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On simulating non-point source pollution with a fully coupled model in the agricultural watershed

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The non-point source pollution is a major threat for water security in agricultural watersheds. The physically-based coupled hydrologic model is used in this study to examine the hydrologic and solute (N, P) budget for the Meilin watershed, east China with an area of 0.737km2, and to evaluate the solute (N, P) transport along various pathways at a watershed scale. With the past and ongoing field studies, different factors (i.e. soil texture, land-use/land-cover, and micro-topography) affecting hydrologic processes were observed and estimated. Based on those analyses, the model calibration was conducted by using a multi-objective approach while the objectives include streamflow, soil moisture, groundwater level, solute concentration, etc. Numerical experiments were designed to elucidate the dynamics of watershed hydrologic processes as well as the interactive relationship on variables in land surface, unsaturated zone, and groundwater. Several scenes of storm events were simulated to further discuss the water budget and non-source pollution drainage responding to land-use, micro-topography variety and surface/subsurface interaction processes. Arising from the simulations, the observed and calculated subsurface hydraulic heads, base flow discharge and the spatial and temporal patterns of the surface drainage network are quantified. The soil texture, land cover, and topography affecting different hydrologic processes and their inter-relationship are demonstrated. The overflow of various saturate areas (VSA) contributing to the stream flow, exchange fluxes between surface and subsurface hydrologic regimes and solute drainage responding different land-use are quantified. This work will help better understand physically-coupled flow and solute transport in the watershed and enhance the quality of watershed flow and solute simulations.