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Teleconnectivity in the Northern Hemisphere wintertime circulation variability patterns

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Tropospheric circulation patterns have been calculated as usual by applying a Principal Component Analysis (PCA) on the extratropical geopotential height field anomalies (500- and 1000-hPa isobaric levels) of the Northern Hemisphere (NH) cold season (November-March). The analysis was applied on filtered daily means of the geopotential height obtained from the NCEP–NCAR and ECMWF reanalysis datasets.

The zonal mean component of the leading EOF pattern (called annular by many authors) has its maximum amplitude at midlatitudes (45-55º N). The contribution of the zonal mean zonal wind at midlatitudes for the statistical connection between tropospheric and stratospheric variabilities was assessed. With this aim lagged correlations between an index of the zonal mean zonal wind at midlatitudes and the polar vortex strength were computed. The connection between the polar vortex and the residual tropospheric variability that remained after the subtraction of variability regressed onto the midlatitude zonal wind was also assessed.

In our results the tropospheric variability patterns which appear to respond to polar vortex variability have a hemispheric scale. Nevertheless these patterns show a dipolar structure only over the Atlantic basin. The dipole resembles the North Atlantic Oscillation (NAO) pattern, but with the node line shifted northward. The midlatitude zonal mean zonal wind anomalies tend to occur before the vortex anomalies and do

not seem to take part on the downward progression of vortex anomalies.

The influence of the vortex variability on the teleconnectivity existing in the leading variability patterns of tropospheric circulation was also investigated. The regression patterns of the geopotential height (500- and 1000-hPa) field anomalies on the 70-hPa NAM are similar to the respective leading EOF patterns but with the zonal mean fields shifted northward. This confirms again that the leading EOF of geopotential field at single isobaric fields strongly exaggerates the zonal mean component at midlatitudes. Zonnally coherent variability seems to be confined to high latitudes.

Finally a study of teleconnectiviy in the residual geopotential variability that remained after the subtraction of the geopotential fields regressed onto the 70-hPa NAM was also performed. Results suggest that a large fraction of the zonally symmetric component at midlatitudes is the imprint of two independent dipoles over the Pacific and Atlantic oceans. The Pacific/North America (PNA), the NAO and a wave pattern extending from East Atlantic through Eurasia appear to be robust teleconnection patterns.