In situ computational steering to assimilate observations into a coupled hydrological model

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Abstract:

One of the limitations of large scale hydrological modeling is the poor knowledge of underground hydrodynamic characteristics. This is particularly problematic in data-poor environments as West-Africa. Remote sensing techniques provide more and more products and information able to constraint hydrological system. This opens the new paradigm of spatial hydrology proposed by Peters Lidars. In this study, we propose to use all the relevant hydrological information from remote sensing and observation networks to constrain a hyper-resolution hydrological model over West Africa (3.15 10^6 km²) and infer its hydrological parameters like manning and hydrodynamic parameters. As stochastic approaches are not possible because of high computational costs (both in terms of compute hours and I/O storage), we propose the steering of single simulations using an *in situ* analysis approach which allows to change parameters during the simulation without stop & restart procedure and without writing any files.

The work flow is based on FlowVR [1], an *in situ* framework which drives both our parflow/CLM hydrological model [2,3,4,5] but also the visualization tool (VisIt) and operates actions directly on the shared memory of a cluster to infer parameters following some prescribed automatic functions or external orders. It also allows to redirect the calculated dataflow to the file system or the visualization tool, in a very modular and portable way. Among side benefits of using such an *in* situ module, specific cores can be dedicated to analyse the hydrological results (or write output files on disk) without stopping the simulation or reducing the performance (with even performance increase when output files are being written by a specific core). This approach will be evaluated on the 10000km² Upper Oueme catchment in West Africa (Benin) for which we already have distributed multiple year river flow series and remote sensing data thanks to the AMMA-CATCH observatory [6,7].

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