oscillation variability with periods near 24 months and 4-5 years as well as to oscillations in the intraseasonal band are examined. In the absence of knowledge about the type of (statistical) process that has generated a time series, there exists no single "correct" method for calculating the spectrum. Results obtained from Burg's maximum entropy method (MEM) and Thomson's multiple taper method (MTM) applied to the data after a noise-reducing application of singular spectrum analysis (SSA), as well as from the wavelet transform method, will be intercompared against a background spectral estimate provided by the classical periodogram with windowing. The focus here will be on the MTM however, since it is reputed to be less biased and more statistically efficient than conventional methods.

Confidence intervals for the MEM spectral estimates are obtained with both Baggeroer's method and a newer technique due to Burshtein and Weinstein. The MTM method yields an analysis-of-variance P-statistic which is used to quantitatively test for the validity of each peak in the spectrum of the AAM data and for its amplitude. Jackknife variance estimates are used as additional cross-checks on the stability of the results.