Antarctic Dipole and its stratosphere connection

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The Antarctic Dipole (ADP) characterizes the leading mode of Antarctic sea ice variability with out-of-phase anomalies in the South Pacific and South Atlantic. Triggered by El Nino /Southern Oscillation (ENSO), ADP develops its high latitude characteristics after the tropical forcing ceases and its anomalies persist 3-4 seasons. This study focuses on ADP's high latitude characteristics and its feedback to the overlying atmosphere. First we establish an ADP index using the sea ice edge anomalies averaged in the Atlantic center (50°W-20°W) minus the mean anomaly in the Pacific center (150°W-120°W). Then the co-variability of the index and the atmosphere is examined systematically through all seasons. We find that the ADP is associated with an upward-propagating planetary Rossby wave in spring. In line with the increase in wave activity flux into the stratosphere associated with this wave, we also find a highly significant negative correlation between the ADP in spring and the zonal mean zonal wind in the polar stratosphere in November. This deceleration of the polar vortex couples downward to the surface, consistent with a significant relationship between the ADP in spring and the tropospheric zonal winds in spring and summer, resembling a poleward shift of the mid-latitude jet. In summer, the ADP anomaly appears to be reinforced by the stratospheric influence on the tropospheric circulation.