Wavenumber Decomposition and Extremes of Atmospheric Meridional Energy Transport in the Northern Hemisphere Midlatitudes

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The atmospheric meridional energy transport in the Northern Hemisphere midlatitudes is mainly accomplished by planetary and synoptic waves. A decomposition into wave components highlights the strong seasonal dependence of the transport, with both the total transport and the contributions from planetary and synoptic waves peaking in winter. In both winter and summer months, poleward transport extremes primarily result from a constructive interference between planetary and synoptic motions. The contribution of the mean meridional circulation is close to climatology. Equatorward transport extremes feature a mean meridional equatorward transport in winter, while the planetary and synoptic modes mostly transport energy poleward. In summer, a systematic destructive interference occurs, with planetary modes mostly transporting energy equatorward and synoptic modes again poleward. This underscores that baroclinic conversion dominates regardless of season in the synoptic wave modes, whereas the planetary waves can be either free or forced, depending on the season.