

# Some SURFEX applications at mesoscale

# Objectives

- Show some examples of use of SURFEX in mesoscale applications (mainly from CNRM)
- Not all applications ...

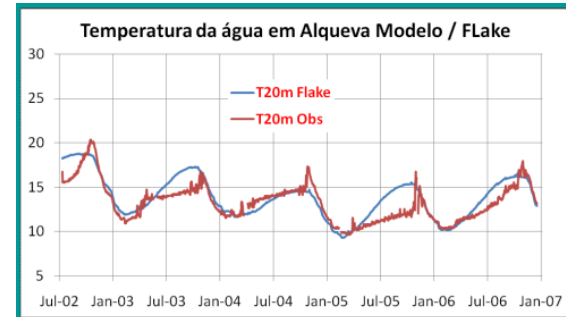
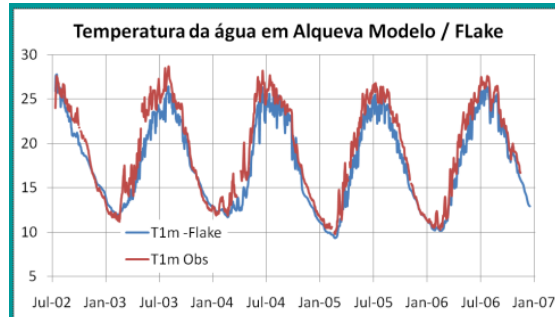
# MesoNH

- SURFEX is the surface model of the atmospheric research model MesoNH since 2006.
- From the MesoNH users' meeting (12-13 oct. 2009) :
  - Turbulent fluxes, in relation with the surface physiography
  - Boundary layer application, including large eddy simulations
  - Heat island studies
  - Impact of the use of Flake on simulated atmospheric circulation
  - Chemical / dust studies

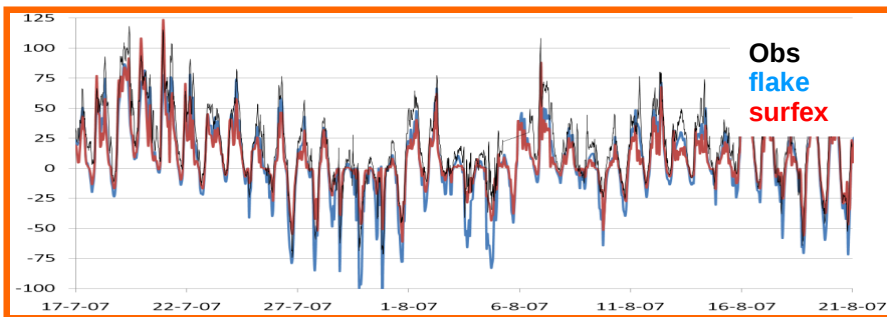
# Flake in off-line mode



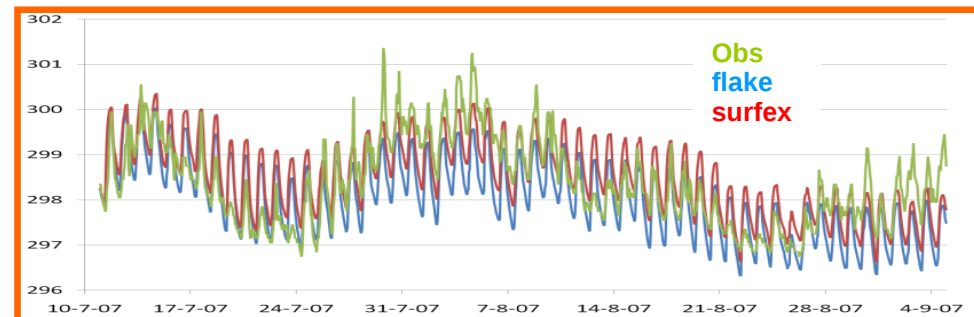
## Validation of Flake over the Alqueva lake



## Flake in SURFEX



Sensible heat flux



Surface temperature

Contact : Rui Salgado U. Evora



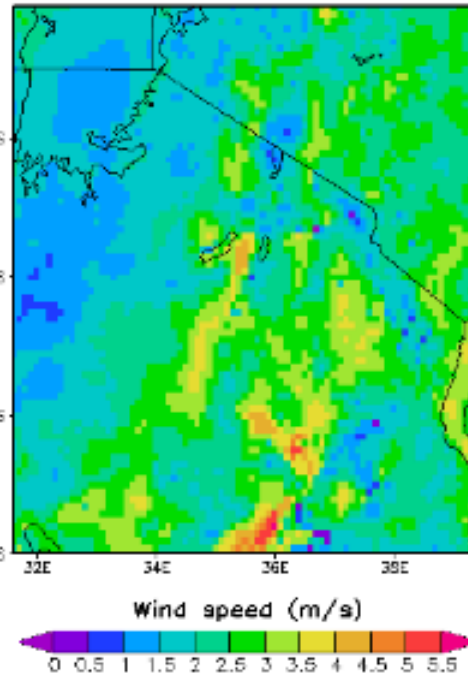
SURFEX training course 14-16/10/09

# NUMLAB project

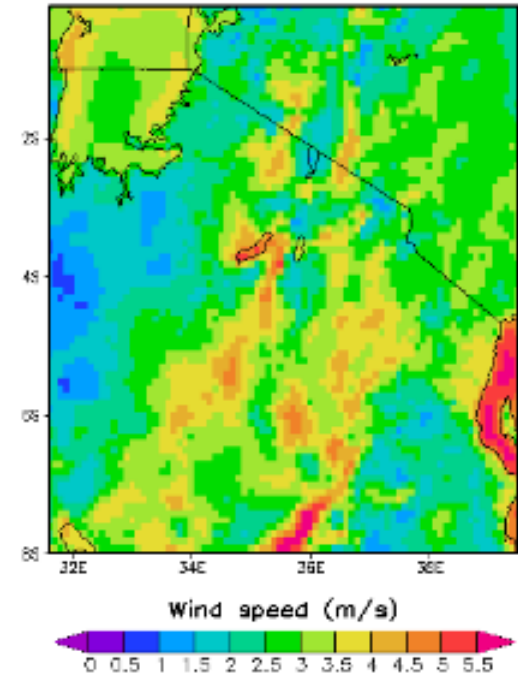
## Victoria Lake



SURFEX



HIRLAM



Experiment on Tanzania, comparison of HIRLAM wind speed an off-line Surfex model over 10 days



Lac Malawi

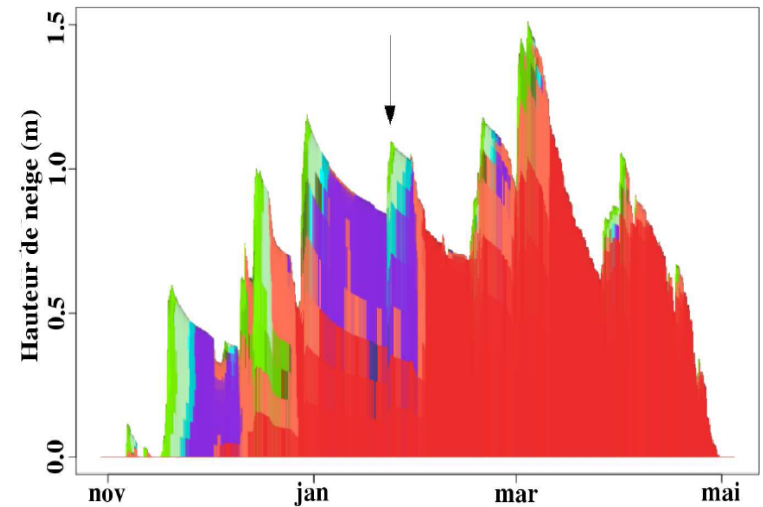
Contact : L. Rontu FMI



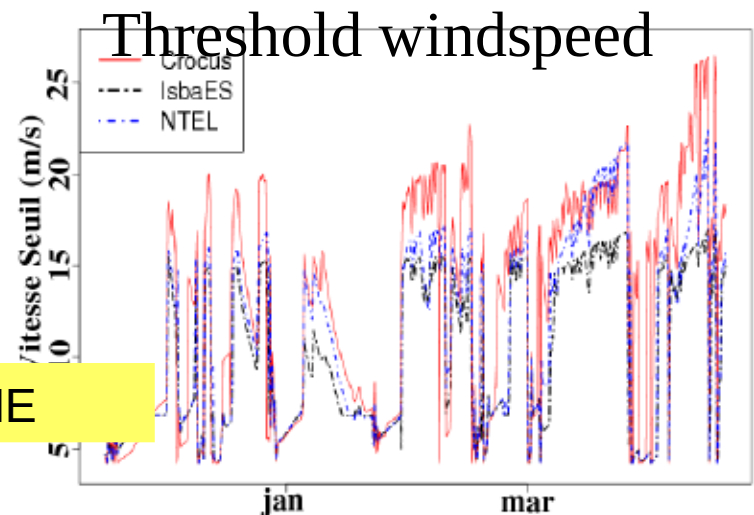
**METEO FRANCE**  
Toujours un temps d'avance

# Snow transport by wind

- Introduction of metamorphosis lows in the multilayer snow scheme of SURFEX (from the snow model CROCUS)
- Dependence of snowdrift on the snow grain types simulated and wind
- First tests with atmosphere
- Further improvements in the description of the snow



Evolution of grain types



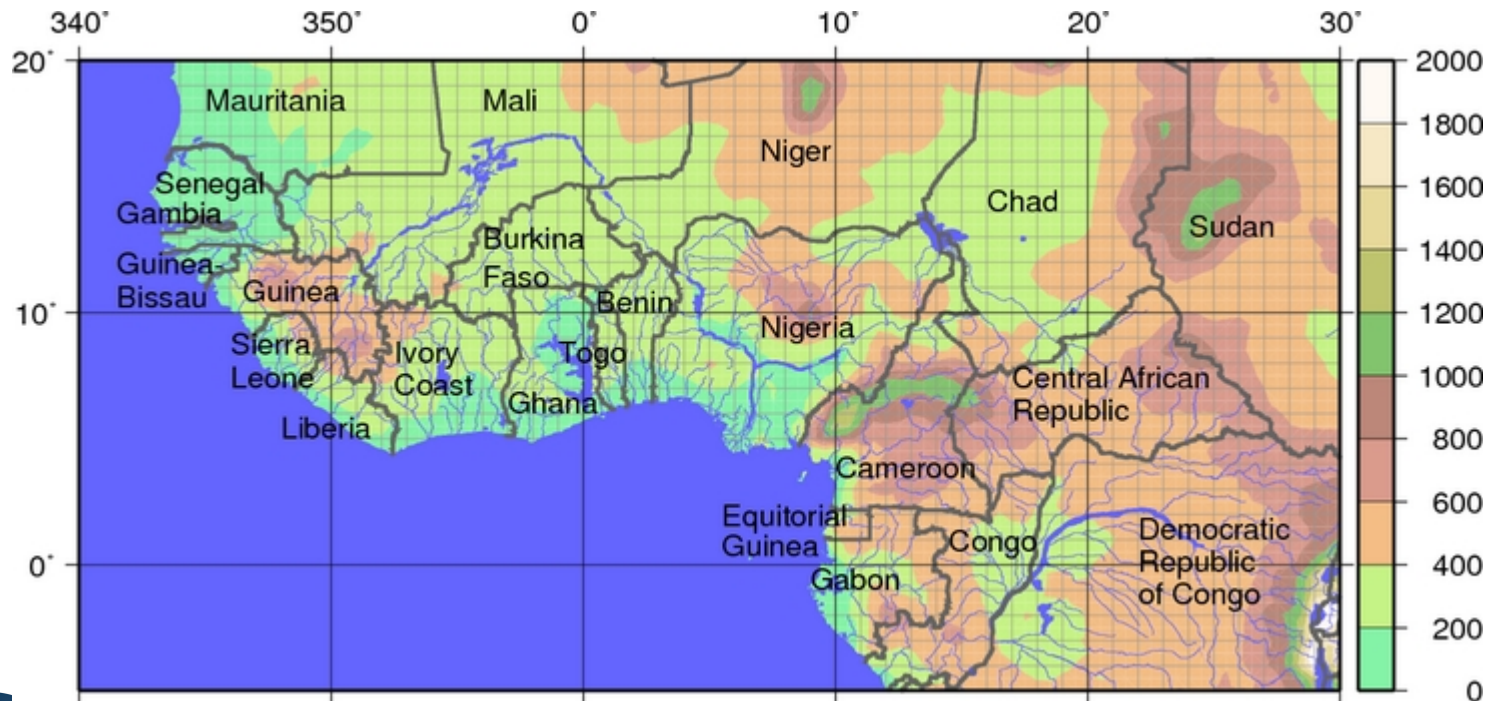
Threshold windspeed

Contact : V. Vionnet, E. Brun CNRM-GAME



# ALMIP : AMMA Land surface models intercomparison

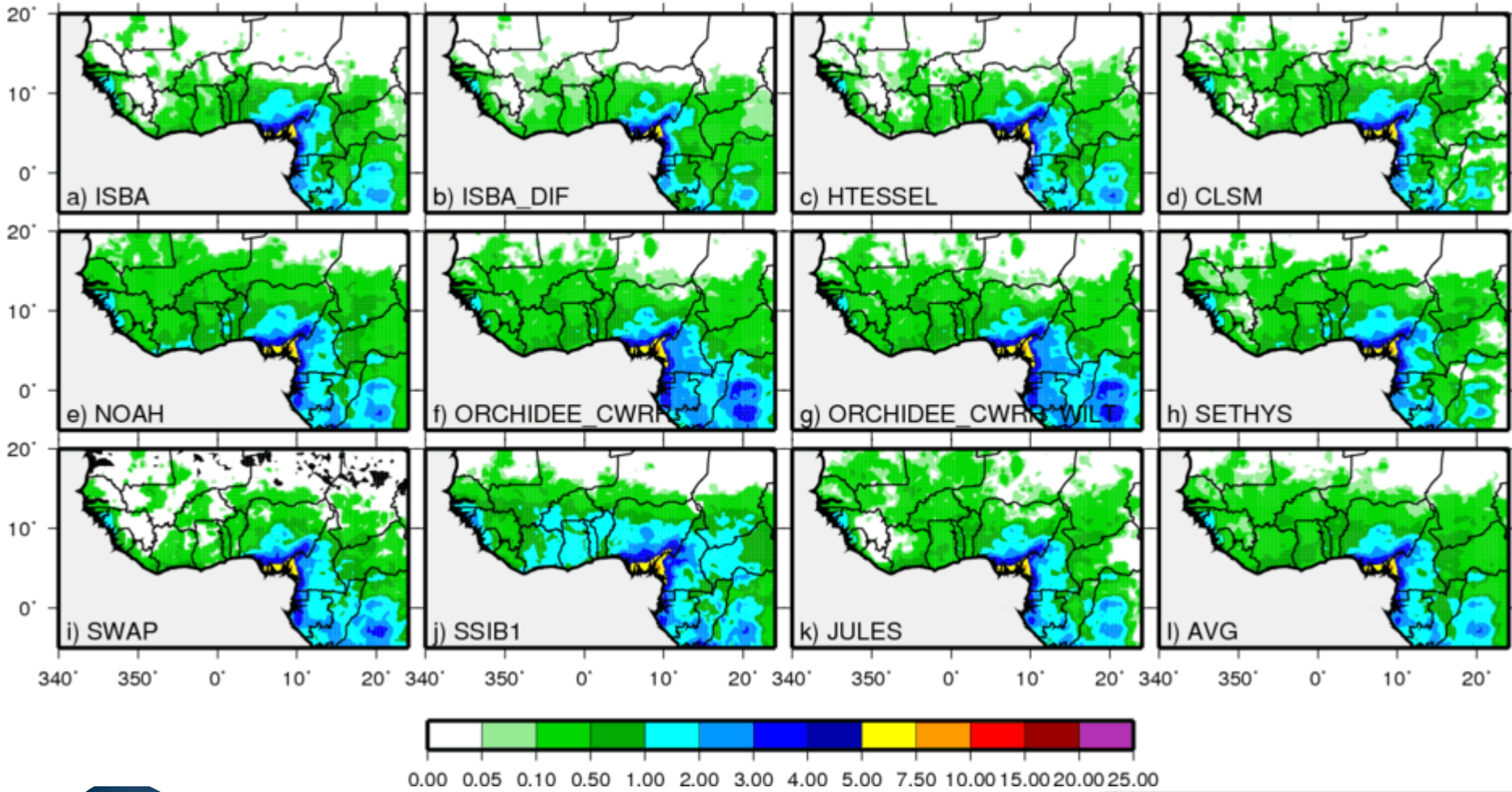
- [http://www.cnrm.meteo.fr/amma-moana/amma\\_surf/almip/index.html](http://www.cnrm.meteo.fr/amma-moana/amma_surf/almip/index.html)





# AMMA : ALMIP

Runoff (kg m<sup>-2</sup> day<sup>-1</sup>) JJAS Exp3 2006





# Coupling SURFEX-ISBA and TOPMODEL for flash floods



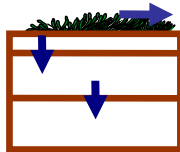
## Atmospheric forcing

**Model :** *MESO-NH AROME*

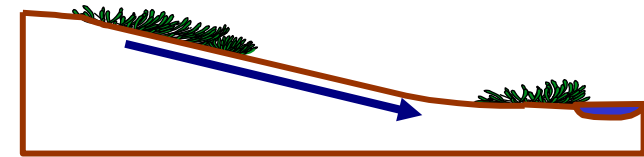
**Observations :**  
*Raingauges*  
*Radar*

Precipitation, radiation, ...

**Surface scheme**  
*SURFEX/ISBA*



Soil water



**Hydrological model**  
*TOPMODEL*

New soil water  
Saturated areas

**Routing**

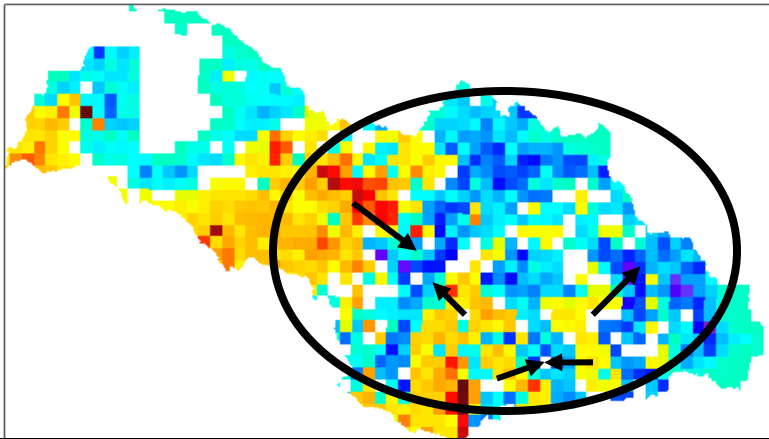
Deep drainage  
Surface run-off

Total Discharge

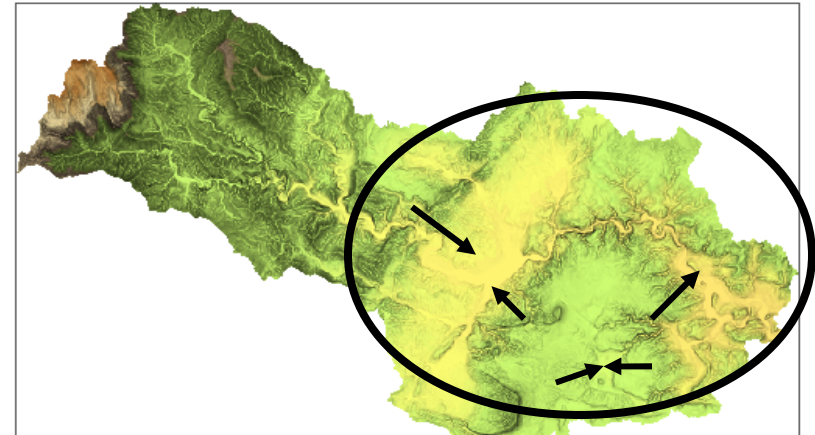
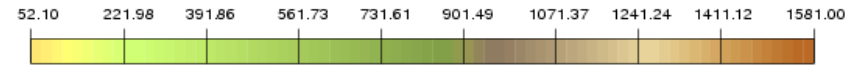
1. Principle & calibration
- 2. Impact of the coupling**
3. Sensitivity to input rain
4. Conclusions

## With or without coupling : soil moistures

Difference of soil moisture : COUPL - ISBA alone



Topography of Cèze catchment



⇒ More realistic soil water contents

⇒ High sensitivity to input rains

# The SIM hydro-meteorological model

Meteorological analysis

**SAFRAN**

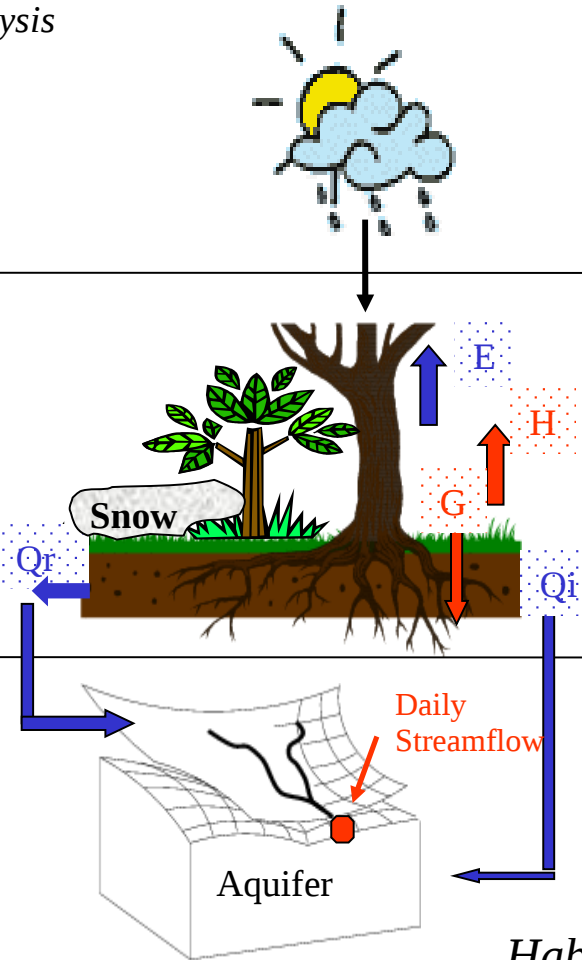
Observations + NWP models  
 ⇒ Precipitation, temperature,  
 humidity, wind, radiations

Surface scheme

**ISBA**

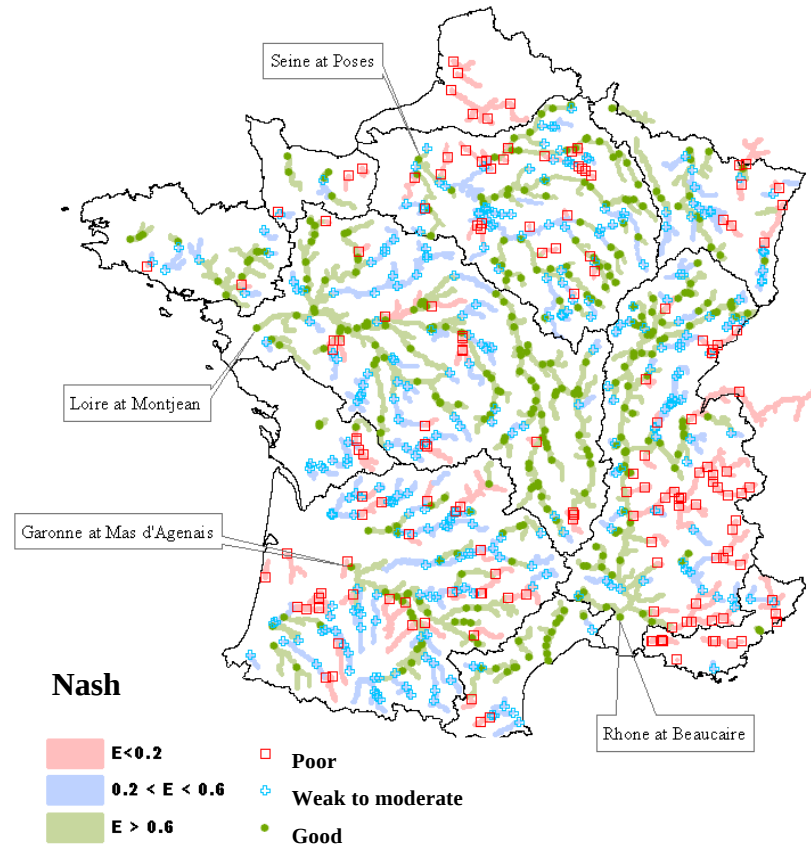
+

Physiographic data for  
 soil and vegetation



Hydrological model

**MODCOU**



Nash

*Habets et al. (2008)*

Contact : E. Martin CNRM-GAME



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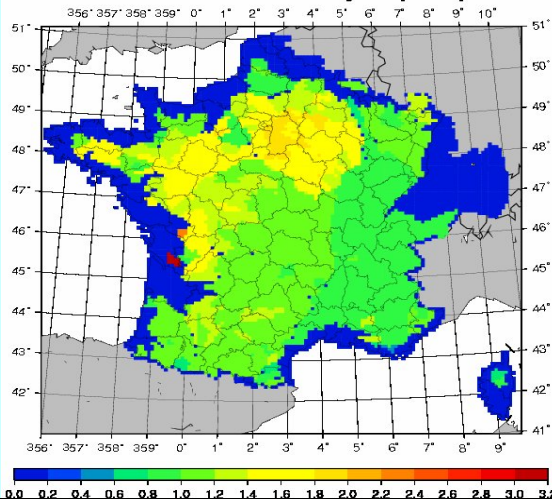
# Coupling SURFEX and MODCOU

Aim of this action :

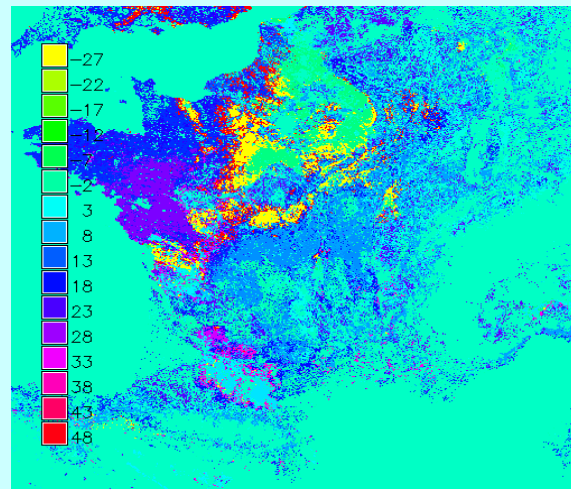
- Use SURFEX (ISBA, TEB, ECOCLIMAP2) instead of the former F90 ISBA code and a specific ECOCLIMAP version.
- Use difference from the first SIM version and observed discharge to validate ECOCLIMAP2

## Spatialised differences

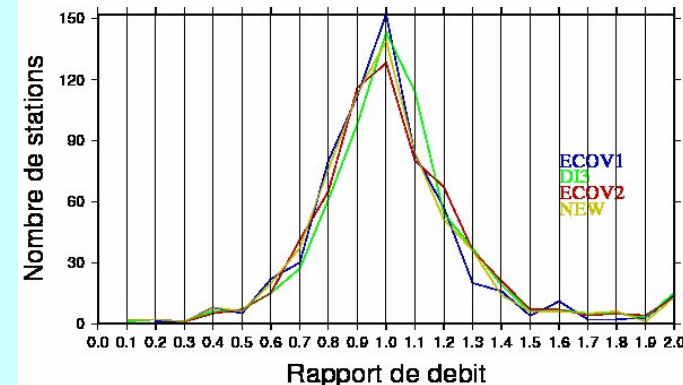
DOMAINE SIM – moyrc par point



## Modification of soil depth for some covers



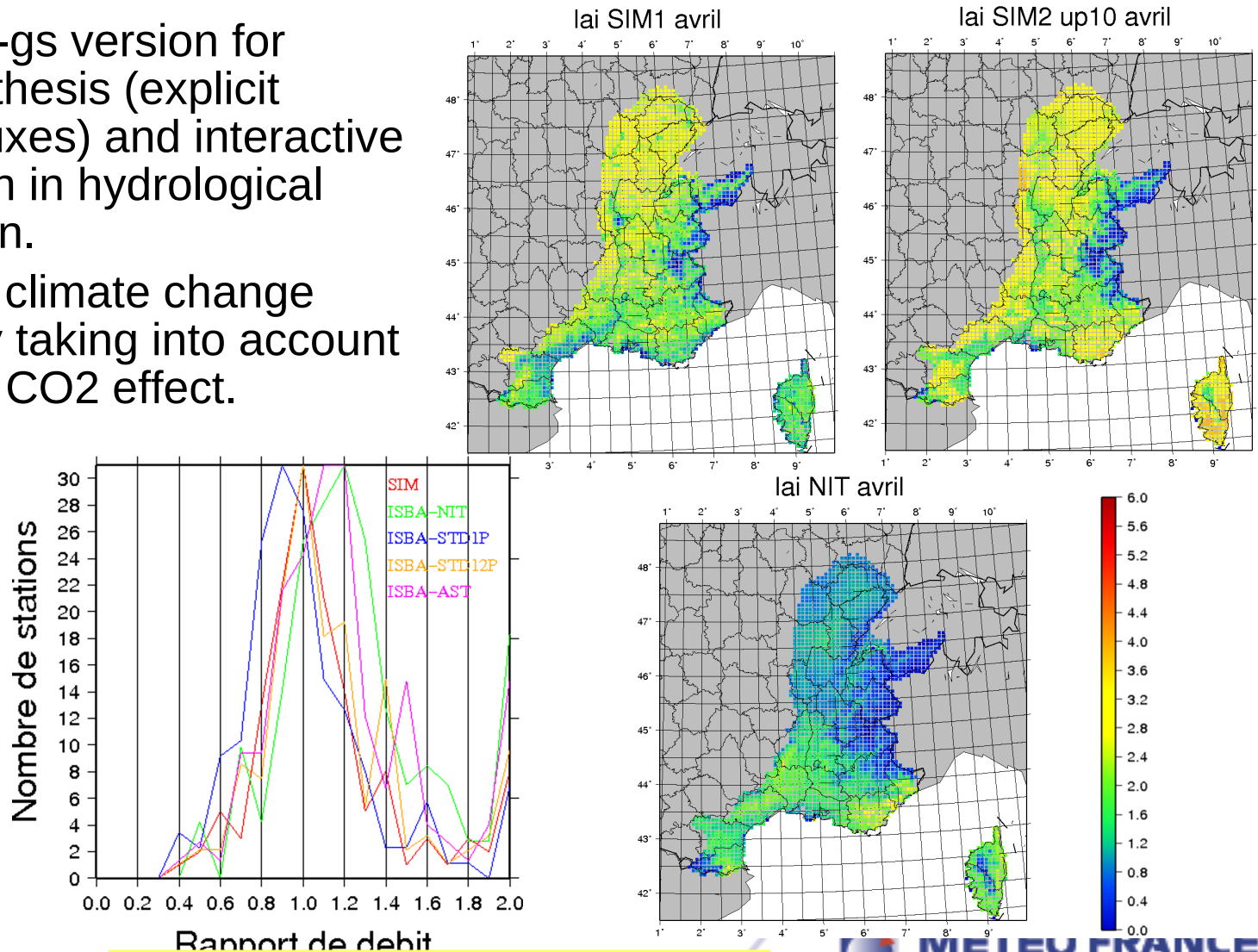
## Impact on Nash scores vs SIM or observed



# Impact of the use of A-gs and NIT version of ISBA on hydrology

Use of the A-gs version for photosynthesis (explicit carbon fluxes) and interactive vegetation in hydrological application.

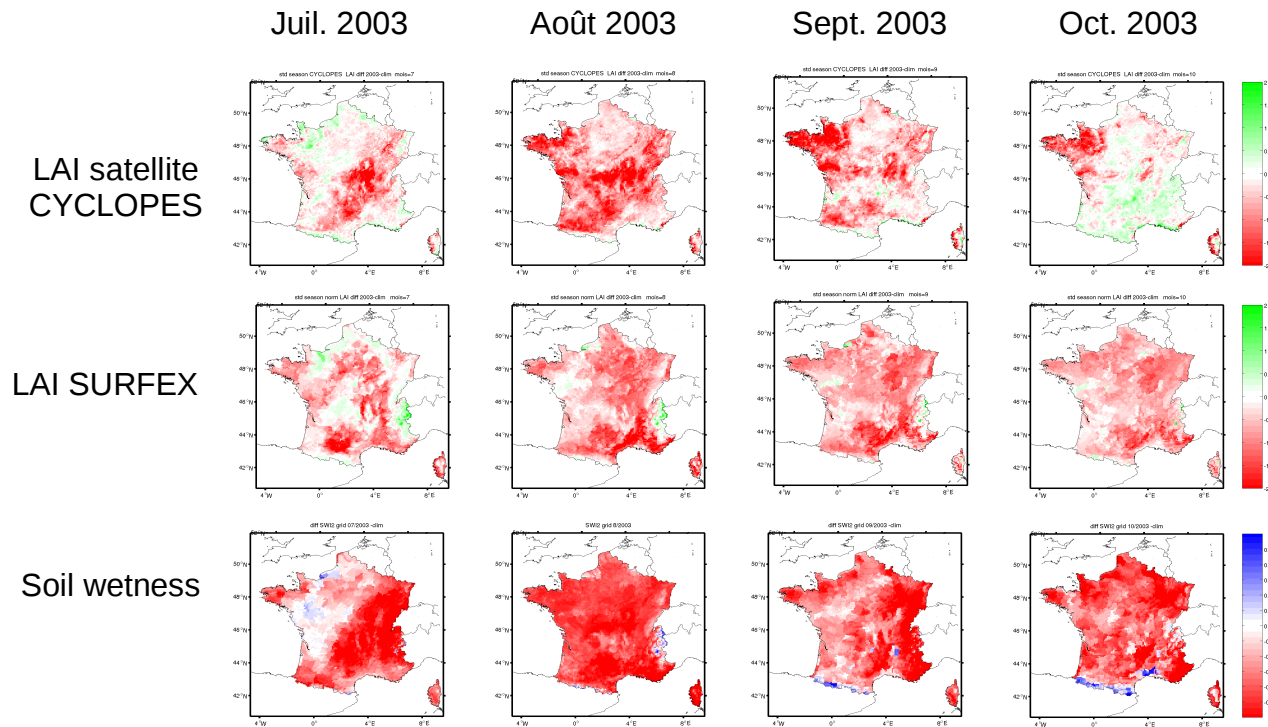
- Impact of climate change explicitly taking into account the direct CO<sub>2</sub> effect.





# Monitoring of LAI, soil wetness and carbon fluxes

- The drought 2003 deviation from the 1999/2002 mean for
- LAI
- Soil wetness index

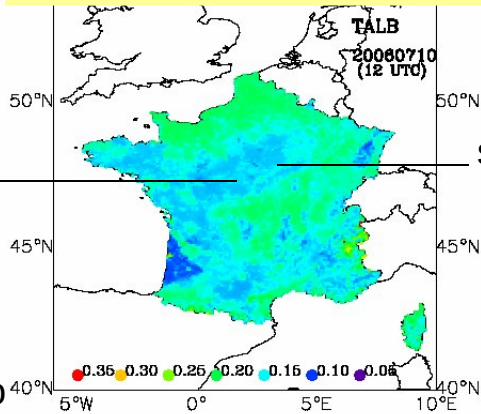


# Added Value of Land SAF Albedo in SURFEX

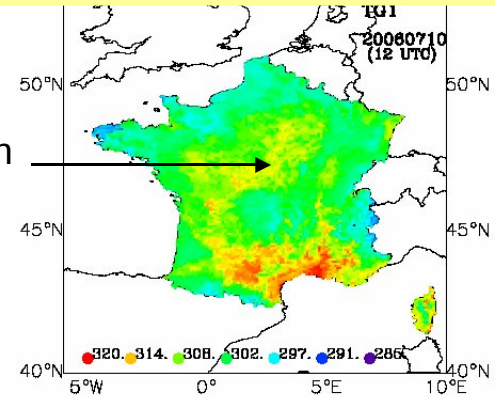
SVAT model: SURFEX

Two experiments: with Ecoclimap albedo and with Land SAF albedo analysis

Ecoclimap albedo 10072006



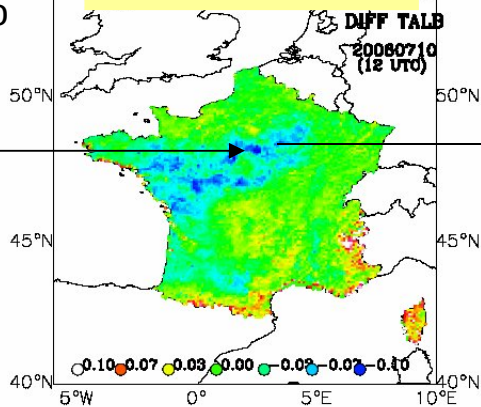
Surface temperature 10072006



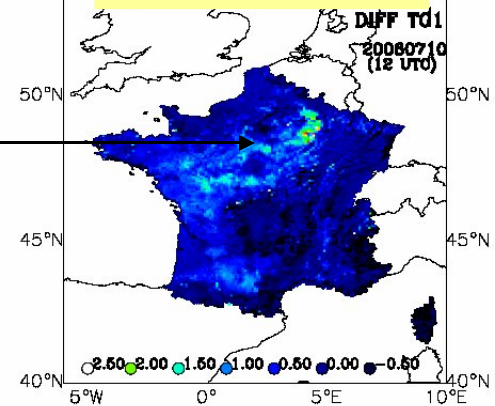
surface albedo impact on surface temperature

Ecoclimap albedo is lower than SAF-Land albedo

reference-LandSAF



reference-LandSAF



higher albedo induced colder surface temperature



Contact : D. Carrer CNRM-GAME

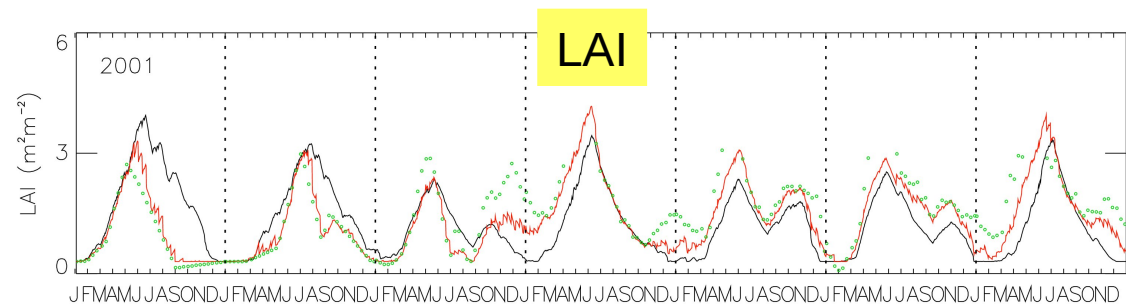
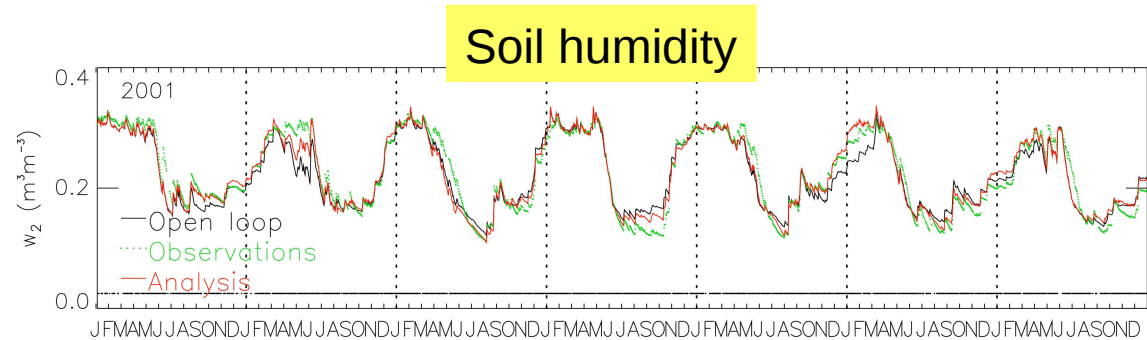
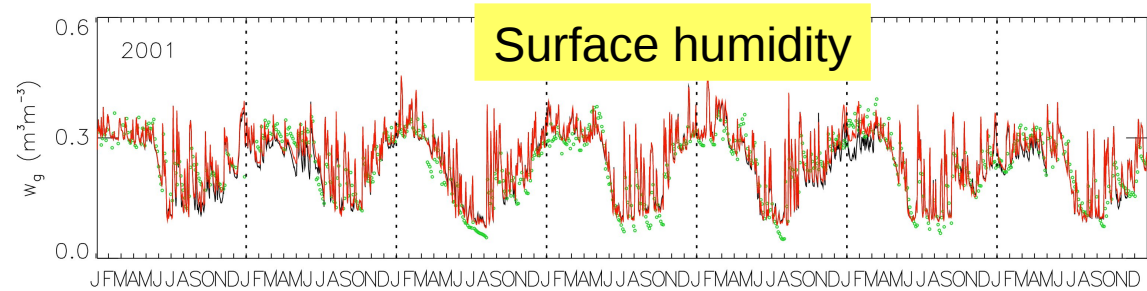


# Assimilation of soil moisture and LAI

Impact of the assimilation of LAI and surface soil wetness on the SMOSREX site (2001-2007)

Surface humidity  
Soil humidity  
LAI

Also with AMSR/E data



Contact : C. Albergel CNRM-GAME