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Development of the Deltares global fluvial flood forecast system

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Deltares operates the Global Fluvial Flood Forecasting System (GLOFFIS) is a real-time fluvial forecasting system with global coverage. At any location in the world, for both the recent past and the near future, the system produces estimates of various hydrological parameters.

The continued investment in GLOFFIS is justified by various reasons. Primarily, there is an R&D rationale. Any operational system that runs in near real-time poses high requirements to the availability of input data and the runtime of the models used. This problem is augmented when applying the system to the global scale: both model domains and data volumes become significantly larger. Also, data originates from a wide variety of sources. Runtimes, however, cannot be significantly larger hence this poses additional requirements to the efficiency of models used. Solving these issues requires a considerable R&D effort. The resulting developments tend to be useful for the 'local' systems we develop and maintain for our clients. An additional rationale is found in the increased demand for global forecasts – notably from a client base that is not able or willing to operate forecasting systems themselves.

At its core, GLOFFIS operates a set of hydrological models that, jointly, cover the entire earth's land. The models are forced by meteorological data – pertaining to both the recent past and the near future. The models produce estimates of various hydrological parameters such as soil moisture content, surface water runoff and streamflow rates. Future versions of GLOFFIS will include hydrodynamic models, allowing to produce estimates of water level in addition to streamflow rates. Also, future versions will include seasonal forecasts, i.e. forecasts going out several weeks if not months. In addition to real-time data, the system enables the production of long-term timeseries.

In terms of the infrastructure of the system, GLOFFIS is based on the wflow framework for hydrological modelling which is embedded within a the Delft-FEWS forecast production system. Neither of these require any licensing fees and the wflow framework is available through an open source license. The Delft-FEWS system is used for many operational flood forecasting systems including those of the US National Weather Service, the English Environment Agency, the Bureau of Meteorology and many other national forecasting agencies. Wflow is a distributed modelling framework specifically designed to accommodate multiple model schematization types and data assimilation techniques. For GLOFFIS, we opted for the physically based wflow_sbm that uses kinematic wave routing for surface and subsurface flow. So-called pedotransfer functions that

translate input base maps to model parameter values ensure that the models require little calibration.

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