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High resolution direct evaporation tagging in a RCM: A case study for West Africa

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One of the central questions in hydrological research is where and to what extent evaporated water of a region returns as precipitation in another region. This study addresses this question and presents a detailed process-based approach implemented into a high resolution regional climate model. It allows tagging and tracking of the moisture evaporating from a given region into the atmosphere until it returns to the land surface as precipitation. Our approach is fully three-dimensional and enables the detailed consideration of vertical transport mechanisms for tagged water. We present a case study for the region around Lake Volta in West Africa, which is one of the largest man made surface water body in the world. The simulation demonstrates the performance of the regional model and the implemented tagging mechanism. It shows the evolution of the tagged moisture field and reveals details of the transport: Moisture evaporated from Lake Volta is initially transported predominantly to the east and north, lifted by convective processes and then transported in upper layers to the west far away from the source of evaporation. The results indicate that the coupling between boundary layer and higher levels through convective processes can be essential for the fate of tagged water substances. Detailed analysis for a 2 month period in the rainy season 1998 shows that locally up to 6% of precipitating water originates from the Lake Volta region. Less than 2% of the evaporated water is locally recycled as precipitation in the source area. A further 10% precipitates in the rest of the Volta Basin.