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CaMa-Flood global river model: its development and future perspectives

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Abstract:

Prediction and impact assessment of river flood caused by extreme rainfall is important for flood risk assessment and disaster prevention. However, numerical simulation of river flood is difficult especially for large river basins, given the water dynamics in rivers and floodplains is regulated by basin-wide water balance and local topography relief. While supercomputers can perform high-resolution large-domain simulations, its practical applicability is limited for operational flood forecast which requires rapid and stable computations. To overcome this, We have developed a new global river flood model CaMa-Flood, which appropriately approximates micro-scale topography and simulates macro-scale flooding in continental-scale rivers by treating floodplain inundation dynamics as sub-grid physics. By this assumption, computationally very efficient simulation of large river hydrodynamics was achieved without significantly degrading the accuracy of detailed local-scale flood models. In addition, because a good numerical model solely cannot achieve precise flood simulations, We are recently focusing on the development of high-accuracy global topography maps (MERIT DEM & MERIT Hydro) by combining satellite big data and extensive numerical analysis. These model-data integration efforts enabled efficient-and-accurate global-scale flood simulation and its applications to flood forecast systems and climate risk assessment. Furthermore, the developed model and datasets are widely used as baseline tools in multiple science fields (e.g. biogeochemistry, climate projection, ecosystem and biodiversity) in addition to flood risk studies, suggesting the importance of researches on fundamental data and theory development.

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https://global-hydrodynamics.github.io/