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Estimation of Precipitation Recycling by Evapotranspiration Tagging

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Hydrometeorology still lacks adequate methods for answering the central question of where precipitated water has originally evaporated, and likewise, where and to which extent evaporated water of one region will return as precipitation in the same or another region.

Current techniques for determining precipitation recycling ratios are based on lumped approaches or Lagrangian techniques. In this study, a process based approach has been implemented into the mesoscale atmospheric model MM5, allowing to track the moisture evaporating from a certain region into the atmosphere, and tagging it till its return to the land surface as precipitation. The approach accounts for all atmospheric processes like e.g. transport, diffusion, phase transitions, and precipitation physics, etc.

First simulations of an episode covering West Africa show tagged moisture evaporating from the Volta Basin, transported into the mid troposphere by advection and convection, building up tropospheric clouds with precipitation events. The analysis of tagged moisture and precipitation allows a detailed quantification of precipitation recycling ratios and contributes to the assessment of land use change impact on regional precipitation patterns.