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Variability of the extratropical zonal-mean tropopause height

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EOFs for the extratropical (32.5-90) zonal-mean tropopause height in the extended winter season (NDJFM) are presented. The first two EOFs are well separated, and correspond to meridional wave-like deformations in the zonal-mean tropopause; no net variations of the extratropical tropopause mean height are found. Both EOFs display a similar dynamics in which a positive feedback between stratospheric polar jet intensity and planetary-wave upward propagation leads to a north-south dipole of potential temperature in the lower stratosphere and a meridional dipole in zonal-mean tropopause height. The upward-shifted wave breaking produces a positive anomaly of EP flux divergence at the tropopause level, causing an intensification of the circulation at this level. In the first EOF, the latitude of this positive anomaly coincides with the northern edge of the eddy-driven extratropical jet, which seems to induce a latitudinal displacement of this jet (together with the anomalous synoptic wave breaking to the south), similar to that associated with the Zonal Index. Regression of the PC over the complete field shows that variations of tropopause height in the first EOF are higher over the Atlantic and Pacific stormtracks, while the second EOF presents a stronger signal over the pole and a more zonal structure.