The spectrum of atmospheric variability

Nedjeljka Žagar (Univ. Hamburg)

Abstract:

The basic laws of fluid mechanics and thermodynamics, which govern the atmosphere, couple the thermodynamical fields (pressure, temperature, density) and circulation (winds), calling for an approach that considers mass and wind field and spatial and temporal variability simultaneously. However, atmospheric spatial and temporal variability are usually considered separately. The former is relatively well observed compared to the latter that is usually estimated for a limited region and individual variables. The former is also regularly assessed in wavenumber domain.

In this seminar, I will discuss a holistic approach to spatio-temporal variability in wavenumber domain using a set of prognostic equations including traditional approximations. In particular, the approximation of a hydrostatic atmosphere requires diagnostic of the vertical component of velocity from the thermodynamical or the continuity equation that is suitable for the large-scale circulation in extratropics (i.e. day-to-day weather). Associated variability spectra of quasi-geostrophic Rossby waves are relatively well understood. In contrast, the vertical velocity associated with small-scale inertia-gravity waves and their kinetic energy spectra are poorly understood. I will present a unified framework for the derivation of vertical velocities associated with the Rossby and inertia-gravity waves and show its application to the global analysis data.