Hydrology and Earth System Sciences
An Interactive Open Access Journal of the European Geosciences Union

Hydrol. Earth Syst. Sci., 13, 367-380, 2009
www.hydrol-earth-syst-sci.net/13/367/2009/

Calibration and sequential updating of a coupled hydrologic-hydraulic model using remote sensing-derived water stages

M. Montanari[1], R. Hostache[1], P. Matgen[1], G. Schumann[2], L. Pfister[1], and L. Hoffmann[1]

[1]Centre de Recherche Public – Gabriel Lippmann, 4422, Belvaux, Grand Duchy of Luxembourg

[2]School of Geographical Sciences, University of Bristol, BS81SS, UK

Abstract. Two of the most relevant components of any flood forecasting system, namely the rainfall-runoff and flood inundation models, increasingly benefit from the availability of spatially distributed Earth Observation data. With the advent of microwave remote sensing instruments and their all weather capabilities, new opportunities have emerged over the past decade for improved hydrologic and hydraulic model calibration and validation. However, the usefulness of remote sensing observations in coupled hydrologic and hydraulic models still requires further investigations. Radar remote sensing observations are readily available to provide information on flood extent. Moreover, the fusion of radar imagery and high precision digital elevation models allows estimating distributed water levels. With a view to further explore the potential offered by SAR images, this paper investigates the usefulness of remote sensing-derived water stages in a modelling sequence where the outputs of hydrologic models (rainfall-runoff models) serve as boundary condition of flood inundation models. The methodology consists in coupling a simplistic 3-parameter conceptual rainfall-runoff model with a 1-D flood inundation model. Remote sensing observations of flooded areas help to identify and subsequently correct apparent volume errors in the modelling chain. The updating of the soil moisture module of the hydrologic model is based on the comparison of water levels computed by the coupled hydrologic-hydraulic model with those estimated using remotely sensed flood extent. The potential of the proposed methodology is illustrated with data collected during a storm event on the Alzette River (Grand-Duchy of Luxembourg). The study contributes to assess the value of remote sensing data for evaluating the saturation status of a river basin.

Final Revised Paper (PDF, 2218 KB) Discussion Paper (HESSD)

Citation: Montanari, M., Hostache, R., Matgen, P., Schumann, G., Pfister, L., and Hoffmann, L.: Calibration and sequential updating of a coupled hydrologic-hydraulic model using remote sensing-derived water stages, Hydrol. Earth Syst. Sci., 13, 367-380, 2009. Bibtex EndNote Reference Manager