Geophysical Research Abstracts,
Vol. 11, EGU2009-9638, 2009
EGU General Assembly 2009

Variability of summer droughts in Central Europe and relation to large-scale circulation types

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Summer droughts are a recurrent feature of Central European climate with distinct relevance for natural and social systems. In this contribution spatiotemporal variations in Central European summer drought severity during the period 1957 and 2000 are depicted and relations to large-scale North Atlantic-European circulation types are investigated.
Temporal variations in drought incidence are estimated via calculation of the standardized precipitation index (SPI) on the basis of 0.5° by 0.5° gridded monthly precipitation sums from the global VASClimO data set available for the period 1951 to 2000.
Corresponding variations in large-scale atmospheric circulation dynamics are described by frequency and within-type variations of 18 North Atlantic-European circulation types for the domain 30.0° - 76°N and 37°W – 56°E. Circulation types are derived by applying an automated circulation classification scheme to daily 1.0° by 1.0° gridded MSLP data from the ERA40 reanalysis data-set covering the period 1957 - 2002.
The relationship between 3-month (JJA) SPI and circulation type frequencies during the respective 3-month period are analysed using stepwise multiple regression analysis. The relative importance of individual circulation types is assessed by the LMG-estimator and the skill of the multiple regression models is estimated by applying several skill-score statistics to the cross-validated SPI-series.
Results highlight the relevance - in terms of relative importance - of anticyclonic and northerly and northeasterly circulation types for Central European summer drought dynamics. Multiple regression models show considerable skill especially in western and north-western parts of the Central European domain. However, a distinct decrease in model skill has to be noticed towards the more continental central and eastern parts.
These deficiencies of the approach point to the fact that frequency variations of circulation types are not sufficient to capture the drought-relevant large-scale circulation variations. Thus, in a further analytical step varying variables characterizing internal variations of large-scale circulation types (e.g. vorticity parameter, persistence of circulation types) are determined and included as additional potential predictors into the stepwise multiple regression approach.
First results show at least for some regions an improvement in model skill related to the inclusion of such within-type characteristics.