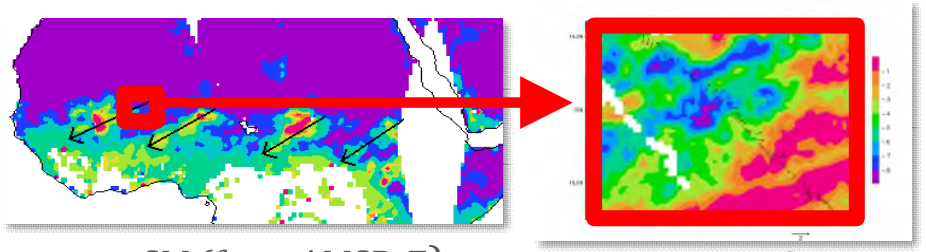
Rainfall over Africa

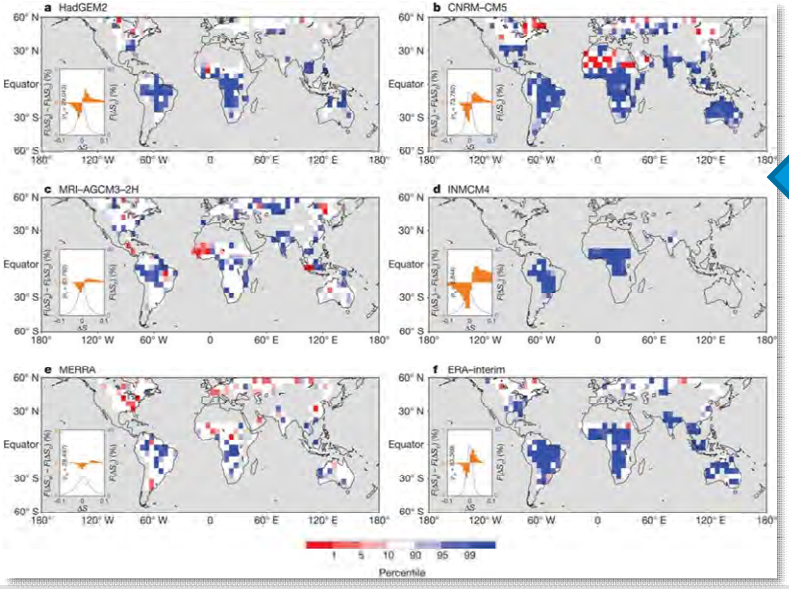
Storms form over land, then travel south-west – and can seed tropical cyclones

- Storms respond to and create soil moisture variation, and are becoming more intense and more frequent
- Models and observations conflict – but science cannot confidently go beyond the observations



SM (from AMSR-E) LST anomalies

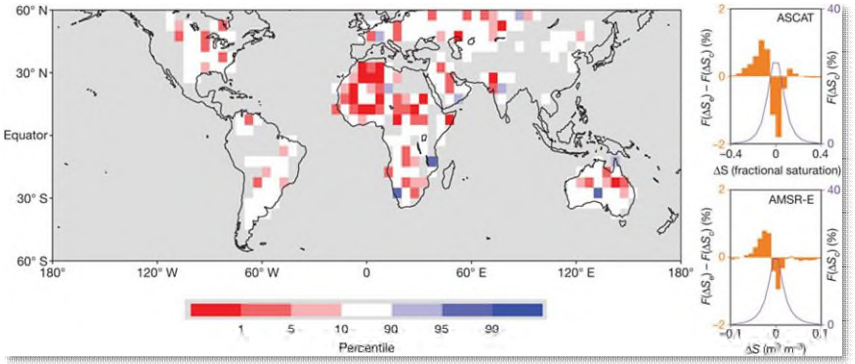
Multiscale Soil Moisture structures and impact on atmosphere



Models (am rain)

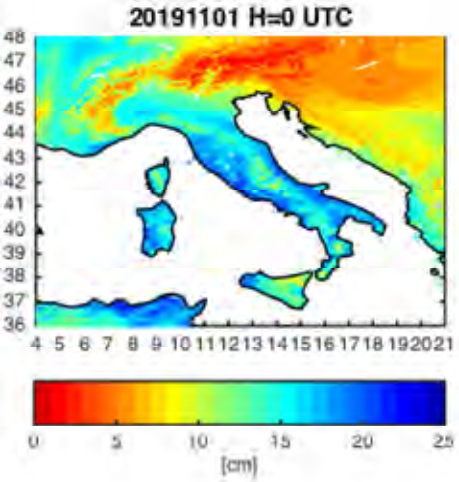
Obs. (pm rain)

Africa images from CEH (UK)

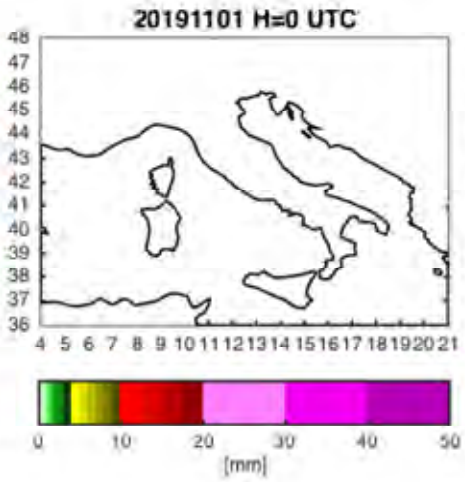


Taylor et al., Nature (2012)

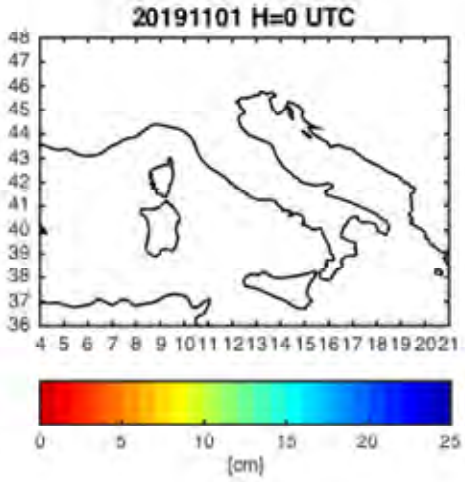
Sampling needs: Integrated Water Vapour (vertical column)



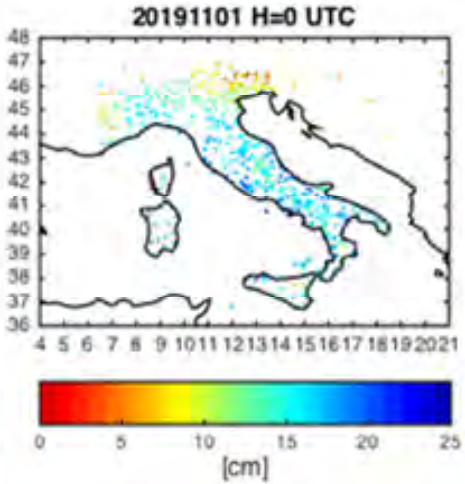
water vapour



hourly rainfall



Sentinel 1 A/B



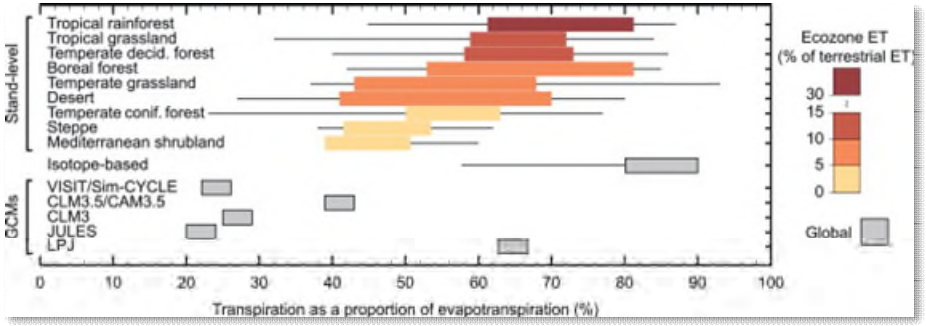
hourly GNSS

Requirement: observe small scale (≤10 km), fast (≤1 hr) variations

Science goal: Surface Energy Balance

Fluxes of heat and moisture represent the surface energy balance

- Models and observations conflict and fail to capture these processes fully
- Evaporation, transpiration and soil drying can be modelled – but are not yet observed at scale



Schlesinger and Jasechko (2014)

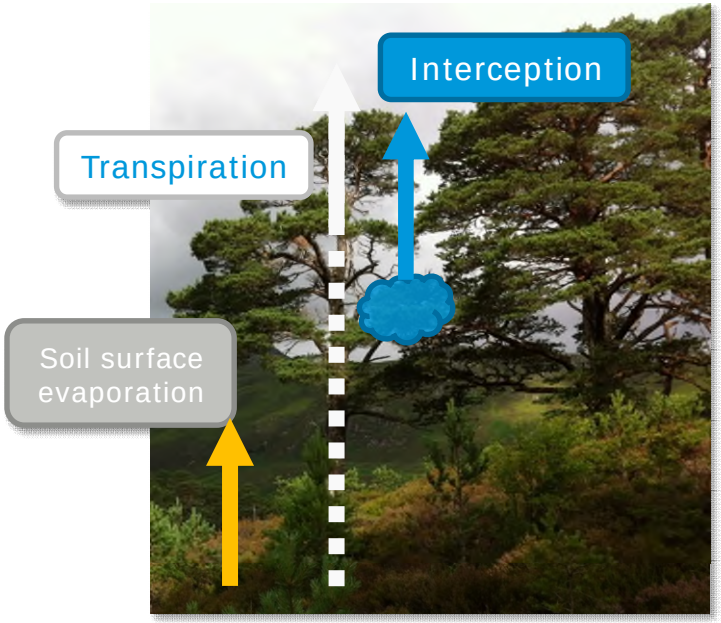
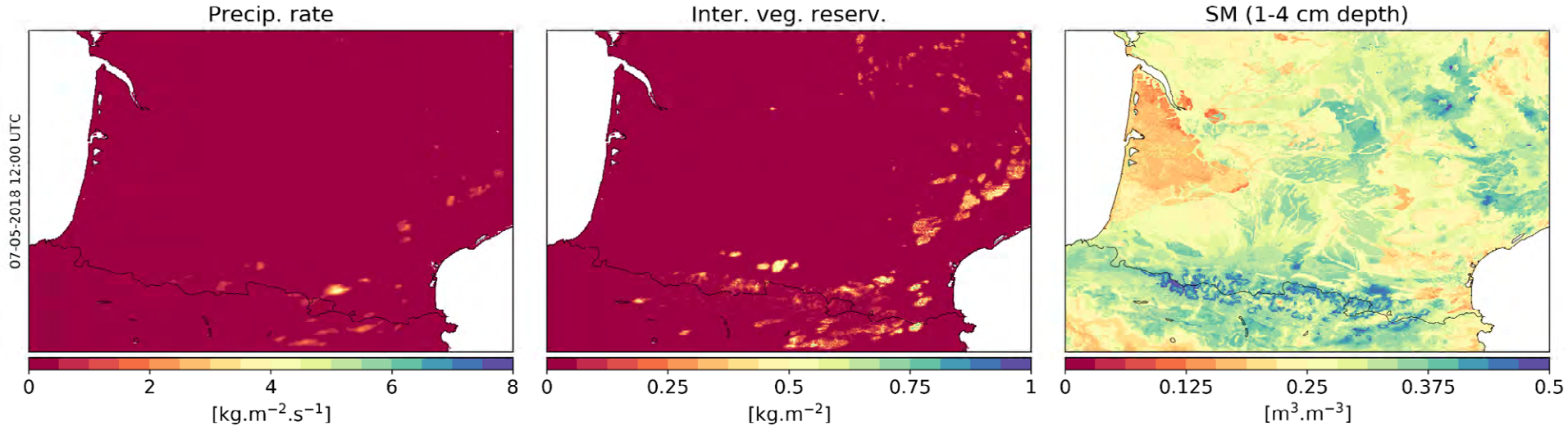


Image: E Blyth (CEH)

Surface Fluxes in Weather and Climate Models

Land surface – atmosphere fluxes of energy and water are a key component of weather and climate models – *models have to represent these processes, but practically no ground truth*

- Diurnal processes such as interception, evaporation and irrigation are essential, but are <u>difficult to observe</u> and are therefore <u>poorly modelled</u>



Meteo France simulation (image every 6 hr)

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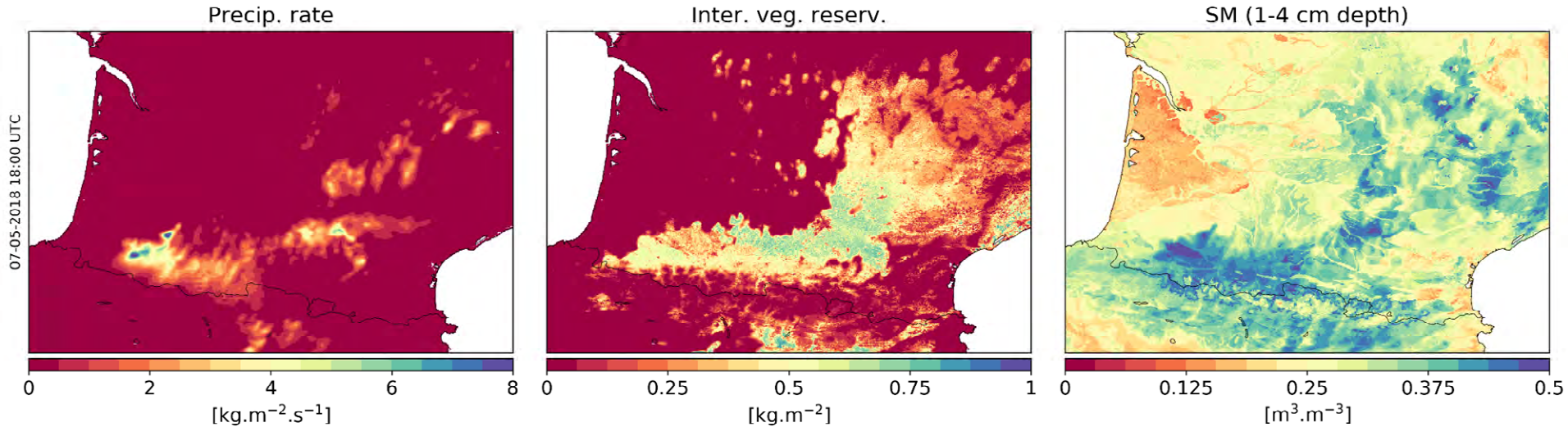

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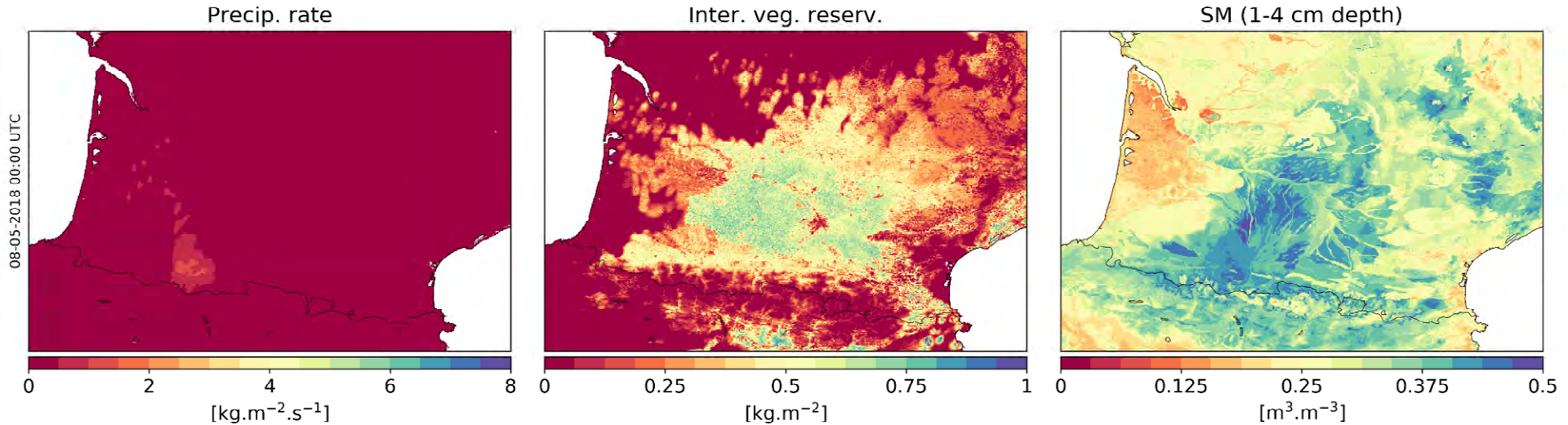

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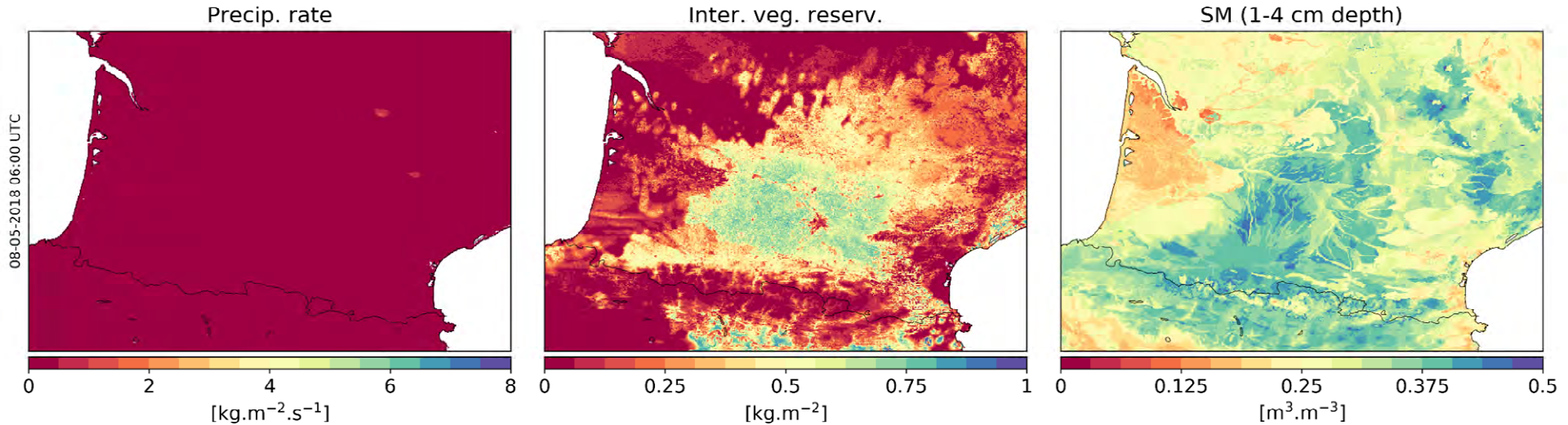

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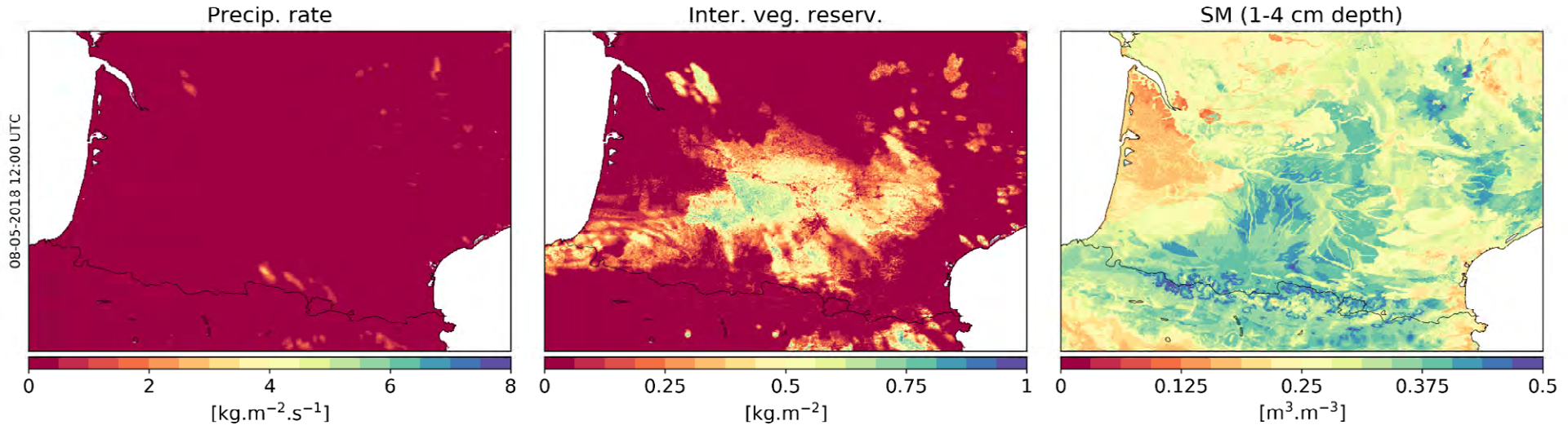
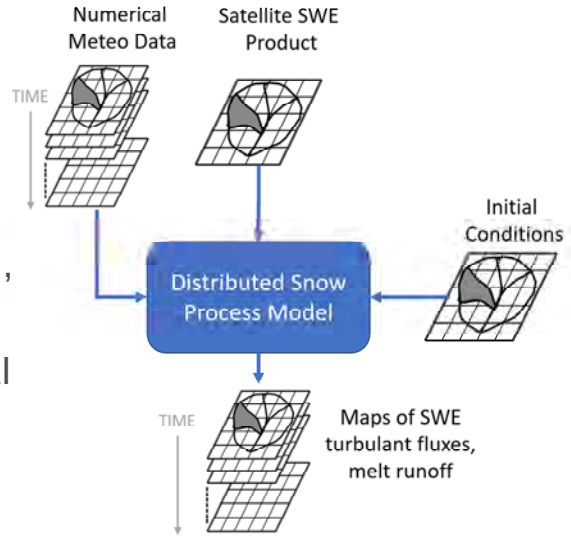


Meteo France simulation (image every 6 hr)

Science goal: Seasonal Snow Cover

Mass of snow accumulation (Snow Water Equivalent - SWE)

- Snow cover (as SWE) is a key parameter for quantifying and modelling surface / atmosphere exchange processes and for forecasting snowmelt contributions to river runoff.
- SWE data are presently based on in situ point measurements, microwave radiometry, and models driven by numerical meteorological data: these do not account for the high spatial and temporal variability of snow mass.



Observation needs:

Daily, spatially detailed (sub-km) observations of SWE, in order to improve the representation of snow in hydrological and meteorological models and to assess the impact of climate change on water resources stored in snow.

Sampling needs: Snow Water Equivalent (SWE)

Frame of 60-day simulation: – point data poorly represent the true distribution