I-GEM
Contribution from the CNRM

8 October 2015

- Contribution overview
- Brief review of SURFEX (ISBA land surface model)
- Task 1 : Evaluation of the offline reference experiment (CFref)
- Task 1 : Idealized offline WTD experiments vs. CFref

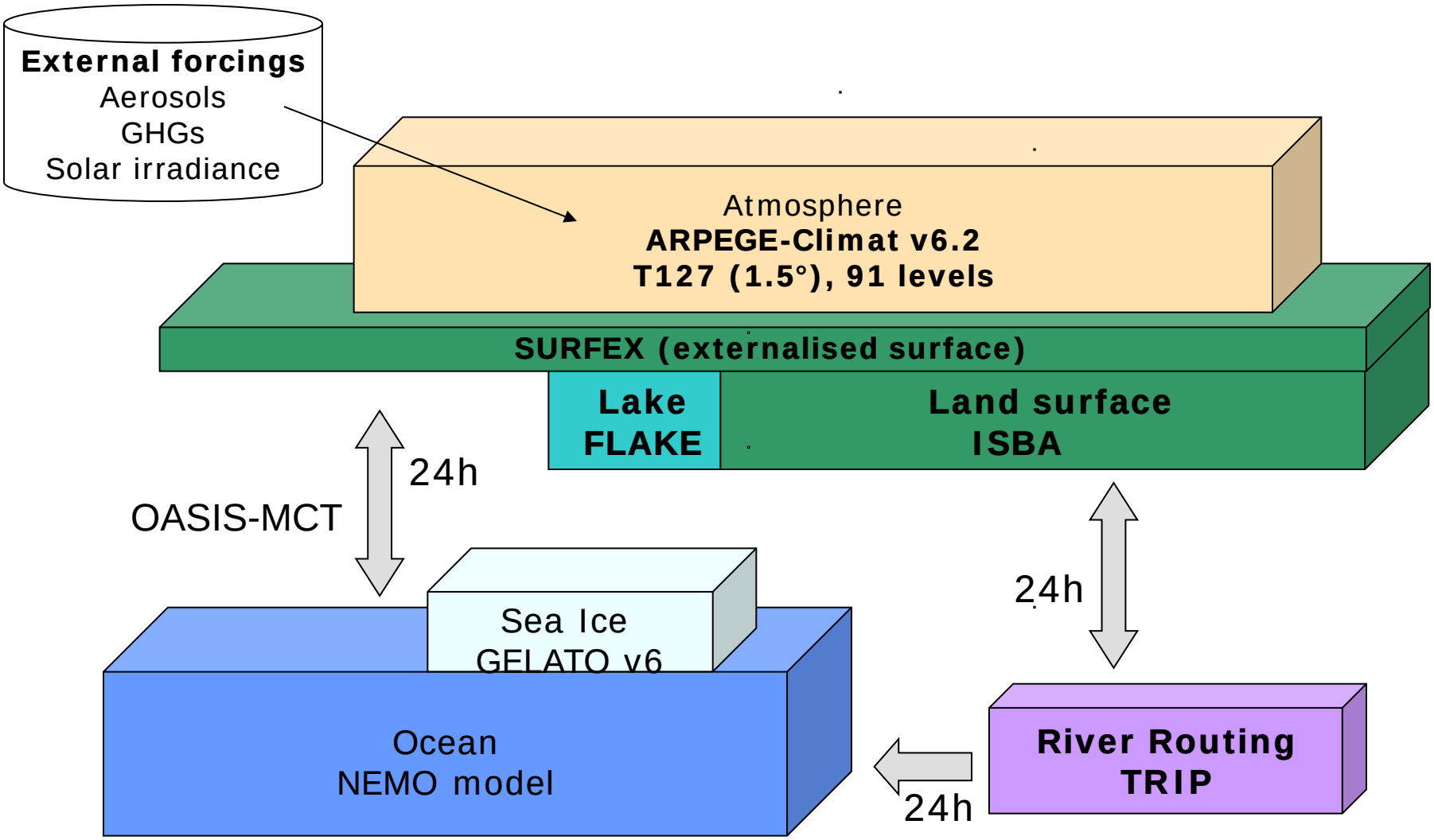
Project contribution at CNRM

- Team (13 pers.month):
  - Bertrand Decharme: Senior Scientist (CNRS), 5 pers.month
  - Jeanne Colin: Research engineer (Météo-France), 5 pers.month
  - Sophie Tytecas: Technician (Météo-France), 3 pers.month

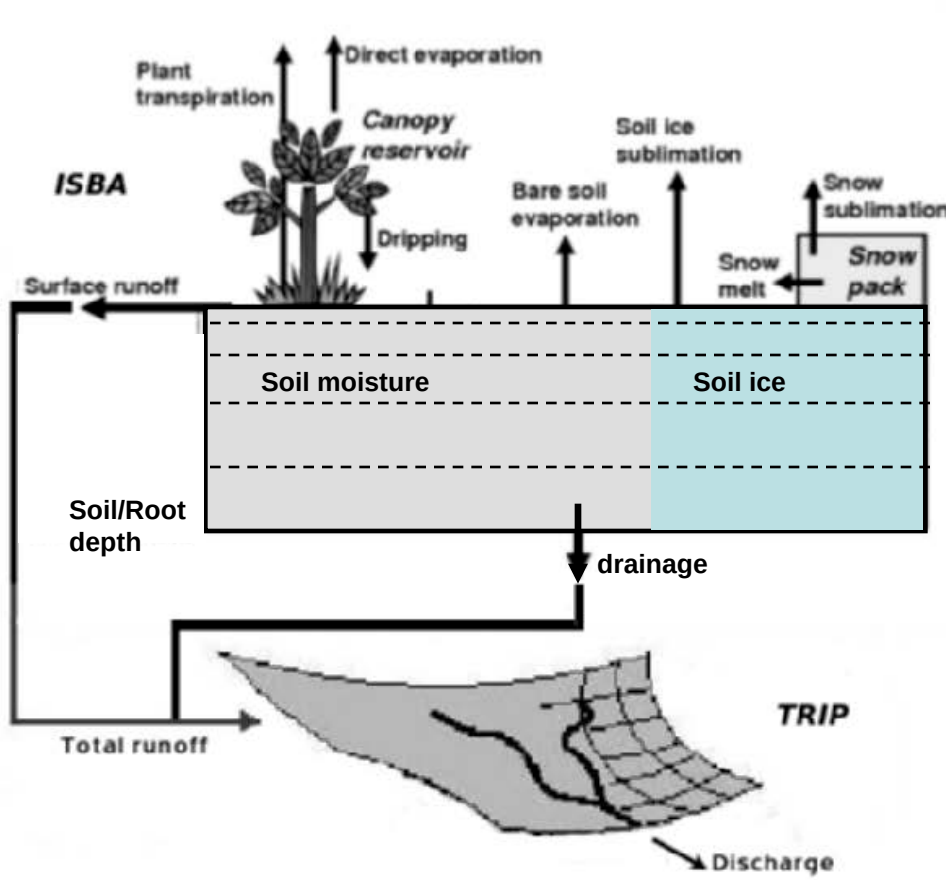
- Budget = 21 000 Euros
  - A large part (15 000 Euros) was used this year to buy bay storage with 26 To and 1 computation node for our server

- Involvements:
  - CNRM contributes to all the tasks only to perform the required simulations
  - Supply of all model outputs required by the project

CNRM-CM6 climate model



SURFEX (ISBA) and TRIP for I-GEM



(Alkama et al. 2010; Decharme et al 2011)

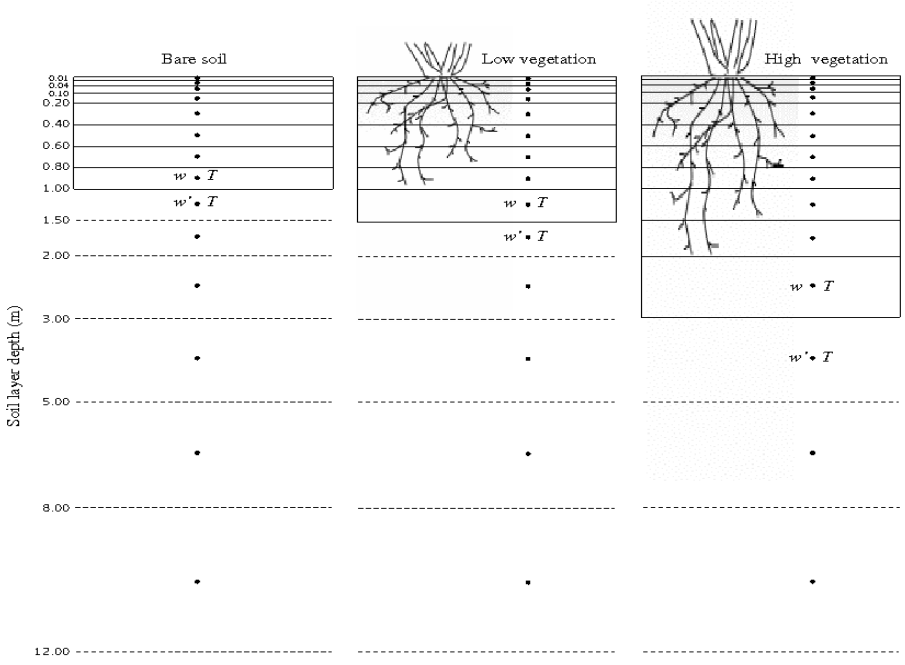
SURFEX (ISBA) for I-GEM

•14 soil layers over 12m « thermal » depth

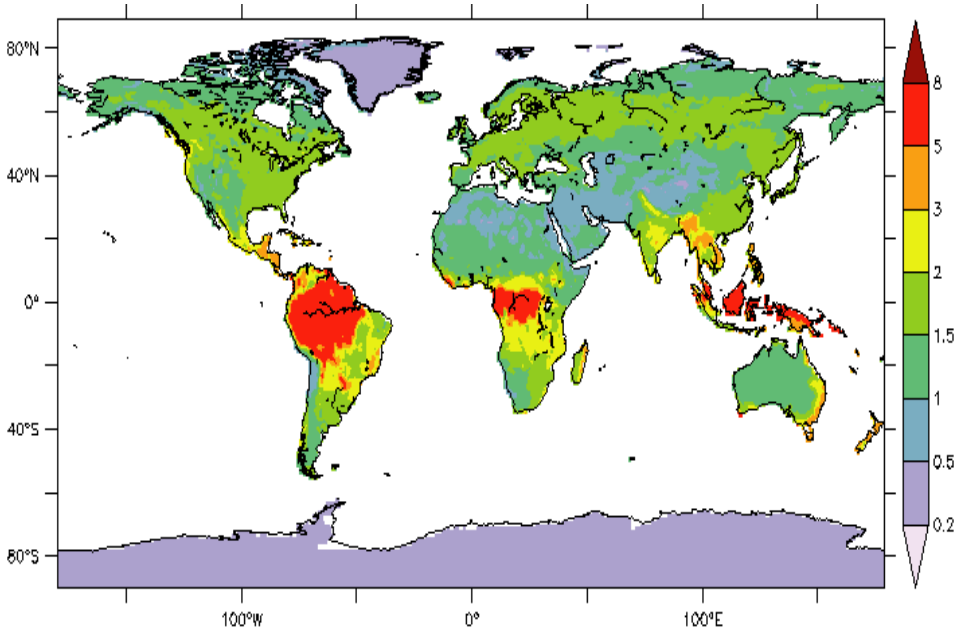
•12 PFT of vegetations where Soil/Root « hydrological » depth varies according to vegetation types (1m for bare soil, ~1.5m for grass/crop, ~2m forest, 8m for tropical forest)

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

•Explicit Snow scheme with 12 snow layers



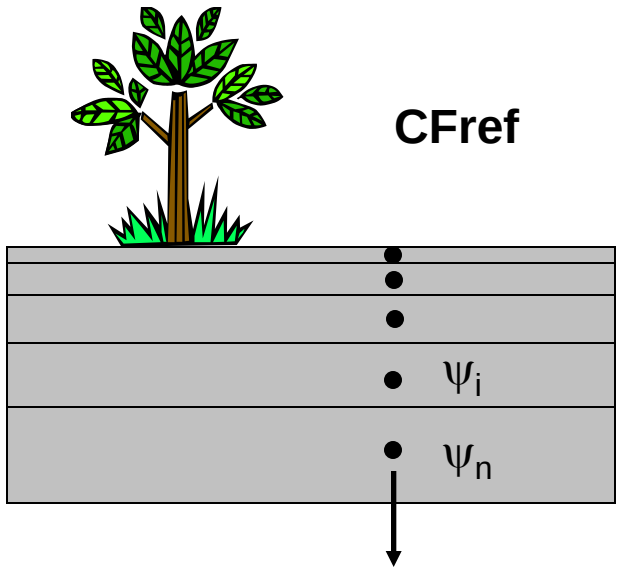
Example of soil vertical grid by PFT
(Decharme et al. 2013)



Grid-average Soil/Root depth at 1° resolution

Simulations for Task 1

- Offline simulations at 1° resolution with PGF forcing:
  - CFref = reference simulation
  - 7 simulations with prescribed WTD at 0.5, 1, 2, 3, 5, 8, 10 m
  - Available at ftp://140.112.66.75/igem/CNRM/task1_offline/
- On-Line simulations with the same configuration
  - T127 (1.5°x1.5°) with 91 vertical levels
  - Available at the end of this winter



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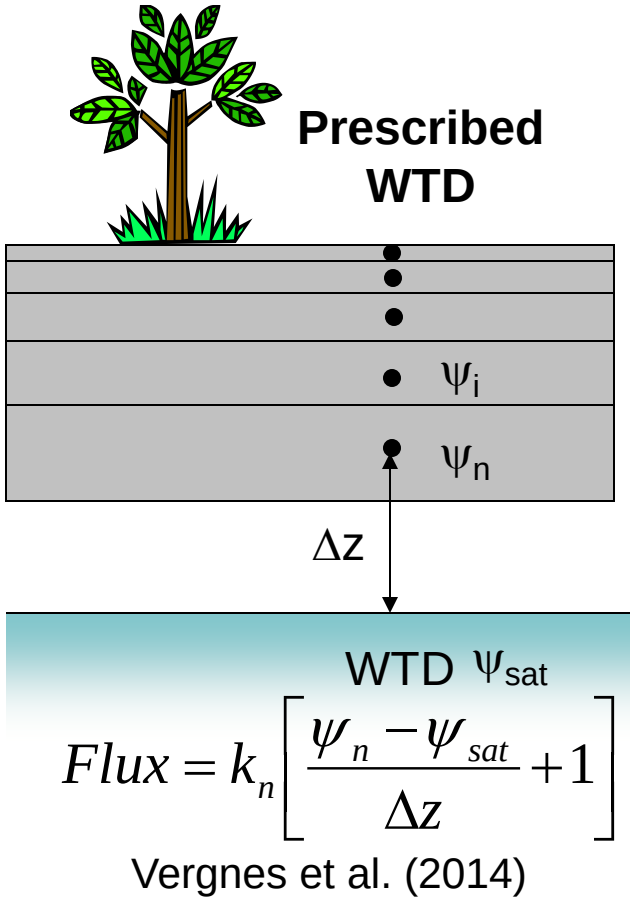
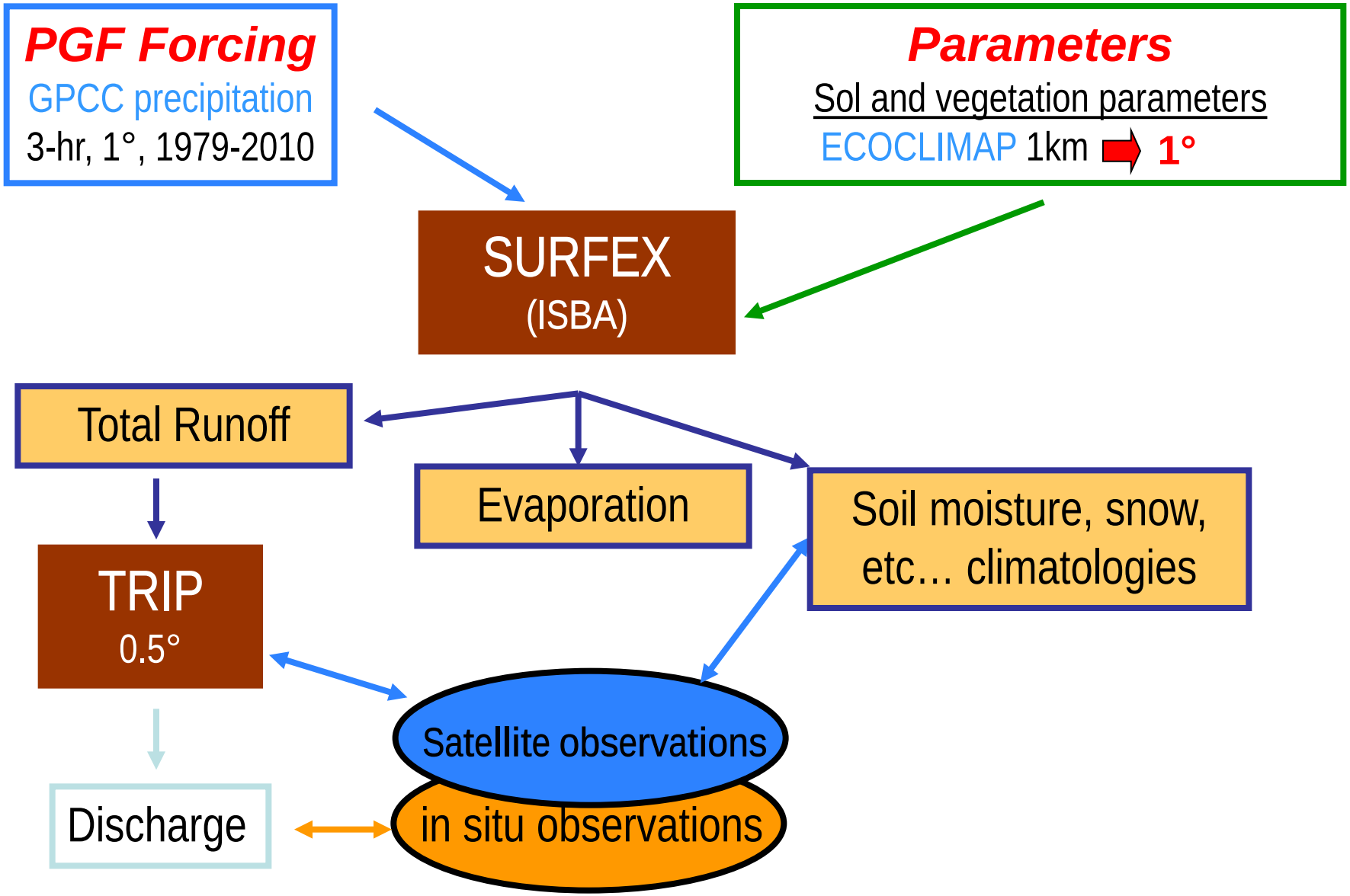


Vergnes et al. (2014)

If WTD is into the ISBA soil : Saturation is imposed in each soil layers below the WTD

CFref simulation protocol and evaluation



CFref Evaluation - TWS

Gravity Recovery and Climate Experiment (GRACE)

Monthly terrestrial water storage (TWS) variation estimates based on earth's gravity field (spatial scale about 300-400 km resolution)

3 products over the 2002 – 2014 period :

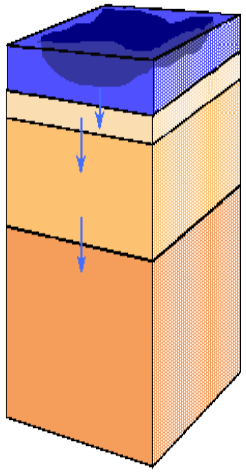
- GeoForschungZentrum (**GFZ**)
- Center for Space Research (**CSR**)
- Jet Propulsory Laboratory (**JPL**)

→ TWS model variations are compared to the **mean of the 3 GRACE products**

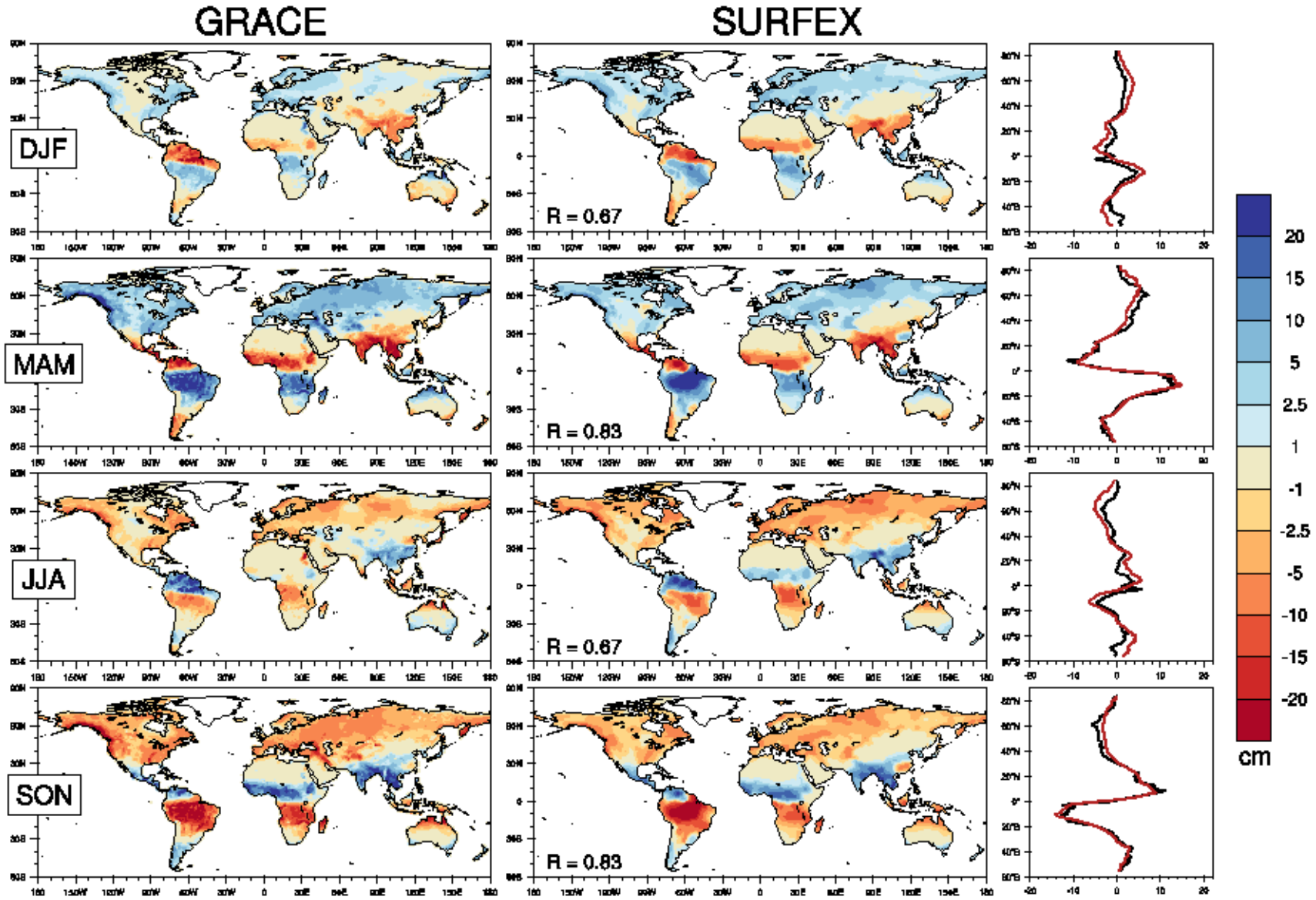
TWS from model compared with GRACE **anomalies.**

Terrestrial water storage TWS

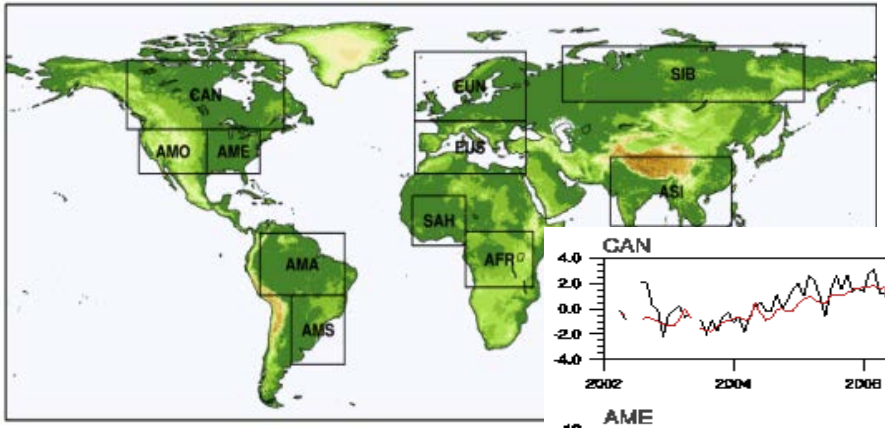
- **surface water (river reservoir)**
- **+**
- **snow + vegetation**
- **+**
- **soil moisture**
- **+**
- **Groundwater (not present)**

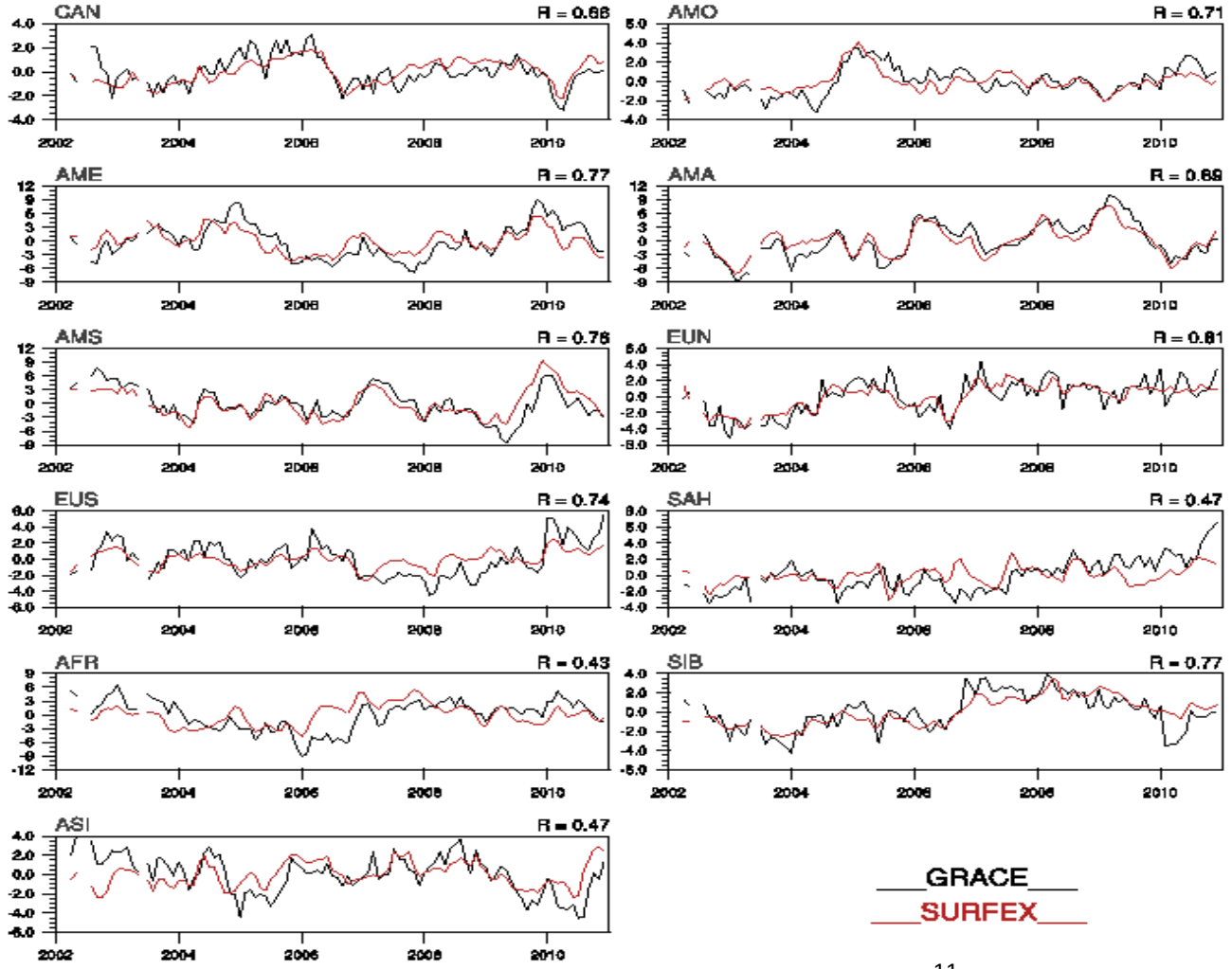


CFref Evaluation – Seasonal TWS (2002-2010)

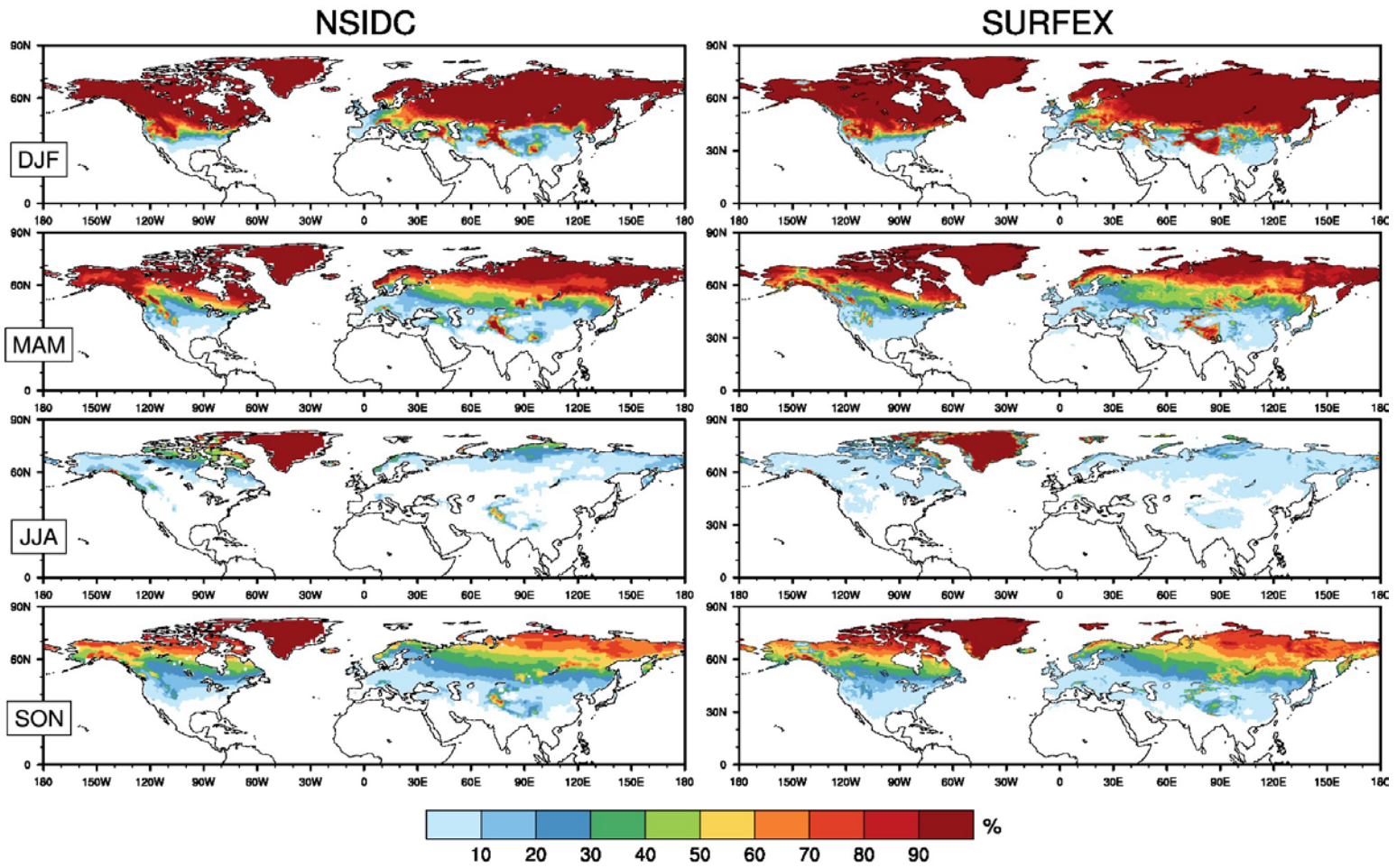


CFref Evaluation – TWS monthly anomalies (2002-2010)





CFref Evaluation – Snow cover extend (1979-2010)



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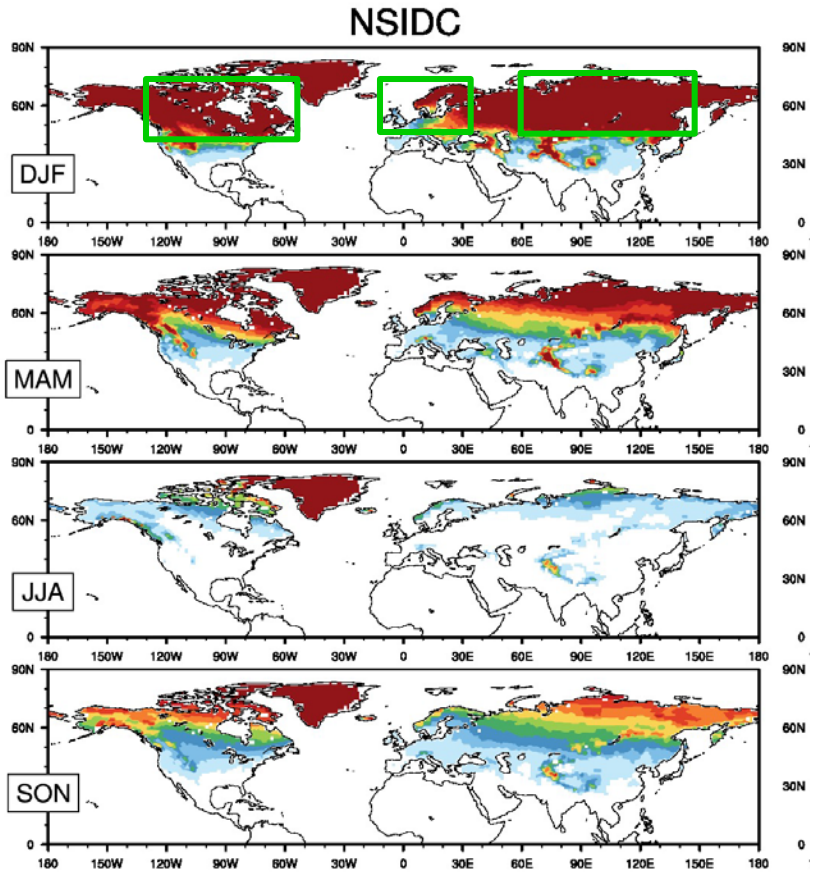
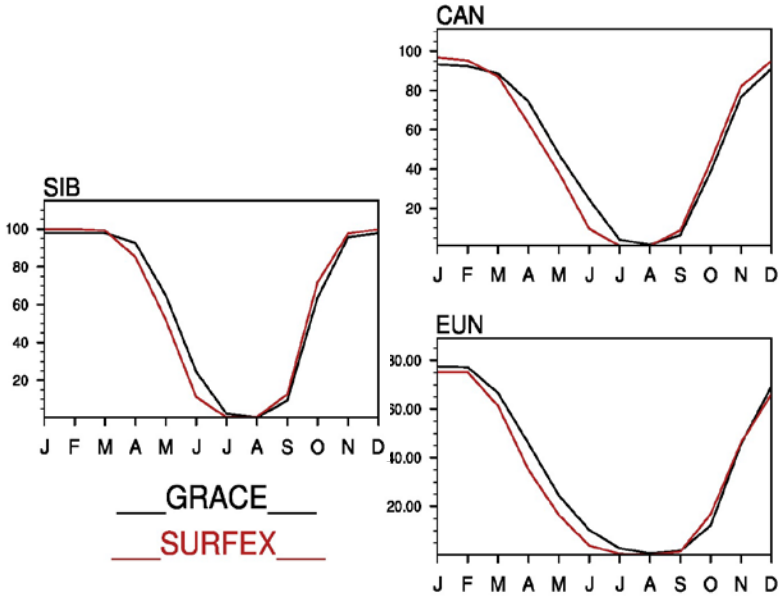
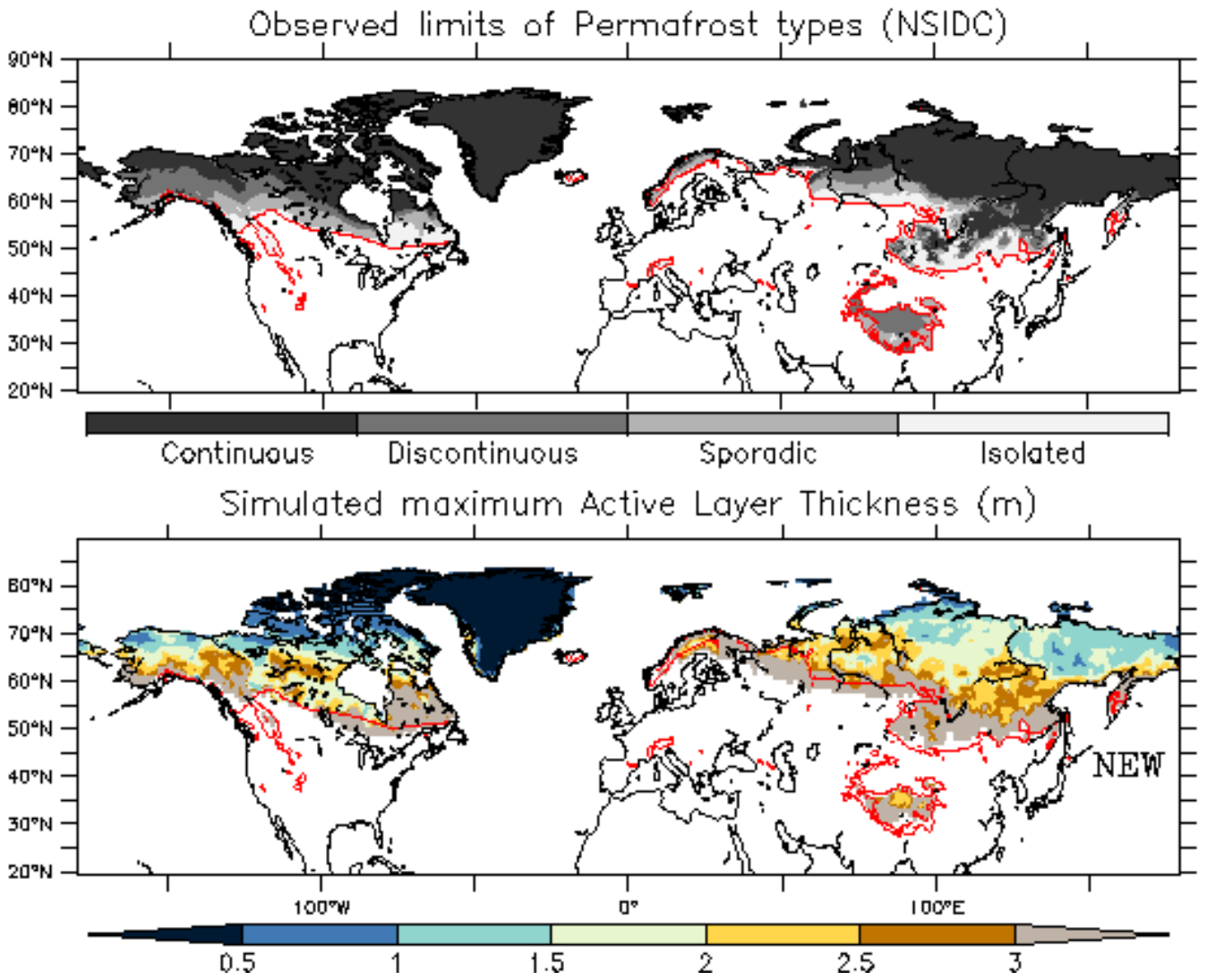


NSIDC/SURFEX snow cover annual cycle

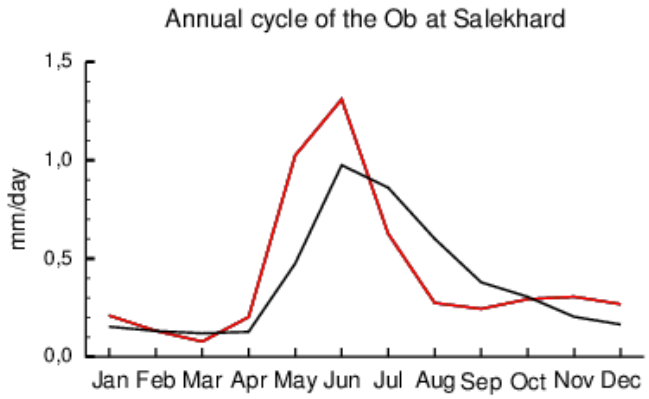


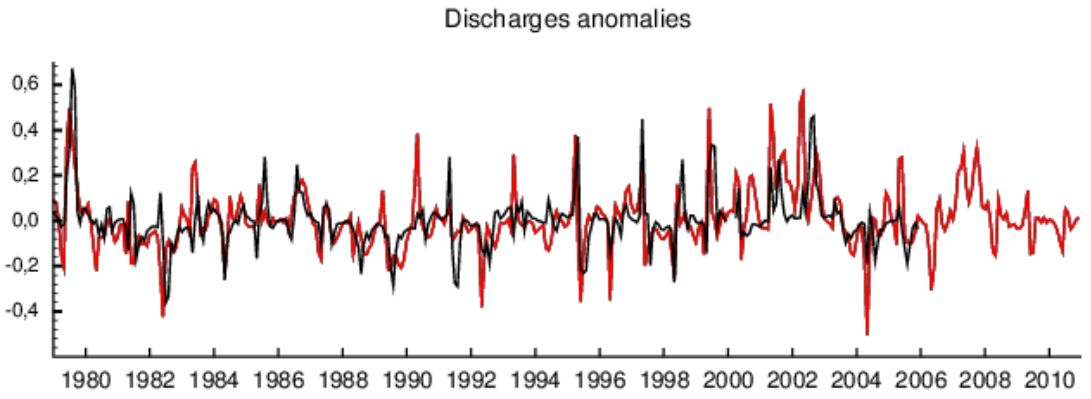
Simple vegetation-snow interactions
--> snow melt slightly too early

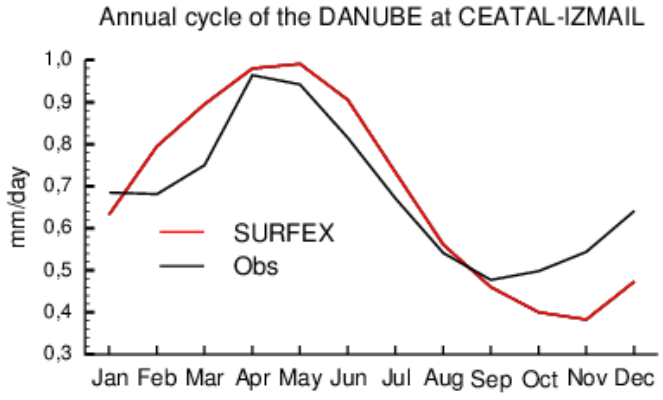
CFref Evaluation – Permafrost cover extend (1979-1990)

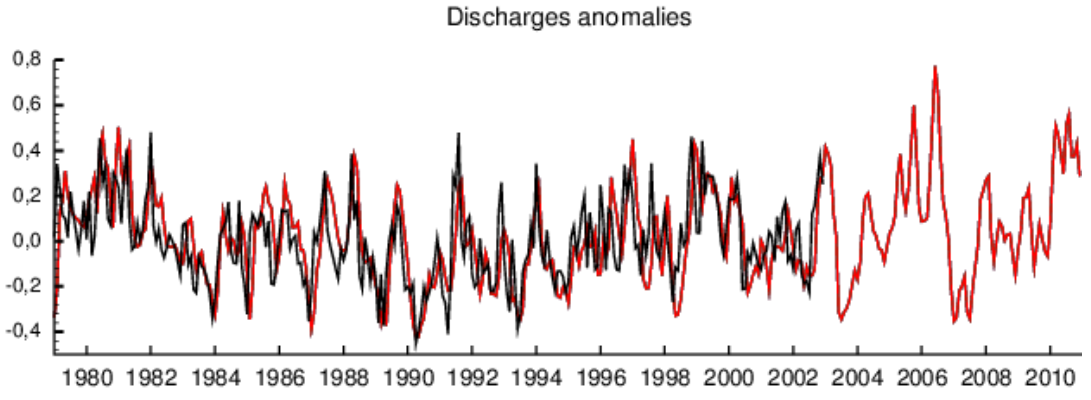


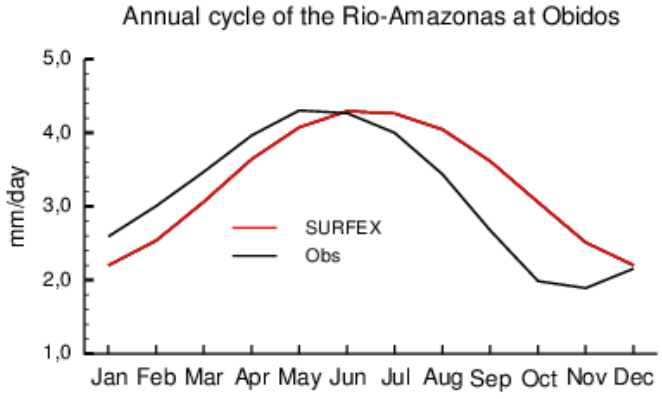
CFref Evaluation – Discharges

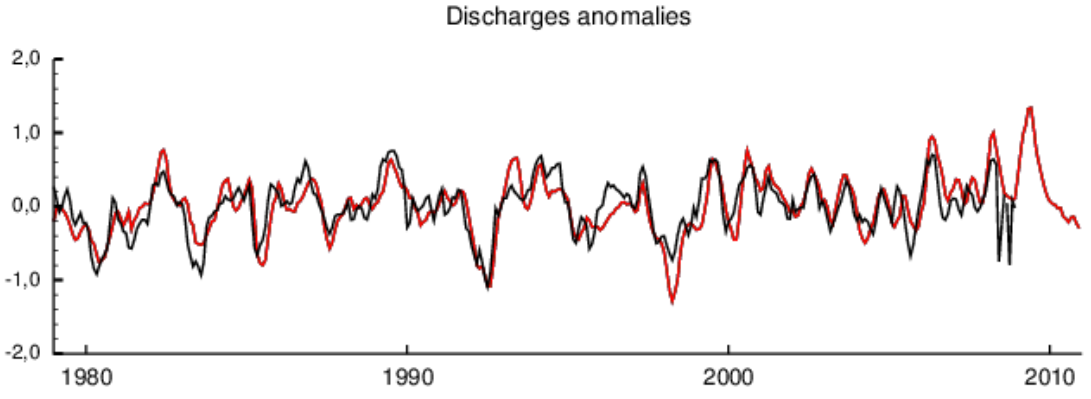




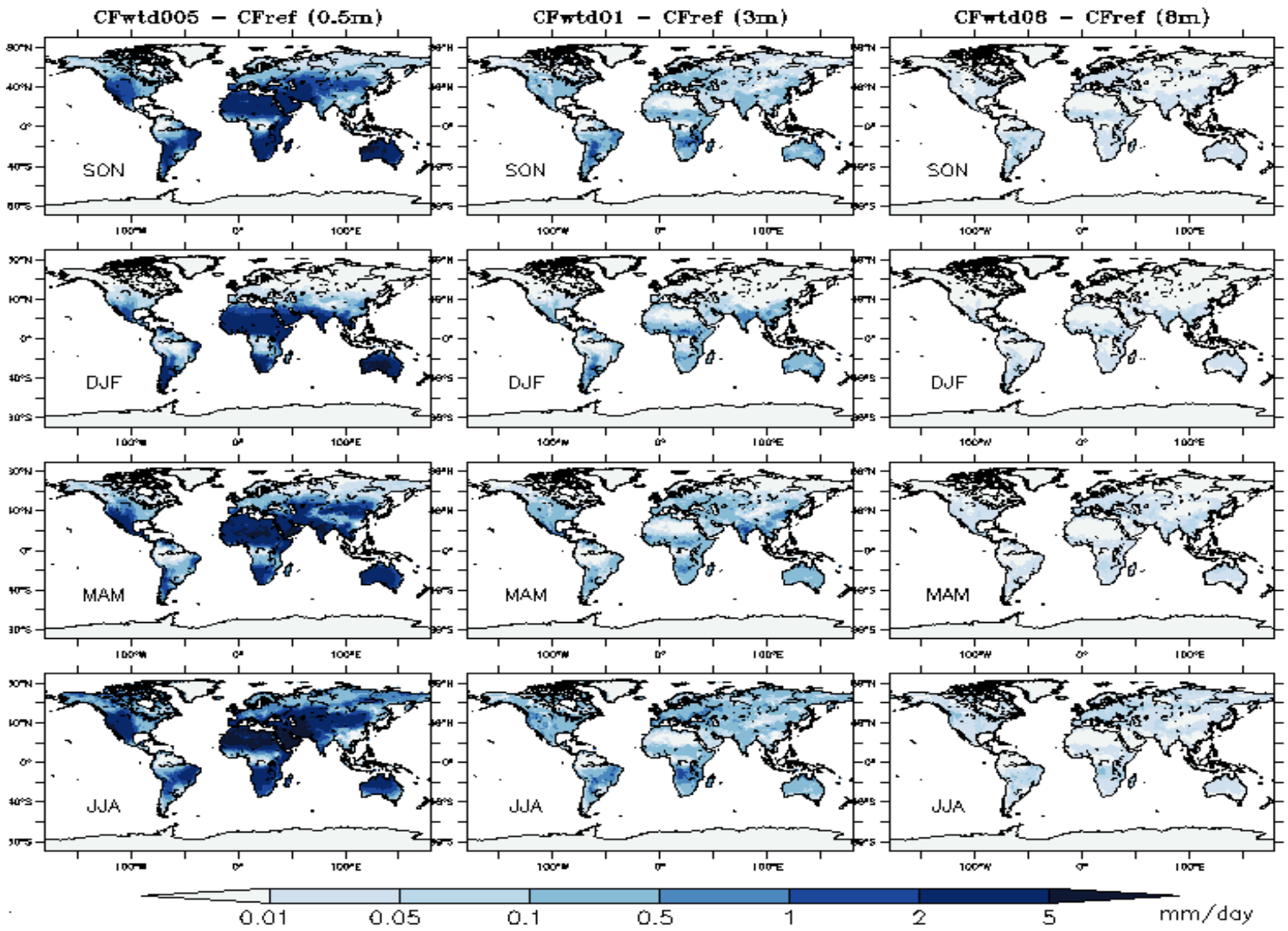




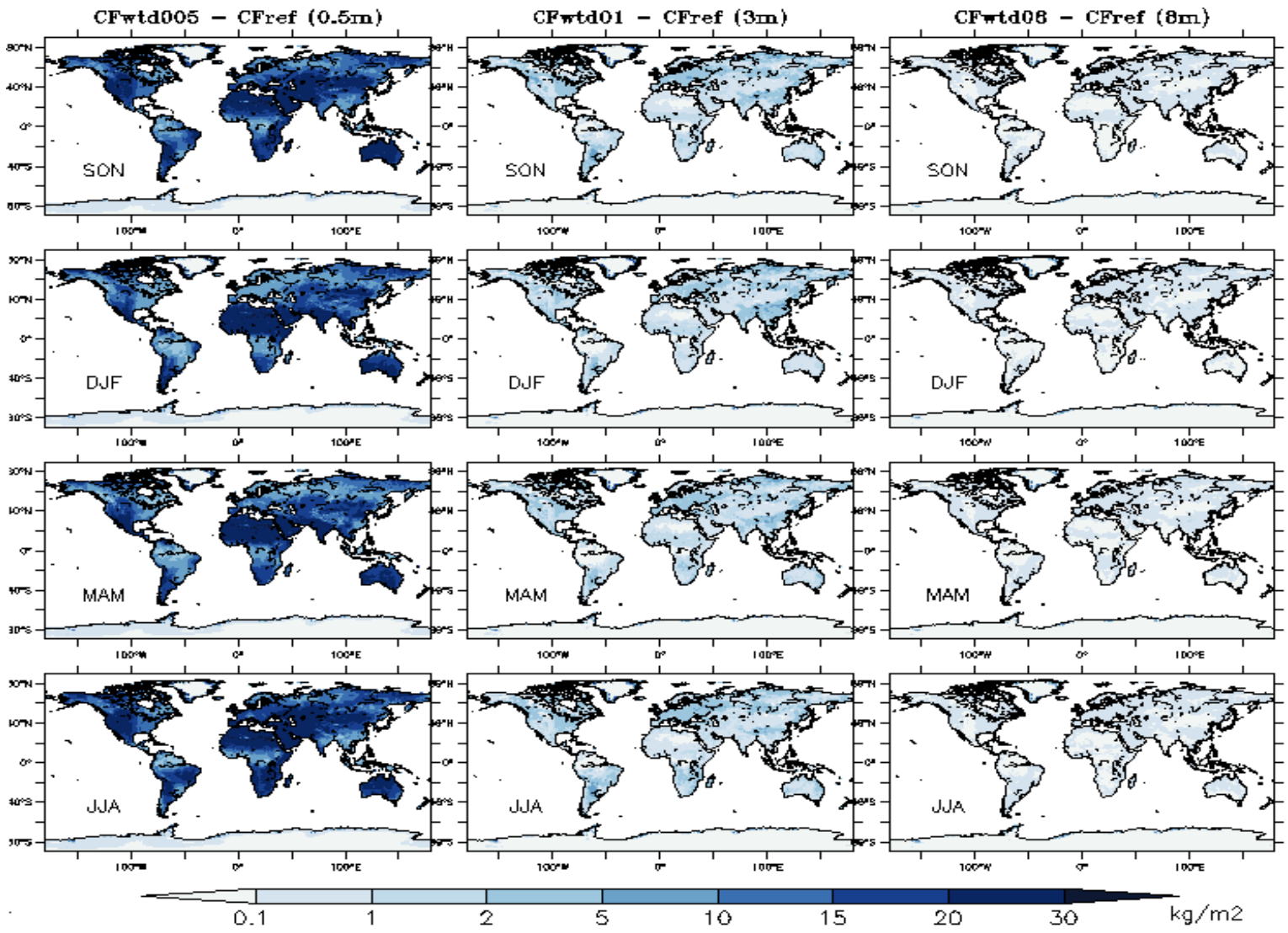




Idealized WTD vs. CFref : Evapotranspiration



Idealized WTD vs. CFref : Soil moisture 10 cm



Conclusions & Next steps

- **CFref results coherent with previous global studies (Decharme and Douville 2007, Alkama et al. 2010)**

- **Offline idealized experiments seem not to be bugged**

- **During December/January on-line simulations will be performed (Jeanne) : Available in January/February, I hope…**

- **Before summer, perform Task 2 simulations (offline/on-line) with dynamic WTD using aquifer scheme from Vergnes et al. (2014)**