Mechanical Engineering Doctoral Defense

Dynamics and Predictability of Large-Scale Atmospheric Waves

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Abstract

Large amplitude westward propagating long waves in midlatitudes of Northern Hemisphere occasionally sustain coherent phase propagation over multiple weeks. Owing to the large amplitude and the life cycle of these waves previous studies have speculated their influence on extended-range weather forecasts but have not quantified them. The primary aim of this study is to establish an updated long-term catalog of Retrograde Wave events which can then be used to investigate the statistics and structure of these waves. Guided by the newly created catalog the dynamics of these waves are further explored. A preliminary look into the dynamics of these waves reveal a sequence of poleward extrusion, westward migration and vortex shedding occurring frequently during certain strong Retrograde wave events. A strong connection between the westward moving low PV structures and the East Asian cold air outbreak is uncovered. Also, the initiation of the sequence of low PV extrusion and vortex shedding is found to be linked with the phase of propagating Wave-1 zonal component. Enhanced predictability of global midlatitude Geopotential Height at 500mb is noted during active period of strong Retrograde wave activity in comparison to inactive period. Skilled forecasts were produced almost (on an average) 12 days in advance during the active period of one of the winters (1995/96) as compared to 9 days during the inactive period of the season.

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Zoom Link: https://asu.zoom.us/j/84007574629