A hexagonal grids based routing method for land surface and Earth system models

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Flow routing is a critical component in land surface and Earth System Models (ESMs). Although flow routing methods in ESMs mostly use latitude-longitude grids, hexagonal grids have shown several advantages in earlier studies. Hexagonal grids can resolve the longstanding diagonal travel path in D8 flow routing scheme and sphere coverage issues. Additionally, hexagonal grids provide an opportunity in coupling land surface models with oceanic models because the latter are usually based on unstructured meshes in ESMs. Despite its potential, there exist several challenges in using hexagonal grids in current generation of land surface and hydrologic models. One difficulty is to maintain flow direction in coarse spatial resolutions. In this study, we introduce recent advances in the hexagon grid-based flow routing model (HexWatershed) and newly developed capabilities such as stream burning and spatial resampling . We use Susquehanna watershed as an example to compare the river networks representations between the latitude-longitude-grid-based and hexagonal grids based methods.