Coupling WRF and grid SWAT for ultra-high resolution hydrologic modelling

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We coupled a grid Soil and Water Assessment Tool (SWAT) and Weather Research & Forecasting Model (WRF) in an offline mode for ultra-high resolution hydrologic predictions. Grid SWAT is a gridded Hydrologic Response Unit (HRU) based model. Each grid HRU has its own spatial locations. Grid SWAT provides a flexible framework for model coupling. WRF model were coupled with grid SWAT based on grid spatial relationships. In order to illustrate the performance of WRF-GSWAT framework, we designed three experiments to illustrate model performances with different forcing data and models. We examined hydrologic spatial pattern e.g. precipitation, evaporation, surface runoff, lateral flow and ground water flow. WRF-GSWAT presented much more spatial detailed information for hydrologic modelling. Rainfall pattern determined vertical and slow horizontal hydrologic processes distribution. Quick response surface runoff was determined by topographic-soil index. WRF-GSWAT provided more reasonable and acceptable hydrologic patterns. High resolution gridded forcing data presented more advantages than weather station data. More efforts are needed to calibrate WRF-GSWAT for hydrologic simulations. WRF-GSWAT combined high accurate and high-resolution weather forecasting ability and comprehensive hydrological modelling ability. It will facilitate the study of climate change and human activity effects on regional hydrologic system.