Modelling river discharge and sediments fluxes at sub-daily time-step: Insight into the CRUE-SIM project devoted to Mediterranean coastal flash floods

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Context and objectives

The CRUE-SIM (2014-2017) project is focused on the transport of dissolved and sorbed matter during **flash floods**. It is an interdisciplinary project that brings together atmosphere physicists, hydrologists and oceanographers to study and model flash floods across the Mediterranean region : it integrates water and sediment transport as a consequence of intense rainfall, **from the catchment to the sea**. The objectives of the project are:

(1) the **coupling** between atmosphere, ocean and sea with continental hydrological and hydrodynamic models

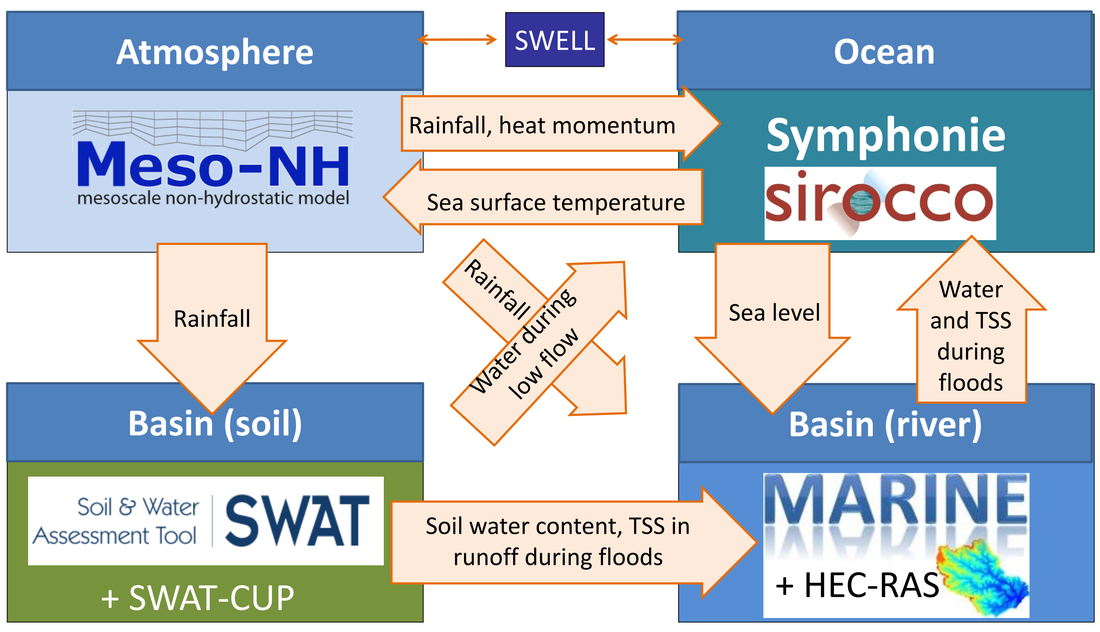
(2) the **integration of the feedbacks** and the **forcing continuity** from one compartment to the other along the brief but intense events that will be studied

In this poster we present the **contribution of SWAT sub-daily modelling** within the CRUE-SIM project.

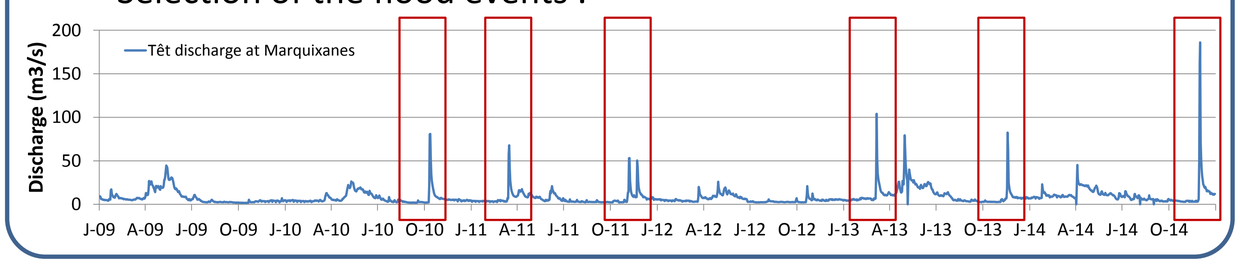
CRUE-SIM modelling approach

TSS : Total Suspended Sediments

- 4 compartments, 4 coupled models:



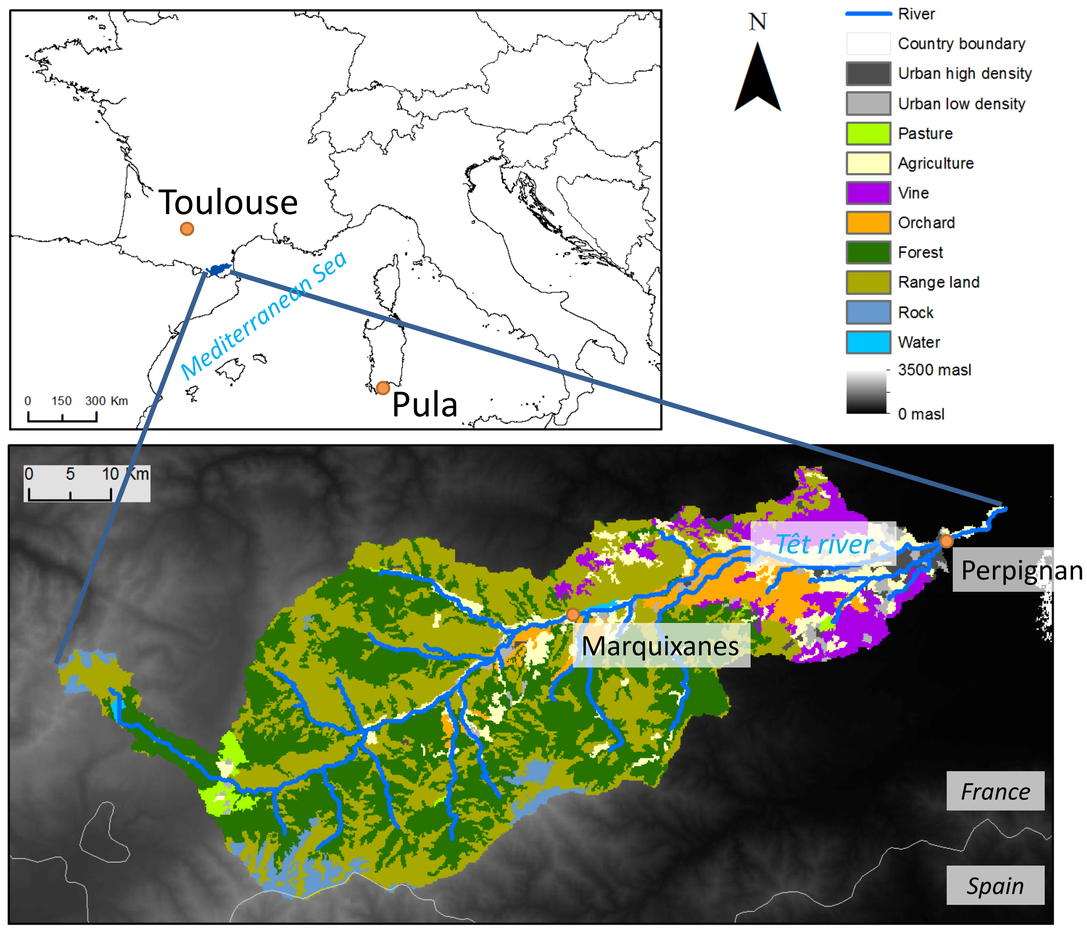
- Selection of the flood events :



Study site

1380 km², shallow sandy soils

Typical flash flood prone coastal Mediterranean basin



Input data

DEM : SRTM 90 m

Land use : Corine Land Cover

Soil : FAO classes, INRA soil properties

Hourly precipitation : SAFRAN when no rain, Meso-NH during rainfall events

PET climate variables : SAFRAN

SWAT model set up

Minimal drainage area = 1500 ha

66 sub-basins (20±14 km²), 549 HRU

Warm up : 2005-08, Cal.: 2009-11, Val. 2012-15

SWAT-CUP set up

Parameters			Min value	Max value	Parameters			Min value	Max value
CN2	.mgt	R	-0.1	0.1	ESCO	.hru	V	0.7	0.9
ALPHA_BF	.gw	V	0.01	1	EPCO	.hru	V	0.7	1
GW_DELAY	.gw	V	0	500	LAT_TTIME	.hru	V	0	180
GW_REVAP	.gw	V	0.02	0.2	CANMX	.hru	V	0	100
GWQMN	.gw	V	0	5000	OV_N	.hru	V	0.01	0.6
RCHRG_DP	.gw	V	0.01	0.99	SOL_K	.sol	R	-0.1	0.1
REVAPMN	.gw	V	0	500	SOL_AWC	.sol	R	-0.1	0.1
CH_N2	.rte	V	0.025	0.15	SOL_BD	.sol	R	-0.1	0.1
CH_K2	.rte	V	0.01	0.5	SOL_CBN	.sol	R	-0.1	0.1
CH_N1	.sub	V	0.025	0.15	SURLAG	.sol	R	-0.1	0.1
CH_K1	.sub	V	0.01	0.5					

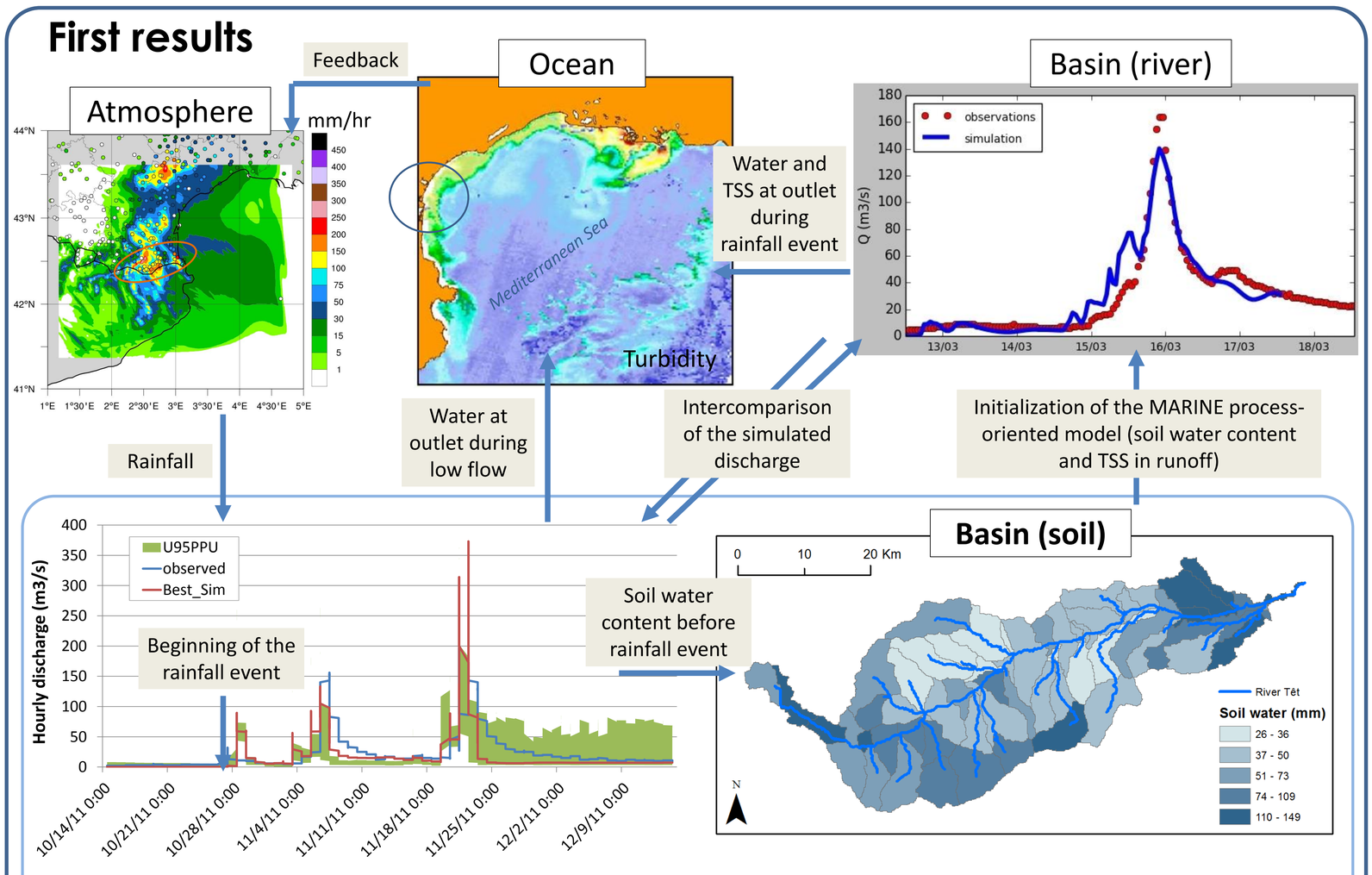
Runoff model

Sub-daily time-step simulation : **Green & Ampt** equation

$$f_{inf,t} = K_e \cdot \left(1 + \frac{\Psi_{wf} \cdot \Delta\theta_v}{F_{inf,t}}\right)$$

where f_{inf} is the infiltration rate at time t (mm/hr), K_e is the effective hydraulic conductivity (mm/hr), Ψ_{wf} is the wetting front matric potential (mm), $\Delta\theta_v$ is the change in volumetric moisture content across the wetting front (mm/mm) and F_{inf} is the cumulative infiltration at time t (mm H_2O).

First results



SWAT contribution: hourly simulations of discharge, soil water content, and total suspended sediment loads in runoff with SWAT/SWAT-CUP

Conclusions and perspectives

- SWAT is able to simulate the hourly discharge of a highly reactive Mediterranean coastal basin
- The calibration of total suspended sediments during flash floods is in progress: next step !

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