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Winter rainfall variability over Europe in the coupled stratosphere-troposphere system

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According to recent studies, it seems that the Northern Hemisphere (NH) wintertime variability in the stratosphere can impact the tropospheric circulation. In most of observational works, the authors show this influence in basis of a certain stratospheric index which reflects variations in the strength of the stratospheric polar vortex. In the present study the connection between stratosphere and anomalous winter weather regimes over Europe is analyzed using a monthly precipitation index (pcp_idx) which is linked to surface geopotential changes in NH. Using one standard deviation (std) as threshold for selecting winter months with high (>+1 std) and low (<-1 std) pcp_idx, composites of NH geopotential anomalies for high pcp_idx cases resemble the positive phase of the Northern Annular Mode (NAM) at different pressure levels (from 1000 to 30 hPa). The opposite appears for low pcp_idx cases. This index exhibits a statistically significant correlation with the 500 hPa transient eddies energy over certain North Atlantic regions, in such a way that negative pcp_idx phase appears associated with a southward shift of storm tracks, which in turn brings more/less rainfall over south/north of Europe. Consequently, this result provides a dynamical explanation of the link between precipitation over Europe and North Atlantic atmospheric variability. Composites of zonal-mean zonal wind through the whole atmospheric column for opposite phases of pcp_idx show differences at stratospheric levels. For instance, daily zonal-mean zonal wind composites at 10 hPa display a statistically significant weakening of the stratospheric jet at high latitudes prior and during anomalously wet (dry) months over Southern-central (Northern) Europe in winter. Overall, these results support the potential contribution of the stratospheric variations in the development of

seasonal forecasting models.