ATS/CIRA Colloquium

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Timescales of the NAO and Annular Modes: Tropospheric Feedbacks and Stratospheric Coupling

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ATS room 101; Discussion will begin at 3:30pm
Refreshments will be served at 3:00pm in the coffee lounge

The North Atlantic Oscillation (NAO) and Annular Modes are the dominant patterns of intraseasonal variability in the extratropical atmosphere. I will present work with a hierarchy of dry, primitive equation atmospheric GCMs to isolate the dynamics governing the temporal structure of these patterns, with a focus on the influence of stationary planetary waves. In the first, a model driven with the Held and Suarez (1994, BAMS) forcing, we investigate an eddy-mean flow feedback within the troposphere that slows movement of the extratropical jet, so extending the persistence of the annular modes. The addition of realistic topography and land-sea contrast (approximated by a large scale thermal perturbation) breaks the strong feedback found in simulations with zonally uniform forcing. In the second, we focus on the influence of the stratosphere on the tropospheric annular modes. We begin with the model of Polvani and Kushner (2002, GRL), but add topography to generate a planetary wave flux into the stratosphere -- and hence a more variable polar vortex. We find that the mean structure and variability of the vortex in the model is very sensitive to the amplitude of the topography, and Northern Hemisphere-like variability, with the correct frequency of warming events, occurs only for a relatively narrow range of topographic heights. In these simulations we find an active coupling that connects the strength of the polar vortex to the latitude of the tropospheric jets, as found on climatological timescales by Polvani and Kushner.