H32B-06: Boosting flood warning schemes with fast emulator of detailed hydrodynamic models

Wednesday, 13 December 2017
11:35 - 11:50
New Orleans Ernest N. Morial Convention Center - 291-292

Floods are among the most destructive catastrophic events and their frequency has incremented over the last decades. To reduce flood impact and risks, flood warning schemes are installed in flood prone areas. Frequently, these schemes are based on numerical models which quickly provide predictions of water levels and other relevant observables. However, the high complexity of flood wave propagation in the real world and the need of accurate predictions in urban environments or in floodplains hinders the use of detailed simulators. This sets the difficulty, we need fast predictions that meet the accuracy requirements. Most physics based detailed simulators although accurate, will not fulfill the speed demand. Even if High Performance Computing techniques are used (the magnitude of required simulation time is minutes/hours). As a consequence, most flood warning schemes are based in coarse ad-hoc approximations that cannot take advantage a detailed hydrodynamic simulation. In this work, we present a methodology for developing a flood warning scheme using an Gaussian Processes based emulator of a detailed hydrodynamic model. The methodology consists of two main stages: 1) offline stage to build the emulator; 2) online stage using the emulator to predict and generate warnings. The offline stage consists of the following steps: a) definition of the critical sites of the area under study, and the specification of the observables to predict at those sites, e.g. water depth, flow velocity, etc.; b) generation of a detailed simulation dataset to train the emulator; c) calibration of the required parameters (if measurements are available). The online stage is carried on using the emulator to predict the relevant observables quickly, and the detailed simulator is used in parallel to verify key predictions of the emulator. The speed gain given by the emulator allows also to quantify uncertainty in predictions using ensemble methods. The above methodology is applied in real world scenario.

Plain Language Summary

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