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Possible linkages between PDO and the Antarctic polar vortex interannual variability

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A number of studies have noted that the polar vortex during October shows a significant interannual variability in the orientation of the major axis of its quasi-elliptic horizontal structure. It has been recently shown that as a result the major axis appears to have migrated from an orientation towards South America (western orientation) to an orientation towards the Grenwich meridian (eastern orientation) with significant interannual variability, and potentially more frequent eastern orientation. Such an interannual oscillation has recently been linked to interannual changes in the phase of quasi-stationary wave 1 (QSW1). Such a "flip-flop" behavior, as quantified in a QSW1 October phase index, appears to be linked to changes in baroclinic wave sources and propagation from the Equatorial Pacific into higher latitudes. The associated wave energy appears to propagate, during eastern orientation events, from the troposphere into the stratosphere in the vicinity of Drake Strait/Wedell Sea strengthening the polar vortex jet. Note that such variability as noted in quasi-stationary waves 1-3 appears to extend barotropically between the lower stratosphere and the middle troposphere. In order to identify possible underlying mechanisms, composites for CAM/NCAR GCM ensemble runs forced with different combinations of ENSO and PDO conditions (based on SST) are compared with results of correlation analysis performed between data from ECMWF ERA/INTERIM reanalysis and CAM/NCAR AMIP simulation and PDO index values. The QSW1 phase index is calculated from these datasets in order to identify coupled variability between PDO phase and vortex orientation. In all cases the calculated QSW1 phase index has a tendency to positive values when the PDO index is negative. In particular, the PDO index for late austral spring early winter months, i.e., May, June, July, appears to have an inverse correlation with the phase index calculated for the following October. On the other hand the index does not appear to have a strong significant dependence on ENSO. The link between Pacific Ocean SST and polar stratosphere seems to be in the residual circulation, that shows during winter a statistically significant enhancement in the tropics when the PDO is in the negative phase. It would appear that the SST anomalies in the tropical Western Pacific play a key role in these stratospheric variability processes.