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A new scheme for the lateral water redistribution of land surface models: case of the Oueme River basin

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This study presents a new parameterization for the lateral water redistribution of land surface models. The flow routing scheme is based on the non-linear version of the Muskingum-Cunge (MC) method coupled with linear reservoirs representing the concentration times of both surface water (runoff) and groundwater (drainage) before reaching the river network. The MC-based scheme requires spatially distributed hydrological information such as river width and slope derived from digital elevation models, classified satellite images and/or in situ observations. For better results, the scheme requires the estimation of three coefficients: the Manning roughness coefficient (n) and two concentration time coefficients (C1 and C2), one for each reservoir. The off-line coupling between the MC-based flow routing scheme and the Interactions Soil Biosphere Atmosphere (ISBA) land surface model (LSM) is evaluated. The study area is the Upper Ouémé River basin, in Benin, with a drainage area of approx. 13,000km^2, where hydrological and meteorological data have been intensively collected during the 2005-2008 period in the framework of the AMMA-CATCH project. A sensitivity analysis of the three model coefficients is performed as a function of soil-related ISBA coefficients by comparing daily simulated and observed discharge at selected gauge stations with drainage areas varying up to 10,500km^2. Results demonstrate that the scheme can represent river flow accurately at different spatial scales. Further applications of the model include the routing of LSM outputs for evaluation with observed discharge within the ALMIP-2 project.