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Midlatitude jet variability: forcing from above and below

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I will discuss aspects of midlatitude eddy-driven jet variability and its response to forcing from the stratosphere and by orography, starting with a zonal mean picture and then focusing on the Atlantic basin. Stratosphere–troposphere interactions are conventionally characterized using the first empirical orthogonal function (EOF) of fields such as zonal-mean zonal wind. Perpetual-winter integrations of an idealized model are used to contrast the vertical structures of EOFs with those of principal oscillation patterns (POPs; the modes of a linearized system governing the evolution of zonal flow anomalies). POP structures are shown to be insensitive to pressure weighting of the time series of interest, a factor that is particularly important for a deep system such as the stratosphere and troposphere. In contrast, EOFs change from being dominated by tropospheric variability with pressure weighting to being dominated by stratospheric variability without it. The analysis reveals separate tropospheric and stratospheric modes in model integrations that are set up to resemble midwinter variability of the troposphere and stratosphere in both hemispheres. Movies illustrating the time evolution of POP structures show the existence of a fast, propagating tropospheric mode in both integrations, and a pulsing stratospheric mode with a tropospheric extension in the Northern Hemisphere–like integration.

The atmospheric jet stream over the North Atlantic exhibits three 'preferred positions', latitudes where the jet maximum occurs more frequently than others. Using a state-of-the-art atmosphere model, the forcing of these preferred positions by upper-atmosphere circulation and northern hemisphere mountain ranges are explored. Changes in the latitude of the time-mean jet manifest as changes in the relative probabilities of the preferred positions, not changes in the preferred latitudes. I will present strong evidence that the Greenland ice sheet is responsible for the northern preferred latitude.

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Refreshments 3:15 p.m
NCAR Foothills Laboratory
3450 Mitchell Lane, Boulder, CO 80301
FL2-1022, large seminar room
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