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An approach of coupling topographic indices to dynamic ecosystem modelling

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Abstract The dynamic ecosystem model LPJ-GUESS combines sophisticated plant physiological and biogeochemical processes and has been successfully used in predicting vegetation dynamics at different scales. However, the water cycling is limited to vertical water movement between the atmosphere–plant–soil. Thus we have developed an enhanced version of LPJ-GUESS (called LPJ-DH) by coupling water routing and lateral water fluxes. The fundamentals are based on the spatial variability of topographic indices, calculated from digital elevation models (DEM). The runoff outputs from LPJ-DH and LPJ-GUESS were compared and the newly introduced hydrology scheme showed a possible advantage in representing the drainage network and topographic effects on water redistribution. The general increase of plant transpiration was also found over the catchment by LPJ-DH, and we demonstrated that the plant transpiration modelled by LPJ-DH was in line with observed data. Overall, the study demonstrated the feasibility and advantages of incorporating topographic effects on water redistribution within the frame of LPJ-GUESS.

Key words surface runoff; LPJ-GUESS; LPJ-DH; topographic index