

Precursors of weak stratospheric polar vortex events: intra-seasonal variability

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It is known that changes in the strength of stratospheric polar vortex are related to forcings that can affect the tropospheric upward wave propagation. In particular, an anomalous weak polar vortex (WPV) is preceded by a strong wave activity from the troposphere into the stratosphere causing a warming over the polar region and a consequent weakening of the polar cyclonic circulation. El Niño-Southern Oscillation (ENSO), Quasi-Biennial Oscillation (QBO) or certain tropospheric anomalous circulation structure, among others, have been identified in many studies as potential precursors of WPV events. However, although the timing of the most effective impact of those precursors on the stratospheric polar vortex is already known, the generation of WPV events at any given time of winter is still unknown in detail.

The aim of this work is to explore the WPV occurred in different boreal winter sub-seasons and their possible precursors. Namely, we consider early winter (from October to December), mid-winter (January and February) and late winter (March and April) separately. For this purpose, we use daily-mean data from ERA-Interim for the period 1979-2011. Preliminary results by the authors give evidence of intra-winter variability in the state of the polar stratosphere prior to WPV events, in the characteristics of the anomalous wave activity triggering them and in the tropospheric circulation structures related to this enhancement of wave activity. In this work we show that mid- and late winter WPV events are preceded by an anomalously strong vortex and a peak of high wave activity with relevant contribution of wavenumber-1 and wavenumber-2 components. In contrast, a preconditioning in the stratosphere is observed for early winter WPVs, which are preceded by a weak enhancement of wavenumber-1 wave activity. The contribution of precursors of WVP events, such as QBO, Arctic sea ice anomalies or ENSO, presents differences among the three winter sub-seasons.