



Contribution of evaporating water to precipitation and atmospheric residence times distribution: An evaporation tagging study for the Poyang Lake Region in Southeast China

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Land – atmosphere interaction analysis still lacks adequate methods for explicitly answering the central question of “where and when precipitated water has originally evaporated”, and likewise, where, when, and to which extent evaporating water of one region returns as precipitation in the same or another region, and what are water residence times across the atmosphere. Here, a process based evaporation tagging (ET-Tagging) approach combined with residence time information has been implemented into a regional climate model. It allows to tag the moisture evaporating from a certain region into the atmosphere, and to track it till returning to the land surface as tagged precipitation. The model also calculates the spatial distribution of the residence times, defined as lifetime between original evaporation till returning to the surface as precipitation.

Our case study investigates, where, when, and to which extent the evapotranspiring water of the Poyang Lake region (about 28,000 km²), i.e. the largest freshwater lake in China, returns back to the land surface as precipitation. The simulation reveals that the location and magnitude of tagged precipitation show large spatial and temporal variations controlled by synoptic weather conditions. On monthly scale, maximum precipitation recycling ratio is in August and in an amount of up to 6% near the Poyang Lake Region. To investigate the impact of different land use types on total tagged precipitation, Evapotranspiration was splitted into evaporation and transpiration. The results show that in 2005, 68% of total tagged precipitation is contributed by evaporated water, and 32% by transpired water. In January, evaporation contributes to a maximum of 95% of total tagged precipitation. With temperature increasing and vegetation growing, transpiration increases and accounts for around 50% in June and August.