

SURFEX Activities at GMME

Aaron Boone (CNRM-GAME, Météo-France)
contributions from B. Decharme, E. Brun, E. Martin,
P. Samuelsson, S. Golvick, A. Lemonsu, P.
Lemoigne, C. De Munck, D. Carrere, S. Lafont, R.
Salgado et al.

SURFEX Scientific Steering
Committee (SSC) Meeting March 28,
2013, CNRM Météo-France,
Toulouse, France



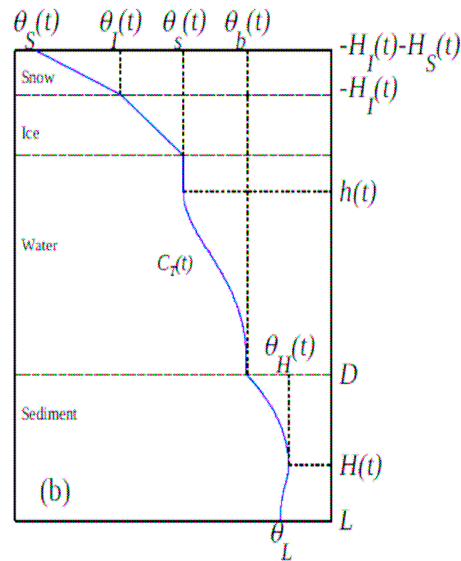
Overview

- FLAKE (lakes)
- TEB (Town Energy Budget)
- ISBA (natural surfaces...DIF, MEB, cold season & semi-arid processes)
- SIM (SAFRAN ISBA MODCOU – met. Analysis system + distributed hydrological model)
- ISBA-TOP (model)
- ECOCLIMAP-albedo improvement
- Benchmarking (ISBA for now...could be extended to other modules)

Lake Model - Flake

Simple conceptually-based model

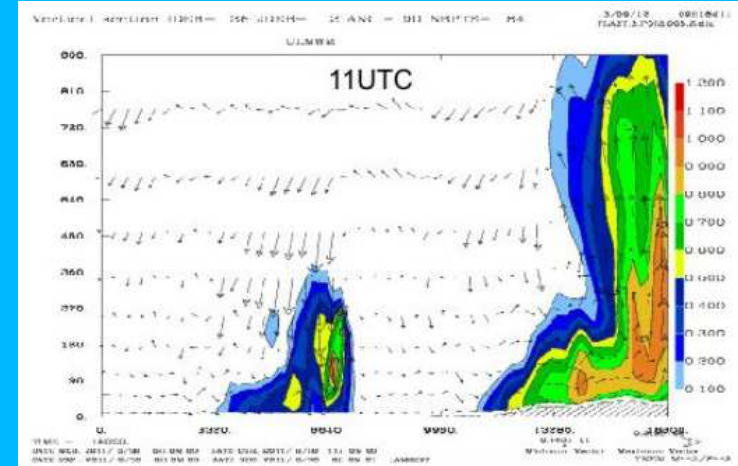
Used extensively in Europe (NWP community)



Process-based studies,
Global scale impacts,
Remote sensing (joint NASA-CNES
SWOT mission), NWP applications

Evaluation/ validation in
offline and coupled
modes

Thaumex campaign in
2010/2011



Development of a lake breeze (TKE)
POI 2



P. Le Moigne, R. Salgado
<http://nwpi.krc.karelia.ru/flake/>

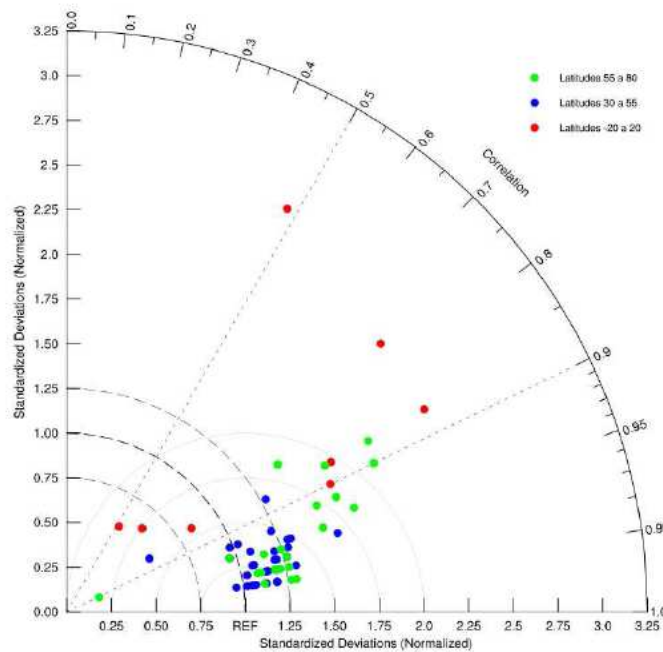
Lake Model - Flake

Lake modelling at global scale using FLake:
SWOT mission

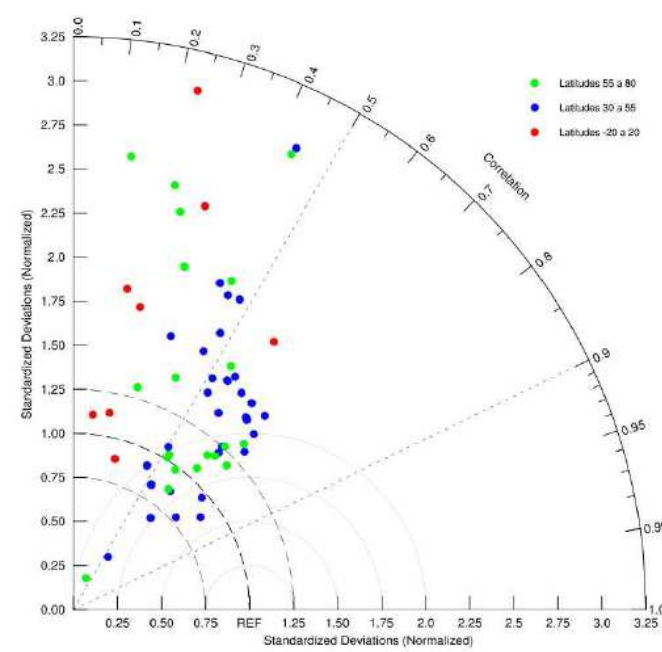
- (i) evaluate the importance of lake representation in climate models at global scale
- (ii) contribution of high resolution SWOT data

Preliminary study:

- (i) Watch/ERA-I atmospheric forcing – 30-year period – $0.5^\circ \times 0.5^\circ$
- (ii) Evaluation of surface temperature : ARC-Lake database

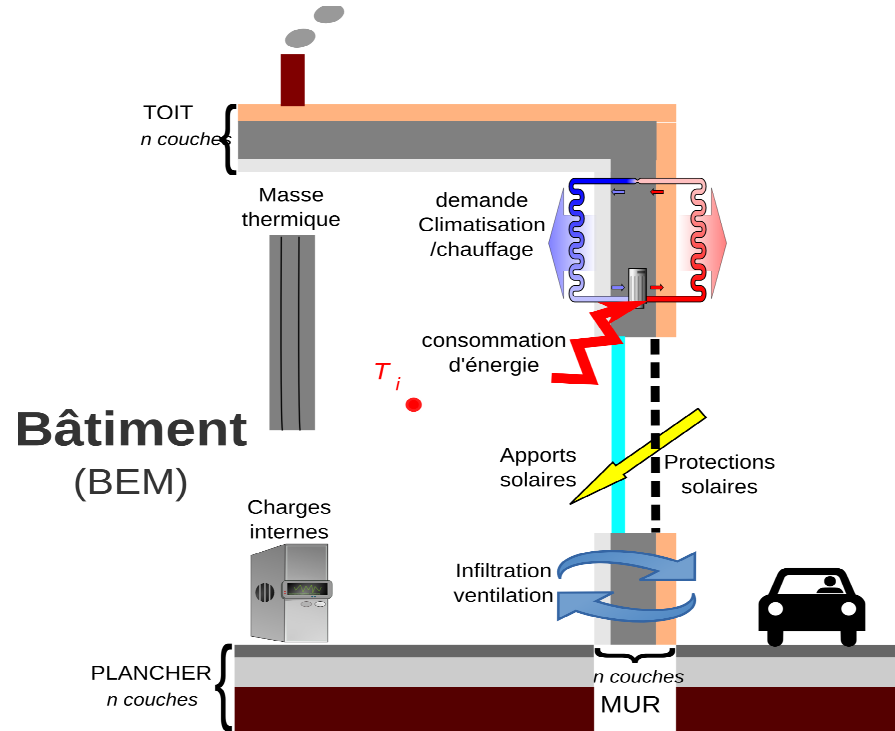


Raw data

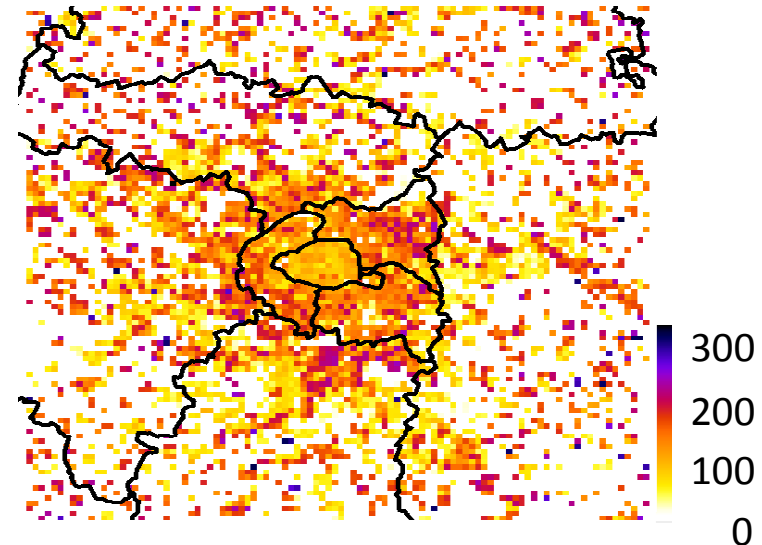


Annual cycle removed

TEB : Building thermal model

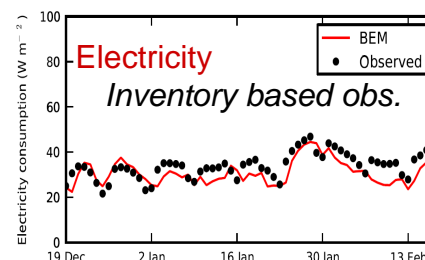
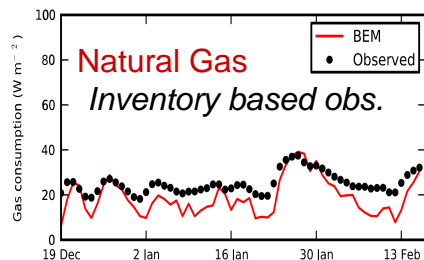


Validation over the Paris region



Paris actuel Heating energy (kWh/m²/an)

Validation sur le centre-ville de Toulouse



Observations

(source: ministère de l'écologie)

- Énergie finale totale, bâtiments résidentiels et bureaux

Ile de France: **12000** ktep/an

Modèle:

- Chauffage : 9400 ktep/an
- Air Cond.: 840 ktep/an
- Eau chaude: non calculé (approx 25% chauffage)
Total : **12600** ktep/an

V. Masson, G. Pigeon,
A. Lemonsu

TEB : Urban Vegetation

Gardens (Lemonsu et al 2012)

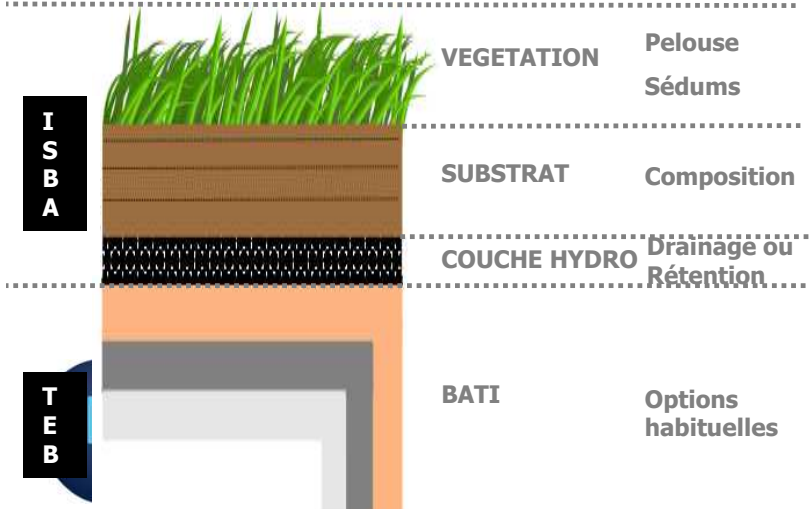
ISBA integrated in the urban canyon
radiative interactions between walls-gardens
interactions with the road micro-climate

2) Vegetated roof (De Munck et al 2013)

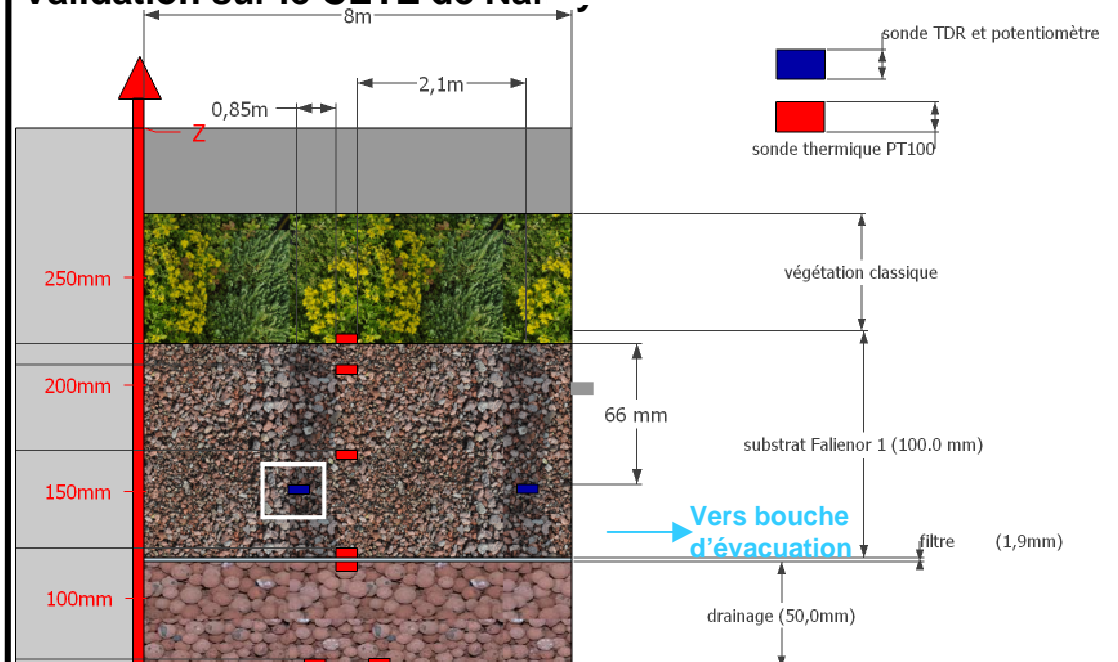
- contenu en eau et potentiel hydrique
- températures à plusieurs niveaux
- débits d'eau en sortie de toiture

Implémentation d'ISBA sur le toit de TEB !

- permet de profiter de la richesse d'ISBA
- MAIS processus particuliers :
sedum (plantes CAM) ; substrat, sol de 10cm...



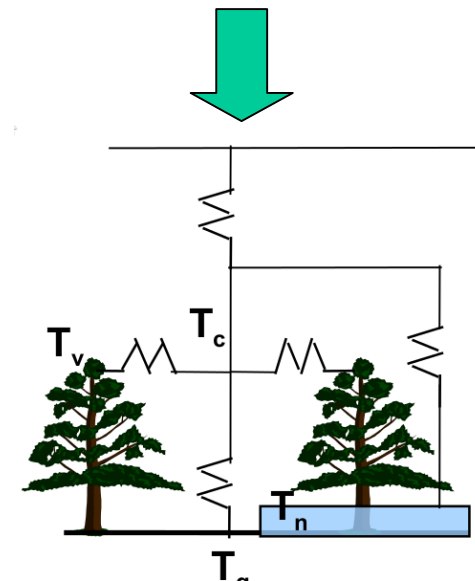
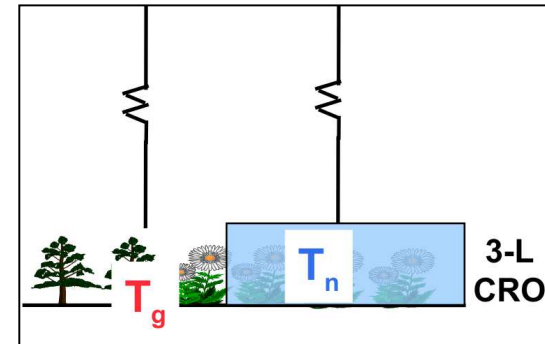
Validation sur le CETE de Nar



ISBA – explicit vegetation

GMME

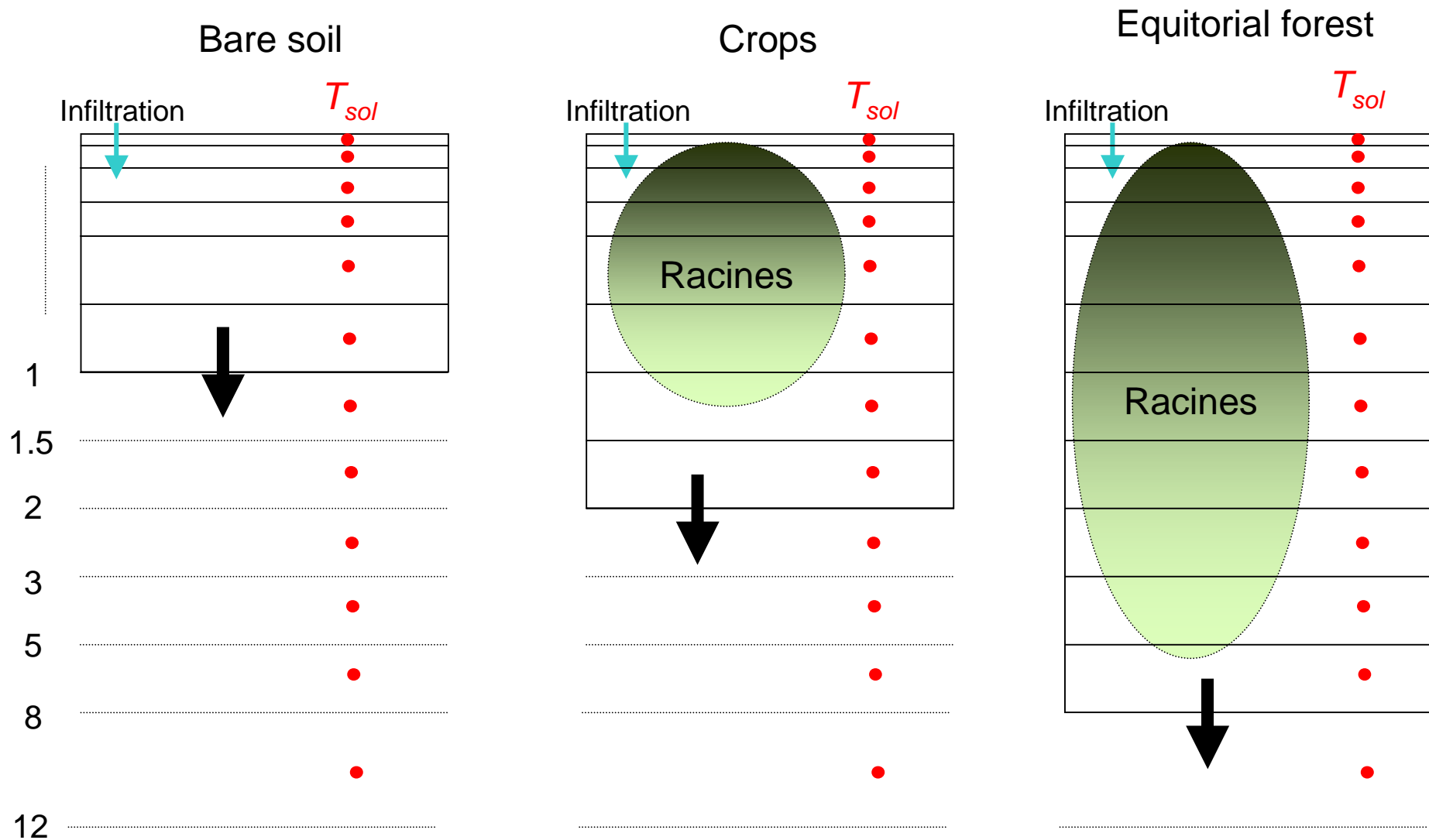
- Continued development/evaluation of MEB (multi-energy balance) – based on HIRLAM
- Vegetation : improvement of radiative transfer for the estimation of photosynthesis (put within MEB)
- Coupled with the explicit snow schemes (ES and CROCUS)
- Coupled with DIF soil option
- Recently phased with SURFEX7.2, Currently phasing with SURFEX7.3
- To be developed/tested in 2013: soil column below snow, coupling with air « Canopy »



A. Boone, P. Samuelsson

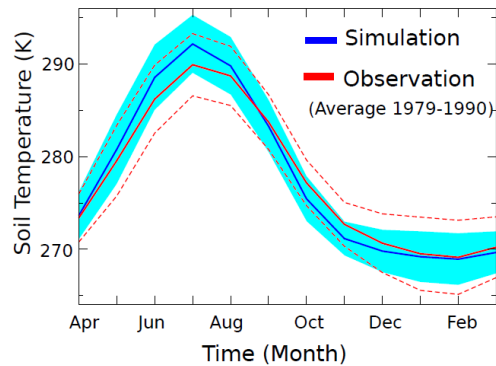
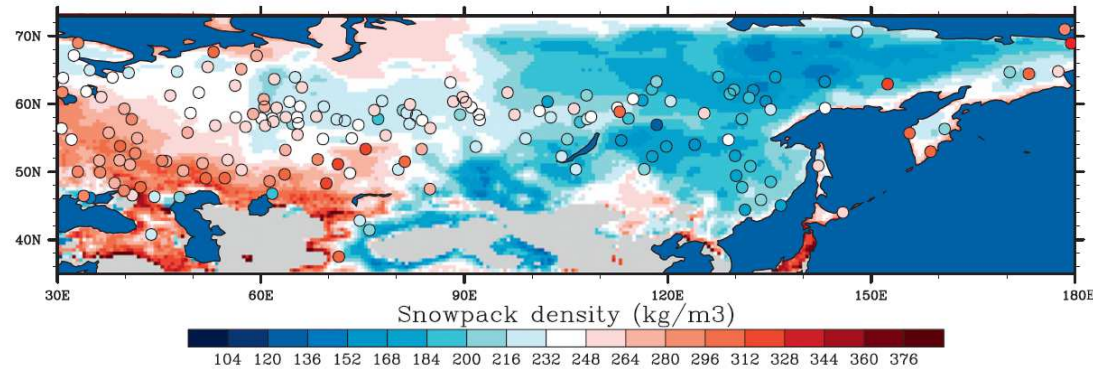
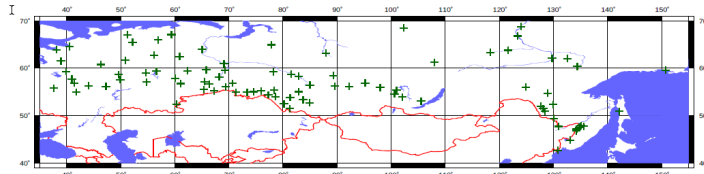
ISBA- soil thermal and hydrological grids

GMME

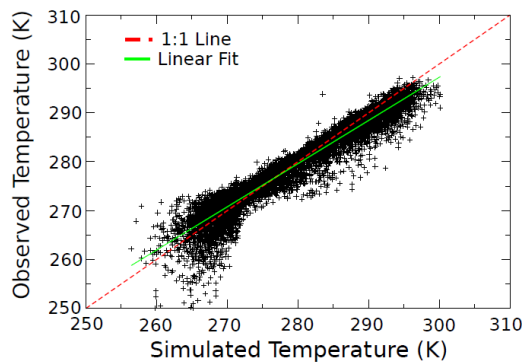


B. Decharme

ISBA - Evaluation of cold season processes over Eurasia (CROCUS and DIF)



Simulation of the snowpack density the 10, March, compared to the observations (points), during the period 1980-1993 (Brun et al., 2013, JHM).



Soil temperature simulation (here shown for 20 cm) during the period 1979-1990 (Brun et al., 2013, JHM).



ISBA - Evaluation of semi-arid processes over Africa (FR, MEB and DIF)

GMME

Semi-arid evaluation,
improvement in surface
physical processes
(hydrology, vegetation...)

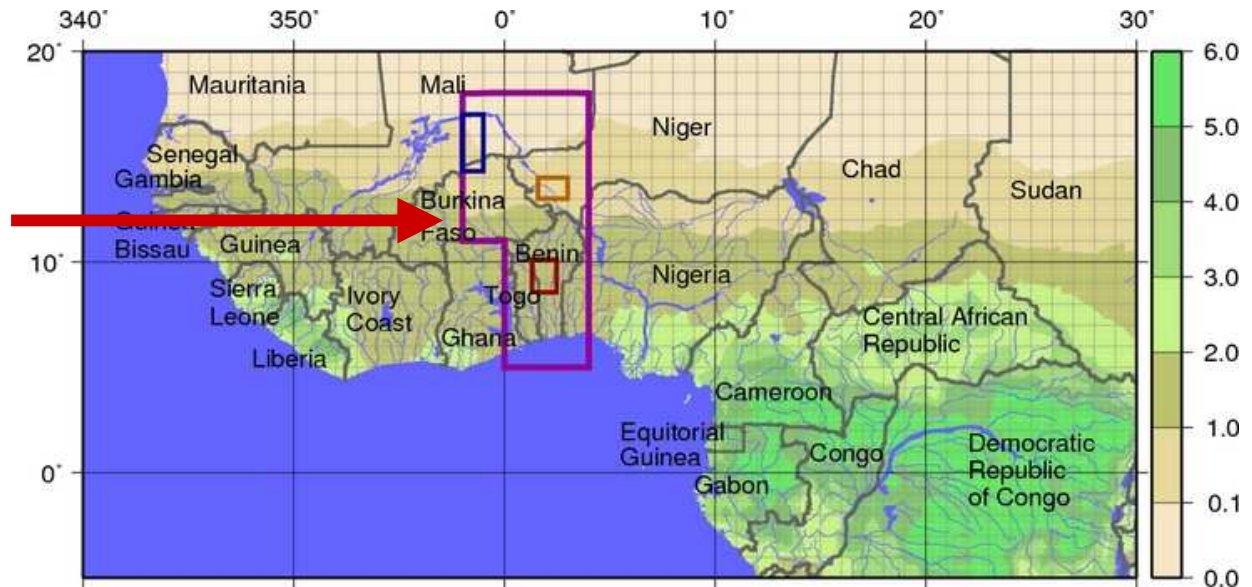
ALMIP2 (AMMA2) – west
Africa (supersites) 2005-8

SICMED – north Africa
(ongoing, end in 2013?) –
CESBIO, Univ. Cadi-
Ayyad, CNRM

AMETHYST – north
Africa (start in 2013) –
CESBIO, CNRM, LSCE,
Univ. Cadi Ayyad,
IRSTEA, AGRINET



ALMIP AMMA Land Surface Model
Intercomparison Project

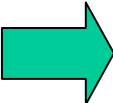


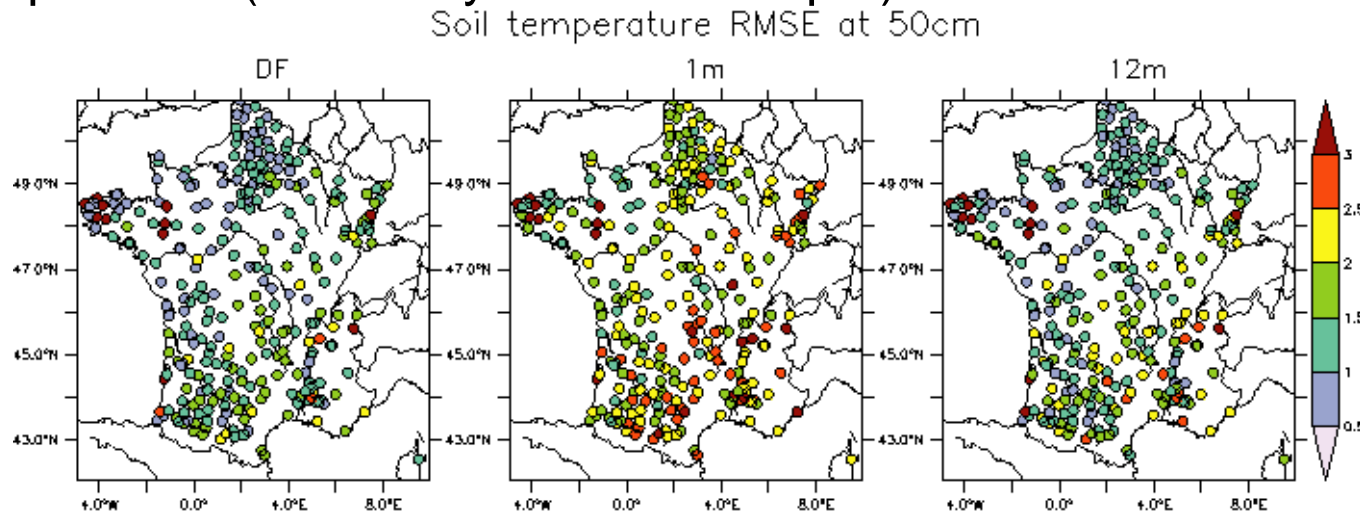
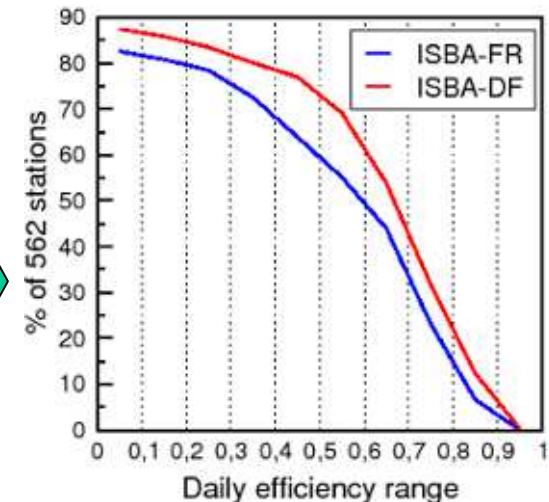
SURFEX SSC Meeting, March 28, 2013



SIM: Spatially distributed validation over France GMME 1

Evaluation of DIF option:

- Validation using river discharge and soil temperature measurements
- Discharge/river flow (also compared to default FR) 
- Temperature (sensitivity to the soil depth)



B. Decharme, E. Martin

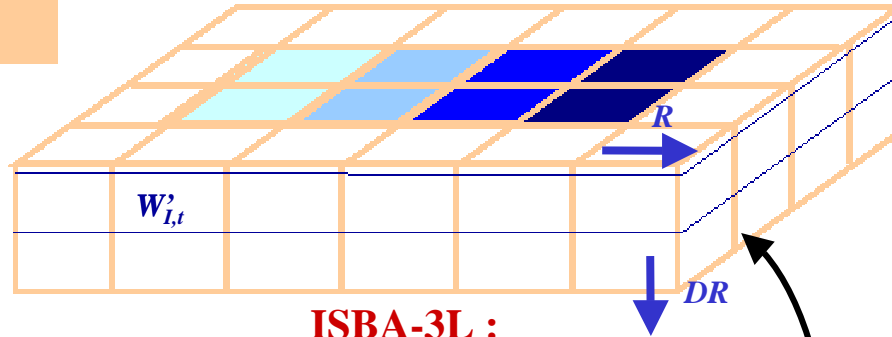
Coupling of ISBA-TOPMODEL for flash flood prediction

GMME

1
2

Résolution du modèle de surface

$\Delta x = 1\text{km} / \Delta t = 15\text{min.}$



ISBA-3L :

Gestion des bilans en eau et en énergie entre surface et atmosphère

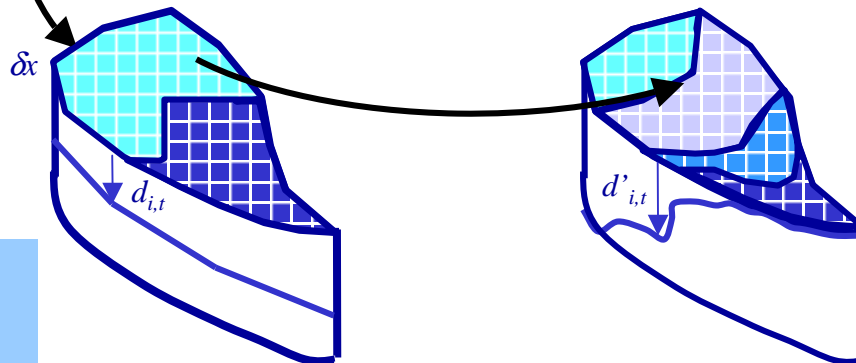
Ruissellement R
Drainage DR

$$d_{i,t} = f(W_{I,t})$$

$$W'_{I,t} = f(d'_{i,t})$$

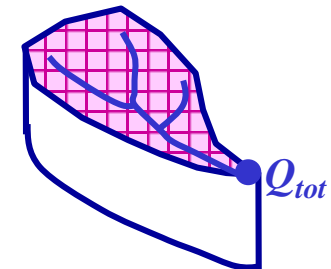
TOPMODEL :

Redistribution latérale sur les bassins versants



MODULE DE ROUTAGE:

Transfert de l'eau le long des versants et en rivière



Résolution des bassins versants

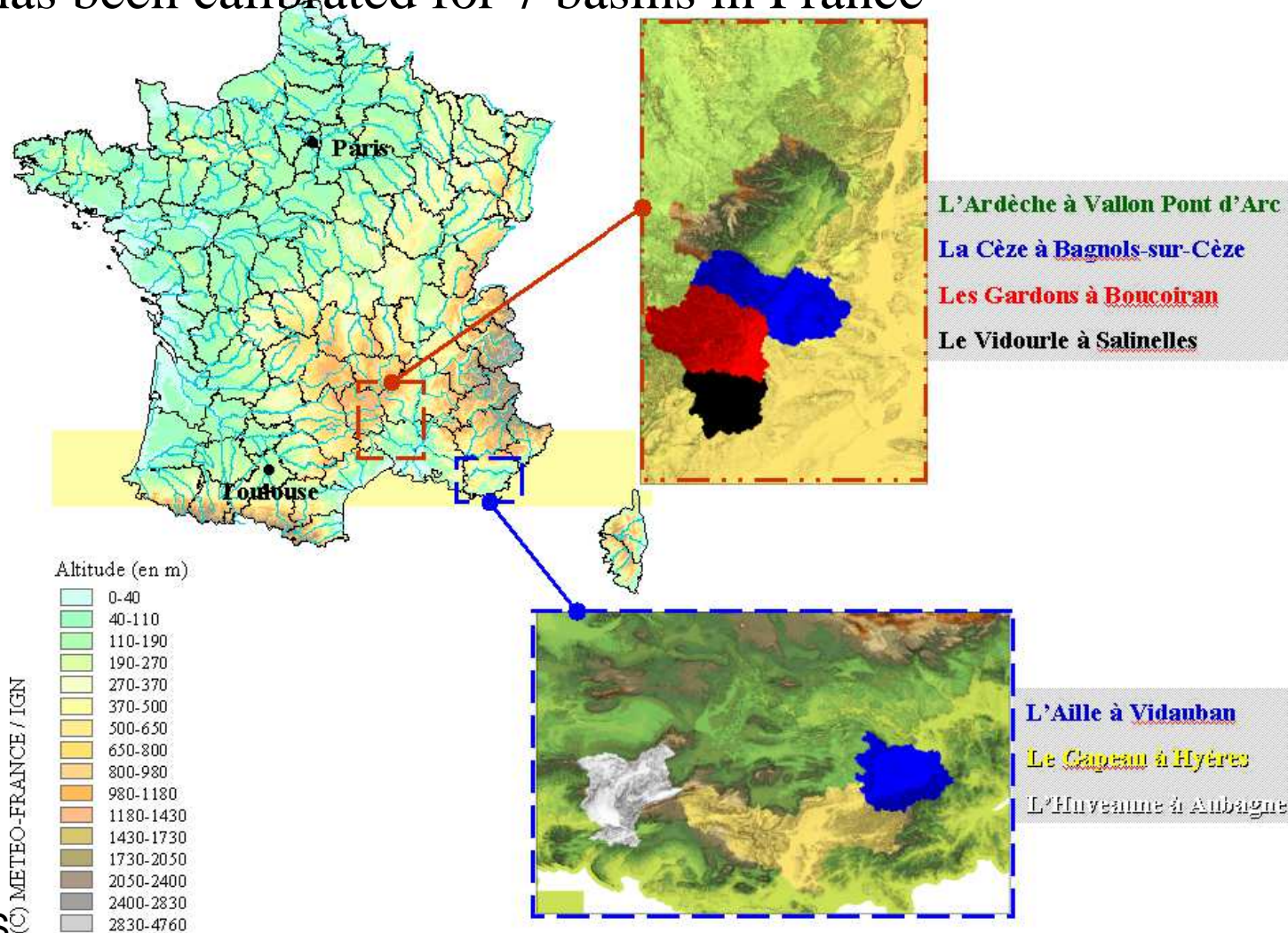
$\delta x = 50\text{m} / \delta t = 1\text{h}$

Coupling of ISBA-TOPMODEL for flash flood prediction

GMME

1
3

- ISBA-TOPMODEL used to simulate Mediterranean flash flood events
- System has been calibrated for 7 basins in France



ISBA-TOP: Towards operational prediction of Mediterranean flash floods

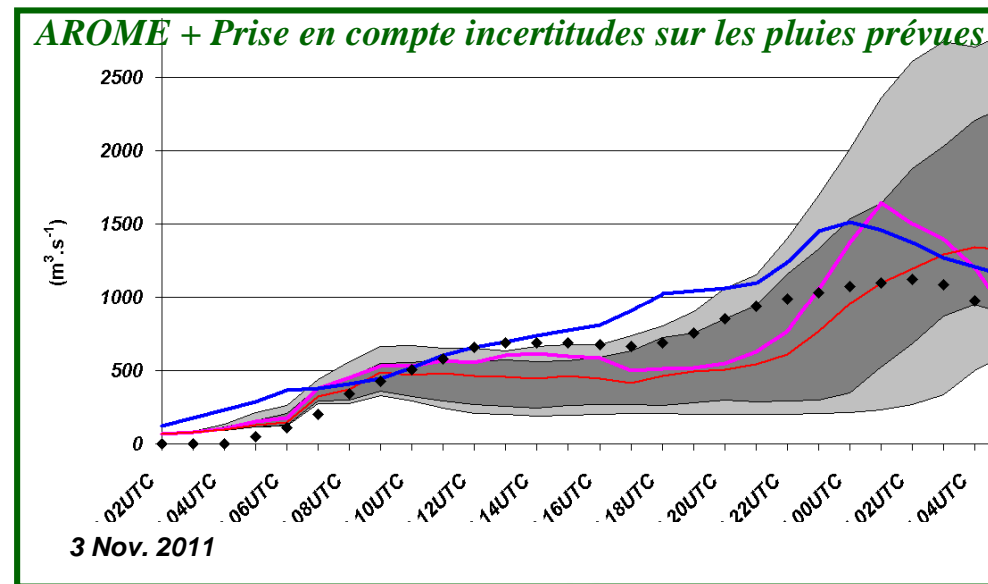
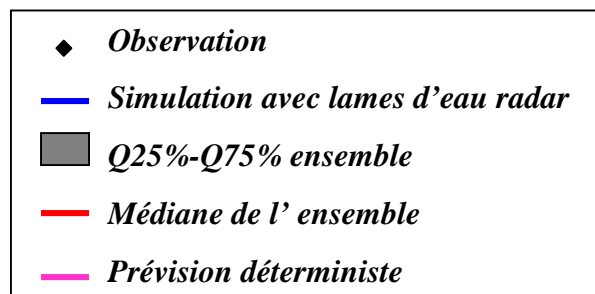
GMME

1
4

In *simulation* mode, meteorological forcing from obs (SAFRAN analysis, precipitation from radar,...)

In *deterministic forecast* mode, forcing from AROME (take advantage of high resolution)

BUT in the latter mode, it is necessary to account for uncertainty w/r/t the **rainfall forecast** →
Use a *forecast ensemble* of discharge output (under the auspices of HYMEX)



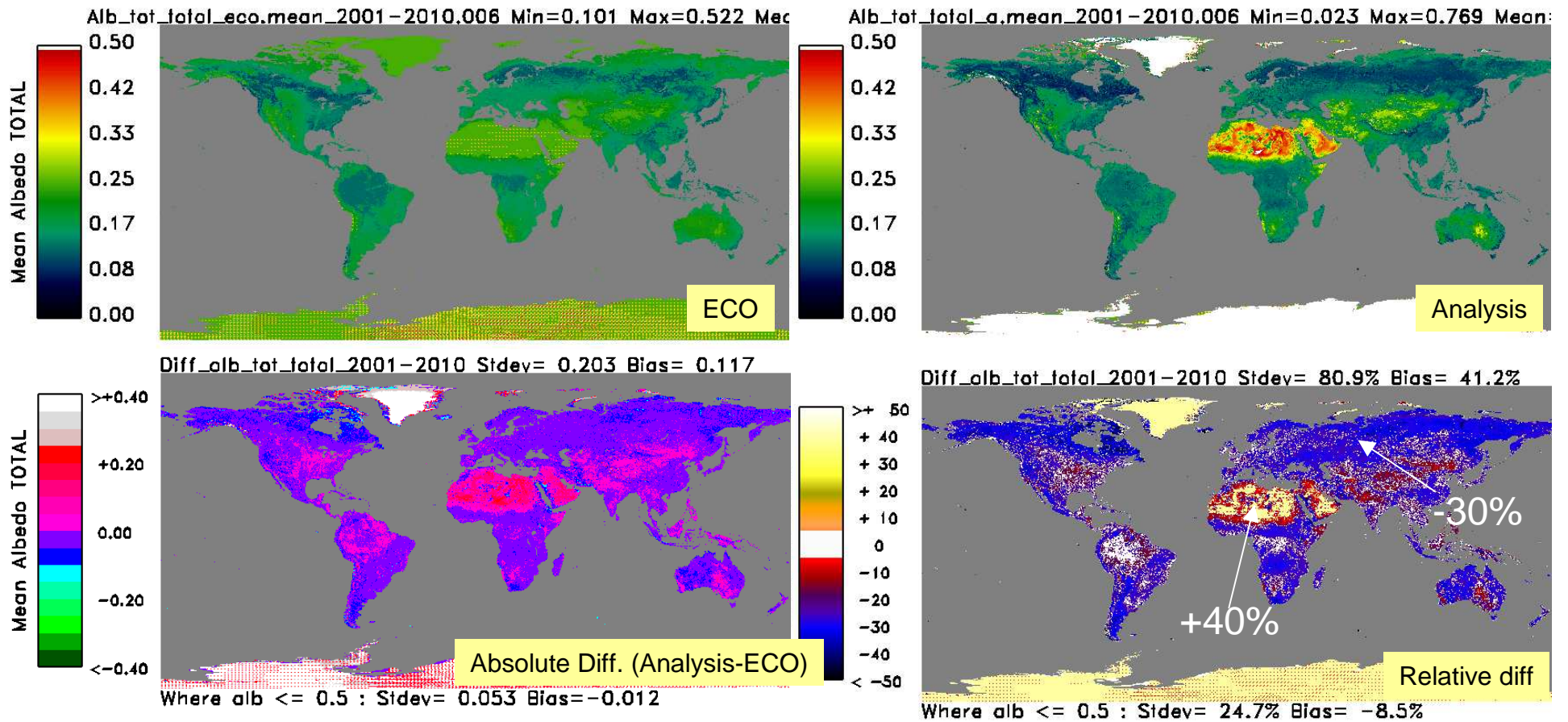
Prévision d'ensemble des débits pour les Gardons à Ners-Boucoiran :

3 nov. 2011 @ 02UTC - 4 nov. 2011 @ 04UTC



New ECOCLIMAP surface albedo cycle

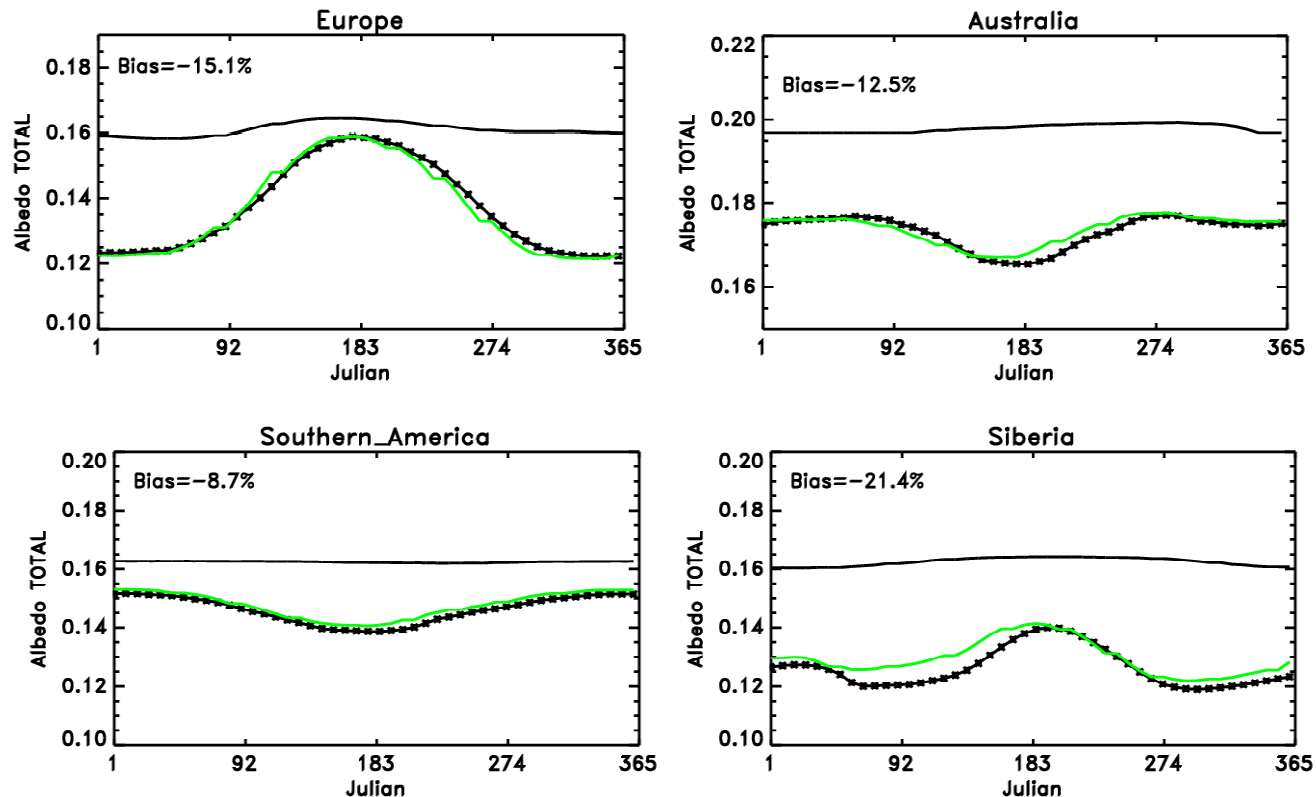
Total Albedo ECOCLIMAP vs. analysis from 10-year MODIS data [2001-2010]



New ECOCLIMAP surface albedo cycle

GMME

1
6



New annual mean of the ECOCLIMAP surface albedo cycle (green line) in comparison to the analyzed albedo from MODIS data averaged over the whole period 2001-2010 (black dotted line) and the current ECOCLIMAP surface (black line). The annual bias (Analysis-ECOCLIMAP) is indicated at the left top corner.



SURFEX SSC Meeting, March 28, 2013



SURFEX Benchmarking

- Objective : compare quickly 2 versions of SURFEX globally against flux tower measurement.
- WFEI forcing (ERA-I + correction)
- FLUXNET open access database, 30 min outputs
- All default parameters (vegetation, soil,...)
- Analysis of H,LE, RN and CO2 fluxes.
- Generate graphs and statistics
- 114 0.5° grid points / 150 FLUXNET sites.
- Limitation : global forcing / local observation
- PALS (Protocol for the Analysis of Land Surface models) - standard land surface model benchmarking, local scale. Part of ILAMB

S. Lafont

