



HAL
open science

On the assimilation of SWOT type data into 2D shallow-water models

Frédéric Couderc, Denis Dartus, Pierre-André Garambois, Ronan Madec, Jérôme Monnier, Jean-Paul Villa

► **To cite this version:**

Frédéric Couderc, Denis Dartus, Pierre-André Garambois, Ronan Madec, Jérôme Monnier, et al.. On the assimilation of SWOT type data into 2D shallow-water models. European Geosciences Union General Assembly 2013 - EGU2013, Apr 2013, Vienna, Austria. pp.0. hal-04020941

HAL Id: hal-04020941

<https://hal.science/hal-04020941>

Submitted on 9 Mar 2023

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.



Open Archive TOULOUSE Archive Ouverte (OATAO)

OATAO is an open access repository that collects the work of Toulouse researchers and makes it freely available over the web where possible.

This is an author-deposited version published in : <http://oatao.univ-toulouse.fr/>
Eprints ID : 9395

To cite this version : Couderc, Frédéric and Dartus, Denis and Garambois, Pierre-André and Madec, Ronan and Monnier, Jérôme and Villa, Jean-Paul *On the assimilation of SWOT type data into 2D shallow-water models.* (2013) In: European Geosciences Union General Assembly 2013 - EGU2013, 07-12 Apr 2013, Vienna, Austria.

Any correspondence concerning this service should be sent to the repository administrator: staff-oatao@listes-diff.inp-toulouse.fr



On the assimilation of SWOT type data into 2D shallow-water models

Couderc Frédéric (1), Dartus Denis (2), Garambois Pierre-André (1,2), Madec Ronan (1), Monnier Jérôme (1), and Villa Jean-Paul (1)

(1) Mathematics Institute of Toulouse, France, (2) Fluid Mechanics Institute of Toulouse, France

In river hydraulics, assimilation of water level measurements at gauging stations is well controlled, while assimilation of images is still delicate. In the present talk, we address the richness of satellite mapped information to constrain a 2D shallow-water model, but also related difficulties. 2D shallow models may be necessary for small scale modelling in particular for low-water and flood plain flows. Since in both cases, the dynamics of the wet-dry front is essential, one has to elaborate robust and accurate solvers. In this contribution we introduce robust second order, stable finite volume scheme [CoMaMoViDaLa]. Comparisons of real like tests cases with more classical solvers highlight the importance of an accurate flood plain modelling. A preliminary inverse study is presented in a flood plain flow case, [LaMo] [HoLaMoPu]. As a first step, a 0th order data processing model improves observation operator and produces more reliable water level derived from rough measurements [PuRa]. Then, both model and flow behaviours can be better understood thanks to variational sensitivities based on a gradient computation and adjoint equations. It can reveal several difficulties that a model designer has to tackle. Next, a 4D-Var data assimilation algorithm used with spatialized data leads to improved model calibration and potentially leads to identify river discharges. All the algorithms are implemented into DassFlow software (Fortran, MPI, adjoint) [Da]. All these results and experiments (accurate wet-dry front dynamics, sensitivities analysis, identification of discharges and calibration of model) are currently performed in view to use data from the future SWOT mission.

[CoMaMoViDaLa] F. Couderc, R. Madec, J. Monnier, J.-P. Vila, D. Dartus, K. Larnier. "Sensitivity analysis and variational data assimilation for geophysical shallow water flows". Submitted.

[Da] DassFlow - Data Assimilation for Free Surface Flows. Computational software

<http://www-gmm.insa-toulouse.fr/~monnier/DassFlow/>

[HoLaMoPu] R. Hostache, X. Lai, J. Monnier, C. Puech. "Assimilation of spatial distributed water levels into a shallow-water flood model. Part II: using a remote sensing image of Mosel river". *J. Hydrology* (2010).

[LaMo] X. Lai, J. Monnier. "Assimilation of spatial distributed water levels into a shallow-water flood model. Part I: mathematical method and test case". *J. Hydrology* (2009).

[PuRa] C. Puech, D. Raclot. "Using geographic information systems and aerial photographs to determine water levels during floods". *Hydrol. Process.*, 16, 1593 – 1602, (2002).

[RoDa] H. Roux, D. Dartus. "Use of Parameter Optimization to Estimate a Flood Wave: Potential Applications to Remote Sensing of Rivers". *J. Hydrology* (2006).