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Role of medium-scale waves on the Annular Modes

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We examined the role of short-period waves on the Northern and Southern Annular Modes (AMs). We focused on medium-scale waves which have shorter periods than synoptic waves. Here, we defined them as waves with periods shorter than about 2 days. Although medium-scale waves generally have much smaller amplitudes than synoptic waves, they have much higher correlations with the AM indices. In fact, the correlation between their amplitudes and the AM indices is the highest among wave components.

Analysis for the contribution of each wave components to the AM variability shows that about one third of wave-driven meridional circulation and zonal wind acceleration is generated by medium-scale waves for the SAM. For the NAM, the contribution is a little bit smaller (about 15%) due to a larger contribution of stationary waves to NAM variability. However, they are found to be an important contributor to the AM variability.

The contribution of medium-scale waves to AM variability is very significant taking account of their small climatological amplitude. It is also found that the zonal wind variability associated with the AM tends to generate the medium-scale waves through baroclinic processes. As a result, there is a positive feedback between the AM variability and the amplitude of medium-scale waves, similar to synoptic waves. The roles of medium-scale waves on the AM for both hemispheres are also compared.