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Exploration of streamflow simulation based on catchment phenological information

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Season-based calibration scheme has been widely used to investigate the variability of hydrological response for catchments with distinct seasonal variations. Given that the hydrological response is primarily impacted by phenological activities of catchment vegetation, it is necessary to divide seasons based on phenological information rather than fixed calendar dates.

This study aims to explore the effect of seasonal variations on hydrological response based on phenological activities of catchment vegetation. We use normalized difference vegetation index (NDVI) to define the phenological activity strength, since remote sensing has proven to be a very efficient tool to characterize vegetation dynamics. The lumped conceptual rainfall-runoff model IHACRES is applied to two catchments with distinct seasonal variations (one is in Sichuan, China and another is in the southwest of England). Model parameters are allowed to vary among phenological seasons during calibration. Several performance criteria have been used to evaluate the performance of the model. We have found that the phenology-based seasons can better explain the variability of hydrological response and calibrating hydrological model based on phenology can improve model performance compared to the calendar season-based calibration scheme. The assessment of high flow behaviour indicates that the phenology-based calibration scheme also has an advantage in predicting high flows, which is useful for flood hazard assessment.

This study provides a more efficient way to simulate streamflow especially the high flows during the flooding for catchments with distinct seasonal variations, and it could also be useful in assessing flood hazards over long term climate change scenarios because catchment vegetation is likely to change accordingly. The study is supported by the RESIST project funded by NERC (UK) and NSFC (China), and China Scholarship Council (China).