

Audrey DOUINOT

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Postdoctoral fellow in hydrology

Education

2013 – 2016	PhD in Hydrology, IMFT laboratory (Institut de Mécanique des Fluides de Toulouse), University of Toulouse, France.
2012 – 2013	Master's Degree in Environnemental Engineering , Engineering School of Toulouse (INP ENSEEIHT and INP ENSAT), University of Toulouse, France. <ul style="list-style-type: none">• hydrology, pedology• physical chemistry, water quality, water treatment• GIS, remote sensing
2009 – 2011	INP ENSEEIHT, Toulouse, France department of hydraulics and fluid mechanics . First and second year of a three-year degree course leading to French Engineering Diploma, equivalent to Master's Degree in Engineering.
2007 – 2009	Classes préparatoires (MPSI, PSI*), Lycée Clémenceau, Nantes, France Two-year intensive undergraduate course to prepare for competitive entrance to National Engineering Schools. Physics, mathematics .

PhD Project

Title	Flash flood modelling for a better understanding of hydrological processes
Supervisors	Pr. Denis Dartus and Dr. Hélène Roux
Laboratory	IMFT (Institut de Mécanique des Fluides de Toulouse), Toulouse, France

The purpose of this thesis is to improve the knowledge of hydrological processes during flash flood events using rainfall-runoff modelling. The study is based on the distributed, physically-based hydrological model MARINE, which has been specially elaborated since a dozen years, for flash flood modelling. The project specifically focuses on hydrological processes occurring into soil and subsoil horizons.

A preliminary study on data affirms the weathered bedrock activity during flash flood. Simple water balance of flash flood events shows that, for 18 of the 26 catchments, water storage in deep layers during flash floods events is at least as important as in the agronomic soil one. In view of those results and the state of art on subsurface flow processing, the model MARINE is developed in order to : i) represent explicitly the soil and subsoil horizons; ii) model subsurface flow contribution as an activation of preferential flow paths localized at the soil / bedrock interface.

The new model is tested on 26 catchments of the studied area. A calibration methodology is specially developed tailoring model assessment to flash floods prediction objective, and uncertain flow peak measurements. The model performs globally well but shows some discrepancies in an extensive analysis on recession curves reproduction, leading to a first characterisation of the catchments. The model seems to overestimates the hydrograph recessions that occur on granitic catchments. It reveals, for those catchments, that a significant contribution of water flow from the weathered bedrock layer seems to be required to better model the recession and second flood peaks of flash flood events. Similarly the parametrisation of the model and the simulated proportion of subsurface flows are used to characterise the hydrological behaviour of each catchment of the study.

Finally, the limit of the proposed characterisation is exposed as a result of compensations between the simulated flow processes. Using an extensive description of the likelihood configuration, guidelines for a better restriction of the model with spatial observation of the soil humidity or surface flow properties are presented.

Employment

Research experience

- 2017 (6 months) **Research assistant**, IMFT (Institut de Mécanique des Fluides de Toulouse), France
Suspended sediment transport modelling into a hydro-hydraulic model
- definition of sediments source and deposition terms
 - programming the advection-diffusion equation system
- 2013 – 2016 **Phd Student**, IMFT, University of Toulouse, France
- critical and physical analysis of hydrological and forcing data of more than 200 flash flood events, over 14 catchments (50 – 500 km²)
 - development of a distributed, physically-based hydrological MARINE model
 - modification of subsurface flow equation in order to transpose the hypothesis of the activation of preferential flow paths during flash flood processing
 - implementation of a novel module, representing the hydrological behaviour of the weathered bedrock
 - sensitivity analysis : GSA
 - elaboration of a new calibration methodology adapted to model expectations and operational discharge data uncertainties
- 2012 – 2013
(6 months) **Research assistant**, master project, IMFT (Institut de Mécanique des Fluides de Toulouse), Toulouse, France
Supervisor; Dr H  l  ne Roux.
Proposal of a new flash flood warning method.
- characterisation of rainfall spatial distribution through indexes
 - establishment of a flash flood warning method including indexes which are found to be informative of the hydrological response
- 2011 – 2012
(4 months) **Field placement**, Bsc. Internship, University of Pierre et Marie Curie, Paris, France.
Supervisor: Dr Sophie Violette
Galapagos Island, Integrated Water Studies project (GIWS, Ecuador)
- maintenance of 2 hydrological monitoring stations (weather station, fog and throughfall gauges, water suction sensors)
 - data analysis with R: data filling, validation and physical analysis
- 2011 – 2012
(6 months) **Research assistant**, Bsc. Internship, Escuela Nacional Politecnica (EPN), Quito, Ecuador.
Supervisor: Dr Marcos Villacis
Hydrological modelling of an Andean paramo catchment
- hydrological modelling with the R package « TOPMODEL » (Buytaert, 2011)
 - model assessment with GLUE methodology (Beven and Binley, 1992)

Teaching experience

- 2013 – 2016 **Assistant lecturer**, Engineering School of Toulouse (INP ENSEEIHT), Toulouse, France
- 160 h (undergraduate students)
 - tutorials and practicals of hydrology, hydraulics, metrology, programming language, particle tracking.
- 2015 – 2016 **Animator** of scientific popularization workshops
- 40 h (schoolboys and family audience)
 - fluid mechanics workshops: presentation of gravity currents, capillarity and granular flows
 - promotion of research careers: work opportunities in a research institute
- 2015 – 2016 **Co-supervision of a master thesis**
Coralie Voirin, M. Thesis, Ecole Nationale de la M  t  orologie, INP Toulouse, France.
Characterization of groundwater flows contributing to flash flood dynamics using recession curves analysis.

Skills

Operating system	Linux, Windows
Programming	Fortran, python, C++, R, Matlab
Software	Qgis, HEC-HMS, CANOE (urban hydrology), TELEMAC
Languages	English (competent), French (native), Spanish (fluent), German (basic)
Driving	Full, clean driving licence
Others	Hiking, self-reliance trekking

Publications and Conferences

Journal Papers	<p>Douinot A., Roux H., Dartus D.. Modelling errors calculation adapted to rainfall – runoff model user expectations and discharge data uncertainties. <i>Environmental Modelling & Software</i>, Volume 90, 2017, Pages 157-166, doi : /10.1016/j.envsoft.2017.01.007.</p> <p>Douinot A., Roux H., Garambois P-A., Larnier K., Labat D., Dartus D.. Accounting for rainfall systematic spatial variability in flash flood forecasting. <i>Journal of Hydrology</i>, Volume 541, 2016, Pages 359-370, doi: /10.1016/j.jhydrol.2015.08.024.</p> <p>Garambois P-A., Douinot A., Roux H. Dartus D. Regionalization methods for a process oriented distributed model dedicated to flash floods. <i>La Houille Blanche</i>, Vol 2, 71-77, 2016. doi : /10.1051/lhb/2016021.</p>
Conference presentations	<p>Douinot A. Flash flood modelling for a better understanding of hydrological processes in the Mediterranean area. 2017. In: LIST seminar, 25th January 2017 (Esch-sur-Alzette, Luxembourg).</p> <p>Douinot A.. Analyse des processus d'écoulement lors de crues à cinétique rapide sur l'arc méditerranéen. PhD defense, IMFT, 12th December 2016 (Toulouse, France).</p> <p>Douinot A., Roux H., Larnier K. Labat D.. On subsurface flow modelling in a physically - based model dedicated to flash flood forecasting. 2015. In: American Geosciences, 14th - 18 th December 2015 (San Francisco, USA).</p> <p>Douinot A.. Focus on subsurface flow coupling to the river in a physically - based model dedicated to flash flood forecasting. 2015. In: FLOODSCALE project workshop, 6th - 7th July 2015 (Montpellier, France).</p> <p>Douinot A., Roux H., Garambois P-A., Larnier K., Dartus, D.. Which hydrological activity in weathered bedrock during flash floods? The case of Mediterranean catchments. 2014. In: 8th HyMeX Workshop - Hydrological cycle in Mediterranean Experiment - HyMeX 2014, 15th - 18th September 2014 (La Valeta, Malta).</p> <p>Douinot A., Roux H., Garambois P-A., Larnier K., Impact of rainfall spatial variability on Flash Flood Forecasting. 2014. In: European Geosciences Union General Assembly 2014, 27th April 2014 - 2nd May 2014 (Vienna, Austria).</p> <p>Douinot A., Roux H., Garambois P-A., Larnier K., Dartus, D.. Flash flood modelling for physical hydrological modelling identification. 2014. In: FLOODSCALE project workshop, 23th - 24th January 2014 (Lyon, France).</p>

References

Supervisor	<p>ROUX Hélène Associate Professor, Institut de Mécanique des Fluides de Toulouse (FRANCE) helene.roux@imft.fr – +335 34 32 28 40</p> <p>VILLACIS Marcos Associate Professor, Head of Civil and Environmental Engineering Department, Escuela Politécnica Nacional de Quito (ECUADOR) marcos.villacis@epn.edu.ec – +593 22 50 71 44</p>
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