Hydrological changes and flood increase in Niger River in Niamey seen with PERSIANN-CDR over the 1983-2013 period

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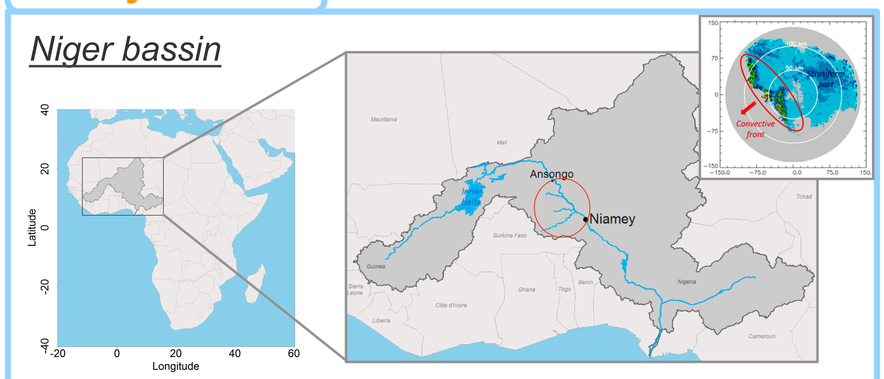
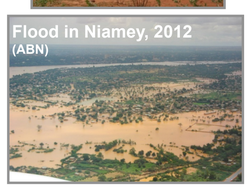
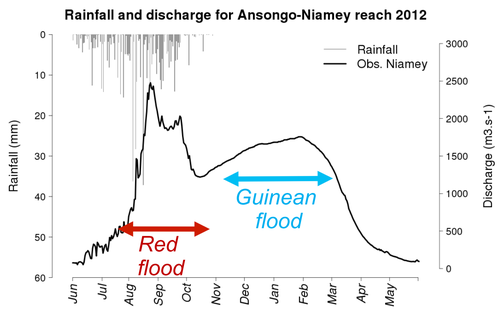
Study area

Niger bassin







Niger : 4200km, 2 000 000km²
Rainfall comes from African Monsoon (from June to October).

Nigerian Middle Niger and Niamey station (~120 000km²) :
- 'red flood' is triggered by local rainfall
- 'guinean flood' comes from the flood wave of upper basin.

Since the 21srt century Niger 'red flood' has increased and the 2010, 2012 and 2013 floods were the highest ever recorded in Niamey.

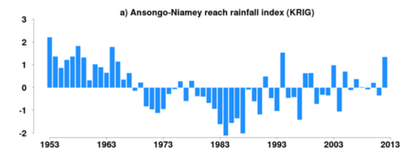
In this region, gauge network is sparse and there is no meteorological radar cover.
Satellite rainfall estimation is an attractive alternative.

Hydrological changes

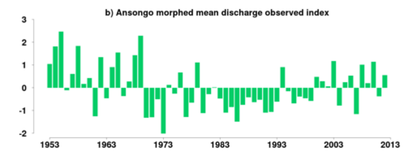
The region has suffered drastic changes over 60 years and for the last 10 years a sharp increase
In flood risk with record occurences of the
'red' flood

The relative role of Rainfall variability versus LULC is debated in the community

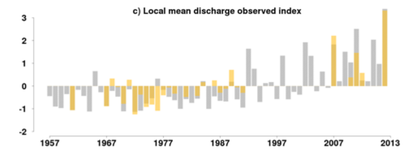
Rain fall over Basin



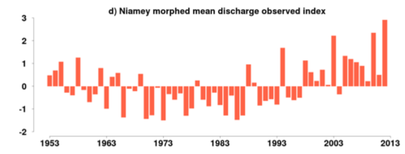
Ansongo discharge



Local runoff



Niamey's discharge



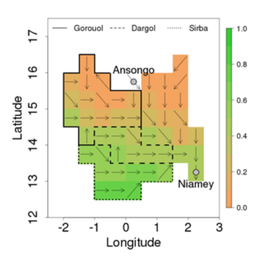
Hydrological Modelling

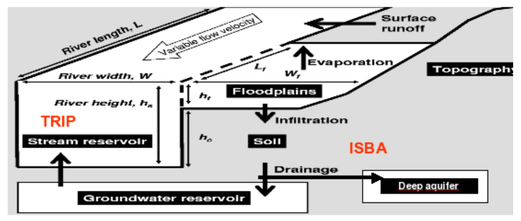
SURFEX plateform (CNRM, Masson et al. 2013)

ISBA (Land Surface Model) coupled with TRIP (Routing model).
Implemented in Ansongo-Niamey reach.

Model resolution : 0,5°*0,5° and 3h
+spatial desagregation (through the model)
+temporal desagregation (offline)

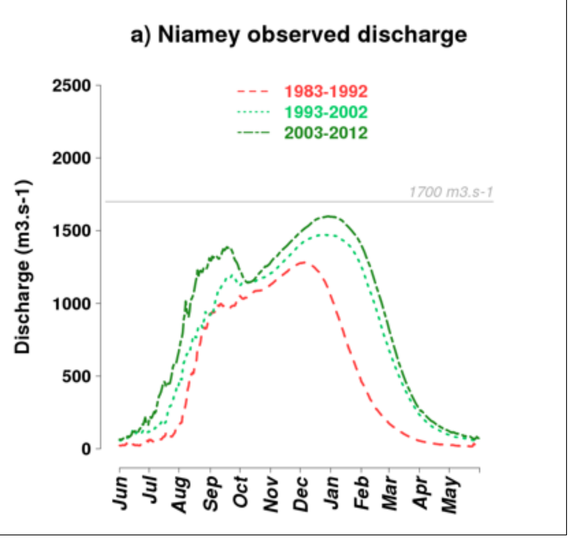
Daily discharge output.

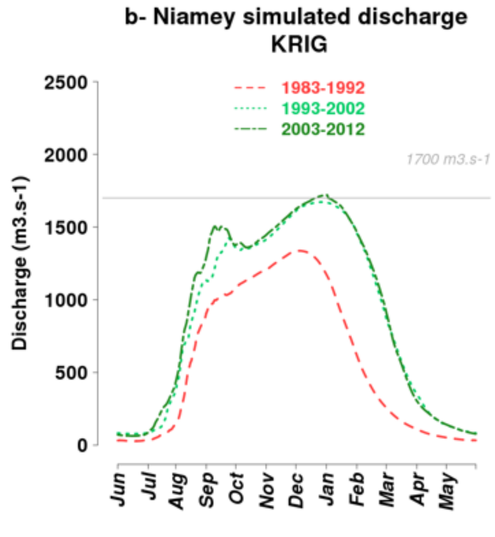


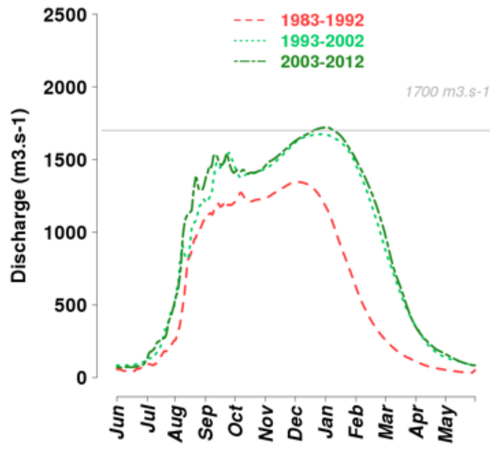


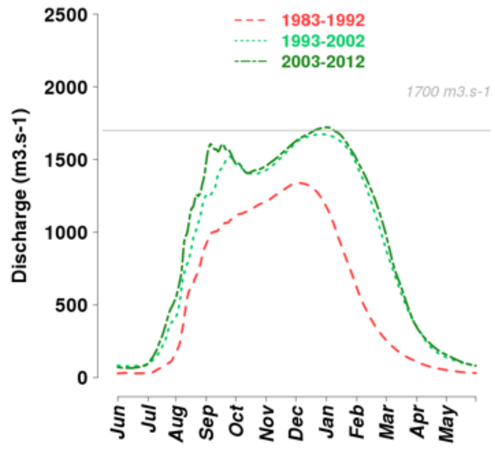
Observed versus simulated changes since 1983

OBS







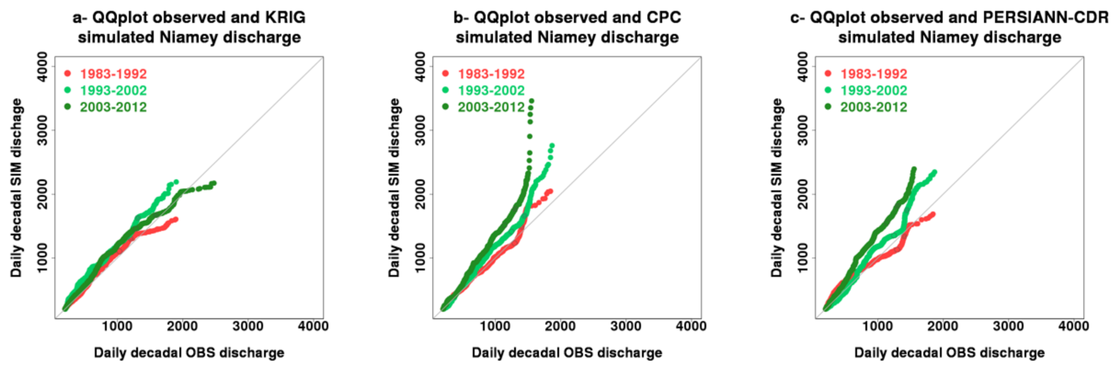


3 different rainfall forcing for the model :

i) KRIGed gauges from local weather services

ii) CPC gauge prod.

iii) PERSIANN-CDR



The model forced with an observed series of rainfall since 1983 (3 products)

Is able to reproduce the main change in the hydrograph since the 80s

Rainfall variability explains the changes in the hydrograph over the last few years

Conclusion

→ Hydrological modeling was used to study the changes observed in the Niger river in Niamey over the last 30 years.

→ showing that rainfall variability is the main driver for the observed changes since the 80s – Long series of satellite products (PERSIANN-CDR) can help understanding hydroclimatic changes

→ a most recent study (*Casse, C. et al, 2016 : Model-based study of the role of rainfall and Land Use Land Cover in the changes in Niger Red floods occurrence and intensity in Niamey between 1953 and 2012. hess-2015-427*) shows that if rainfall variability alone can explain the changes over the last 30 years, LULC is needed to explain the changes over 60 years.

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