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Circulation variations due to combine effect of the QBO and SSC: a reanalyses comparison

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Regular variations in the period bands of 23-33 months and 10-12 years were studied analyzing various reanalyzed variables. The oscillations are linked to the quasi-biennial oscillation (QBO) and to the 11-year sunspot cycle (SSC) and they were investigated using the pseudo-2D wavelet transform with focus on variations in circulation fields. The analysis follows paper Pisoft et al. 2012: Imprint of the 11-year solar cycle in reanalyzed and radiosonde datasets: a spatial frequency analysis approach, Climatic Change, 110, 1-2, 85-99.

We have studied the ERA-40, NCEP-DOE 2, NCEP/NCAR and 20th century reanalysis V2 datasets that included time series of air temperature, zonal, meridional and vertical wind velocities, ozone mass mixing ratios, total ozone column and the tropopause temperature. Vertically expressed variables were analyzed from 1000 up to 10 hPa. Most of the datasets covered the second half of the 20th century.

The results illustrate spatial distribution of statistically significant wavelet power and they are presented in the form of horizontal maps, vertical profiles of zonal means, and vertical profiles representing longitudinal variations connected to selected latitude. The results point to the presence of the QBO in the tropical stratosphere along with the regions of induced changes in residual circulation and related variations in temperature or ozone amount across extratropics. The SSC imprint is located mainly over similar locations showing that the cycles' signals are mutually affected there.

The study also points to the differences among the reanalyses, especially to the imperfection of the oscillations representation in the 20CR dataset (Compo et al. 2011: The Twentieth Century Reanalysis Project. Quarterly J. Roy. Meteorol. Soc., 137:1-28).