Finding the optimal time for the integration in Lagrangian analysis for the best estimation of moisture sources.

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Moisture transport from their sources (continents/oceans) towards their sinks establishes the connection between evaporation and continental precipitation (or the available moisture). Different methods have been used to establish source-sink relationships for the atmospheric water vapour. The major part of the studies has used Lagrangian approaches to investigate the changes in the net water vapour along a large number of back trajectories to infer the moisture sources for precipitation falling in a target region. However, the results derived from these approaches are very sensitive to the integration time of the trajectories used in the analyses. The use of different time periods to find sources and sinks of moisture could alter the initial results, the subsequent analyses, and the interpretations.

We present here the annual and monthly optimal integration time for Lagrangian methods for the best estimation of sources of moisture. To do that we have implemented a Lagrangian moisture transport approach using the FLEXPART model with data from the European Centre for Medium-Range Weather Forecasts (ECMWF) Interim Re-Analysis (ERA-Interim) (Dee et al., 2011). This reanalysis (the most appropriate for representing the hydrological cycle), covers the period from January 1979 to the present, and contains data at 6-h intervals with a spatial resolution of 1°x1º in latitude and longitude for 61 vertical levels (1000 to 0.1 hPa).

To achieve the optimal integration time we have compared the monthly precipitation estimated by the Lagrangian approach to gridded data such as ERA-Interim, GPCP and/or MSWEP precipitation. All the data was downscaled to 0.25 degrees using linear interpolations and aggregated over monthly intervals for the common period 1980 - 2015.

Keywords: Lagrangian models, Moisture transport, Optimal integration time, Sources and sinks of moisture

