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The contributions of local and remote atmospheric moisture fluxes to East Asian precipitation and its variability

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We investigate the contribution of the local and remote atmospheric moisture fluxes to East Asia (EA) precipitation and its interannual variability during 1979-2012. We use and expand the Brubaker et al. (1993) method, which connects the area-mean precipitation to area-mean evaporation and the horizontal moisture flux into the region. Due to its large landmass and hydrological heterogeneity, EA is divided into five sub-regions: Southeast (SE), Tibetan Plateau (TP), Central East (CE), Northwest (NW) and Northeast (NE). For each region, we first separate the contributions to precipitation of local evaporation from those of the horizontal moisture flux by calculating the precipitation recycling ratio: the fraction of precipitation over a region that originates as evaporation from the same region. Then, we separate the horizontal moisture flux across the region's boundaries by direction. We estimate the contributions of the horizontal moisture fluxes from each direction, as well as the local evaporation, to the mean precipitation and its interannual variability. We find that the major contributors to the mean precipitation are not necessarily those that contribute most to the precipitation interannual variability. Over SE, the moisture flux via the southern boundary dominates the mean precipitation and its interannual variability. Over TP, in winter and spring, the moisture flux via the western boundary dominates the mean precipitation; however, variations in local evaporation dominate the precipitation interannual variability. The western moisture flux is the dominant contributor to the mean precipitation over CE, NW and NE. However, the southern or northern moisture flux or the local evaporation dominates the precipitation interannual variability over these regions, depending on the season. Potential mechanisms associated with interannual variability in the moisture flux are identified for each region.

The methods and results presented in this study can be readily applied to model simulations, to identify simulation biases in precipitation that relate to the simulated moisture supplies and transport.