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Anomalies of moisture flux associated with Mediterranean cyclones contributing to heavy precipitation in the south-eastern Alps

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Mediterranean cyclones cause severe weather phenomena not only in the Mediterranean but also in other parts of Europe. It is well known that when a thermally asymmetric Mediterranean cyclone moves along the so-called Vb-track to the north-east, heavy and large-scale precipitation often falls in its rearward cold sector. Precipitation is enhanced especially on the northern windward slopes of mountains due to orographic effects. Significant anomalies of moisture flux from the north typically accompany this synoptic pattern over the area affected with heavy rains.

Although the region of the south-eastern Alps is situated between the Mediterranean and central Europe, the above described mechanism can hardly produce heavy rains there because of the position of the region relatively to the cyclone track and different orientation of slopes. The presented study focuses on explanation of the role of Mediterranean cyclones and related moisture fluxes in producing heavy rains in the region.

Heavy rain and flood events in eastern Alps were selected from years of 1958-2001 covered by reanalyses ERA40. The selection criterion was based on evaluation of the runoff increases in three rivers (Sava, Drava, Mura) running eastward from the south-eastern Alps. The set of hydro-meteorologically significant events was studied from viewpoints of (i) synoptic causes and (ii) seasonal distribution. A deep trough and/or a Mediterranean cyclone remaining several days approximately over Italy are the typical synoptic patterns of the events. In the warm sector of the cyclone, significant anomalies of moisture flux were detected. The events were concentrated mainly in autumn. This fact was explained by the climatology of moisture flux over the studied region: southern component of flux of moisture is most intense just in autumn there. The findings demonstrate the fact that heavy rains in both central Europe and the south-eastern Alps are connected with Mediterranean cyclones; however, through other mechanisms.