The Saint-Louis beach (Senegal) evolution between coastal changes and Senegal River variability

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The Saint-Louis beach (Senegal) evolution between coastal changes and Senegal River variability

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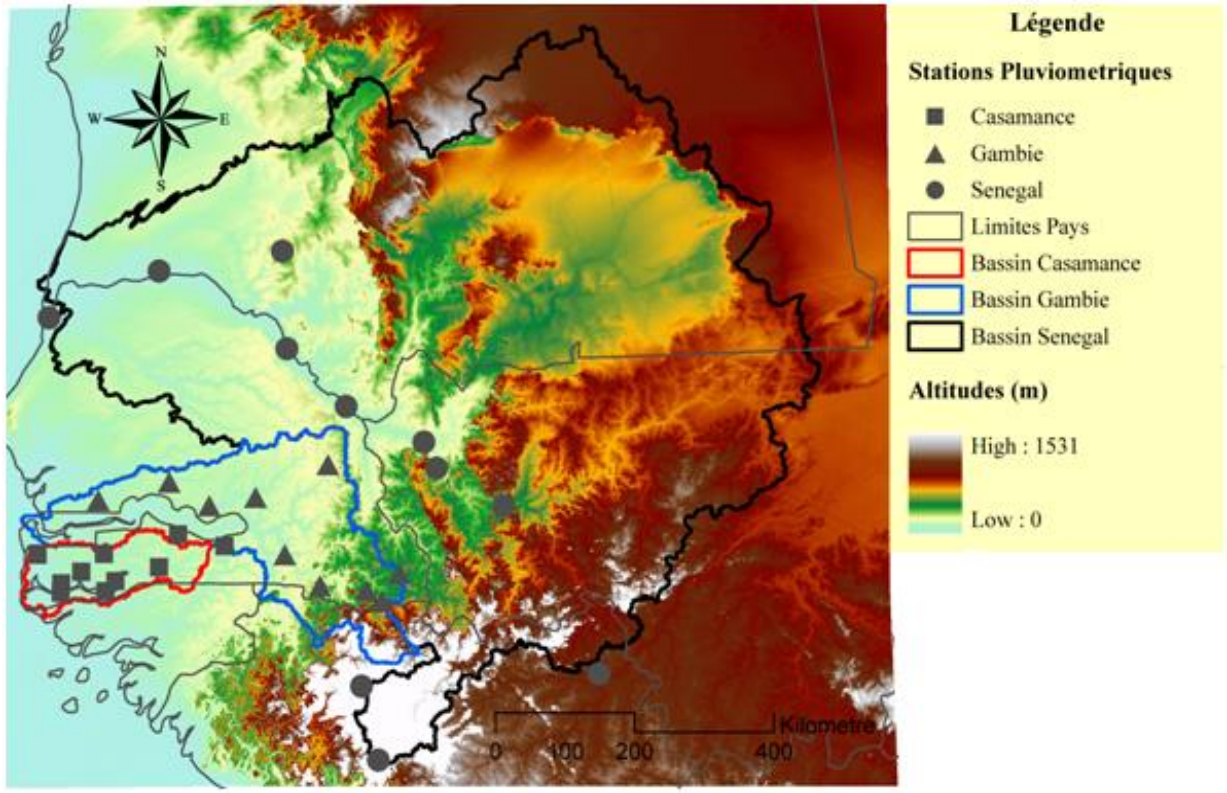
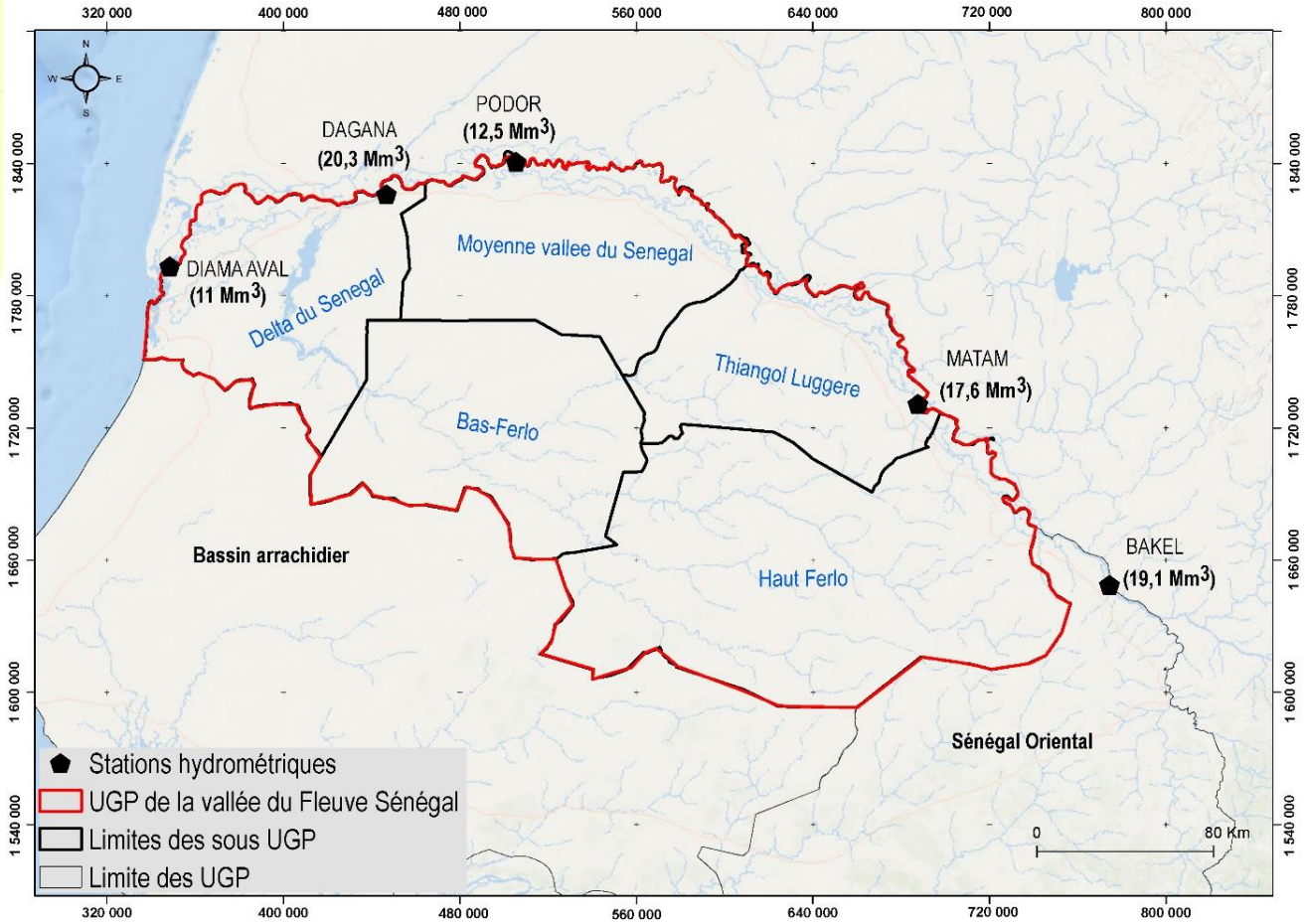
Senegal river basin



Senegal's main watersheds

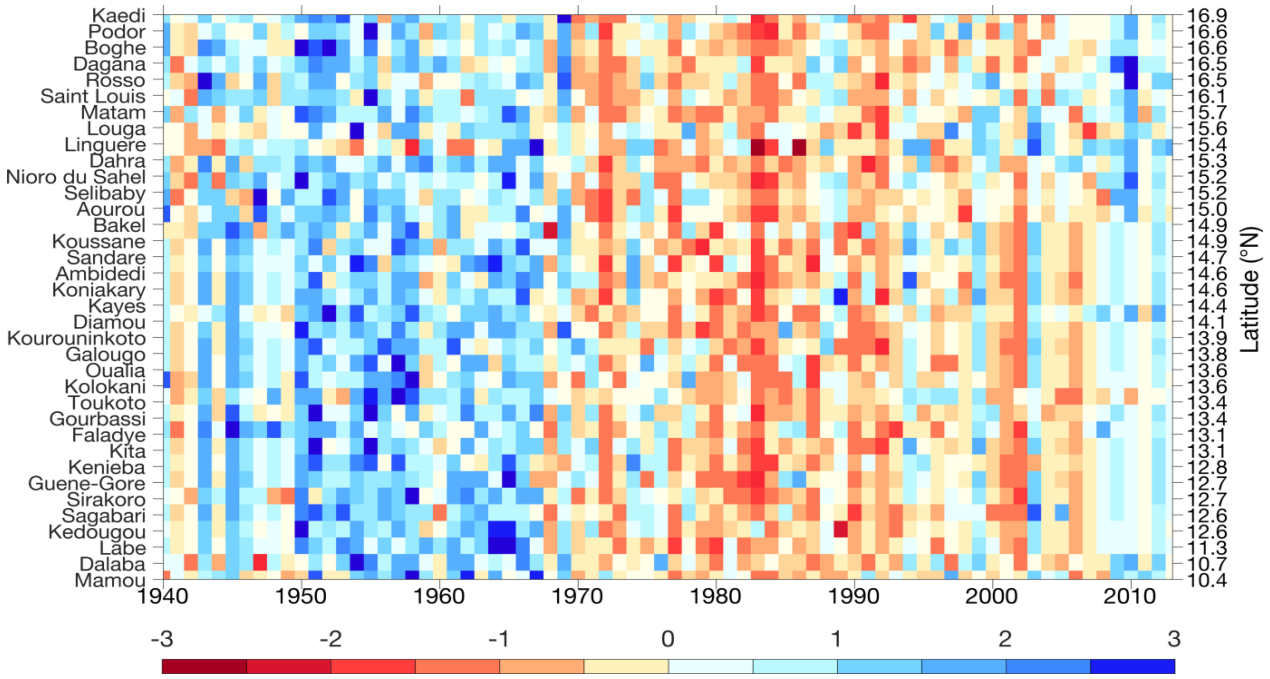
- Surface: 300,000 km2 of which 9.5% concerns Senegalese territory.
- Average flow of 600 m^3/s in Bakel (1950-2014). Volume of 19 billion m^3//year

- ✓ Senegal Basin covers four countries: Guinea Conakry, Mali, Mauritania and Senegal;
- ✓ Second most important river basin in WA after Niger;
- ✓ River basin under the jurisdiction of the OMVS.

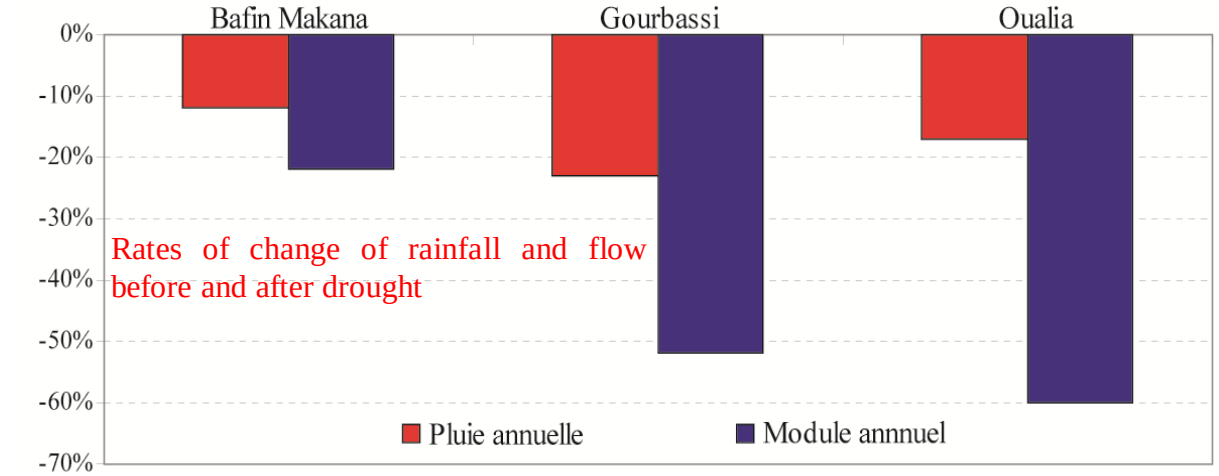


Annual water availability

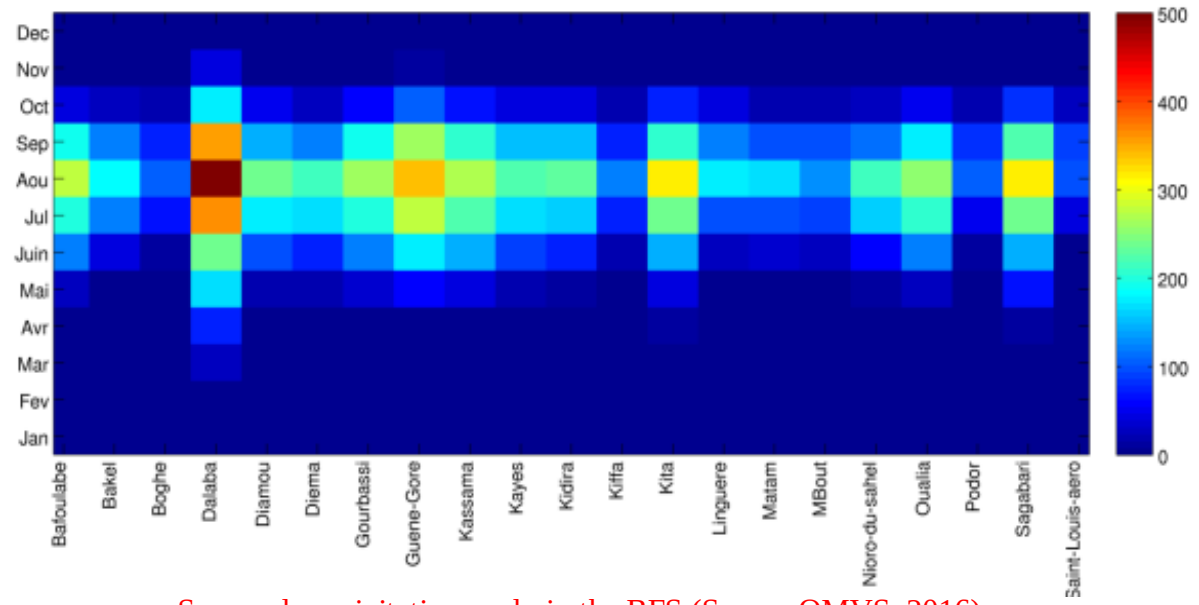
Water resources already impacted by drought



Variability of standardized rainfall anomalies in the Senegal basin over the period 1940-2013 (Bodian et al., 2020).



Rates of change of rainfall and flow before and after drought

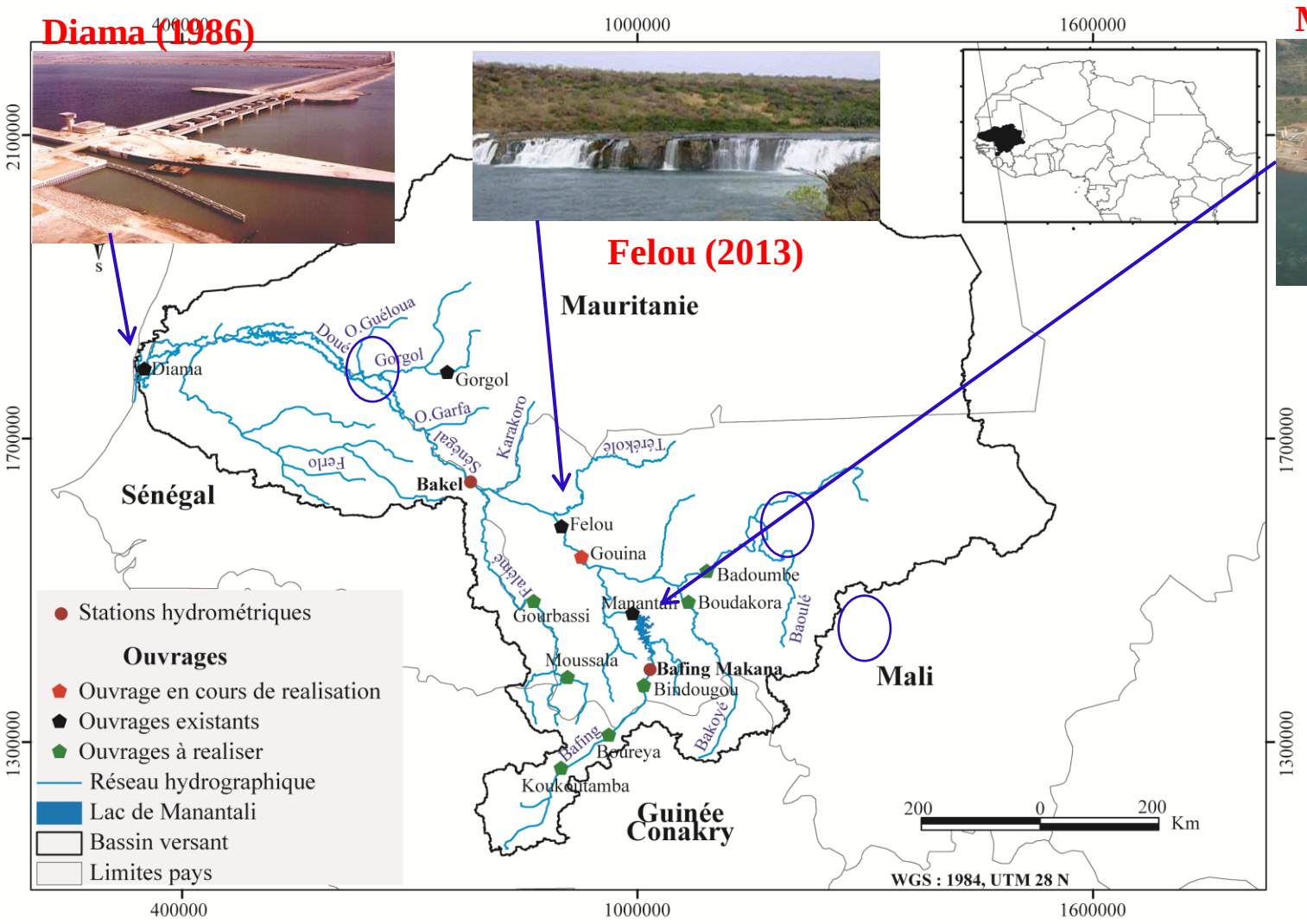


Seasonal precipitation cycle in the BFS (Source OMVS, 2016)

- Drought of the late 1960s
- Decrease in rainfall and flows in the Senegal basin with negative impacts on people's lives

✓ The drought of the late 60s strongly impacted water resources
✓ Water deficit amplified compared to the rainfall deficit

Drought Response: Hydraulic Works



Main hydraulic structures in the Senegal River basin (Bodian et al., 2015)

- ✓ 3 dams built
- ✓ 1 dam under construction
- ✓ 7 dam projects in the future

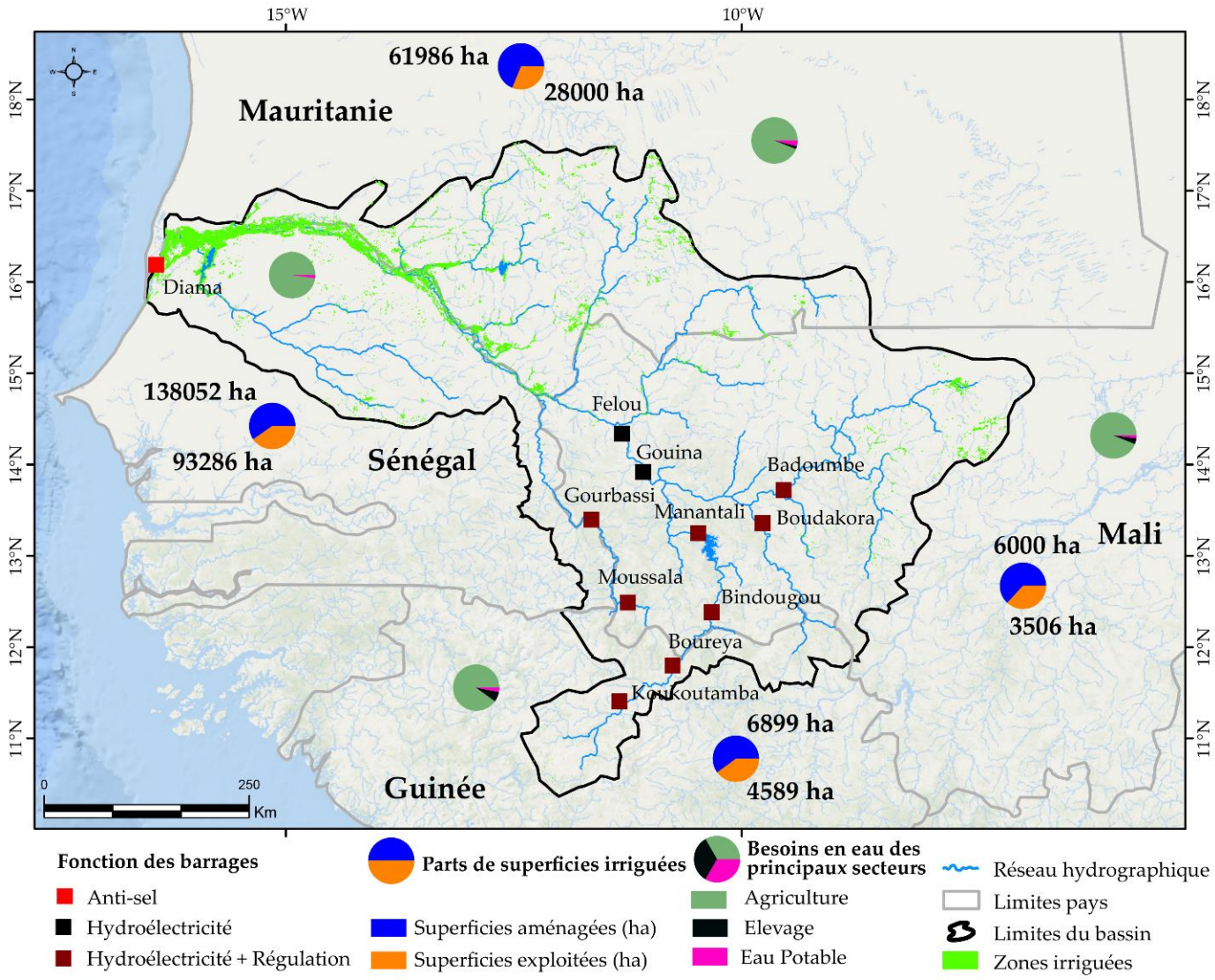
Manantali : ouvrage multi usages :

- une capacité de stockage de 11,3 milliards de m^3
- une production d'énergie de 800 GWh/an
- une capacité d'irrigation de 255 000 ha

Felou : Barrage au fil de l'eau

Productible en énergie : 350 GWh/an)

Senegal River: main source of water

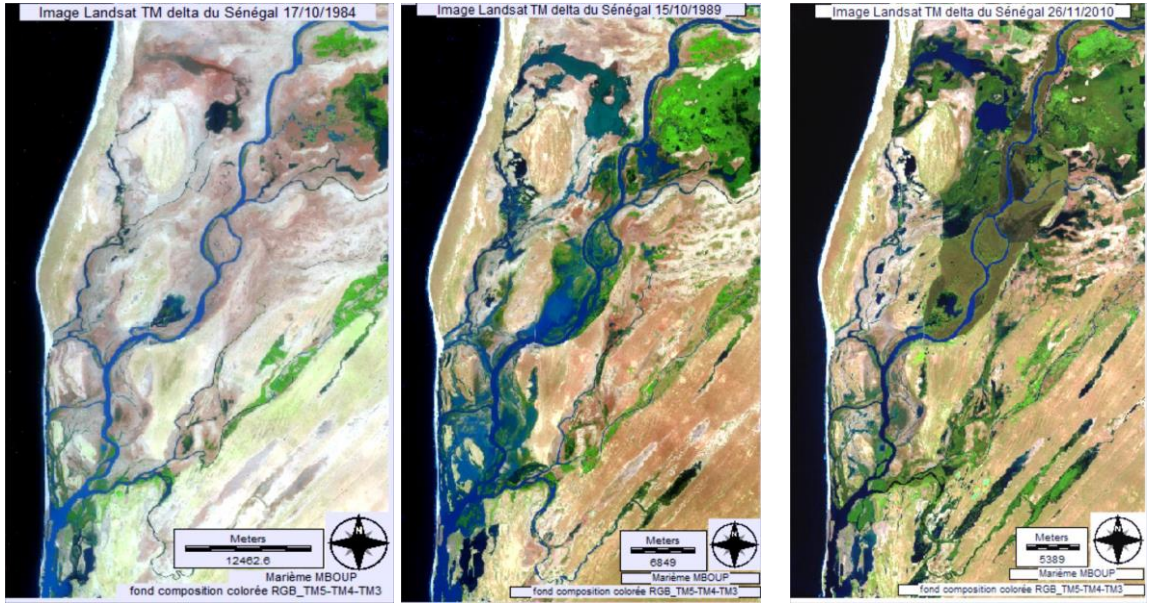


Dams, irrigated areas and areas, water needs of the main sectors of activity (Ndiaye, 2021)

Some advantages of hydraulic structures

- Securing water for agriculture
- Improving water availability for the AEP (Dakar and Nouakchott)
- Limitation of marine intrusion
- Implementation of development Possibility of navigability of the river to Ambidédi (nearly 900 km)

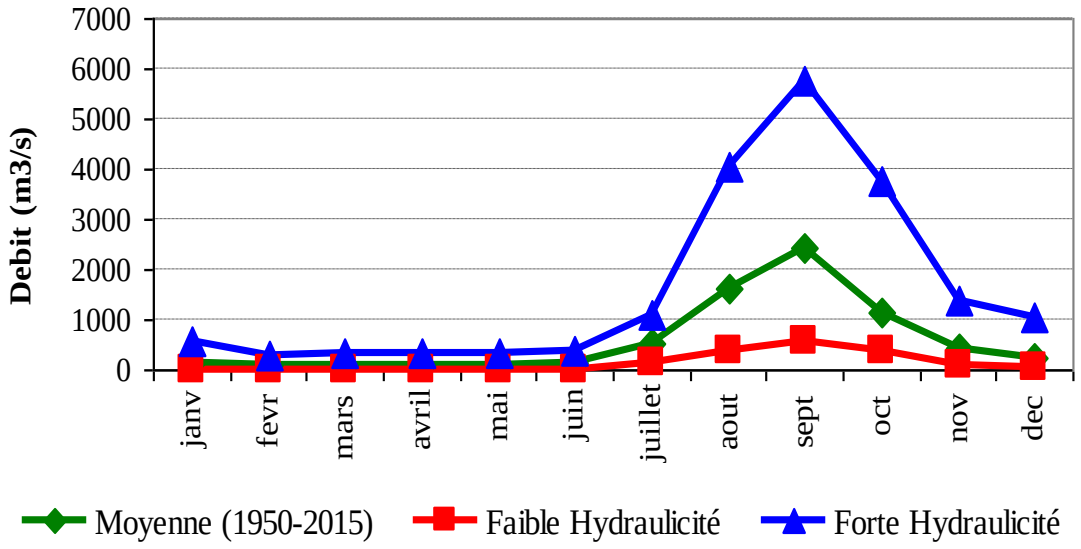
Disadvantages related to hydraulic structures



Landsat TM images of the Senegal Delta in 1984, 1989 and 2010 highlighting the evolution of aquatic vegetation in the Diama Reservoir (Mboup M, 2014)

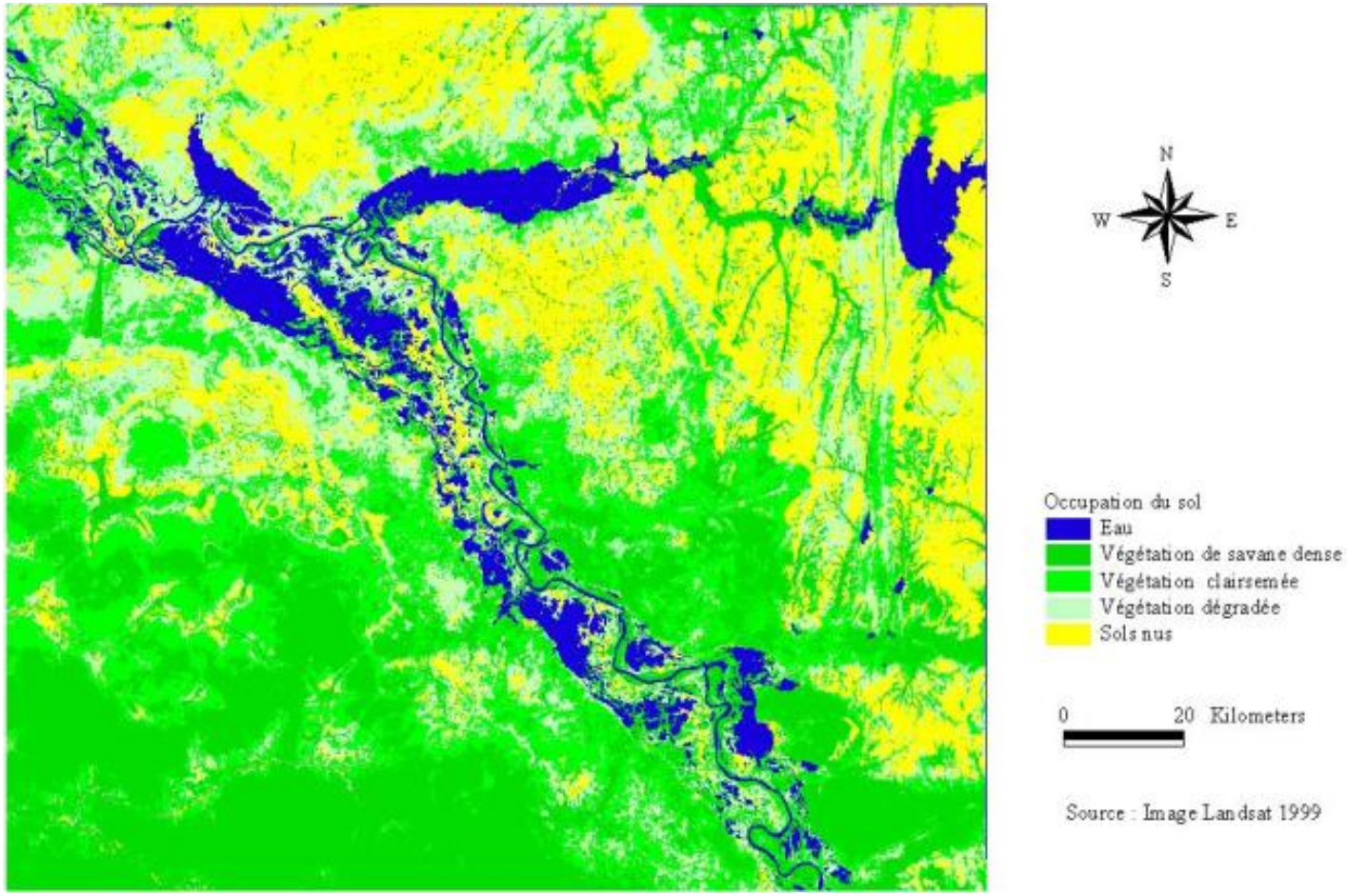
Senegal River floods: a risk factor

Flow regime: Rainfall
Hydrological Maximum : September

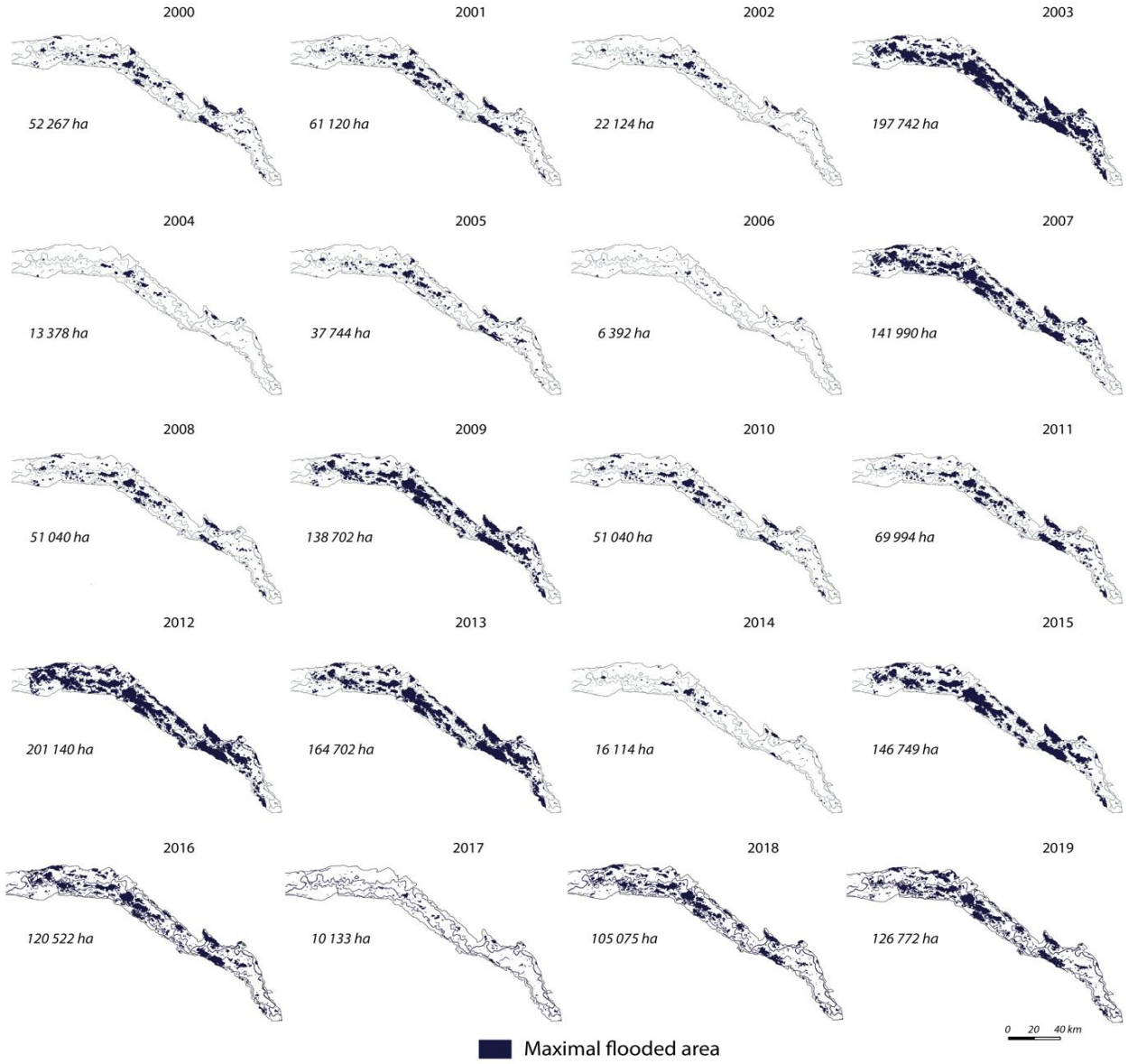


During the flood period, cities that are in the floodplain and in the delta (Saint Louis) are threatened by the floods of the river.

Floodplain in the Senegal River Valley in October 2019 (Bodian, 2006)

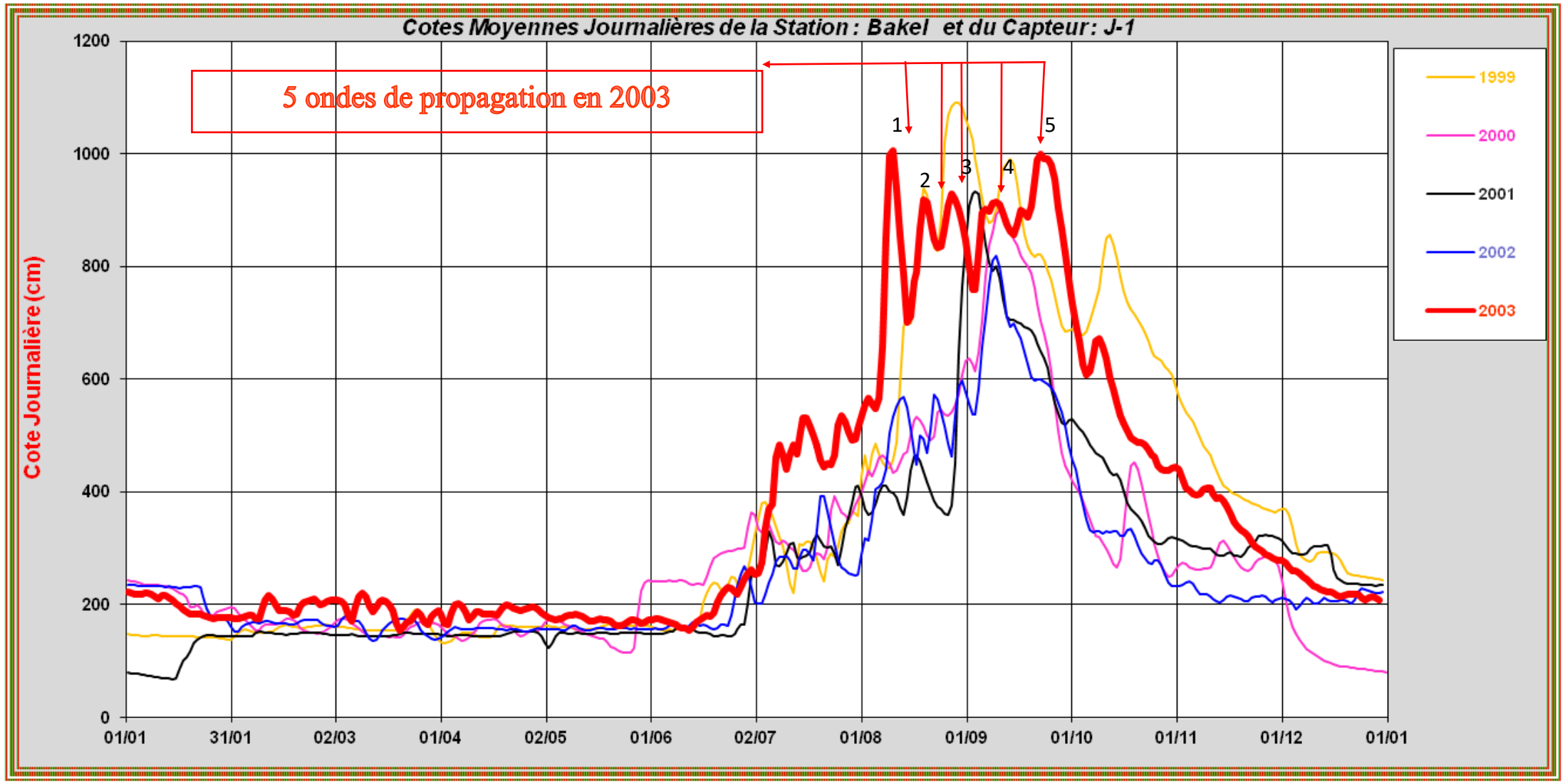


Senegal River floods: a risk factor



Maximum flooded areas between 2000 and 2019. Flooded area is detected using NDWI > 0. Data from MODIS MOD09A1 (Bruckmann et al., 2022)

Floods of the Senegal River: a risk factor



Hydrological situation of the Senegal River in 2003: year of opening of the Saint Louis breach

A Breach to save Saint Louis from floods

03 oct. 2003: 4 m

06 oct. 2003: 200 m

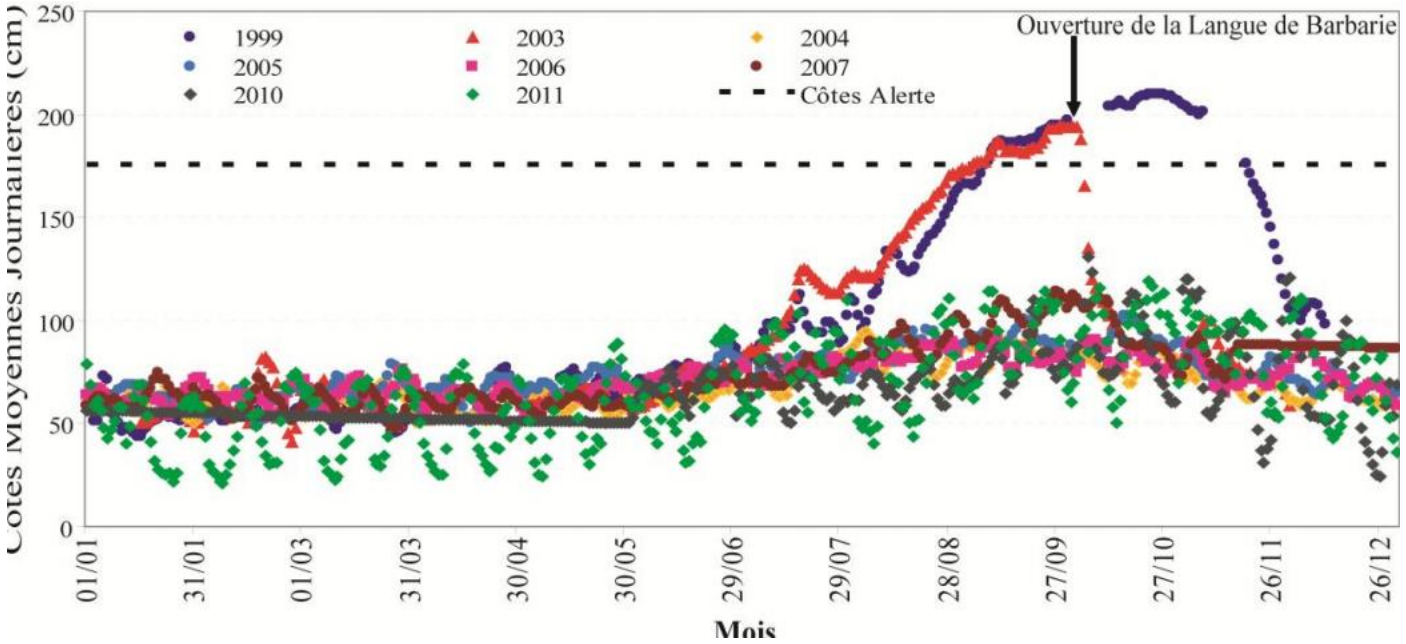
Juin 2004: 730 m

Mai 2005: 1200 m

A Breach to save Saint Louis from floods

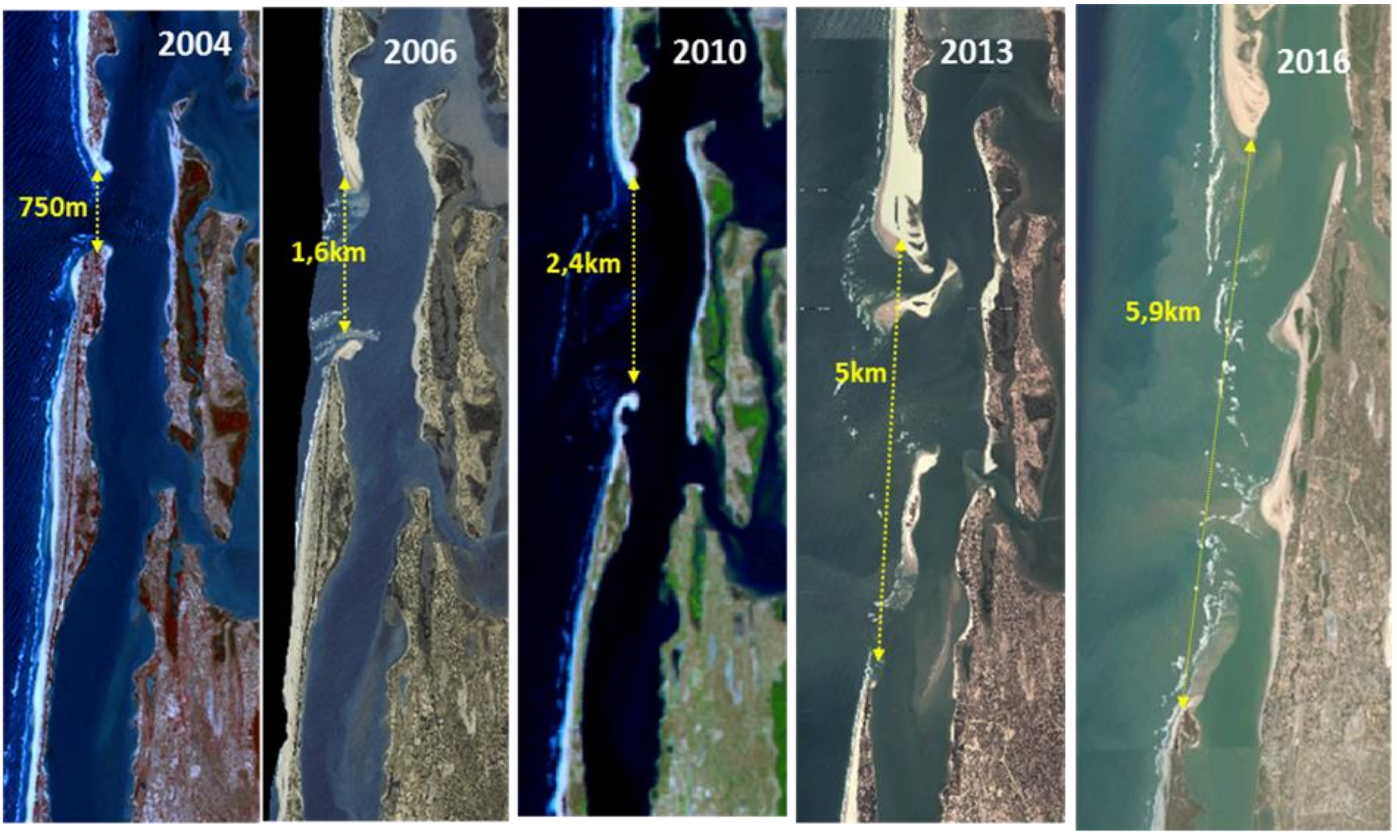
Falling river level

The Senegal River under the Faidherbe Bridge in Saint-Louis, December 2003



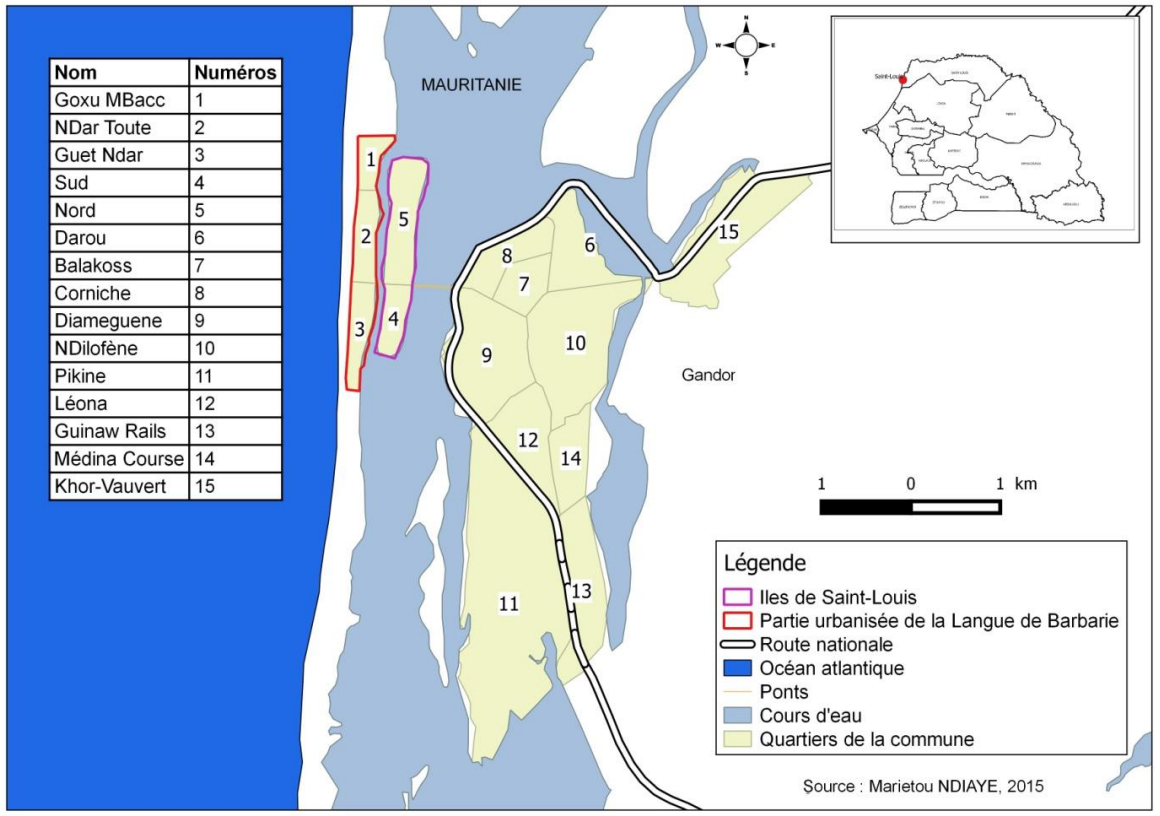
Since the opening of the breach, the alert coast has never been exceeded in Saint-Louis.

Breach: factors of vulnerability



Evolution of the breach from 2004 to 2016 (Source Niang, 2017)

Source : Ndiaye-Dia (2013)



Nom	Numéros
Goxu MBacc	1
NDar Toute	2
Guet Ndar	3
Sud	4
Nord	5
Darou	6
Balakoss	7
Corniche	8
Diameguene	9
NDilofène	10
Pikine	11
Léona	12
Guinaw Rails	13
Médina Course	14
Khor-Vauvert	15

The dynamics of the breach threaten to make disappear the districts of Saint Louis located at the level of the Langue de Barbarie (sandy cordon that separates the river and the ocean)

Breach: factors of vulnerability

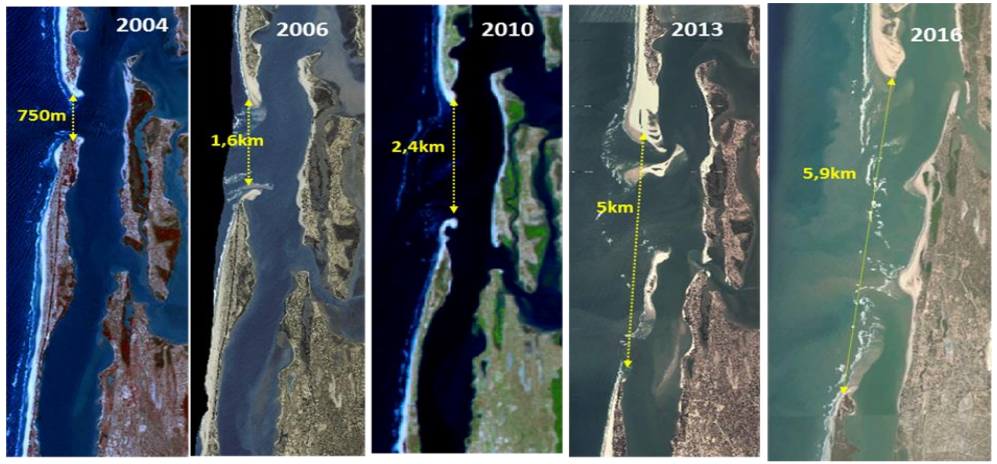
Consequence of the erosion of the Langue de Barbarie

Erosion and collapse of houses in Doun Baba DIÈYE, October 2010

Filaos in the water on the coast of St-Louis-Gandiol, 2009

Image source: Sy A.A., 2013

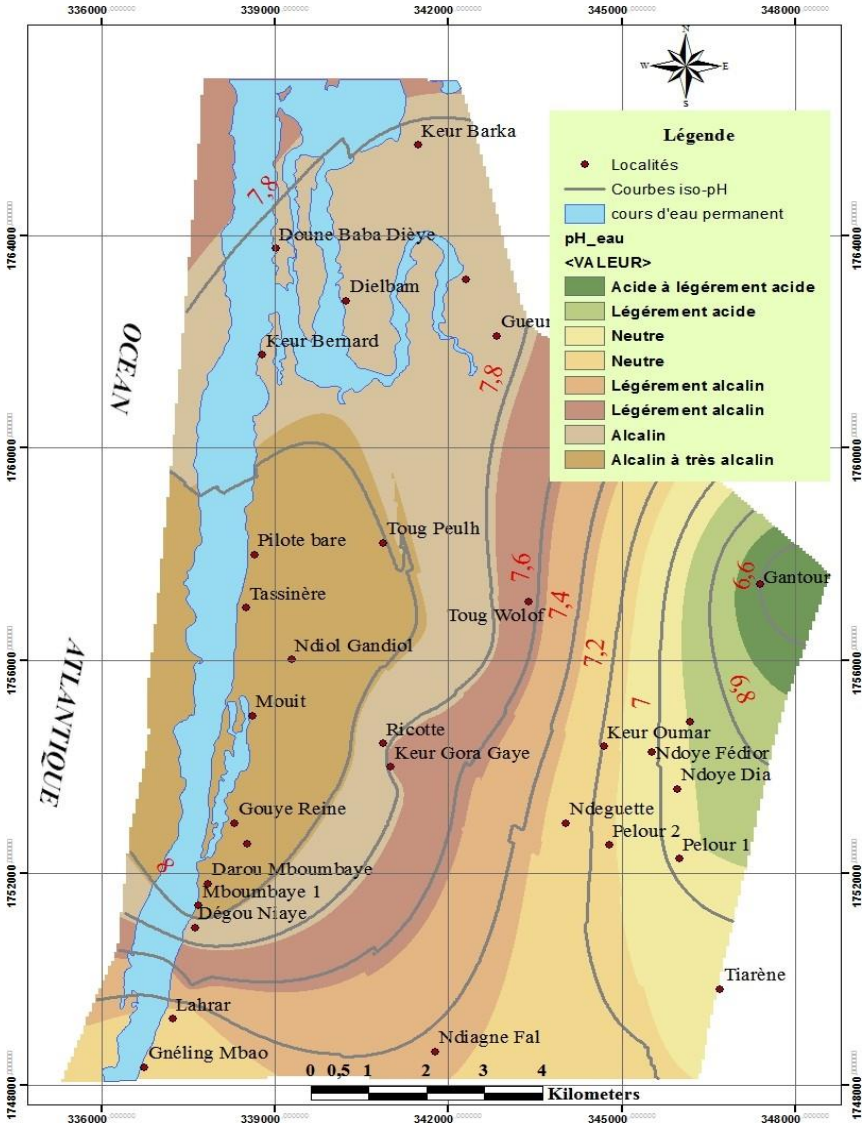
Breach: factors of vulnerability



Evolution of the breach from 2004 to 2016 (Source Niang, 2017)

The dynamics of the breach creates a salinization of the agricultural land of Gandiolais thus threatening the continuation of market gardening activities in the area.

Abandoned wells on Vegetable plots Ricotte and Gouye Reine (Source Niang, 2017)



Salinization of gandiolais lands (Niang, 2017)

Breach: factors of vulnerability

The dynamics of the breach accentuate the vulnerability of the coastline of senegal's great coast; especially in Saint Louis and its surroundings:

- increased coastal erosion;
- habitat vulnerability;
- vulnerability of the fishing sector (fishermen's accidents related to sandbank movements at the breach);
- vulnerability of agriculture, in particular the market gardening of Gandiolais with the salinization of land.

THANK YOU FOR YOUR ATTENTION!!!