Geophysical Research Abstracts,
Vol. 11, EGU2009-10322, 2009
EGU General Assembly 2009

Ensemble-based assimilation of SAR-derived water stages in a coupled hydrologic-hydraulic model

M. Montanari (1), P. Matgen (1), R. Hostache (1), C. Fosty (1), L. Pfister (1), G. Schumann (2), D. Plaza (3), and V. Pauwels (3)

(1) Centre de Recherche Public - Gabriel Lippmann, Environnement et Agro-biotechnologies (EVA), Belvaux, Luxembourg (montanar@lippmann.lu), (2) School of Geographical Sciences, University of Bristol, Bristol, UK (Guy.Schumann@bristol.ac.uk), (3) Laboratory of Hydrology and Water Management, University of Ghent, Ghent, Belgium (vpauwels@taoren.ugent.be)

Over the last decade, many studies demonstrated that spatial information on the distributed physiogeographical characteristics and hydrological responses of rivers basins can be gained from remote sensing observations. Moreover, the onset of new satellite constellations and technologies enables the supply and processing of multi-mission satellite data at a temporal frequency that starts to become compatible with operational water resources management requirements. Nonetheless a time continuity that is crucial in monitoring applications cannot be obtained by the sole use of remote sensing observations. The information that may be extracted from discrete Earth observation data has to be used as time-varying state or flux data in flood forecasting systems.

In this framework, the near all-weather, 24 hours capabilities of imaging radars overcome the limitations in collecting data during flood events, related to the sensors operating in the visible and thermal portions of the electromagnetic spectrum, making this technique very suitable for the spatial characterization of floods. Moreover, through the integration of radar imagery of flood events with high precision digital elevation models, distributed inundation depths with associated uncertainty are extracted from remote sensing observations.

This paper focuses on the sequential assimilation of SAR-derived water stages into a modelling sequence where the output of hydrologic models (rainfall-runoff models) serves as input of 1-D hydraulic models and investigates the reliability and usefulness of a systematic remote sensing of floods for operational forecasting studies.

A thorough statistical analysis of both remotely sensing-derived and simulated water stages represents a pre-requisite for performing such assimilation studies. By using perturbed model parameters, initial conditions and meteorological forcings, an ensemble of hydraulic model applications is generated.

The methodology consists of adjusting the water surface lines simulated by the coupled hydrologic-hydraulic model, by comparing the ensemble of modelled water stages with those that are derived from remote sensing observations, thereby increasing the overall accuracy and reliability of flood predictions at subsequent time steps. The potential of the proposed methodology is illustrated by a well-documented flood event of the Alzette River (Grand-Duchy of Luxembourg).