



Do the Surface and Mid-tropospheric Modes of Circulation Variability have the same Effect on the European Climate?

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Over the Northern Hemisphere, circulation modes of low-frequency variability at the SLP and Z500 levels are identified using the orthogonal rotated principal component analysis. Both types of data needed for the analysis are provided by the NCEP/NCAR reanalysis (the SLP data for the period 1946-1999, and 500-hPa heights for 1958-1998). Circulation modes at the 500 hPa level for all seasons were defined as a “reference” modes, and simple correlations were used to identify corresponding modes at the SLP. A linkage of the modes between both levels is documented by the statistical significant correlations of the modes with the temperature and precipitation in Europe. The North Atlantic Oscillation mode is best pronounced in the Z500 during the year, and correlations with the mode of similar character in the SLP are higher than 0.60 in all seasons. In winter, the NAO mode and the East Atlantic mode are strongly combined, and links with the modes in SLP are not clear. The vertical structure of all circulation modes can be well identified for autumn. In other seasons, however, the situation is more complex. The different positions of mode centers at both levels indicate the baroclinity of the atmosphere. Statistically significant correlations with temperature and precipitation over the European region show that the NAO and EA modes in both levels affect the climate similarly, except for the summer season. Characters of two other modes differ a lot at the levels examined, and the correlations with the climate elements vary in a wide range.