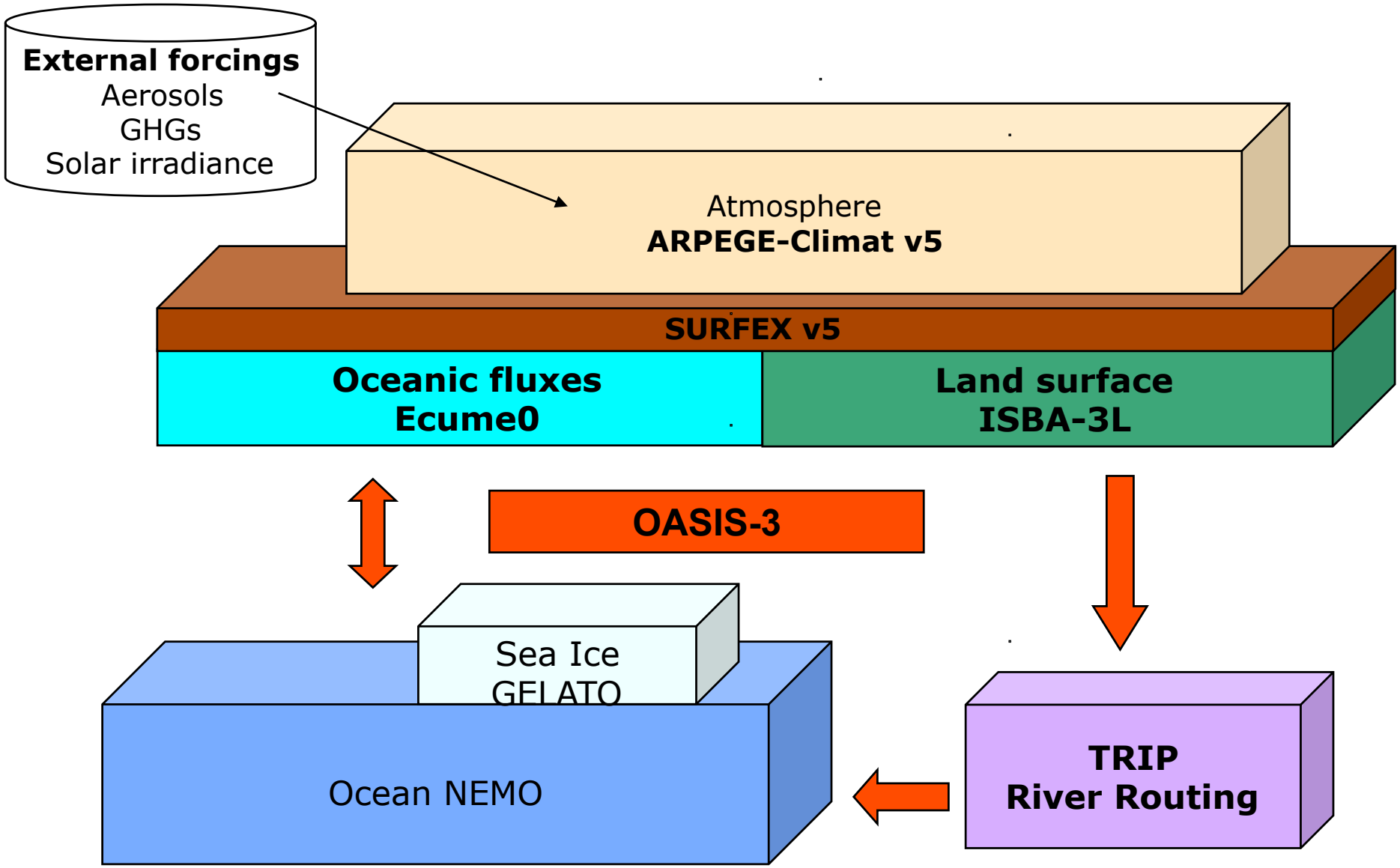
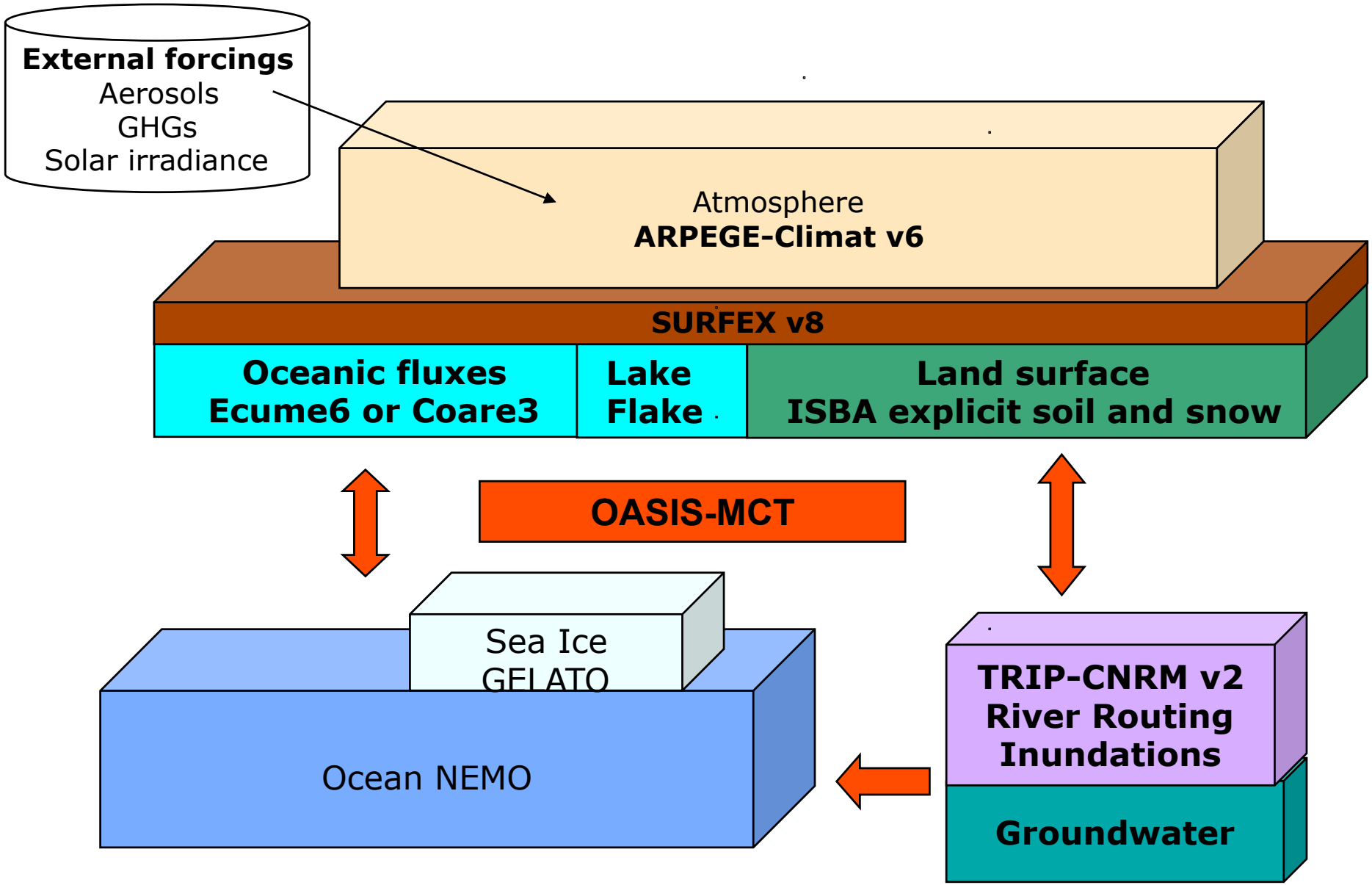
Modélisation des surfaces continentales au CNRM

Bertrand Decharme, Jeanne Colin, Aurore Voldoire, David Saint-Martin et al.

SURFEX-TRIP pour CNRM-CM5



SURFEX-TRIP pour CNRM-CM6



SURFEX-TRIP pour CNRM-CM6

SURFEX-TRIP	Evaluation Off-line	Evaluation On-line	Publications
Flake (schéma de lac)	Ok	Ok	(offline) LeMoigne et al. 2013, Tellus A (offline/online) LeMoigne et al. 2015, à soumettre
Gelato-1d pour run AMIP	Ok	Ok	
Ecume6	En cours	En cours	
Albédo Land MODIS	Ok	Ok	(Methodologie) Carrer et al. 2014, RSE
Explicit diff. 14 couches	Ok	Ok	(Offline) Decharme et al. 2011, JGR (Offline) Decharme et al. 2013, JGR
Explicit Snow 12 couches	Ok	Ok	(Offline) Decharme et al. 2015, soumis, The Cryopshere D.
Végétation interactive et Cycle du carbone	Ok	Ok	(Offline) Joetzjer et al. 2015, GMD (Online) Séférian et al. 2015, en revu, GMDD
Albédo Océan Diff / Dir	Ok	Ok	(Online) in prep
Aquifères	Ok	OK	(offline) Vergnes et al. 2012, J. Hydromet. (offline) Vergnes and Decharme 2012, HESS (offline) Vergnes et al. 2014, JGR
Inondations	Ok	En cours	(offline) Decharme et al. 2008, JGR (offline) Decharme et al. 2012, Clim. Dyn.

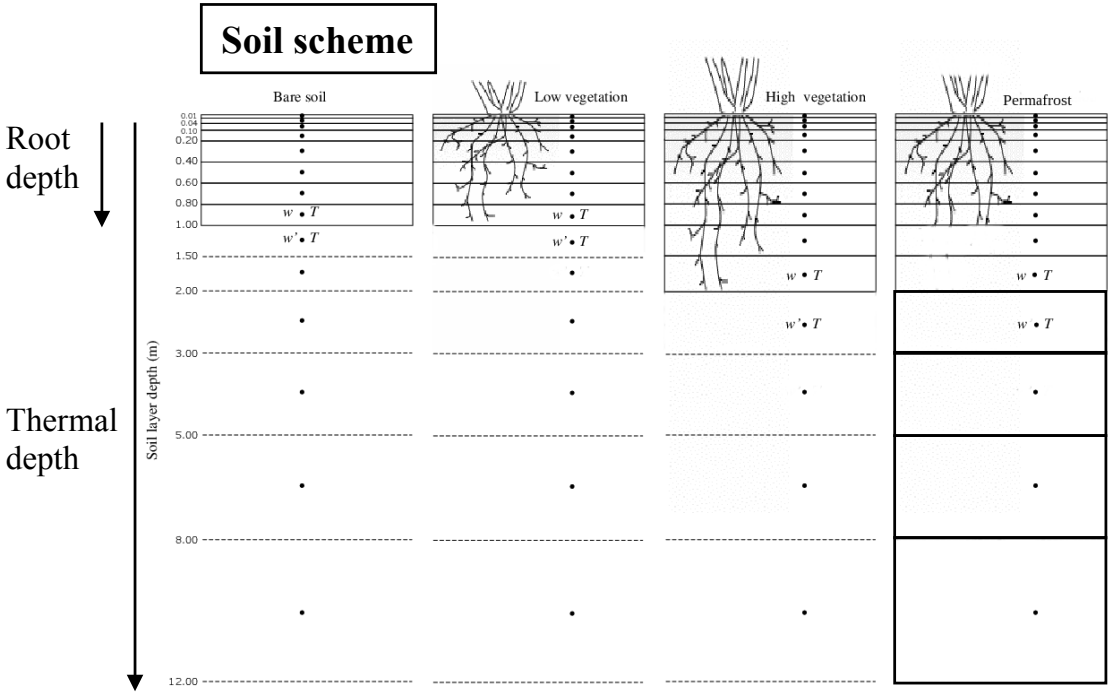
SURFEX sol et neige pour CNRM-CM6

- 14 soil layers over 12m « thermal » depth (Fourier law)

- Soil/Root « hydrological » depth varies according to 12 PFT (1m for bare soil, ~1.5m for grass/crop, ~2m forest, 8m for tropical forest)

- 12 snow layers within an Explicit Snow scheme

- Effect of soil organic carbon on thermal and hydrological soil properties



(Decharme et al. 2013, JGR)

Snow scheme	New version (based on Crocus)
Layers	12 (adjusted only if thickness of layer 1, 2 or 12 become too large)
Albedo	3-bands: 1 visible + 2 nir accounting for snow grain size (Brun et al. 1992)
Compaction/Settling	Viscosity from Brun et al. (1992) (accounting for liquid water) Surface compaction during wind drift (Brun et al. 1997)
Thermal conductivity	Yen et al. (1981) Interfacial harmonic average

(Decharme et al. 2015, Submitted)

Validation “offline” du schéma de sol sur la France

Forcing
SAFRAN
1-hr, 8km, 1992-2012
20 years Spin up (4 x 1992-1996)

Vegetation & Soil parameters
ECOCLIMAP & HWSD (1km)
PFTs, LAI, Clay, Sand, etc…

SURFEX
(ISBA + MODCOU)

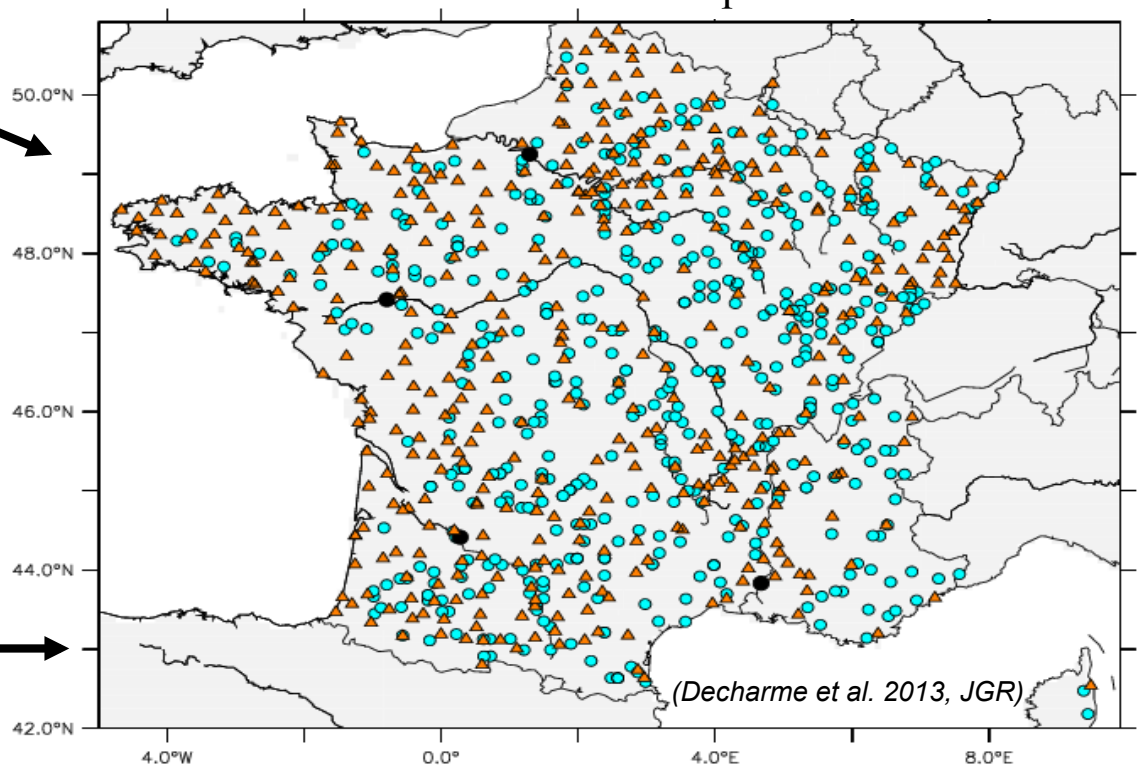
Soil temperature

Runoff & Drainage

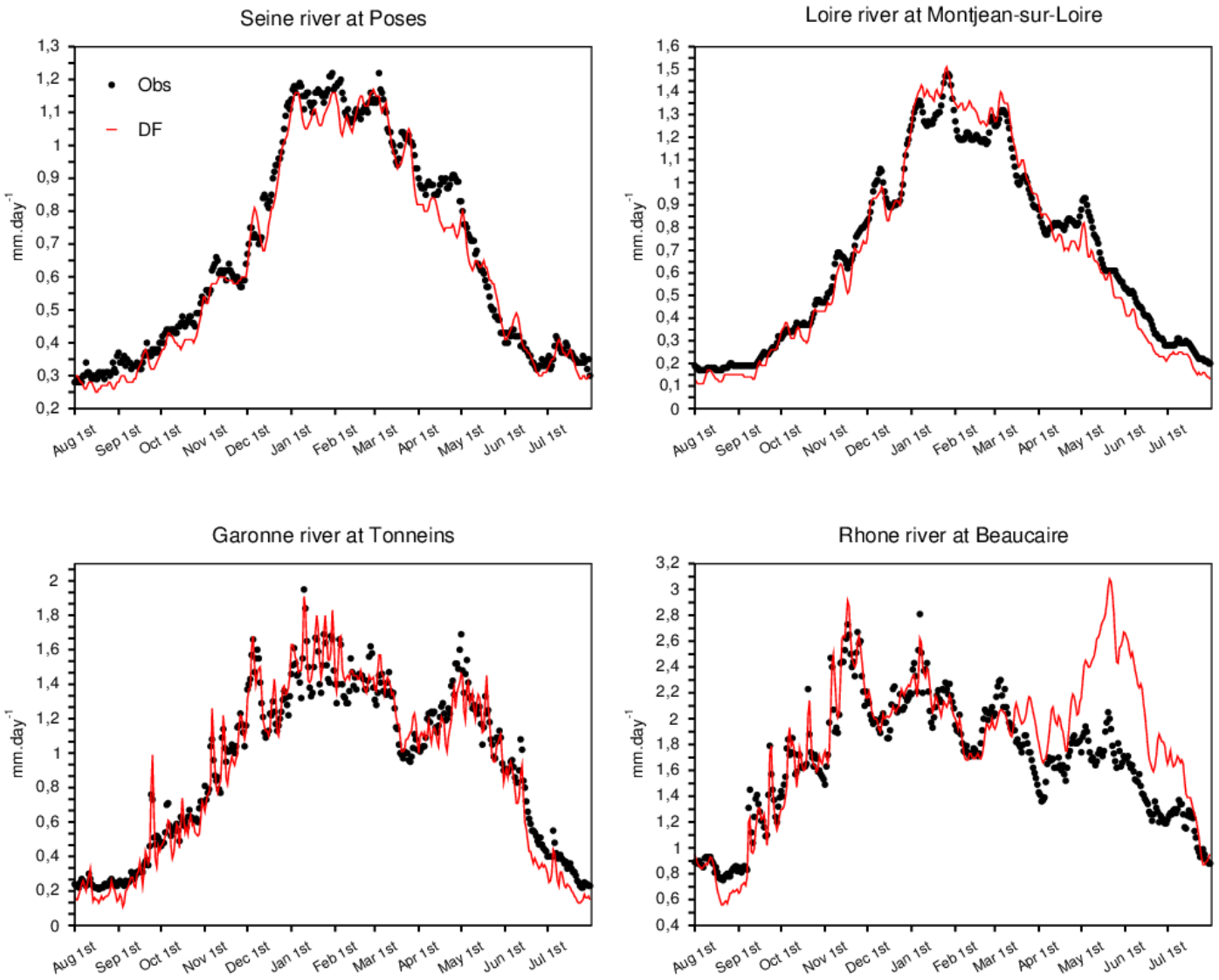
MODCOU

Discharges

Discharges and Soil Temperature stations

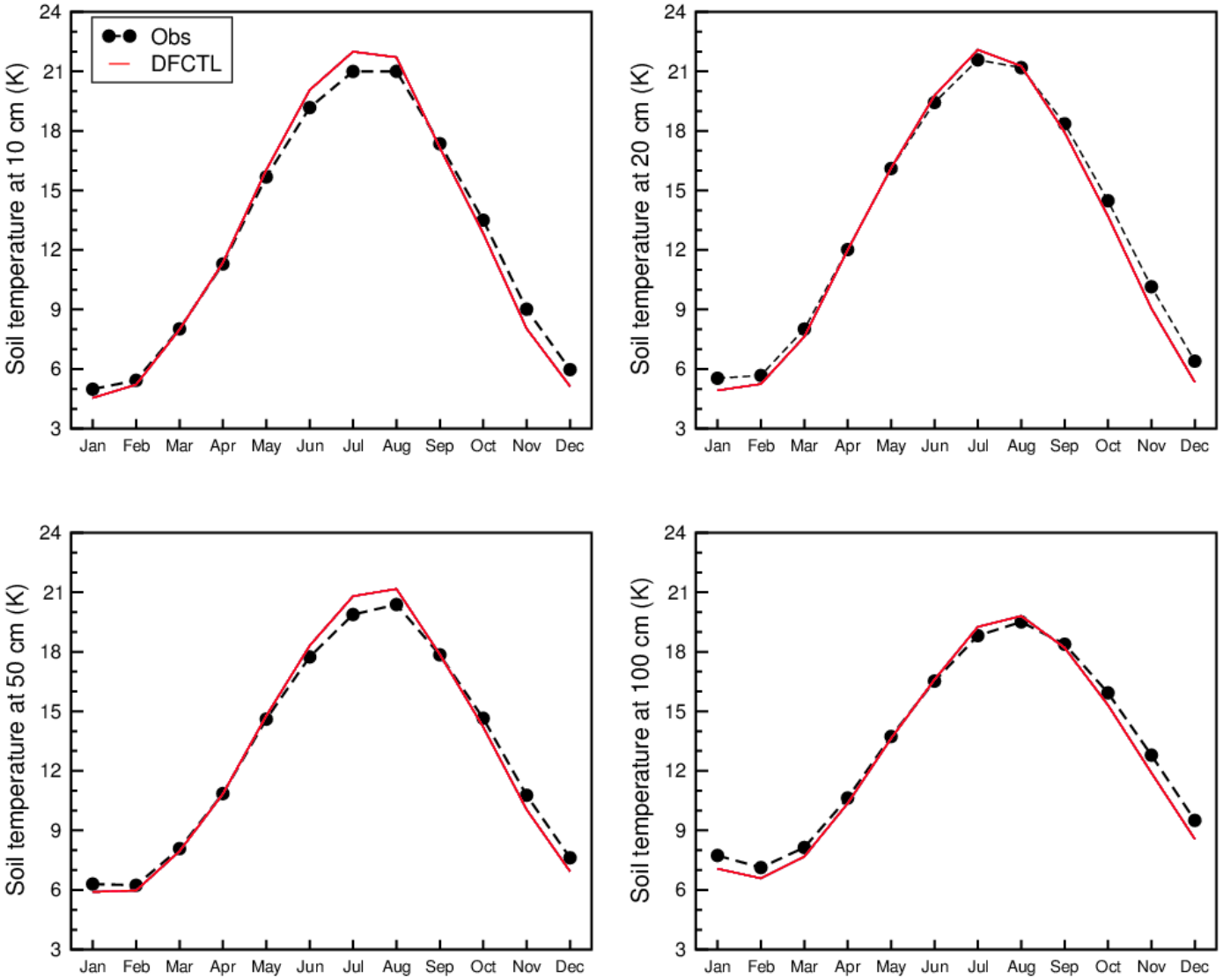


Discharges: daily climatology over 1992 – 2012



(Decharme et al. 2013, JGR)

Soil Temperature: monthly climatology over 1992 – 2012



(Decharme et al. 2013, JGR)

ISBA Explicit Snow and Soil Validation over Siberian data

Forcing

ERA-I. Reanalysis + GPCC

3-hr, 0.5°, 1979-1993

100 years Spin up (10 x 1979-1988)

Soil parameters

HWSD (1km)

Clay, Sand, Topsoil and Subsoil OC

SURFEX

(ISBA)

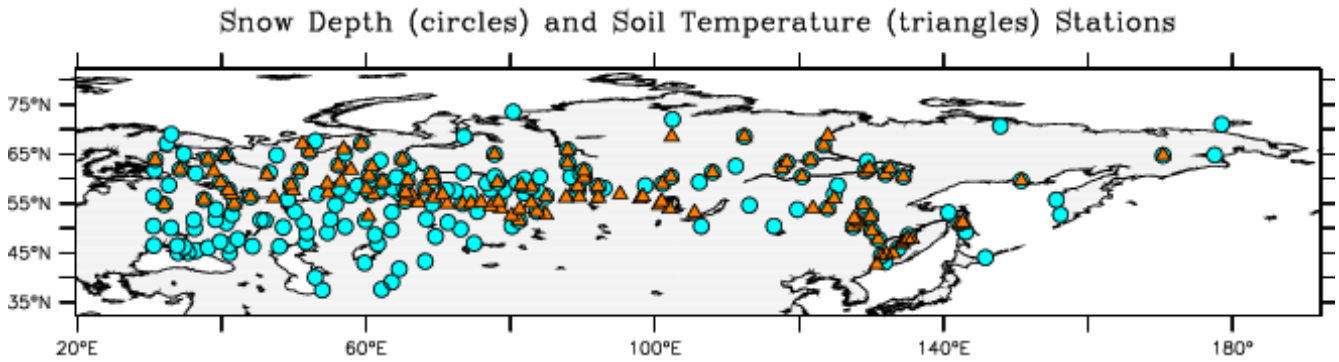
Snow depth

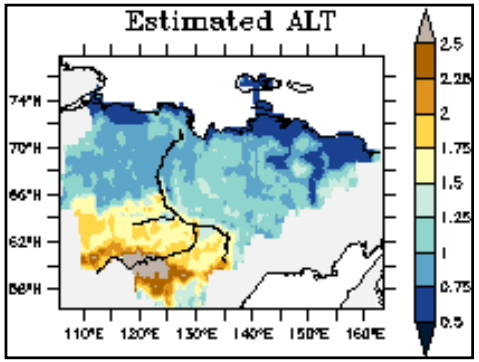
Soil temperature

« open field only »

Active Layer Thickness

over Yakutia



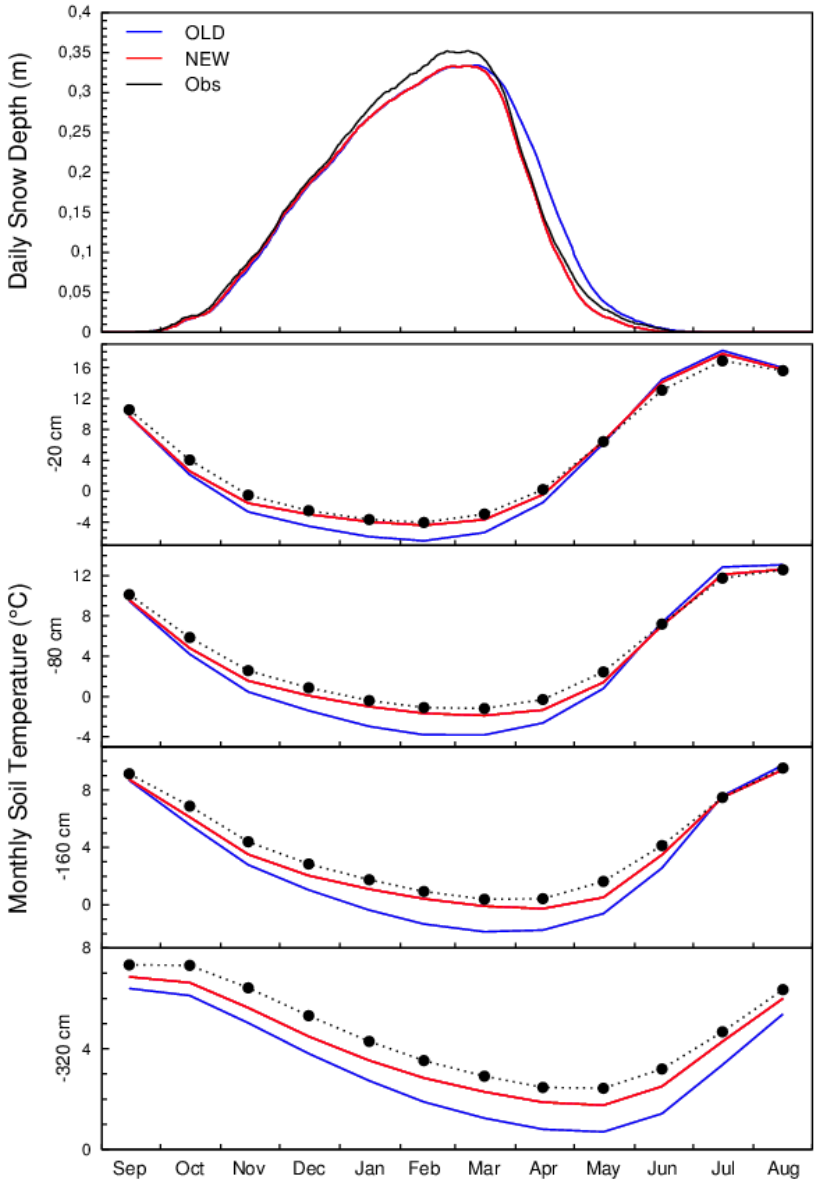


From Beer et al. [2013]

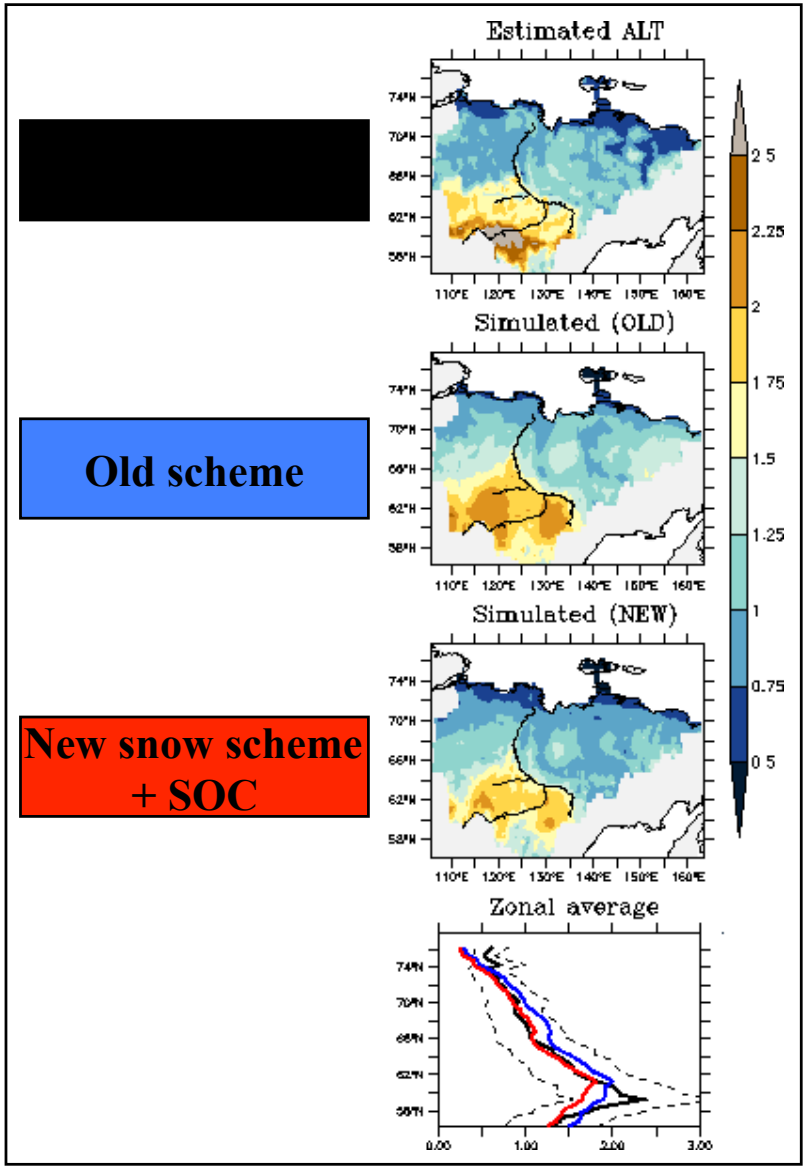
(Decharme et al. 2015, Submitted)

Offline validation over Siberian data (1979-1992)

Snow depth and soil temperatures



Maximum Active Layer Thickness



Comparaison « on-line » SFX-CM5 vs. SFX-CM6

Pérode 1979-2007

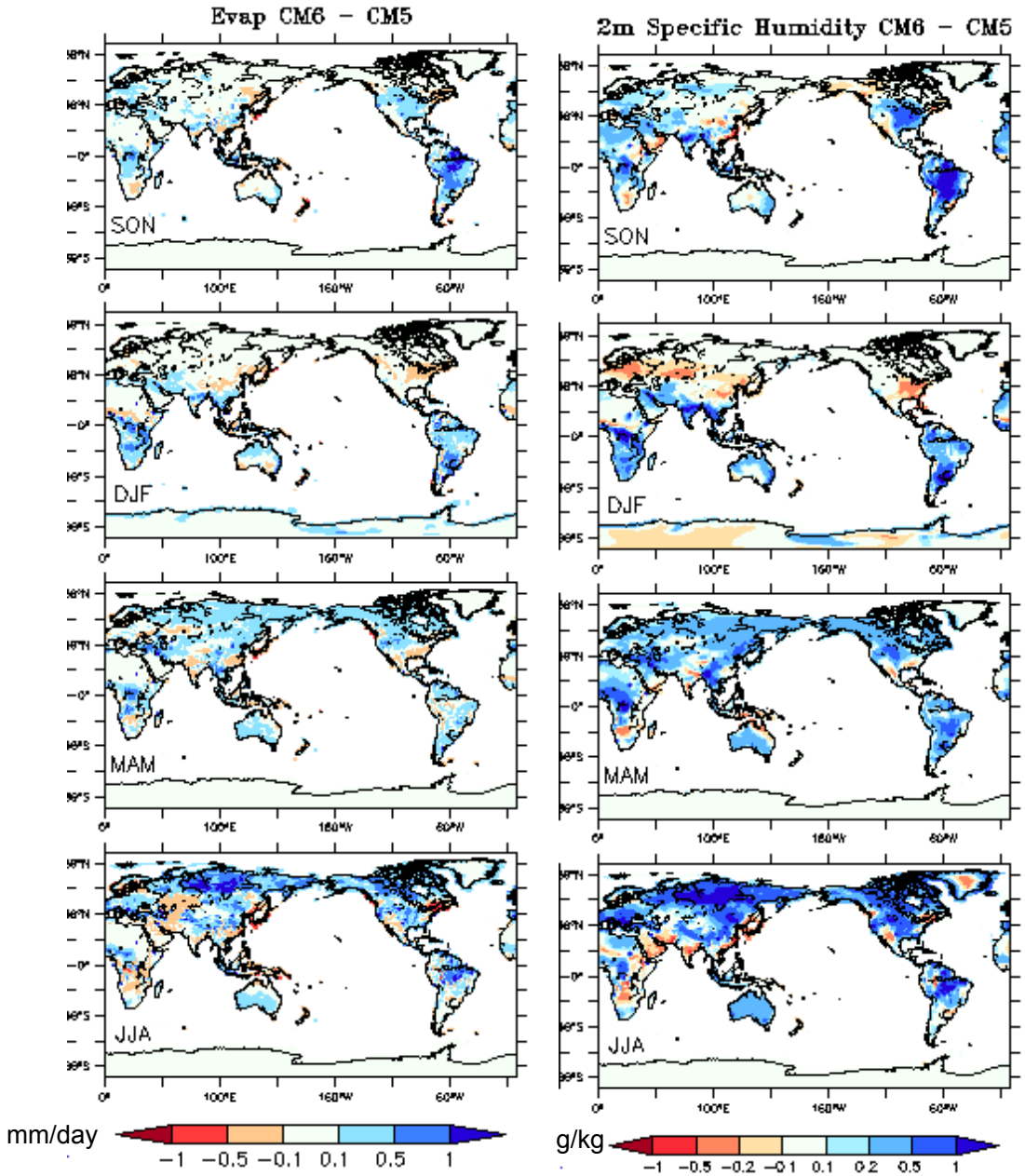
Même physique atmosphérique (Arpègev6) :

Même Albedo MODIS

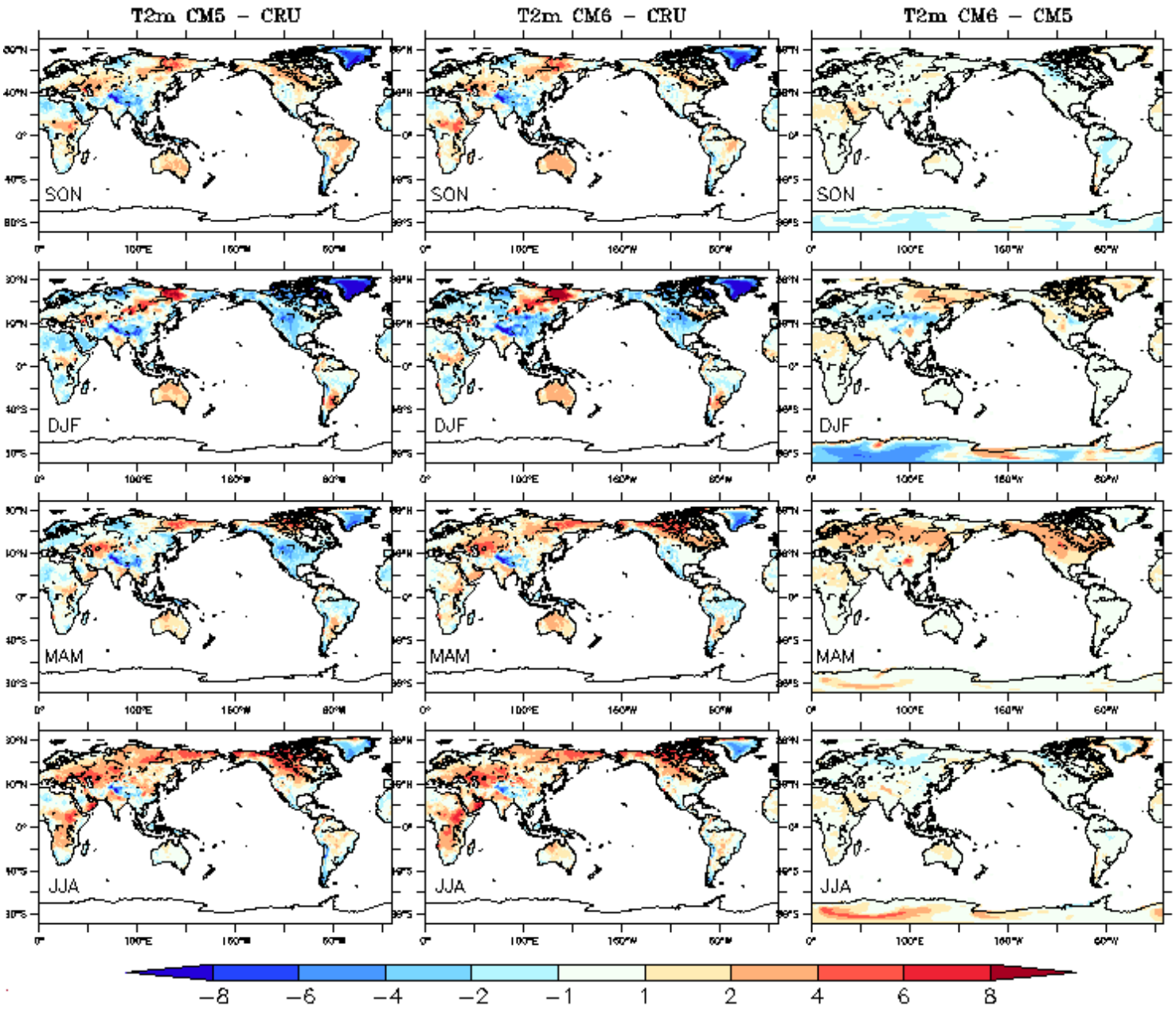
Flake activé dans les 2 cas suivant :

-CM5 : ISBA 3L + neige 1L

-CM6 : ISBA 14L + neige 12L + groundwater



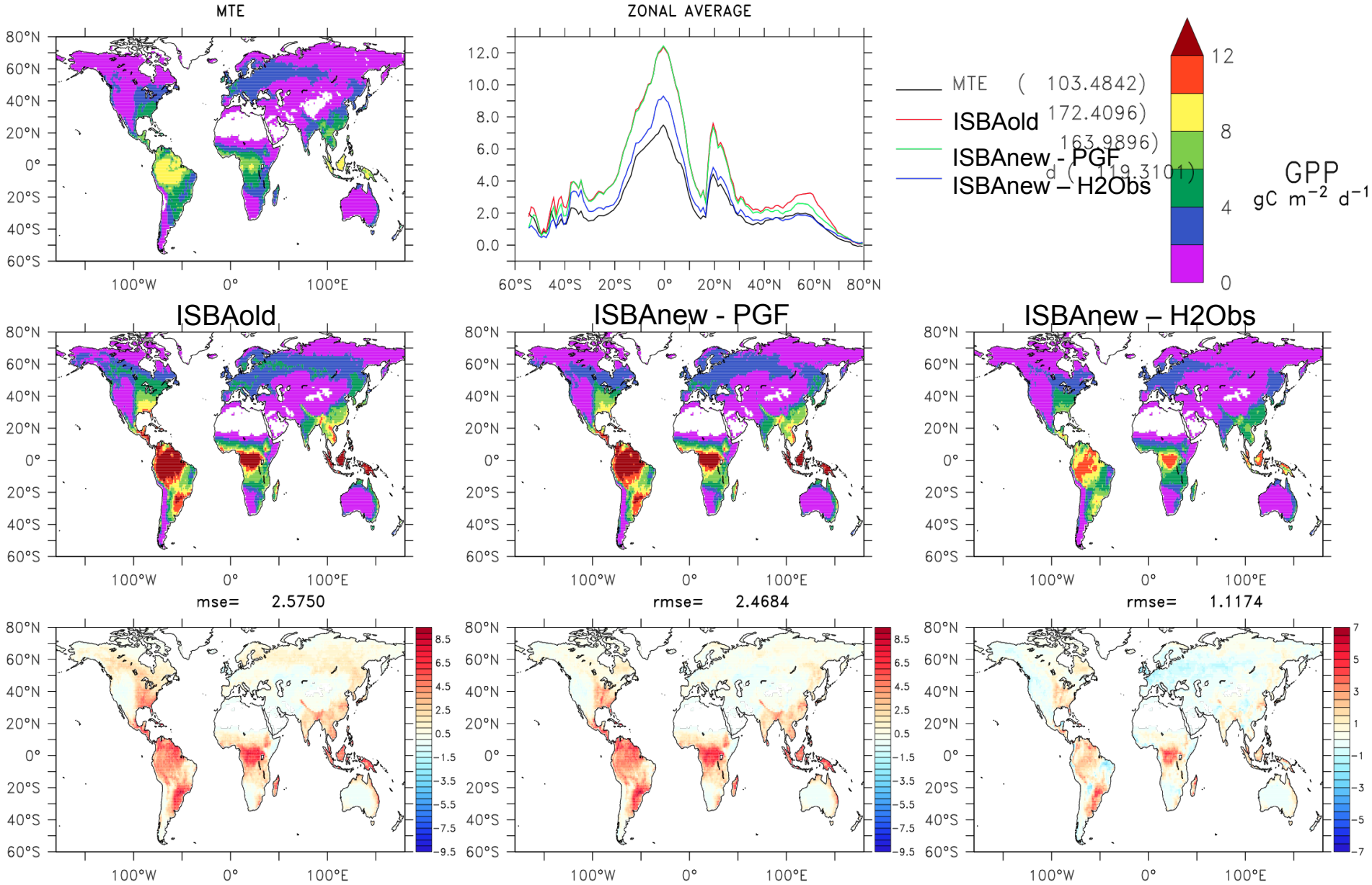
Biais T2m « on-line » SFX-CM5 vs. SFX-CM6



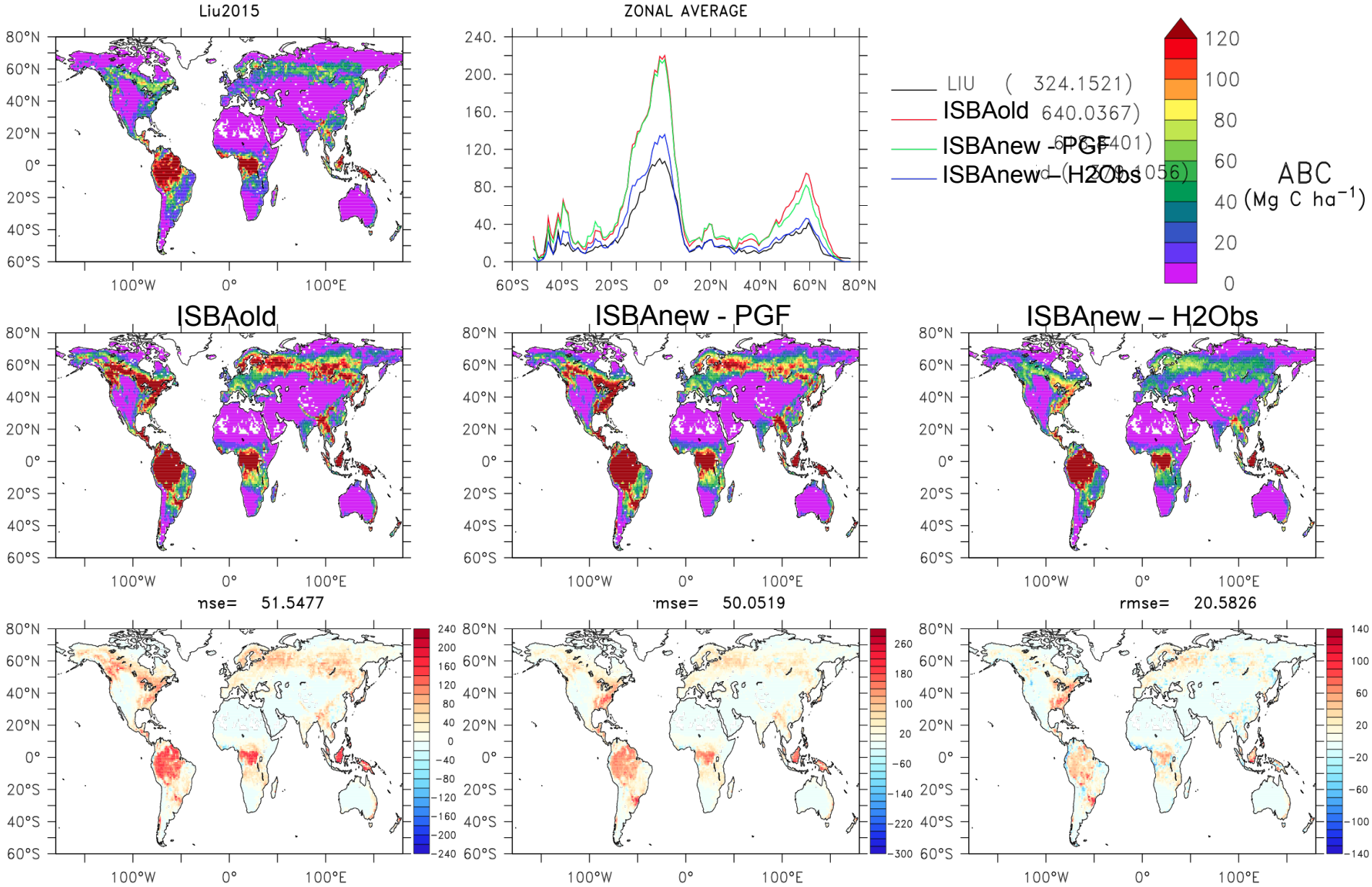
SURFEX-TRIP pour CNRM-ESM2

SURFEX-TRIP	Evaluation Off-line	Evaluation On-line	Modifications/améliorations
Végétation	Ok	Ok	Passage à 19 PFTs séparation par biomes boréaux/tempérés/tropicaux
Photosynthèse	Ok	En cours	Calibration à partir de la base TRY
Limitation azote	Ok	En cours	Revisité sur la base des travaux de Yin et al., 2002 (loi allométrique)
Respiration autotrophe	Ok	En cours	Application des travaux Joetzjer 2015 aux autres PFTS
Feux naturels	Ok	Ok	Implémentation de GlobFirm/IFM + couplage hydrologie 14-L
Land-use	En cours	…	Implémentation et adaptation des PFTs à Hurrt et al.

Comparaison GPP SURFEXv7 vs SURFEXv8



Comparaison Biomasse SURFEXv7 vs SURFEXv8



Feux naturels dans SURFEXv8