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Understanding the atmospheric kinetic energy spectrum

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The Kinetic Energy spectrum of the atmosphere in the mesoscales (10-500 km) is poorly understood. Aircraft measurements in the eighties first revealed that there was a kink in the spectrum, a transition from a slope of -3 to a slope of -5/3, that occurred at scales below around 400 km (Nastrom et al. [1984]). Since that time many possible mechanisms have been posited for the transition but there has been no consensus. We will present a new way of analysing the *local* scaling laws of geophysical data using coarse-graining, extending the work of Sadek and Aluie [2018]. Our technique allows for the creation of spatial maps of spectral slope, as well as conditioned spectra that can be used to analyse the relationship between different meteorological variables and the atmospheric kinetic energy power spectrum. This enables us to explore causes for the observed shallower slope. We observe shallower spectral slopes in regions of greater convective activity, as well as shallowing in regions of high orographic variability and interesting latitudinal effects. The important implications of our work for the celebrated Nastrom and Gage spectrum (Nastrom et al. [1984]) will be discussed.

References:

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