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A novel model for global hydrological simulation

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The partitioning of precipitation among the variations of continental water storage, evaporation, transpiration, and freshwater runoff has a major influence on the terrestrial water budgets. The evaluation of continental hydrology is therefore a crucial task that can assess the effect of global change on the world's water resources. Global hydrological models (GHMs) have been built effectively for this purpose and have been rapidly developed in last two decades. GHMs are based on either energy balance, or hydrological balance, or both and usually taking into account land surface characteristics by considering a few simplified land cover categories. Here, a process based GHM have been developed, where the key elements of the physical processes are represented by bucket models in different hydrological landscape classes. In this study, hydrologic landscape regions (HLRs) are delineated by using geographic information system (GIS) tools and statistical methods including principal components and cluster analyses, in which the topography is the main driver and geological, geomorphological and land use information are included. The advantage of this model over other available GHMs is that it provides the possibility to distinguish the dominant hydrological process in a certain grid by making use of all the information available in the topography (in term of HLR). The newly developed model is currently applied in a global scale of 0.25 degree from 1991 to 2000 by using the daily precipitation and temperature data from GLDAS 2.0 product as the driven force. The datasets used for HLRs classification include DEM, height above nearest drainage (HAND), slope and land cover in 30-meters spatial resolution. Preliminary results show a good match by comparing to annual streamflow time series from 99 large river basins.