

Longitudinal structure of stationary planetary waves in the middle atmosphere – extraordinary years

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The longitudinal structure in geopotential heights and meridional wind is analysed based on MERRA data over 1979-2013 and limited NOGAPH-ALPHA data in order to find its persistence and altitudinal dependence with focus on extraordinary years. The SPW1 in geopotential heights and related two-cell structure in meridional wind covers the middle stratosphere (lower boundary \sim 50 hPa), upper stratosphere and most of the mesosphere (almost up to about 0.01 hPa). It is a relatively persistent feature; only 9 out of 35 winters (Januaries) display more complex structure. Morphologically the deviation of these extraordinary Januaries consists in upward propagation of the second (Euro-Atlantic) peak (i.e. SPW2 structure) to higher altitudes than usually, mostly up to the mesosphere. All these Januaries occurred under the positive phase of PNA index but there are also other Januaries under its positive phase, which behave in ordinary way. The decisive role in the existence of extraordinary years (Januaries) appears to be played by the SPW filtering by the zonal wind pattern. In all ordinary years the mean zonal wind pattern in January allows the upward propagation of SPW1 (Aleutian peak in geopotential heights) up to the mesosphere but it does not allow the upward propagation of the Euro-Atlantic SPW2 peak to and above the 10 hPa level. On the other hand, the mean zonal wind filtering pattern in extraordinary Januaries is consistent with the observed extraordinary pattern of geopotential heights at higher altitudes.