Global Teleconnections via the Tropospheric Subtropical Waveguide

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In contrast to most teleconnection patterns, which have a distinct meridional component to their structure, there is a class of intrinsic patterns of variability that are primarily oriented in the zonal direction. These patterns occur in both hemispheres and are located in the subtropical jets of the troposphere.

In this presentation, after characterizing the spatial and temporal characteristics of these patterns in nature and in general circulation models, we investigate the dynamical mechanisms that are responsible for their prominence. We find they are well approximated by the stochastically driven linearized primitive equations. We also find through PDF analysis that some pattern amplitudes are preferred, indicating that nonlinearities have a perceptible influence on their behavior.

Next we point out some of the phenomena where these zonally oriented patterns play a prominent role. One example is ENSO, with the stimulation or non-stimulation of one of these patterns being a key to determining whether a given event will have far reaching impacts. Another is seasonal variations in North Pacific sea surface temperatures. Upstream midlatitude events have nearly as much influence as tropical heating on these SSTs because of the zonal patterns. A third phenomenon is global change with the regional structure of trends in many GCM experiments being strongly influenced by these patterns.