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Comparative study of atmospheric water vapor budget associated with precipitation in Central US and eastern Mediterranean

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Abstract. Water vapor budget (WVB) analysis is a powerful tool for studying processes leading to precipitation (P), since the linkages among atmospheric dynamics, water vapor fields, surface conditions, and P are constrained by the moisture continuity equation. This paper compares WVB calculations over the US Midwest (MW), the US Southern Great Plains (SGP), and the eastern Mediterranean Sea (EM) during their seasons of maximum P. Despite the inter-regional differences in time of year, size of region, and surface characteristics, the WVBs over these regions have common features. First, the change in precipitable water (dPW) is highly correlated with the moisture flux divergence (MFD) and not evaporation (E), implying that atmospheric humidity is affected more by the large-scale atmospheric circulation than land-atmosphere interactions. Second, P is positively correlated with moisture inflow (IF/*A*). However, a pronounced difference exists between the North American and the Mediterranean study regions with respect to the processes associated with increased P. For the MW and the SGP, increased P is associated with moisture flux convergence (−MFD) due to increased IF/*A*. In contrast, increased P over the EM is not associated with −MFD, since both the outflow (OF/*A*) and IF/*A* increase at similar rates.

Recycling ratio (*R*) estimates were calculated for each region using an equation previously developed. The moisture recycling methodology involves the externally advected versus locally evaporated contributions to P being expressed in terms of a "bulk" formulation in which IF/*A* and OF/*A* are defined at the boundaries of the study area. Due to its scale dependence, *R* cannot be directly compared among the different regions, and a normalization procedure was developed for this comparative study. Its results suggest the normalized *R* ranges between 12-25% for the study regions, with the value for the oceanic EM being somewhat larger than over the continental MW and SGP.

Full Article in PDF (PDF, 481 KB)

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