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Length and time scales of atmospheric moisture recycling

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The work presented here was recently published with the same title in ACP-D. In this paper we present a novel approach to quantify the spatial and temporal scale of moisture recycling, independent of size and shape of the region under study. This is a significant step forward as previous quantifications, of the degree to which terrestrial evaporation supports the occurrence of precipitation within a certain study region (i.e. regional moisture recycling), where limited by the use of scale- and shape-dependent regional moisture recycling ratios. Our calculation is based on ERA-Interim reanalysis data for all major continental areas for the period 1999 to 2008. It is shown that in the tropics or in mountainous terrain the length scale of recycling can be as low as 500 to 2000 km. In temperate climates the length scale is typically between 3000 and 5000 km whereas it amounts to more than 7000 km in desert areas. The time scale of recycling ranges from 3 to 20 days, with the exception of deserts, where it is much higher. The most distinct seasonal differences can be observed over the Northern Hemisphere: in winter, moisture recycling is insignificant, whereas in summer it plays a major role in the climate. The length and time scales of atmospheric moisture recycling can be useful metrics to quantify the effects of land use change on climate and water resources.