Geophysical Research Abstracts
Vol. 20, EGU2018-8682, 2018
EGU General Assembly 2018

The role of routing - implementing a global routing model into a framework for integrated hydrologic-hydrodynamic inundation modelling

Jannis Hoch (1,2), Hiroaki Ikeuchi (3), Dirk Eilander (2,4), Fedor Baart (2), Hessel Winsemius (2,4), Rens van Beek (1), Marc Bierkens (1,2)

(1) Utrecht University, Departement of Physical Geography, Utrecht, the Netherlands (j.m.hoch@uu.nl), (2) Deltares, Delft, the Netherlands, (3) University of Tokyo, Department of Civil Engineering, Tokyo, Japan, (4) VU Amsterdam, Institute for Environmental Studies, Amsterdam, the Netherlands

When choosing a hydrodynamic model for simulating large-scale inundation, there are many different model codes available, each with a different structure and parameterization of the routing algorithm. To account for model code-specific advantages and shortcomings, the recently developed GLOFRIM framework (Hoch et al., 2017, GMD) allows for spatially explicit online coupling of the global hydrologic model PCR-GLOBWB with either the hydrodynamic model Delft3D Flexible Mesh or LISFLOOD-FP. The number of models to be coupled is, however, not limited and other models can be added due to the extensibility of the framework. Applications show that, for example, discharge estimates within the coupled domain can be improved by replacing the kinematic wave routing with a full hydrodynamic model (Hoch et al., 2017, HESS).
GLOFRIM was originally developed to improve large-scale inundation modelling and can also be applied for nested modelling approaches: modelling high-resolution 1D/2D hydrodynamics in a sub-domain, forced by discharge (upstream) and water levels (downstream) as derived from lower resolution full-domain hydrologic and hydrodynamic models. The currently outside of the coupled domain employed kinematic wave approximation of PCR-GLOBWB, however, may result in biased discharge forcing of the hydrodynamic model, and hence the routing in the mid- and upstream areas should be replaced with a more advanced approximation.
In this study, we extended the GLOFRIM framework with the global river routing model CaMa-Flood (Yamazaki et al., 2011, WRR) which solves the local inertia equations and was already applied in multiple large-scale hydrodynamic studies. Adding this model to GLOFRIM as a routing module was made possible by extending it with a BMI adapter for online coupling. The model can then function as an intermediate step between PCR-GLOBWB and Delft3D Flexible Mesh or LISFLOOD-FP.
We here present a technical feasibility study and first assessment of how coupling several models across different scales can help to improve the representation of flow processes, particularly with respect to the role of routing. To that end, different configurations of GLOFRIM were applied for simulating inundations in different basins and model results were critically assessed. While this is still on-going research, the presented modelling approach may eventually improve current global flood modelling practices by providing a tool accounting for a wider range of processes to be simulated simultaneously across multiple scales.