# Satellite Products bias Propagation in Hydrological Model :

# Some Preliminary test studies


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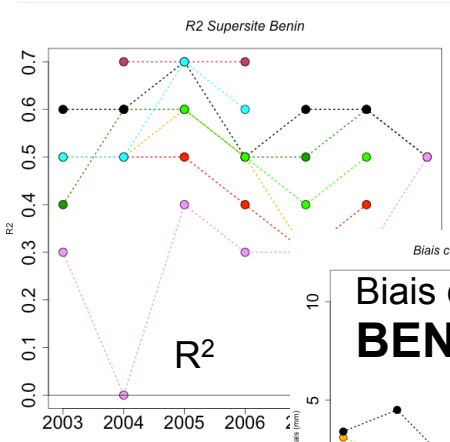
**Christophe Peugeot HSM/ AMMA-CATCH**
**Aaron, Boone, Vanessa Pedinotti, CNRM**

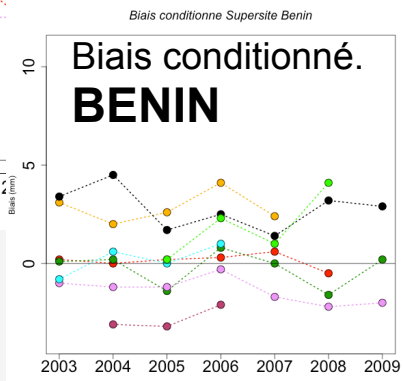
## Recent work on products evaluation over West Africa in link with AMMA :

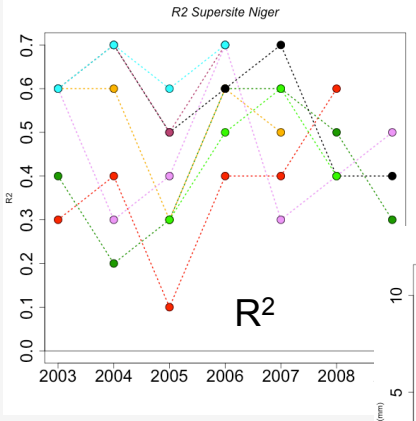



RT glob: PERSIANN, CMORH

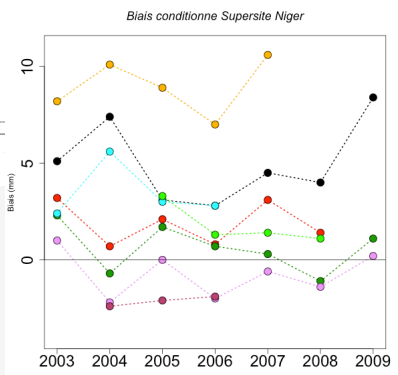
Post-calibr global: GSMAP, GPCP1dd, TRMM3B42v6

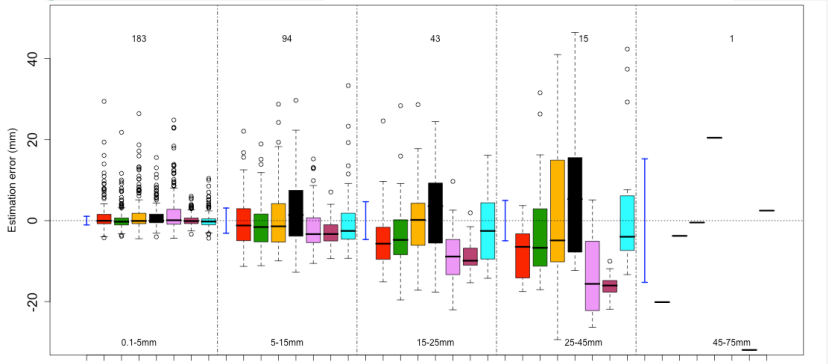
Regional: RFE2, EPSAT-SG

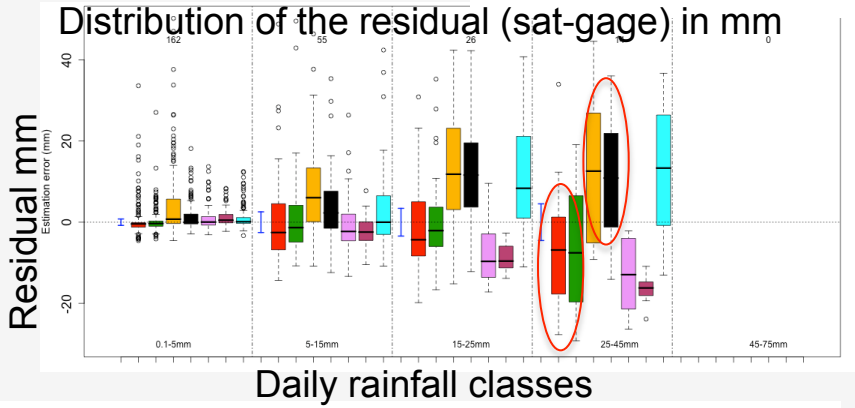



Biais conditionné.
**NIGER**



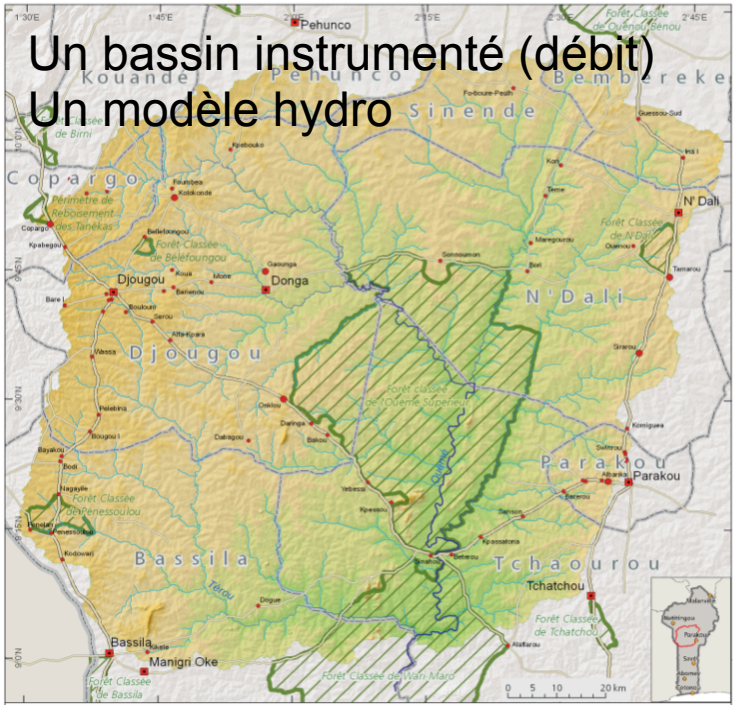

- Multi-criteria shows that no product is best overall
- The best at 10 days are not necessarily the best at 1 day
- Interannual variability of performances
- Differences between the Benin/sudanese regime site and the Niamey/sahel site

# Produits Satellites et Hydrologie :

- Quel Apport de la pluie Sat pour l 'hydrologie
  - Peut-on utiliser les produits RT
- Aide à la régionalisation des études hydro. / à la compréhension des processus ?
- Prevision hydro – previ des extrêmes ?

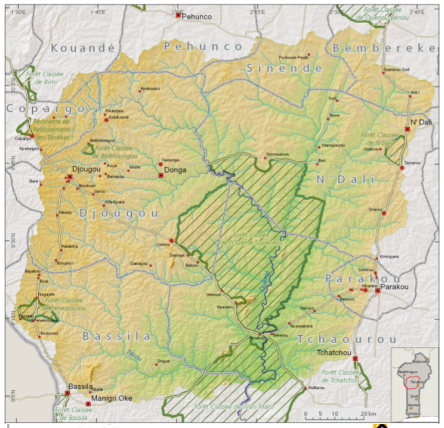
- Utiliser la réponse hydrologique / les bilans par bassins pour valider
  - Validation hydrologique des produits sat ?

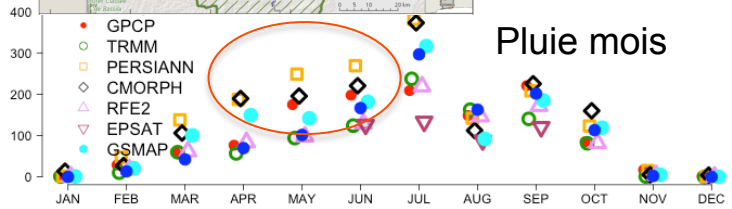
**Test zone :**
**Upper Oueme ‘meso’ basin**
**TopAMMA Model**
**Peugeot et Viarre.**



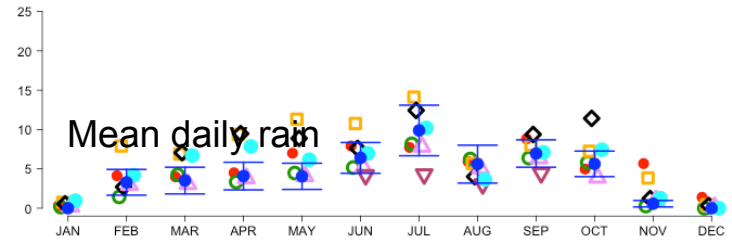

Contexte : AMMA – CATCH
Site Oueme Benin
IRD / AMMA / DG-Eau

# The products biases :

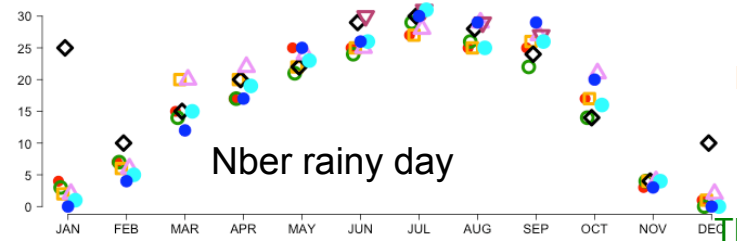



Pluie mois

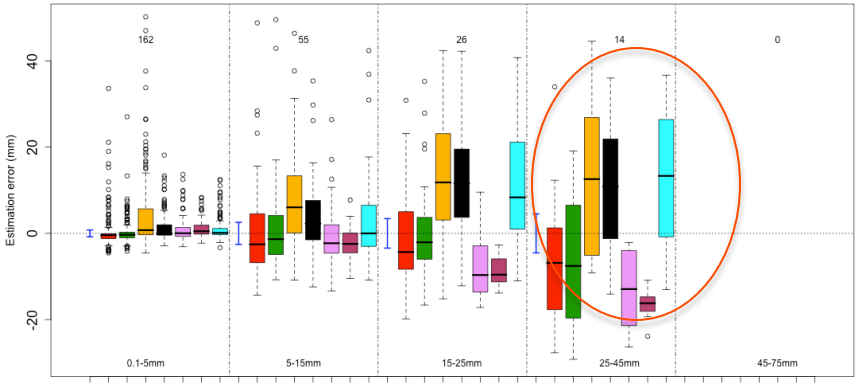



Mean daily rain



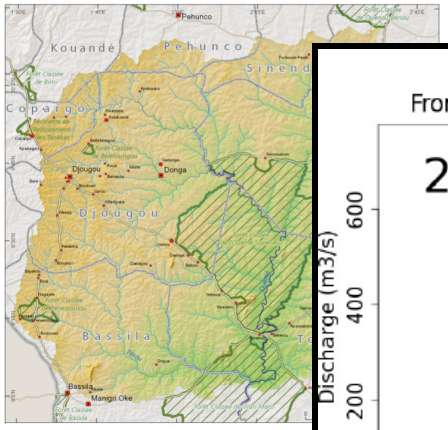

Nber rainy day

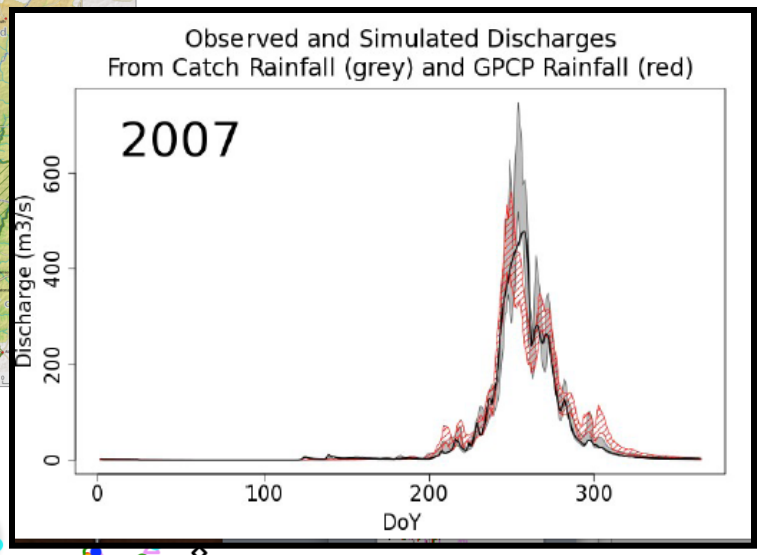
PERSIANN
CMORH
GSMAP
GPCP1dd
TRMM3B42v6
RFE2
EPSAT-SG

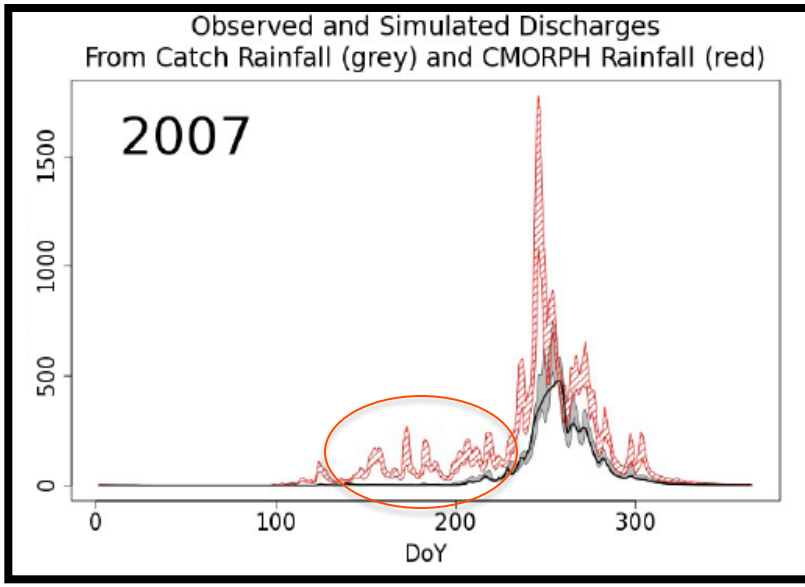


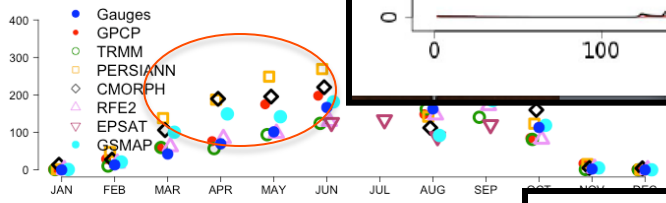

Gosset et al 2012 , subm
Poster Alcoba

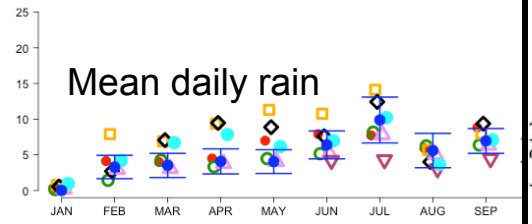
# Consequences on the simulated outflow

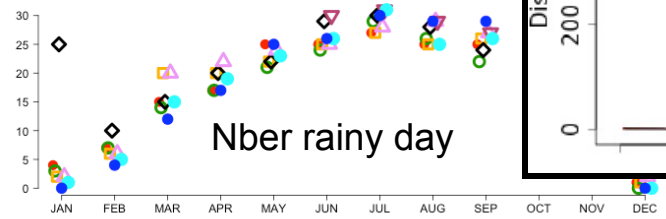


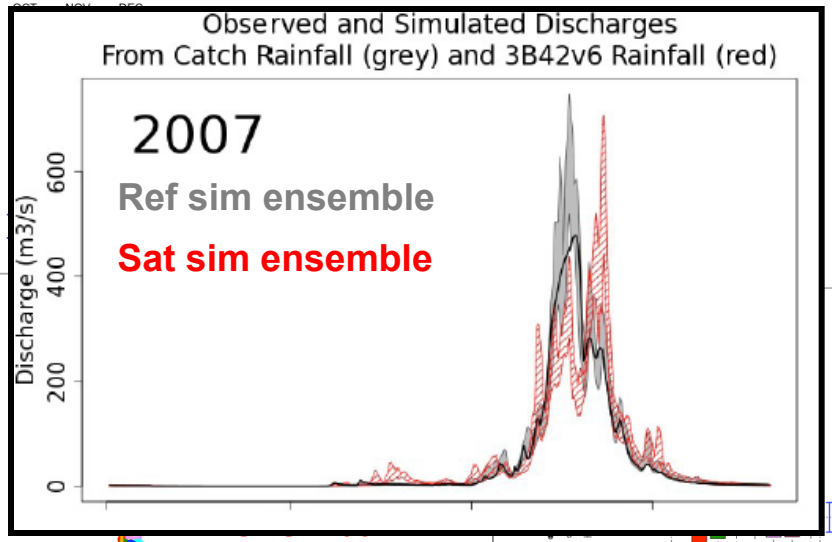



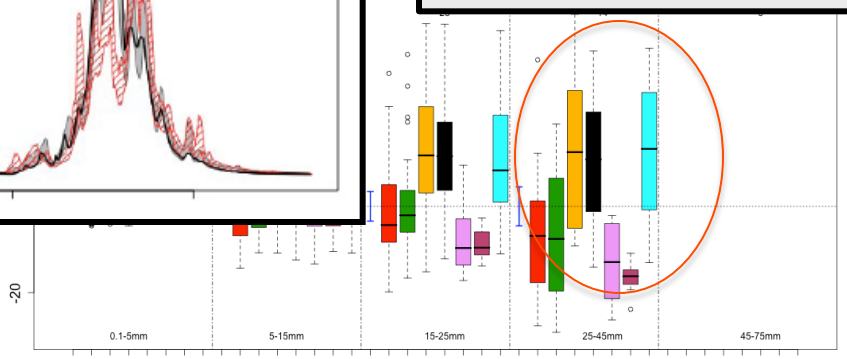




Impact sur debits simulés
(ici TOP-AMMA
Fait aussi avec
GR4J - DG Eau)

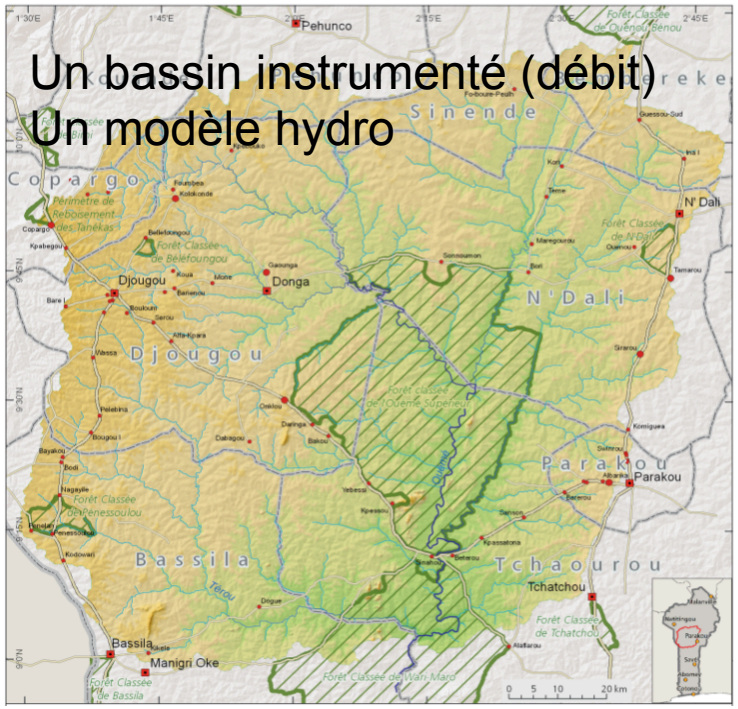


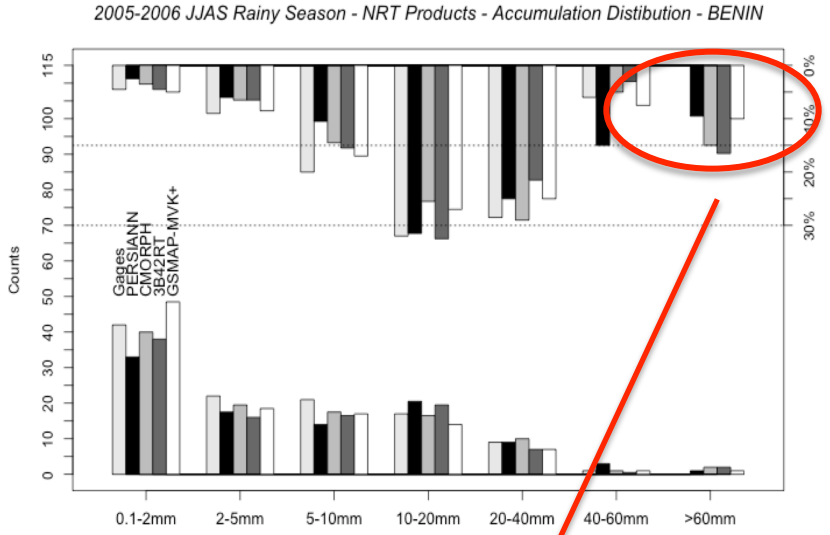

TRMM3B42v6
RFE2
EPSAT-SG

Gosset et al 2012 , subm
Poster Alcoba

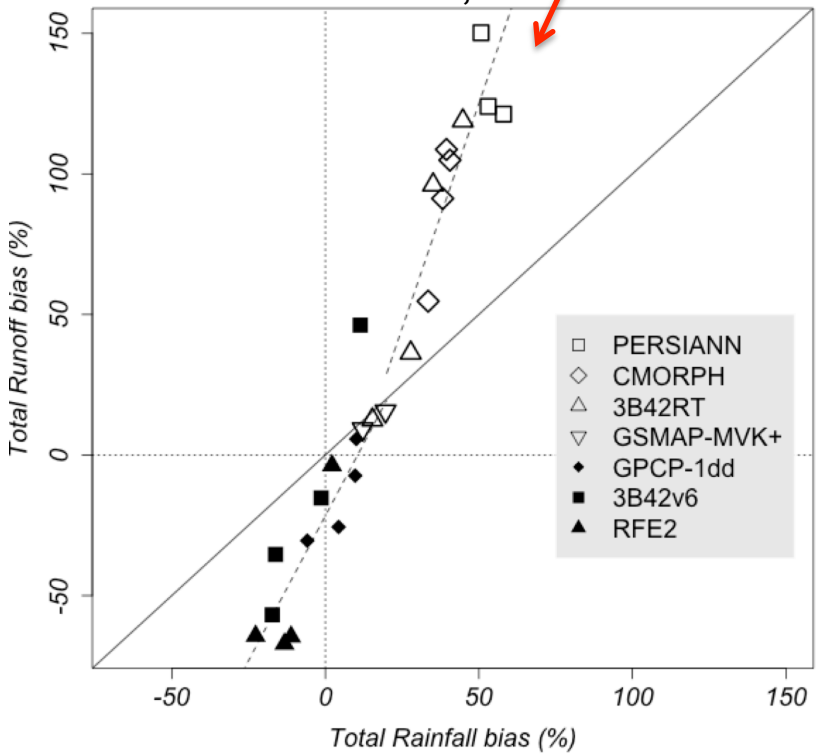
# MT - Hydro

## Echelle méso – bassin instrumentés




Gosset et al, 2012




Comprendre la propagation des biais/ incertitudes pluie dans un modèle hydro.
-Evaluer la pertinence de produit + Modèle pour l Hydrologie.

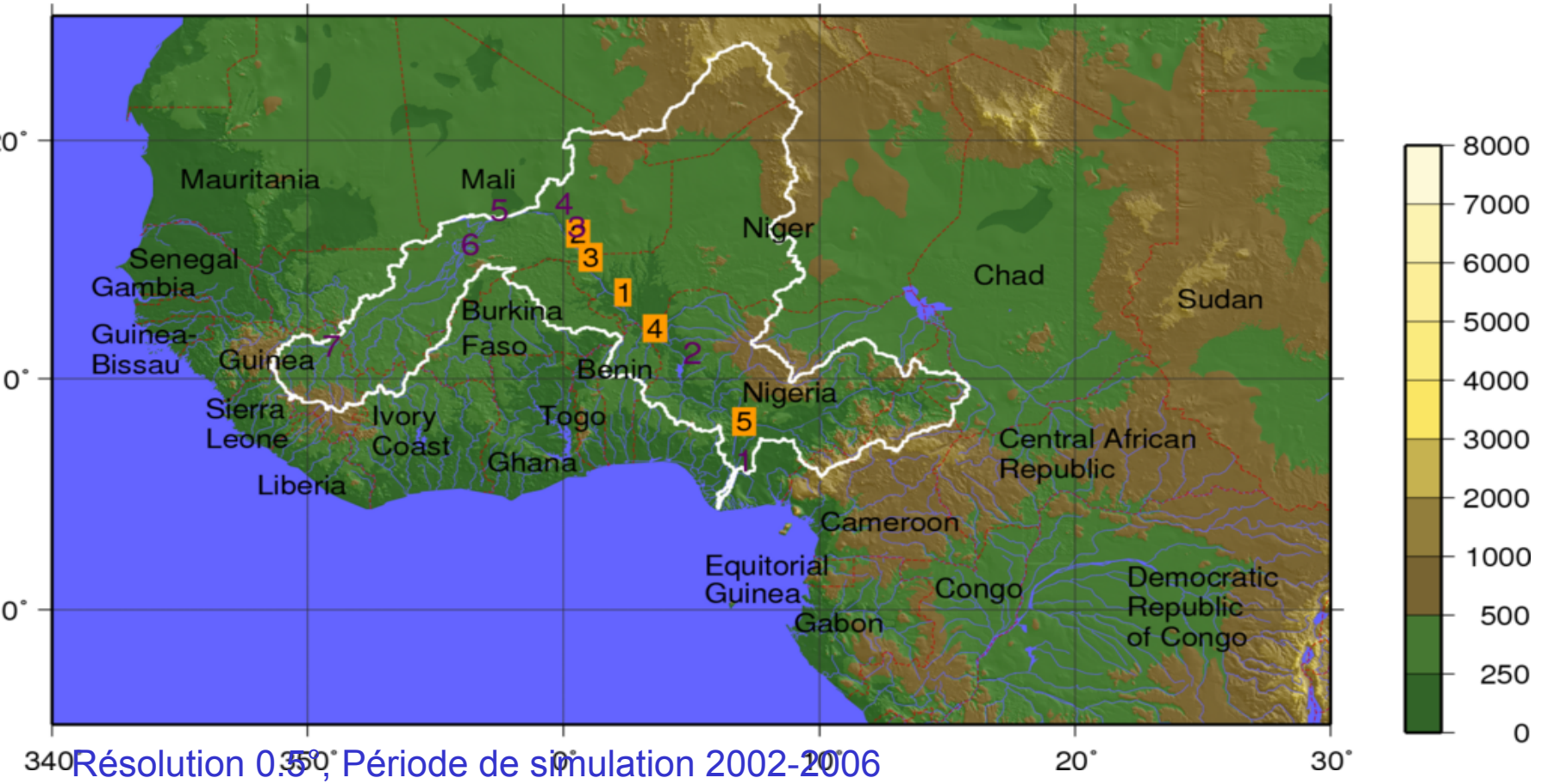
Valid Hydro ou intégrée - Inverser le diagnostic ?

# MT-Hydro perspectives

**Collab avec Vanessa Penadotti / aaron Boone CNRM cadre SWOT**

**– Modélisation du bassin du Niger (SURFEX/ISBA/TRIP) debit/inondations**

-Test de sensibilité avec produits – cadre Master Gildas Dayon

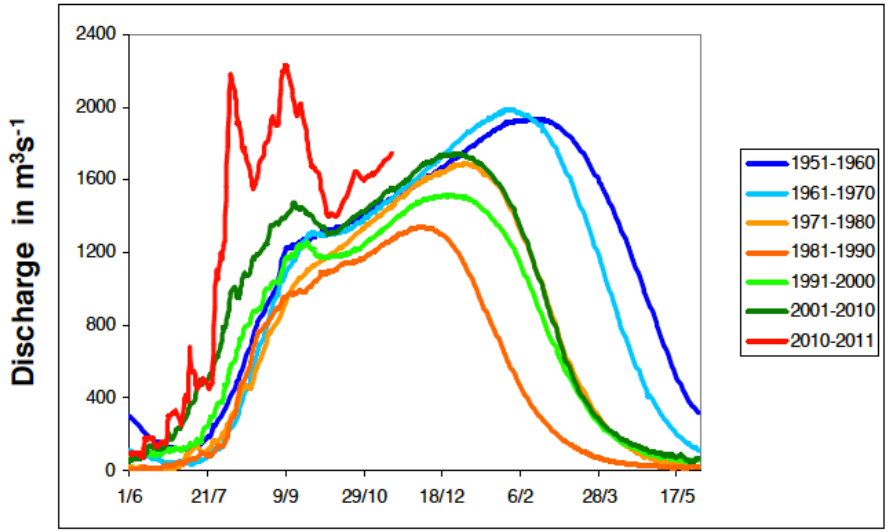



Résolution 0.5°, Période de simulation 2002-2006

Can satellite RT info help monitoring flood events like the Niamey 2010 one ?

…resulting in the inundation of 310 hectares in the right bank part of the city of Niamey (Niger)

**Exemple: la crue de mousson (crue rouge) à Niamey en août et septembre 2010 est la plus forte jamais observée depuis 1929, alors que les pluies n'ont été que les 21èmes plus fortes depuis 1929 sur le bassin alimentant la crue roiuge (Sahel)**



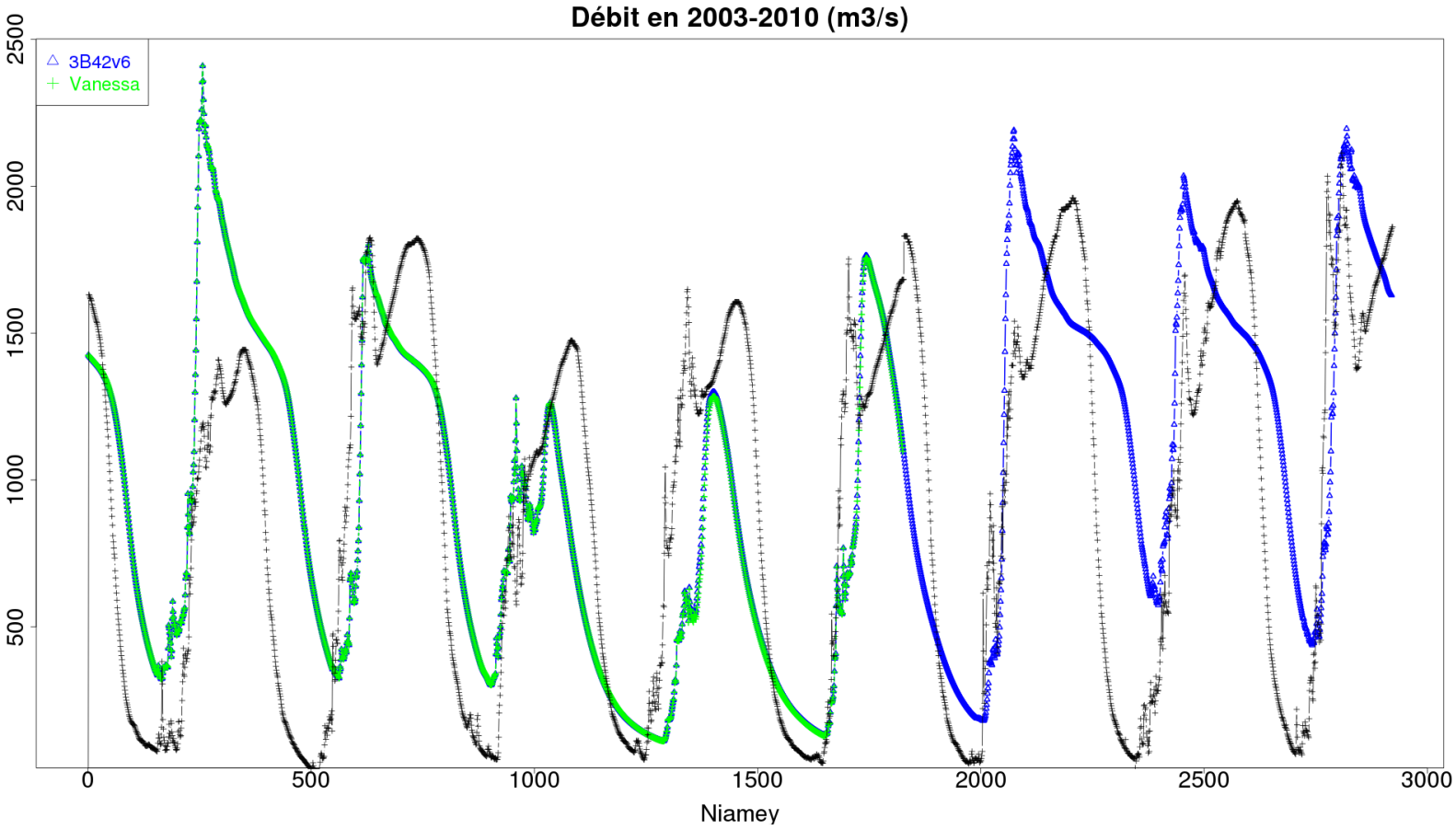

*(Descroix et al, submitted)*

The first (local or « red ») flood more and more marked and earlier

Courtesy Descroix et al, LTHE

# MT-Hydro perspectives

**Collab avec Vanessa Penadotti / aaron Boone CNRM cadre SWOT**
**– Modélisation du bassin du Niger (SURFEX/ISBA/TRIP) debit/inondations**
**-Autre routage + Hydro**




Simulated / Observed Niamey Outflow 2003-2010

Résolution 0.5°, Période de simulation 2002-2006-2010

# MT-Hydro perspectives

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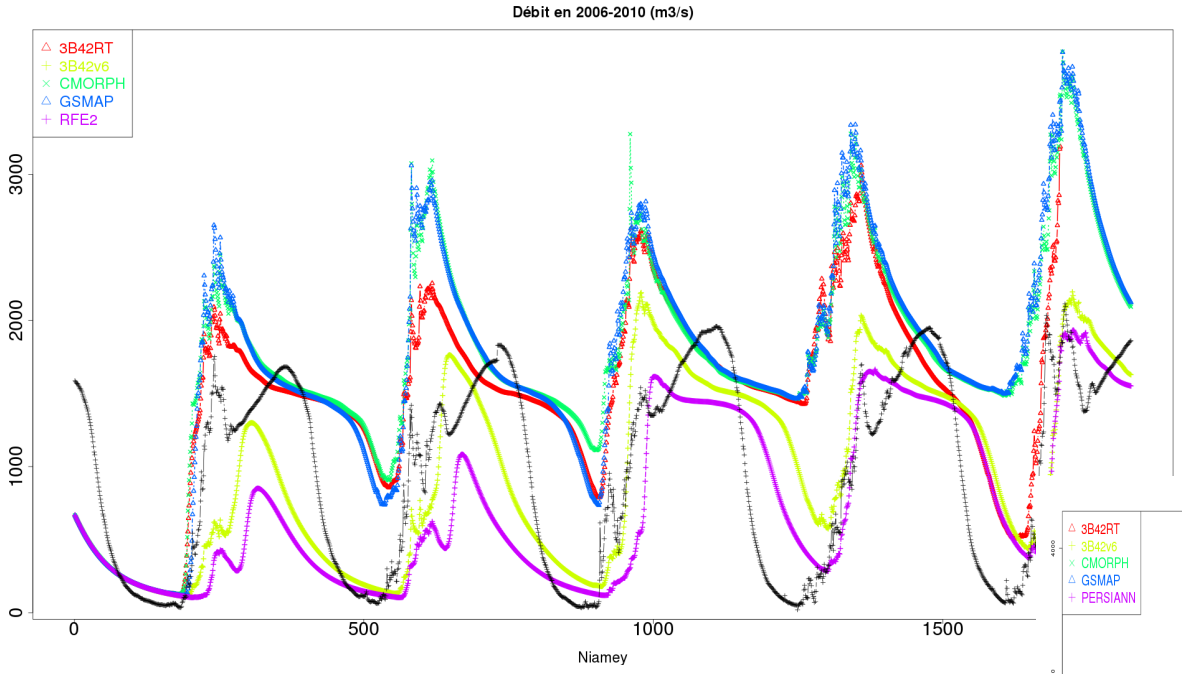
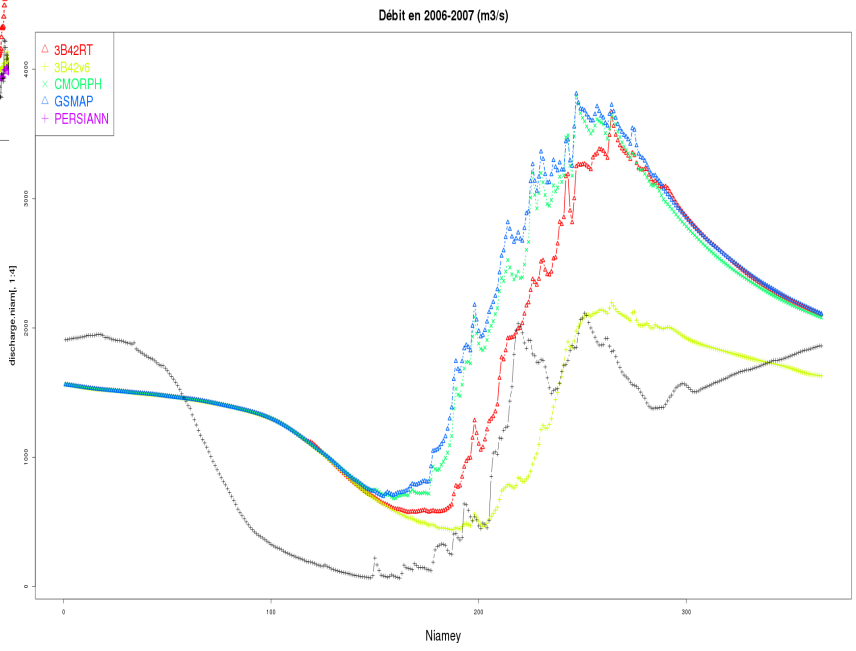
**– Modélisation du bassin du Niger (SURFEX/ISBA/TRIP) debit/inondations**

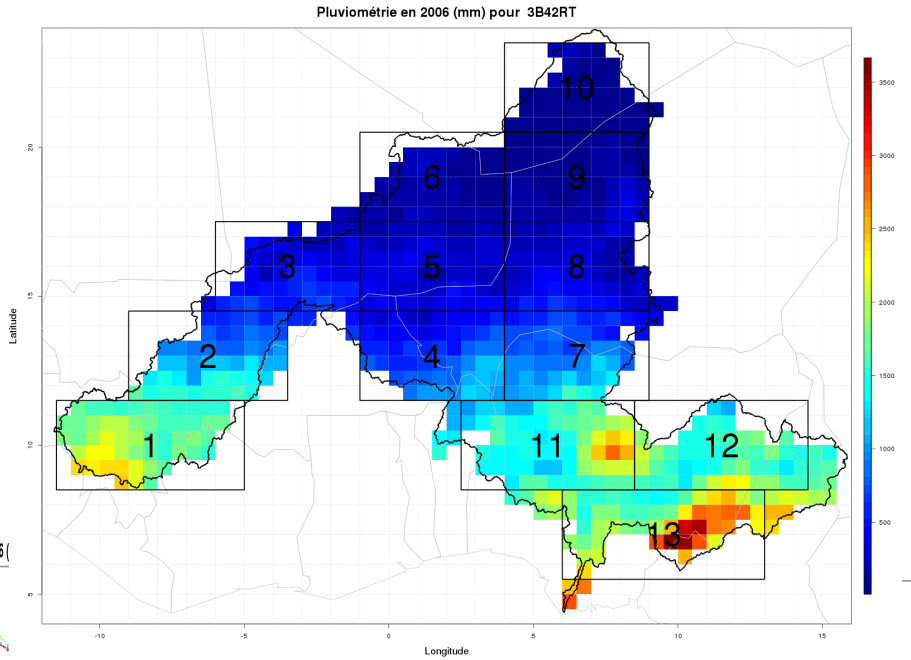



Zoom on 2010 :

RT products overestimation ( as we knew …..)

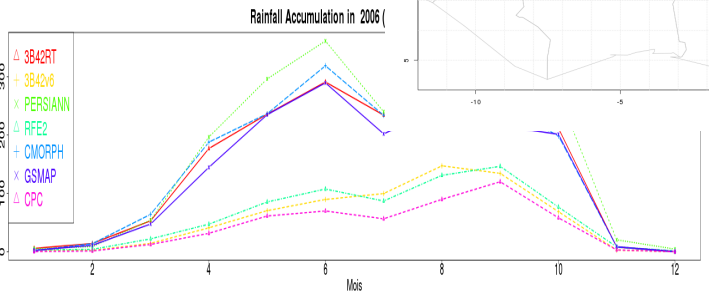
Next exercice : pdf matching based unbiasing and check …..

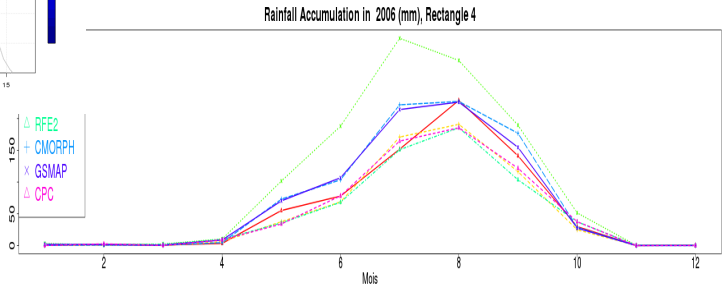


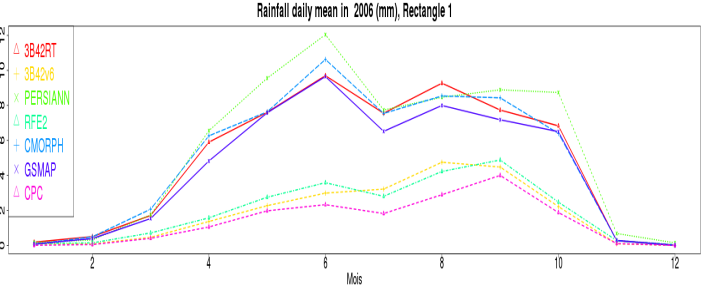

Problem :

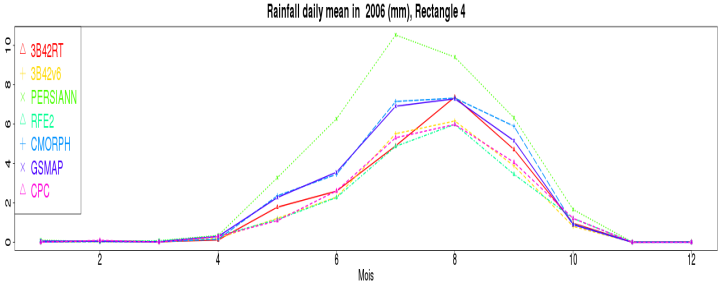
How to correct given variability inside the basin ?

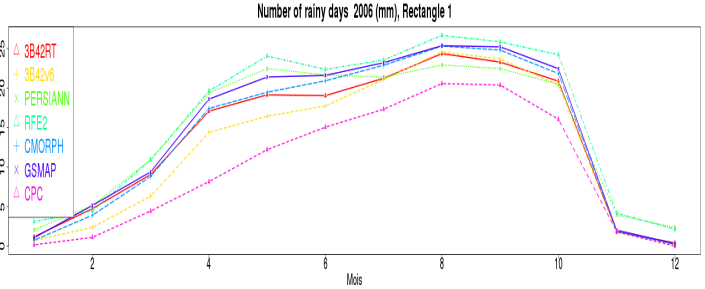
Which quality ref data to do that ?

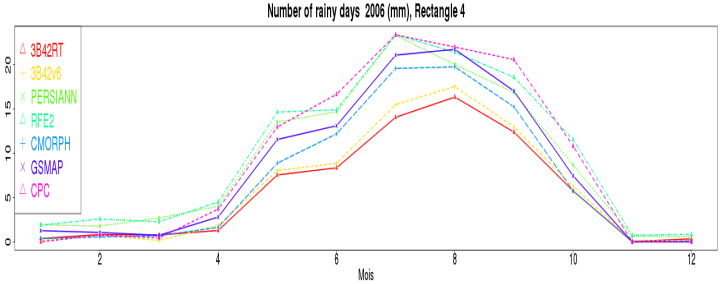


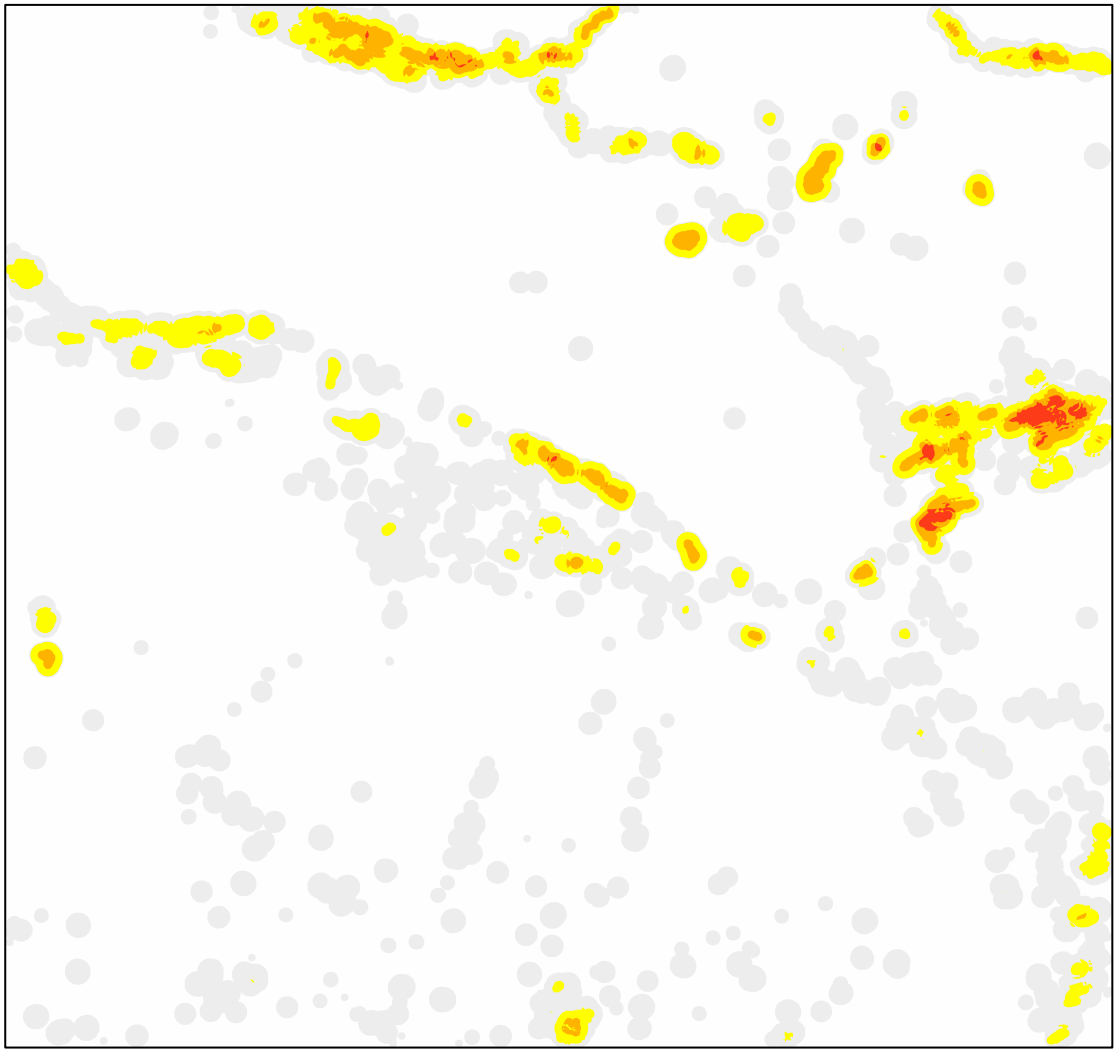



Collaboration with LA/ CNES - satellite applications to health issues

Region of Barkeji
Farlo, Senegal

40x40 km



**Application :**
Predicting the size and evolution of Ponds
-> to feed a Rift Valley risk model
Based on moskito life cycle
-> provide a risk index

1 gage only at the moment

Can the satellite provide more detailes spatial information ?

TEST :
The pond model is tested with :

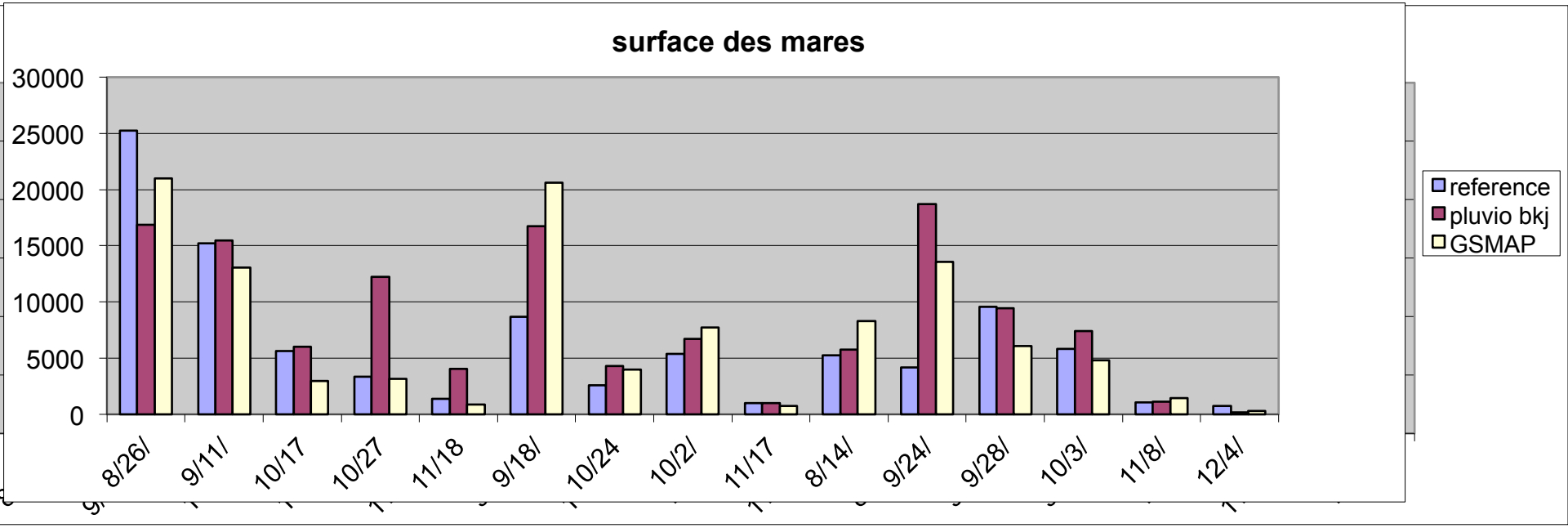
- The 1 gage info (uniform rain over domain)
- The GSMAP - 10 km resol – daily product

- The number and size of pond are compared with satellite (rad) observations – 15 images

PLUVIO
**correl (surface)** 0.669
**correl (nbr)** 0.625
GSMAP :
**correl (surface)** 0.779
**correl (nbr)** 0.847

RESULT :
Improvement when the model is run with the satellite rainfall GSMAP instead of the single gage :

Reason : satellite depicts better the spatial variability

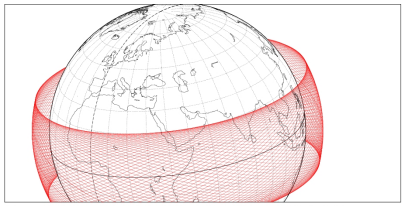


## Some perspectives :

- **Very preliminary work – to be continued**
- Extend the sensitivity studies to other diagnose then outflow
- For hydrological validation :
  - test with other model to check consistency of sensitivity (in the bias propagation for instance )
  - Work on inversing outflox_bias into rainfall diagnosis
- Test PDF matching of RT products to see if they can be used with a simple and systematic correction
- -How to integrate the product error bar / uncertainty information – generate ensembles ?

Thank you – questions or advices ?

# A new era ……. What is new ?



The sampling

More Physics

## Error bars !

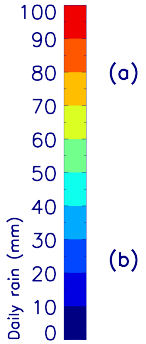
TAPEER the 1° x 1 day rainfall product

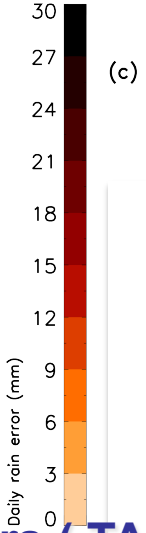
Integrates MT and other platform MW BRAIN based rainfall
+ IR information

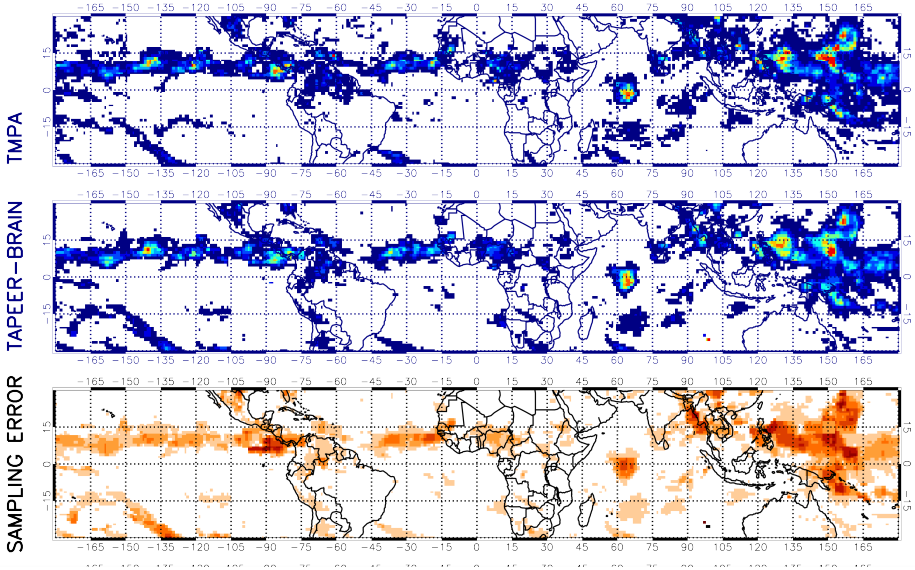
Tropical Amount of Precipitation with an Estimation of ERror

Provided with an estimation of uncertainty :

-sampling
-algorithmic (from BRAIN L2 to TAPEER L4)



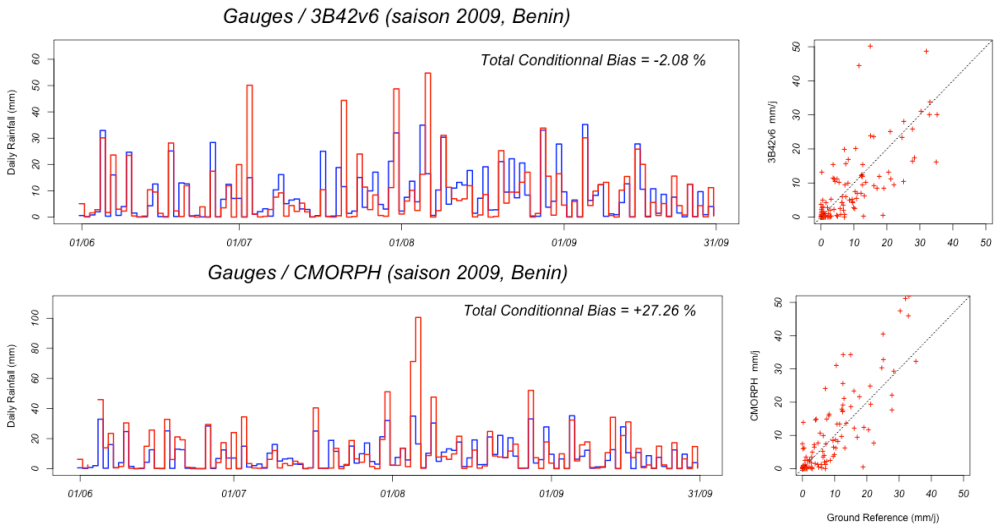




Example from 2009 test run
Courtesy Roca/Chambon

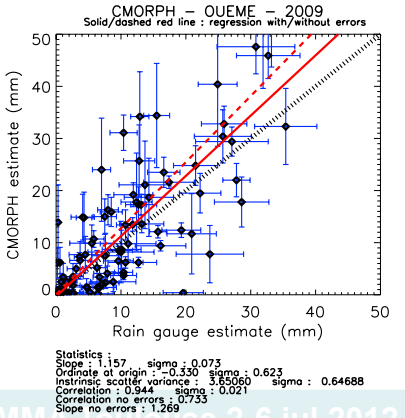
- **Error bars now available to users ( TAPEER – 3B42 v7) to account for uncertainty**
  - **Perspective = refine error model - time-space correlation of the errors**

## Some of what we have we have learned :

- 'good' depends of what you want to use the product for
  - Sensitivity of your application to (biases ? Far/ND ? Etc ..) to be checked




| BENIN | CMORPH | TRMM3B42v6 |
|---|---|---|
| Biais cond (mm/j) | 2.7 | -0.1 |
| Biais total (mm/j) | 2.3 | -0.2 |
| RMSD (mm) | 11.6 | 8.8 |
| WRMSD | 10.9 | 8.3 |
| Nash | -0.5 | 0.1 |
| R2 cond | 0.5 | 0.4 |
| R2 total | 0.6 | 0.5 |
| FAR (%) | 16.7 | 33.3 |
| NDR (%) | 9.5 | 13.8 |
| Nobs conditionné | 104 | 100 |

- Account for uncertainty / representatitivity error in the 'truth'

**Roca et al, 2010**