Geophysical Research Abstracts
Vol. 15, EGU2013-4748, 2013
EGU General Assembly 2013

Effect of spatial resolution of radar-based inundation maps on the calibration of a spatial inundation model

Sacha Gobeyn (1), Hilde Vernieuwe (2), Bernard De Baets (2), Paul Bates (3), and Verhoest Niko E.C. (1)

(1) Laboratory of Hydrology and Water Management, Ghent University, 9000 Ghent, Belgium (Sacha.Gobeyn@UGent.be, Niko.Verhoest@UGent.be), (2) Department of Mathematical Modelling, Statistics and Bioinformatics, Ghent University, 9000 Ghent, Belgium (Hilde.Vernieuwe@UGent.be, Bernard.DeBaets@UGent.be), (3) School of Geographical Sciences, University of Bristol, Bristol, UK (Paul.Bates@Bristol.ac.uk)

With advances in both flood mapping with satellite radar and computational science, the use of real-time spatial flood data holds the potential to support decision making during flood events. With recent improvements in satellite radar technology, current and future radar images are/will be delivered with higher spatial resolution. It is expected that these higher resolutions should improve the accuracy of the calibration and the prediction through data assimilation as more detailed information is available. However, these finer resolution data will result in an increased computational cost. Still, radar data of coarser resolution will remain available, and the question may then arise whether the calibration of a 2D-hydraulic model is significantly influenced by the resolution of the remotely-sensed inundation map. In order to answer this question, the raster-based inundation model, LISFLOOD-FP (Bates et al., 2000) is calibrated using a high resolution synthetic aperture radar image (ERS-2 SAR) of a flood event of the river Dee, Wales, in December 2006. Different radar resolutions are simulated through coarsening this image to different resolutions and retrieving the flood extent maps for the different resolutions. These flood maps are then used for calibrating the hydraulic model using the generalized likelihood uncertainty estimation (GLUE) framework presented by Aronica et al. (2002) as well as alternative calibration methods (e.g. Particle Swarm Optimization, PSO) to assess the possible impact of spatial resolution of the observed flood extent on the floodplain and channel Manning coefficient. Furthermore, the sensitivity of the calibration surface to error sources in radar measurement is evaluated by applying different magnitudes of noise to the radar image.

References

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