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Comparison of atmospheric circulation patterns controlling surface air temperature anomalies over Eastern Europe and Northern Asia

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In order to study circulation patterns responsible for temperature anomalies over Eastern Europe and Northern Asia, the observed monthly mean surface air temperature (SAT) at 768 stations in ex-USSR during 1950-2005, interpolated into 5x5^o grid points, as well as results of transient climate change experiments with HadCM and ECHAM numerical models are examined using empirical orthogonal function (EOF) analysis. First five statistically significant rotated PCs revealed to be correlated to the following Northern Hemisphere (NH) Teleconnection Patterns: North Atlantic Oscillation (NAO), Scandinavian (Scand), Pacific-North American (PNA), West Pacific (WP), East Atlantic (EA), East Atlantic-West Russia (EAWR), Polar-Eurasia (Pol). Impact of the NH circulation modes on SAT variations is evaluated using the multiple stepwise backward regression (MSBR).

Analyses of monthly winter time (December to March) and July temperature rotated PCs indicate that within the Northern Eurasia territory, there are several regions with temperature anomalies, respondent to certain NH Teleconnection Patterns. Winter temperature variability over Northern Eurasia as a whole is mostly related to NAO and Scand patterns. January-March warming in the East Europe is mostly related to positive NAO phase, whereas in the Northern Asia positive SAT anomalies seemed to be caused by negative Scand phase. Broad-scale extreme SAT anomalies spreading over almost entire Northern Eurasia, as a rule, are related to simultaneous NAO and SCAND anomalies. MSBR analysis shows that in 1951-1974 the leading role in winter SAT variability over Northern Eurasia belongs to the Scand. After 1975, Scand has passed over the leading role to NAO.

Such circulation modes as EAWR can influence both east Europe and west and central Siberia. Moreover, spatial scales of the circulation mode influence can depend on season and even month within the season. For instance, February SAT anomalies related to EAWR pattern are located in the north of Siberia, however in March an increased impact of EAWR leads them to spread over to the north-east of Europe. In July EAWR impact becomes the most essential. Probably due to prevailing role of EAWR pattern in the summer SAT variability, distribution of the temperature anomalies has intrazonal character in summer.

Similar analysis applied to the temperature simulated by HadCM and ECHAM numerical models shows that they don't always reproduce adequately anomalies resulted from the NH Teleconnection Patterns. This is mostly true about EAWR, probably connected to the variations of the North Atlantic sea surface temperature.

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