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Evaluation of cyclone track and frequency changes in the western Mediterranean region

J. Bartholy (1), R. Pongracz (1), and M. Pattantyus-Abraham (2)

(1) Eotvos Lorand University, Department of Meteorology, Budapest, Hungary (bari@ludens.elte.hu, +36 1 3722904), (2) Budapest University of Technology and Economics, Department of Hydraulic and Water Resources Engineering, Budapest, Hungary

Midlatitude cyclones are analyzed on a selected region covering most part of southern Europe and the western part of the Mediterranean Sea (i.e., 35-50°N, 10°W-25°E). On the basis of mean sea level pressure fields of the ECMWF (European Centre for Medium-range Weather Forecast) Reanalysis Dataset (ERA-40), detailed evaluation of the Mediterranean cyclones is accomplished for the period between 1957 and 2002 on a 1-degree horizontal resolution grid.

First, cyclone centers are identified using sea level pressure anomaly fields. Potential midlatitude cyclone centers are defined on grid points with depression of sea level pressure where the following main criteria are fulfilled: (i) the sea level pressure is less than 1013.5 hPa, and (ii) local pressure minima are selected as the centers of 5×5 grid boxes. Then, the paths of these midlatitude cyclone centers are tracked with a 6-hour time step (using 00 UTC, 06 UTC, 12 UTC, and 18 UTC) using an automated cyclone tracking algorithm. Two subsequent potential cyclone centers may belong to the same cyclone track if the following criteria are fulfilled: (i) their geographical distance is less than 450 km, and (2) the absolute difference of their sea level pressure is less than 6 hPa. Decadal, annual, and seasonal statistical analysis of cyclone tracks includes the study of the genesis, the frequency and the activity of the Mediterranean cyclones, as well, as the variability of cyclone tracks.

The results suggest that the cyclone frequency in the western Mediterranean region increased in summer and autumn, and decreased in winter and spring. A special belt-shape area is identified, which plays a special role in cyclogenesis, and also, the cyclone tracks often remain within this belt. An overall decreasing trend is detected in winter and spring in the entire Mediterranean belt, while cyclone frequency increased in autumn. The largest positive and negative trend coefficients are identified in summer.