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Using HPC within an operational forecasting configuration

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Various natural disasters are caused by high-intensity events, for example: extreme rainfall can in a short time cause major damage in river catchments, storms can cause havoc in coastal areas. To assist emergency response teams in operational decisions, it's important to have reliable information and predictions as soon as possible. This starts before the event by providing early warnings about imminent risks and estimated probabilities of possible scenarios. In the context of various applications worldwide, Deltares has developed an open and highly configurable forecasting and early warning system: Delft-FEWS.

Finding the right balance between simulation time (and hence prediction lead time) and simulation accuracy and detail is challenging. Model resolution may be crucial to capture certain critical physical processes. Uncertainty in forcing conditions may require running large ensembles of models; data assimilation techniques may require additional ensembles and repeated simulations. The computational demand is steadily increasing and data streams become bigger. Using HPC resources is a logical step; in different settings Delft-FEWS has been configured to take advantage of distributed computational resources available to improve and accelerate the forecasting process (e.g. Montanari et al, 2006). We will illustrate the system by means of a couple of practical applications including the real-time dynamic forecasting of wind driven waves, flow of water, and wave overtopping at dikes of Lake IJssel and neighboring lakes in the center of The Netherlands.

Montanari et al., 2006. Development of an ensemble flood forecasting system for the Po river basin, First MAP D-PHASE Scientific Meeting, 6-8 November 2006, Vienna, Austria.