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Influence of atmospheric waves on the formation and the maintenance of the subtropical jet during the Northern Hemisphere winter

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A new analysis technique that allows for the breakdown of the meridional circulation or the acceleration of zonal wind, etc. into its various contributions from forcings at a specific location or a frequency band was proposed, and it is applied to examine the formation and the maintenance of the subtropical jet during the NH winter.

Analysis shows that the climatological balance on the equatorial flank of the subtropical jet during winter is shown to be established between Coriolis acceleration associated with tropical heating and subtropical cooling and deceleration associated with eddies. In contrast, the polar flank of the jet is balanced between acceleration due to eddies and Coriolis deceleration induced by frictional forcing at the surface. It is also found that stationary waves, which reach up to 1.4 m/s/day, are the greatest accelerator of the jet core, whereas synoptic waves decelerate the jet core.

When the variability of the jet is considered on a day-to-day and month-to-month time scale, it is apparent that the acceleration is induced mainly by eddies. In contrast, diabatic heating in the mid-latitudes associated with wave activity and surface friction act to suppress the acceleration. Regarding the month-to-month variability of the jet, stationary waves are the primary accelerator of jet variability, followed by synoptic waves. On the other hand, Low Frequency Transient (LFT) waves act to suppress the variability. However, synoptic waves play a key role in creating the variability on a monthly scale, whereas stationary waves work only for the maintenance of the jet.