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The influence of large-scale atmospheric circulation on the variability of Barlad river streamflow

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The seasonal variability of Barlad river flow, situated in the eastern part of Romania, in connection with large-scale atmospheric circulation is analyzed for the period 1951-2005. The relationship with precipitation (PP) and temperature (TT) in the European sector, global sea surface temperature (SST), atmospheric circulation over the Northern Hemisphere and the moisture transport is investigated. Applying correlation and composite analyses, it has been found that the variability of winter flow is influenced by a North Atlantic Oscillation (NAO) like pattern. On seasonal time scale, high flow anomalies are strongly correlated with winter TT and PP anomalies over land. There is an out-of-phase relationship between Barlad flow and TT over Scandinavian region and an in-phase relationship with TT anomalies over the southern part of Europe. This pattern in the TT field is similar to the negative phase of the NAO.
High anomalies of the river flow are associated with a tripole-like pattern in the North Atlantic and with negative SST anomalies in the central North Pacific and positive anomalies in the eastern and central tropical Pacific. Positive anomalies of winter streamflow are associated with positive anomalies of sea level pressure (SLP) and 500 hPa geopotential height (G500) centered over the northern part of Europe and Greenland and negative anomalies centred over the mid Atlantic Ocean and the southern part of Europe.
Vector plots of the vertically integrated water vapour transport composites show that during years with low flow anomalies there is a significant reduction of the water vapour transport downstream southern Europe and a shift of the axis of the water vapour transport towards Scandinavia are. Low flow anomalies are also found in connection with an intense zone of divergence over the eastern part of Romania, where the catchement area of Balrad river is situated.
Wavelet and cross spectra techniques are also used to identify the coherent cyclic and non-stationary modes in the winter streamflow time series. The wavelet analysis reveals strong periodicities in the 2.5 to 4.5 years band, possibly associated with the NAO phenomenon.