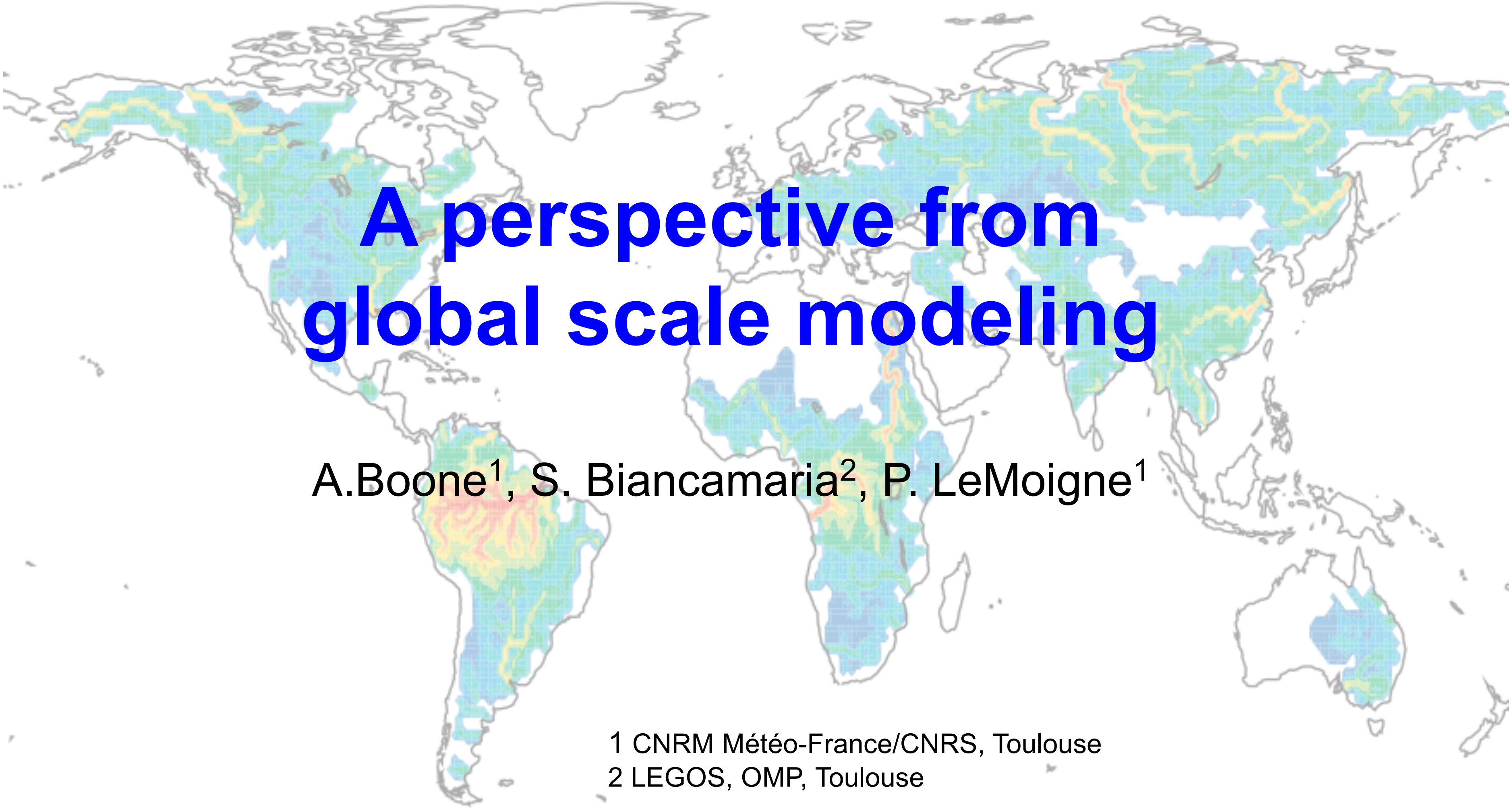


A perspective from global scale modeling

A.Boone[1], S. Biancamaria[2], P. LeMoigne[1]

1 CNRM Météo-France/CNRS, Toulouse
2 LEGOS, OMP, Toulouse

SWOT-ST, June 26-29/2018, Montreal, CA

Outline :

- Land surface model (LSM) and River Routing Models (RRMs) in a large scale → global context

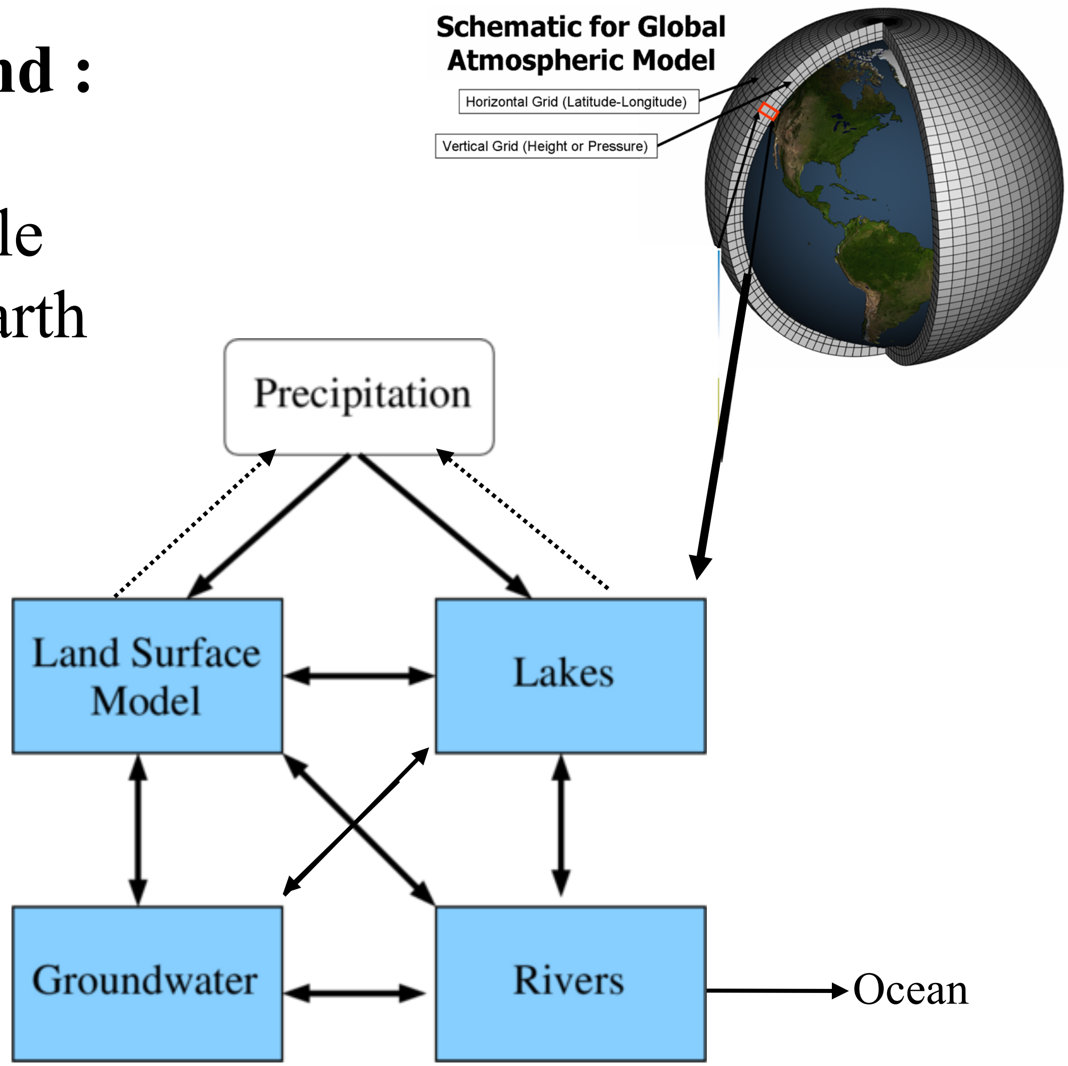
- Some examples of regional/global scale discharge (Decharme, LeMoigne, Emery, David et al...)

- Summarize value of a SWOT discharge product, even with significant errors...

Global Land surface-Hydrologic Modeling

Basic Background :

Hydrological cycle components in Earth Sytem/Global Climate models :



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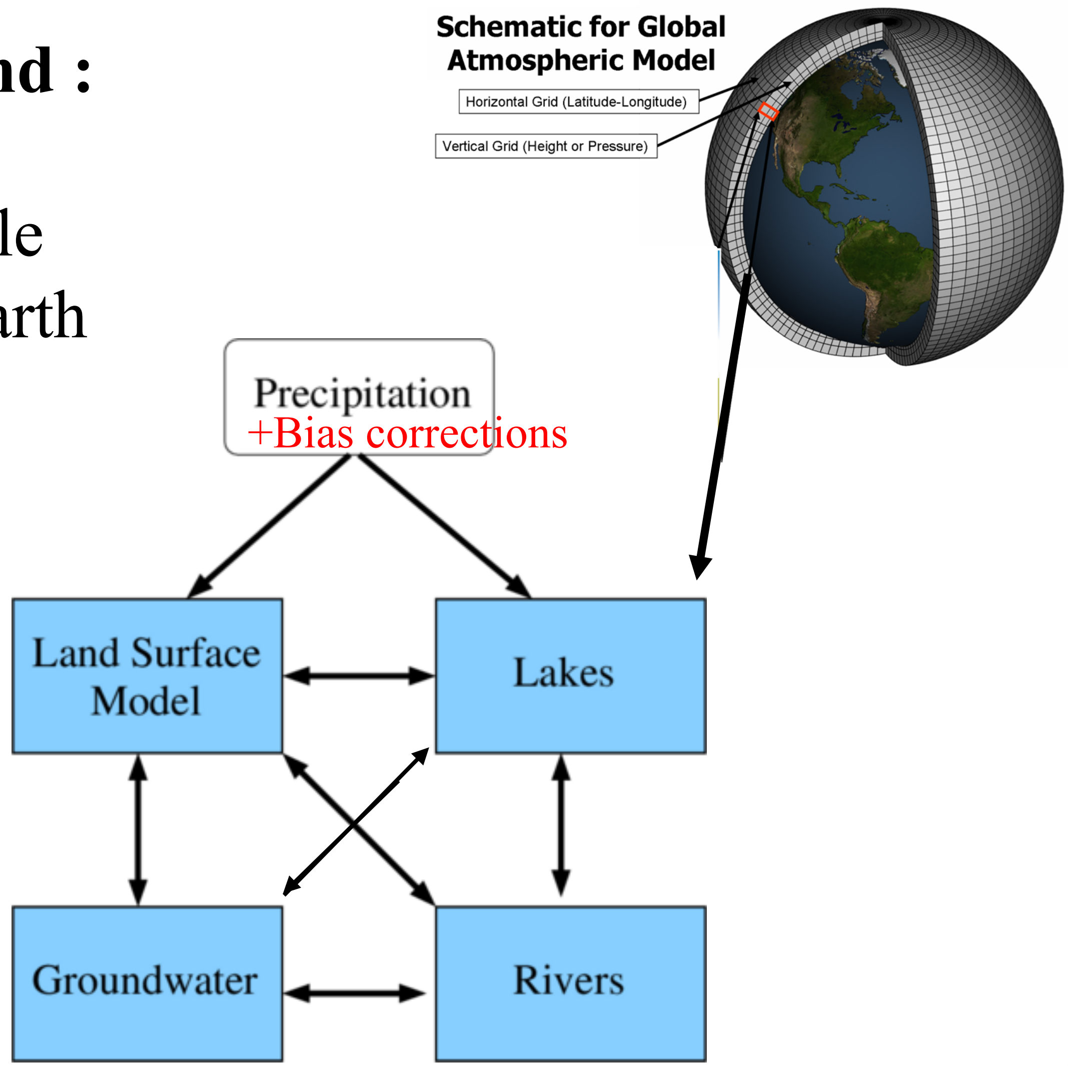

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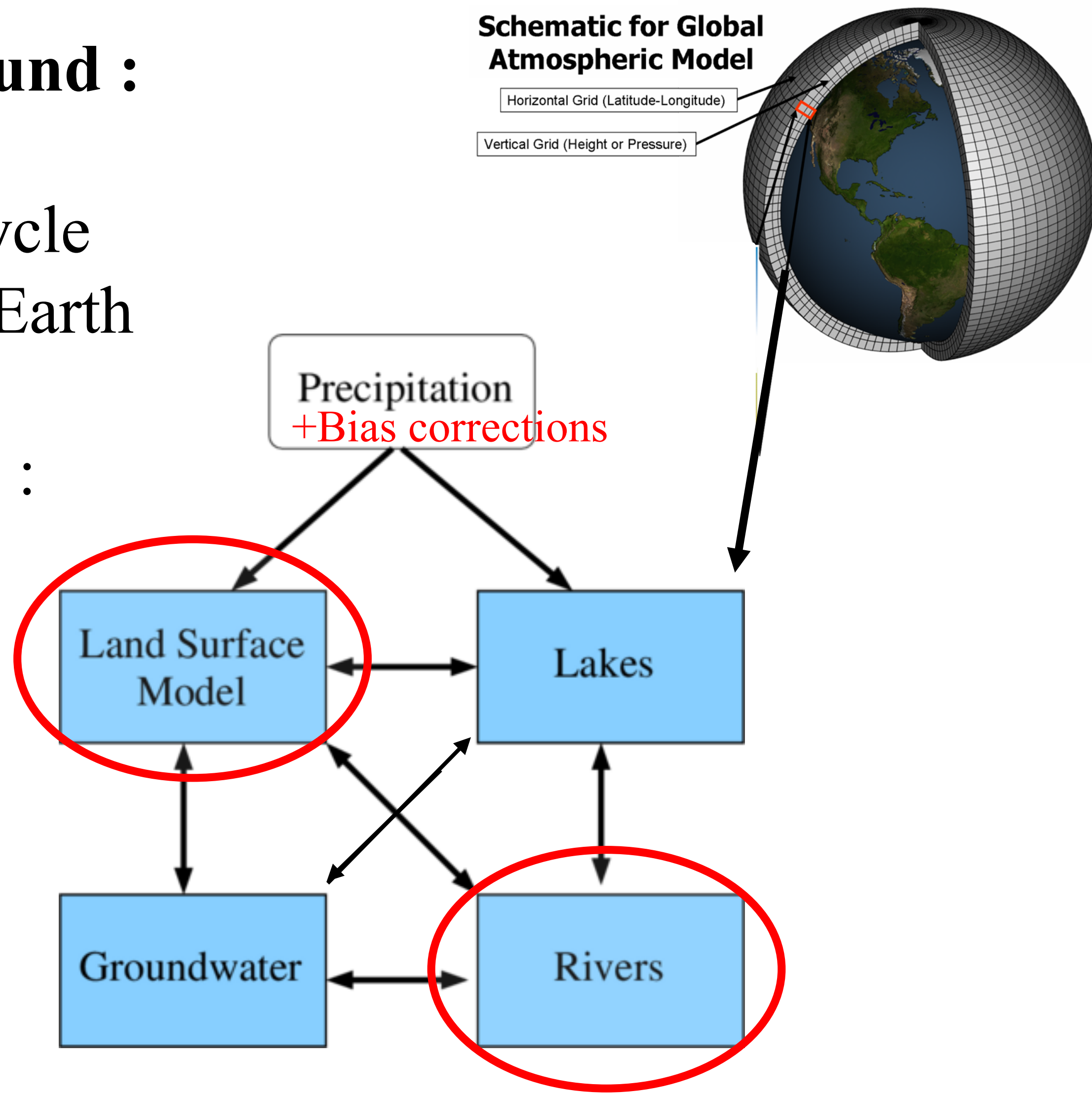
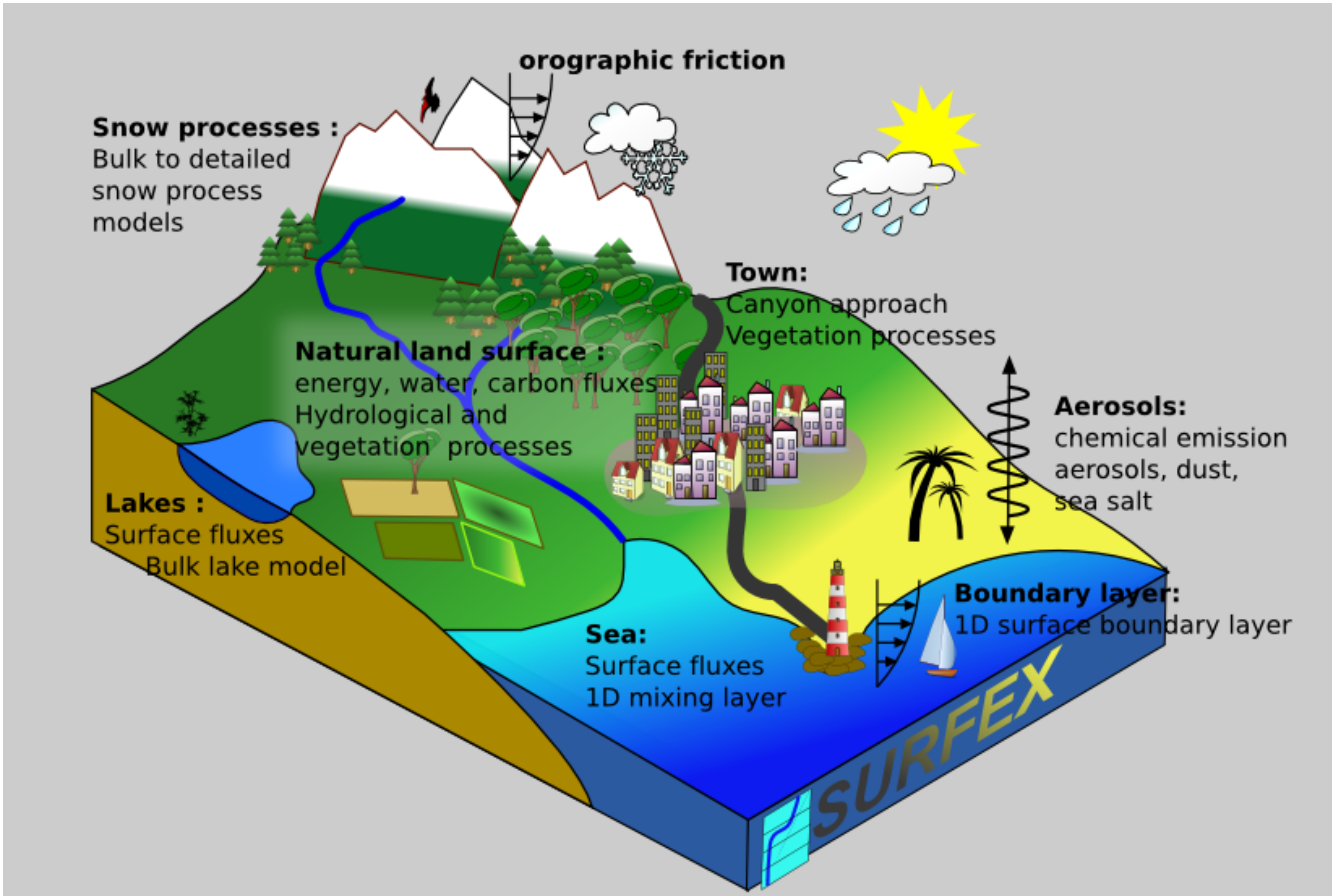
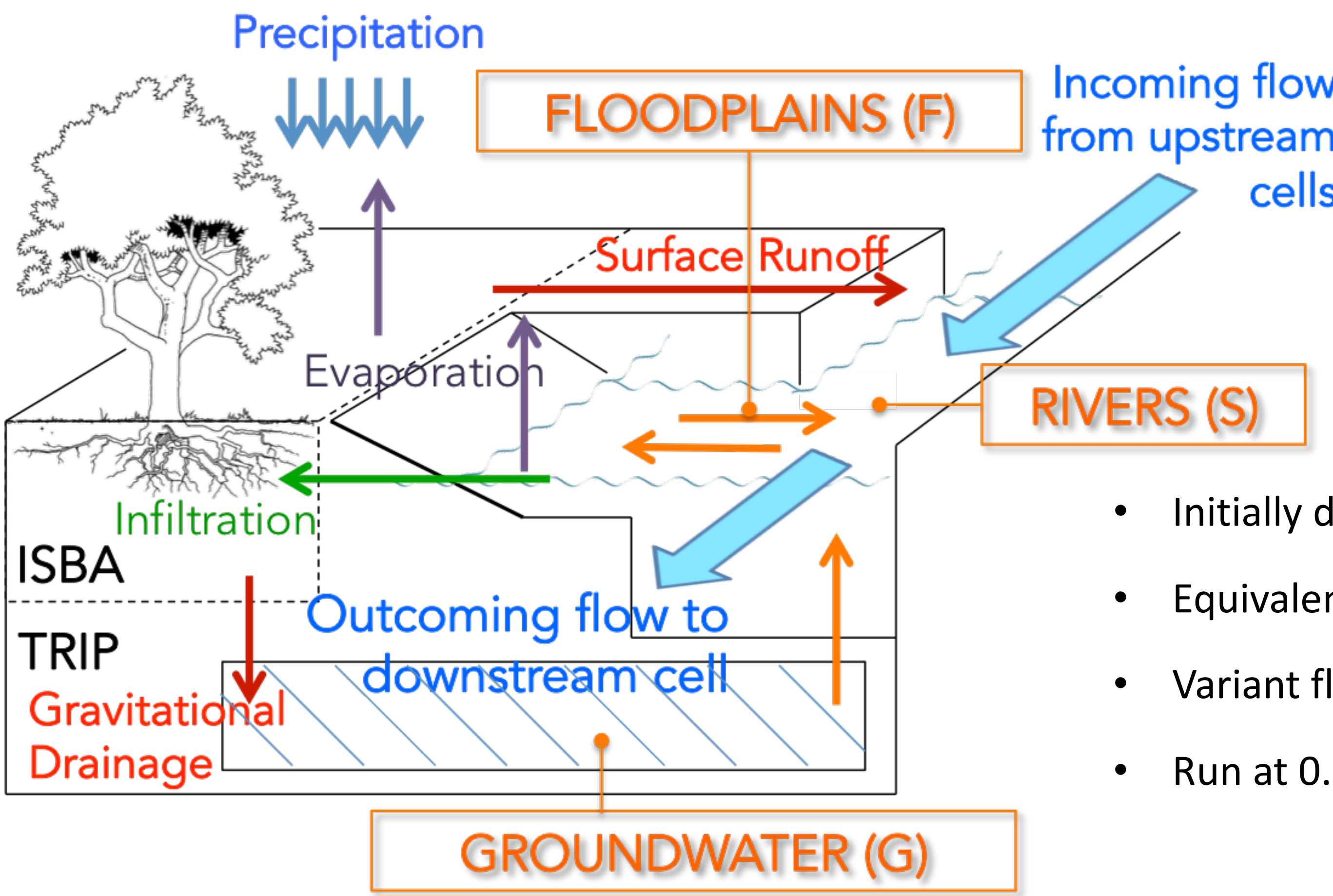


Land surface model : ISBA-SURFace EXternalisée (SURFEX)



Model & Data

The global ISBA-CTRIP hydrologic model



- Initially designed to convert surface runoff int
- Equivalent river with rectangular section + gr
- Variant flow velocity calculated with the Man
- Run at 0.5°x0.5° (~50km x 50 km)

Decharme et al. (2012)

ISBA-CTRIP :

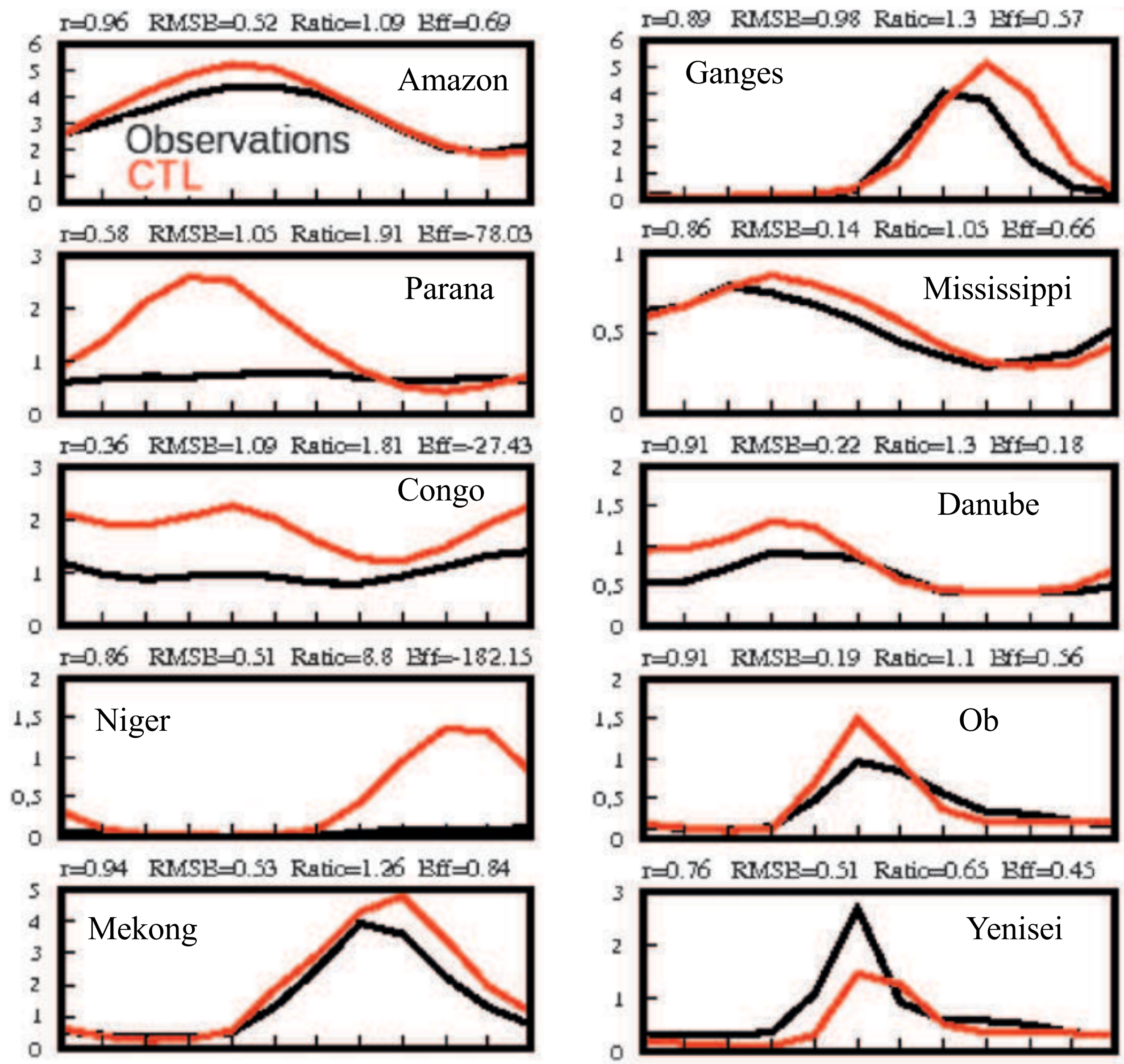
1 deg resolution (LSM and TRIP river network)

Simple grounwater scheme, Manning velocity

Princeton Forcing, 1986-2006

Rainfall bias Corrections → GPCC

GRDC discharge for evaluation



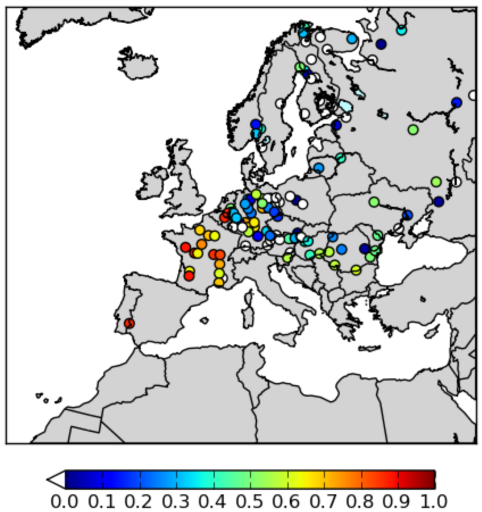
(Decharme et al., 2010)

River Discharges: 1962-1995

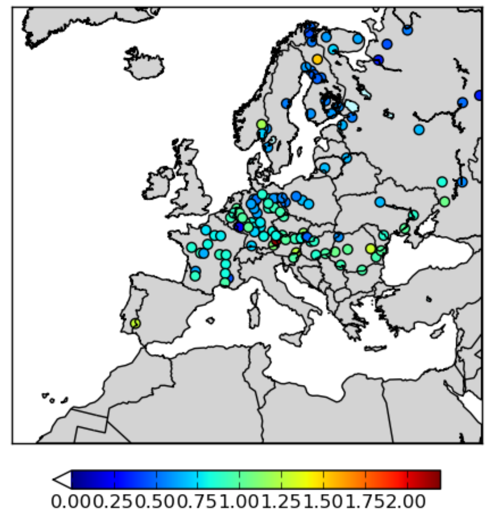
ISBA-CTRIP 0.5 deg res

GRDC gauging stations

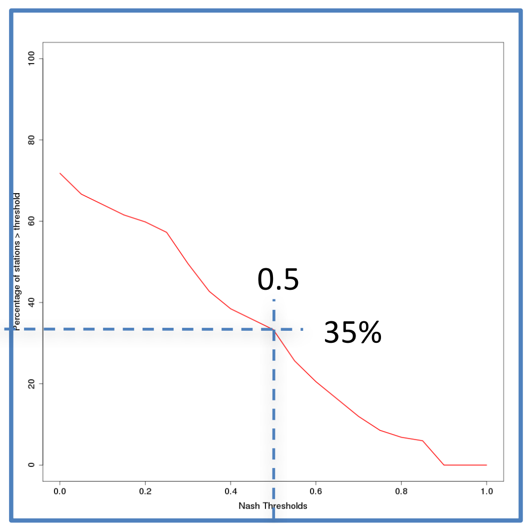
Nash Efficiency



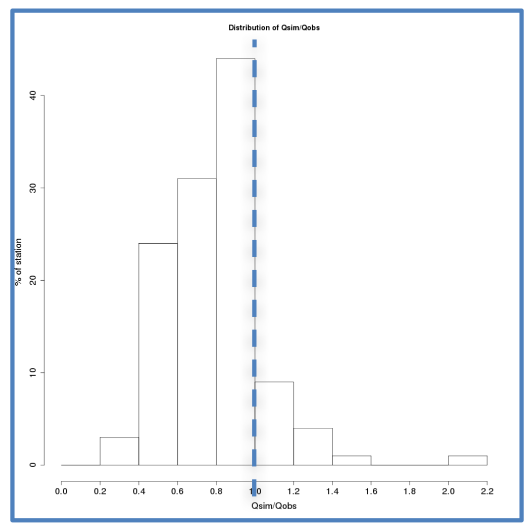
Discharge ratio



Gauging Stations (%)



Nash Efficiency



Discharge ratio

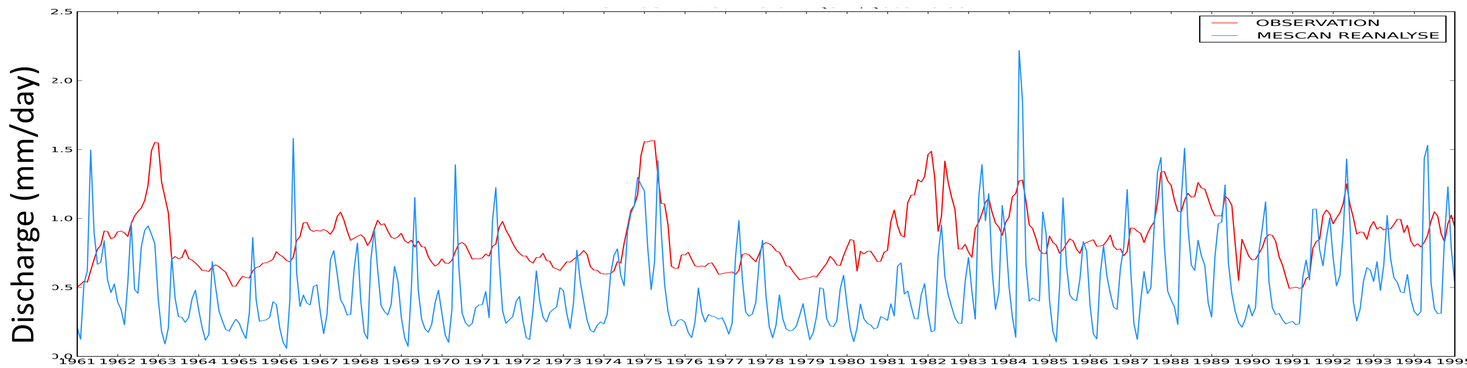
Le Moigne et al.

River Discharges: 1962-1995

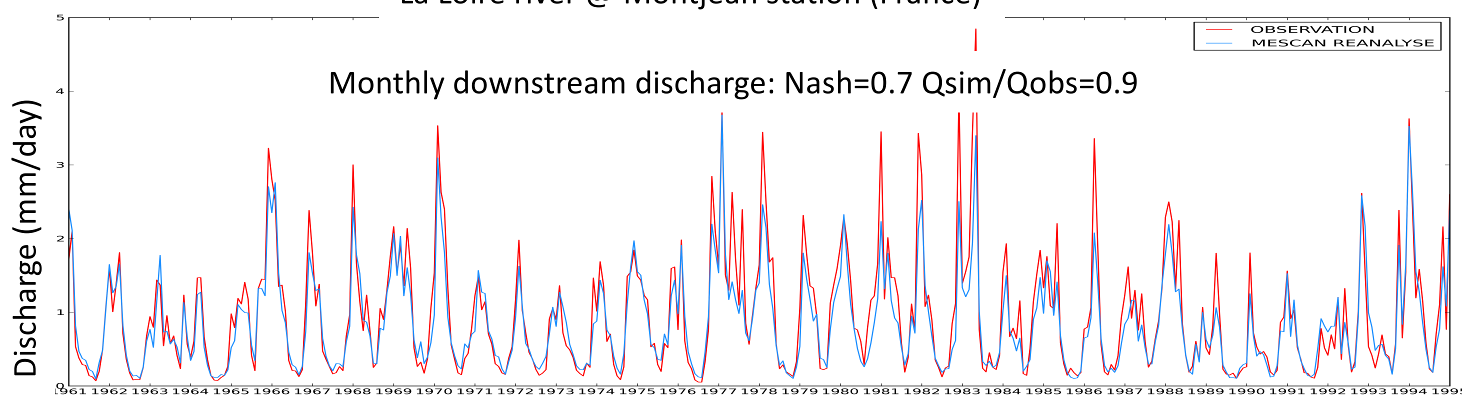
URA
Uncertainties in Ensembles of Regional ReAnalyses

How to explain discharge underestimation?
- Physics of the system: Radiation overestimation, Underestimation of precipitation
- Human activity not accounted for in the model: Presence of dams

Vuoksi river @ Tainionkoski station (Finland)



La Loire river @ Montjean station (France)



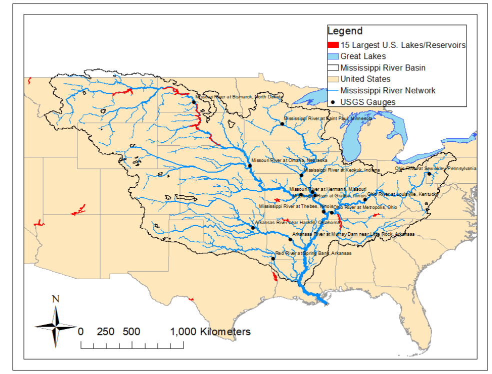
Le Moigne et al.

CNRS

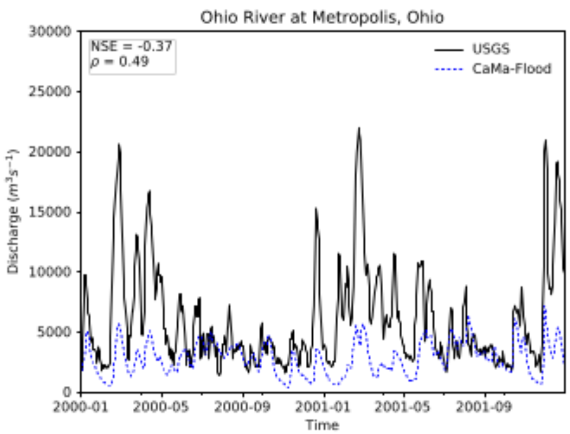
LEGOS

METEO FRANCE

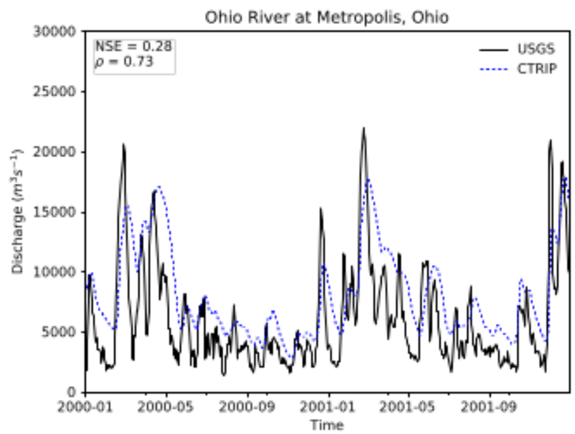
RiverMIP Project (David et al., NASA-JPL)



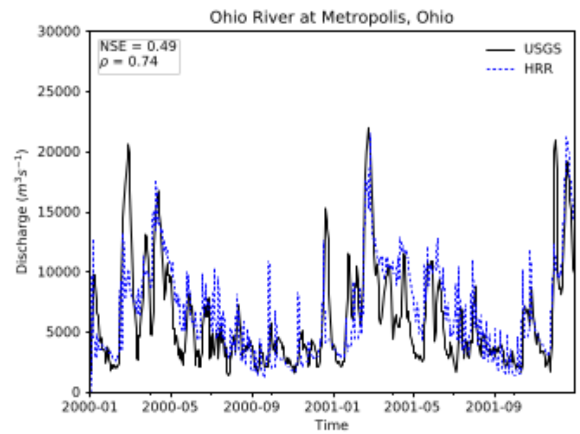
Model simulations



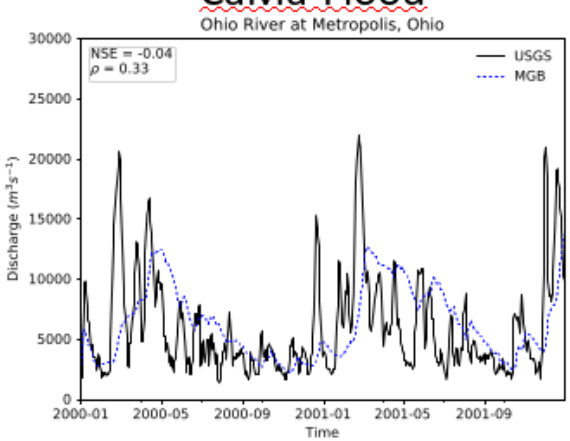
CaMa-Flood



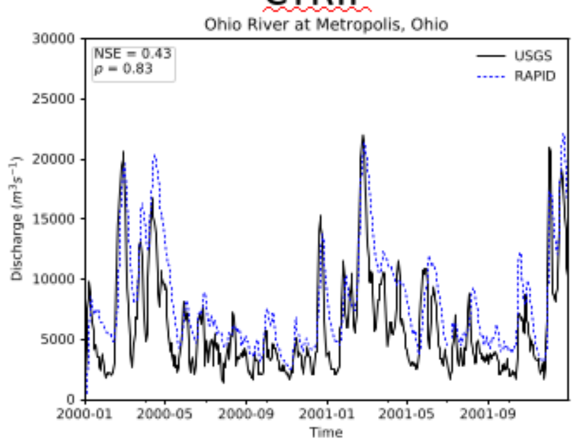
CTRIP



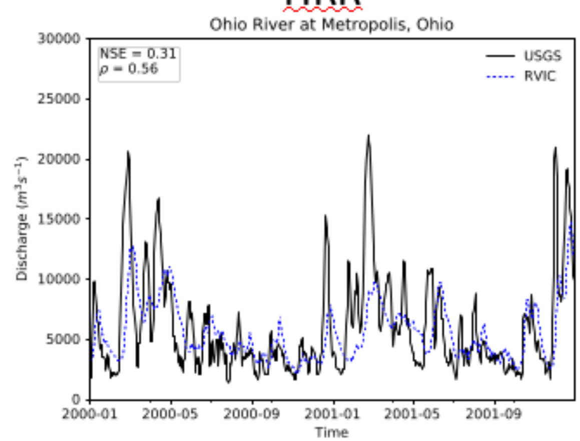
HRR



MGB



RAPID



RVIC

Model and Data

Free run performances and study objective

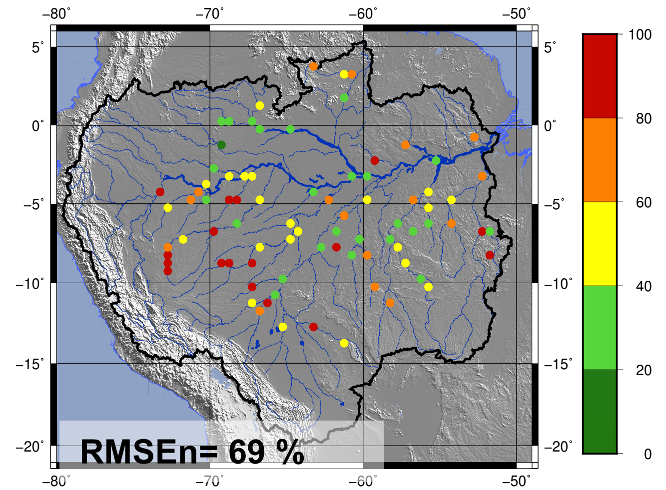
(Emery et al. 2018 : see presentation from Thurs)

- Study area: whole Amazon basin
- Time period: year 2009 (ENVISAT)

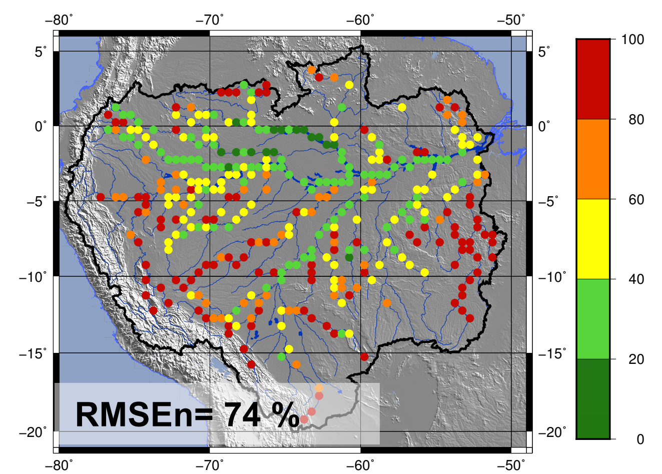
- In situ discharges from Brazilian Water Agency used for validation: 81 active gauges

- Free run RMSEn over entire basin:
    - With in situ = 69 %
    - With ENVISAT alone = 74 %

In situ



ENVISAT



Discharge simulation degrades for smaller basins...

Perspectives :

- Global scale RRMs are being improved (higher resolution, incorporation of satellite data…)

- Discharge generally well simulated globally, however, specific time periods and basins characterized by large errors (bias and correlation…)

- Errors : Precipitation, physiographic data, simplified or missing RRM physics (parameters), runoff generation by LSMs, coupling to aquifers, lakes/reservoirs, anthropization…

- How will SWOT discharge be used :
  - Evaluation of LSM-RRM simulated discharge
  - Assimilation (parameter est. And hindcast-reanalysis, hydrologic forecast….)

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