HydrologyWS21
June 29th – Jul 1st

Towards an operational forecasting system using altimetry assimilation : 2 case studies on the Niger and the Congo river basins

ECMWF

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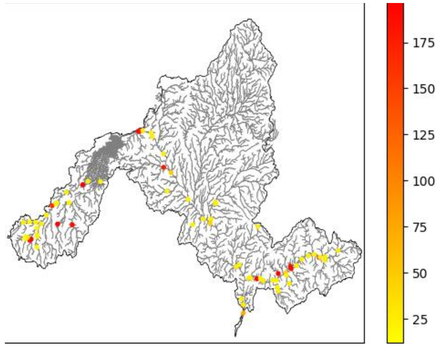
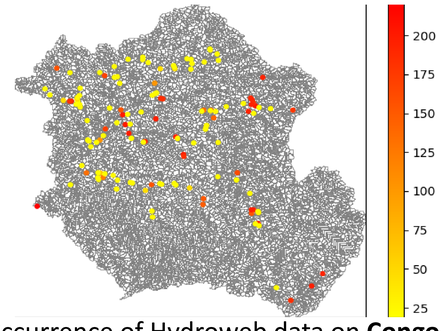
1. Context

- **Problem**: real-time flow prediction is subject to data and model uncertainties
- **Need**: the advent of new satellite missions requires the establishment of effective methods for integrating these data into hydrological models
- **Objectives** : Develop a hydrological forecasting platform using multi-source data assimilation

2. Study areas



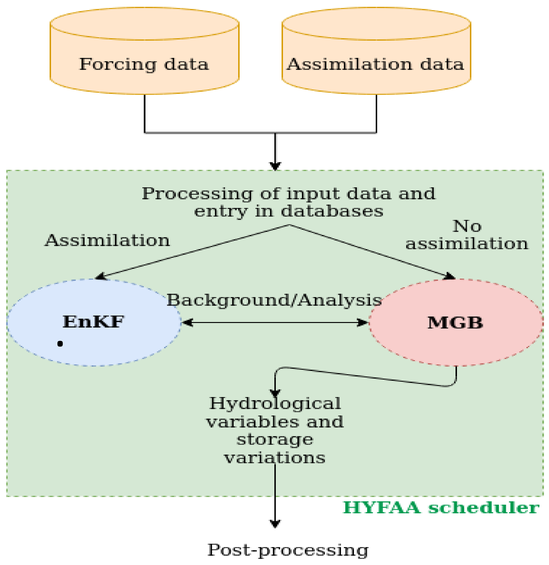
Occurrence of Hydroweb data on **Niger river basin** from 2012 to 2017



Occurrence of Hydroweb data on **Congo river basin** from 2012 to 2017

3. Method and design

HYFAA: **H**ydrological **F**orecasting **S**ystem with **A**ltimetry **A**ssimilation



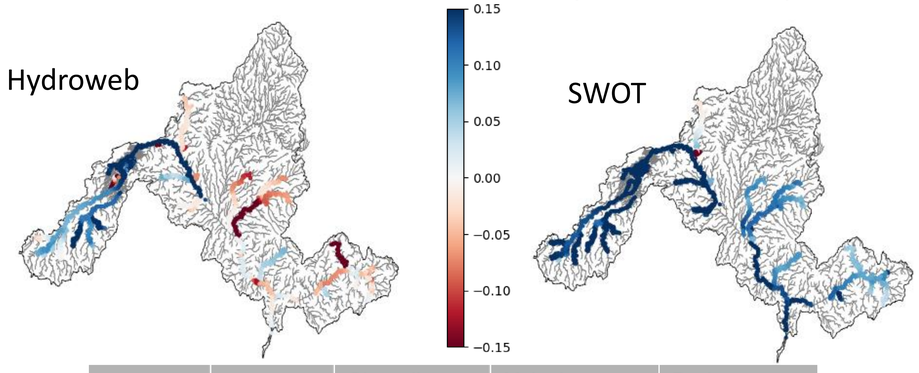
- **MGB model**: large-scale, distributed, process-based hydrological and hydrodynamic model.
- **Sequential DA method** : ensemble Kalman filter (**EnKF**)
- **Observations:** Hydroweb (Niger+Congo) **& SWOT** (Niger) **dicharge** derived from water levels

HYFAA platform could integrate others models and evaluate the impact of different observations design using the Kalman filter

- 1st validation in the framework of **Observing System Simulation Experiments** (OSSEs) or twin experiments (virtual observations)
- 2nd validation in the framework of **real experiments**

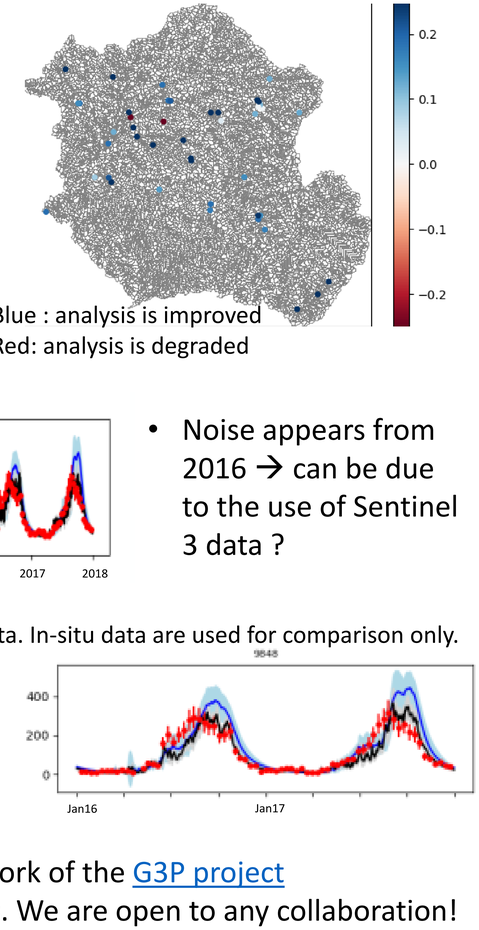
4. OSSEs results (Niger+Congo)

Difference of normalized RMSE (No assim-Assim)



NRMSE		Obs cells		Main river		Basin	
		Ctl	Anl	Ctl	Anl	Ctl	Anl
NIGER	Hydroweb	0,13	**0,08**	0,44	**0,31**	0,47	**0,46**
	SWOT	0,27	**0,12**	0,44	**0,18**	0,47	**0,39**
CONGO	Hydroweb	0,58	**0,34**	-	-	-	-

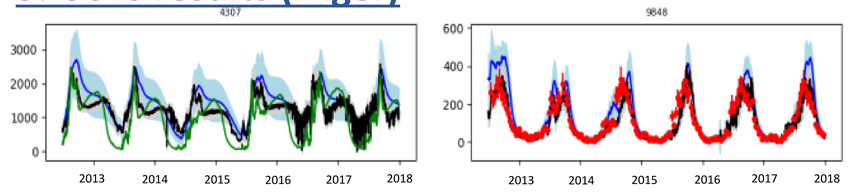
Ctl: control run (w/o assimilation) Anl: analyzed run (w/ assimilation)



Blue : analysis is improved
Red: analysis is degraded

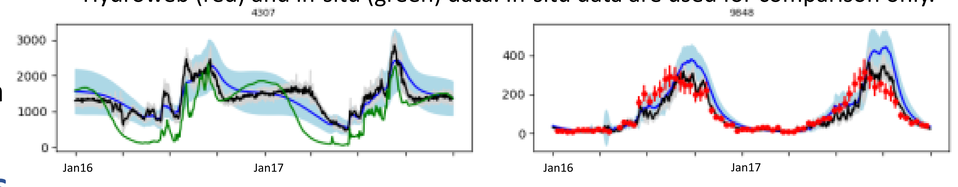
- DA generally improves simulated discharge
- Correction of hydrodynamics parameters improves discharge estimation
- For SWOT data, best results obtained with localization and selection algorithms

5. OSEs results (Niger)



Control (blue) and analyzed (black) discharge,
Hydroweb (red) and in-situ (green) data. In-situ data are used for comparison only.

- Noise appears from 2016 → can be due to the use of Sentinel 3 data ?
- Noise is reduced using quality control algorithm



6. Perspectives

- Perform/improve OSEs on Congo basin in the framework of the G3P project
- Extend the study to other basins or modeling systems. We are open to any collaboration!