EMS Annual Meeting Abstracts
Vol. 8, EMS2011-683-1, 2011
11th EMS / 10th ECAM

Forecasting the weather
- ensemble techniques
in probabilistic weather prediction

On the detection of cooling regions in the lower boreal stratosphere during the 1957 - 2002 period

J.A. Lopez-Bustins (1), E. Serrano-Mendoza (2), A. Sanchez-Lorenzo (3), and B. Ayarzagüena (2)

(1) Group of Climatology, Physical Geography Department, University of Barcelona, Catalonia, Spain (jlopezbustins@ub.edu), (2) Departamento de Geofísica y Meteorología, Universidad Complutense de Madrid, Spain, (3) Institute for Atmospheric and Climate Science, ETH Zürich, Switzerland

In this study, we analyse temperature anomalies at 50 hPa level poleward of 30°N in order to regionalize temperature variability patterns at the lower boreal stratosphere. The main goal is to detect those regions with statistically significant trends in the stratospheric temperature during the 1957-2002 period. The analyses are carried out for November to May (grouping in two sets: November-February and March-May) to relate temperatures changes to the variability of the northern polar vortex. Daily data from NCEP/NCAR and ERA40 reanalyses are used.

To identify the main regions with similar temperature variability, an S-mode Principal Component Analysis (PCA) is applied on correlation matrices of 10-day temperature anomalies grid at a horizontal resolution of 5°, and subsequently rotation is applied using the Varimax criterion. Trends are calculated on the PCA scores obtained for each region and month by means of the least squares fitting, and their statistical significance is established by the Mann-Kendall non-parametric test. Several time trends are considered using running windows of variable width, between 21 and 45 years.

The results obtained from NCEP/NCAR and ERA-40 databases are nearly identical. Coincident results between both reanalyses identify two main regions in the low stratosphere with statistically significant cooling trend: one centred over the Arctic and a second one tracing an annular subtropical ring (south of 40° N). The first one is associated to the polar vortex intensity, and a significant negative trend in the stratospheric temperature is detected in the early and mid-winter during several decades, particularly in the middle of the study period (i.e. 1975-1985), as well in the late spring, especially in May, during central and final years of the study period (i.e. 1975-2002). The subtropical ring shows a steady cooling from November to May since 1975, being this stratospheric cooling extensive to the whole period when early winter months are not considered. The mid-latitudes, which appear represented by other temperature variability patterns, do not show any statistical significant trend in the low stratospheric temperature.