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WELCOME !



AI FOR WATER



# RAINSMORE/SWOT WORKSHOP ON ARTIFICIAL INTELLIGENCE

OCTOBER 24th-28th 2022

Online and Presential Conference

FORTALEZA, BRAZIL

Bienvenue  
à toute et  
tous!

Bemvindas  
Bemvindos!

- LABOMAR Auditorium, Fortaleza
- <https://www.youtube.com/c/LabomarUFCE>
- <https://us02web.zoom.us/j/85911974011?pwd=Y29hOG0rZWRpcVpjMTNychBmNE0rUT09>



Marielle Gosset (IRD / Get Toulouse ; FUNCEME Fortaleza)

## Objectives :

- This is thought as the first workshop of a series
- The objective is to gather
  - AI specialists – with expertise in numerical methods
  - HydroMeteorologists – with data and questions to be addressed-> to develop better analysis / estimation / prediction tools and products.



### Organization / program :



Geraldo  
Ferreira  
LABOMAR/EOLLAB



Marielle  
Gosset  
IRD/GET



Tarcisio  
Maciel  
UFC/GTEL



Emilie  
Caillault  
ULCO



Nicolas  
Araujo  
UFC/GTEL



Geoscience  
Remote Sensing

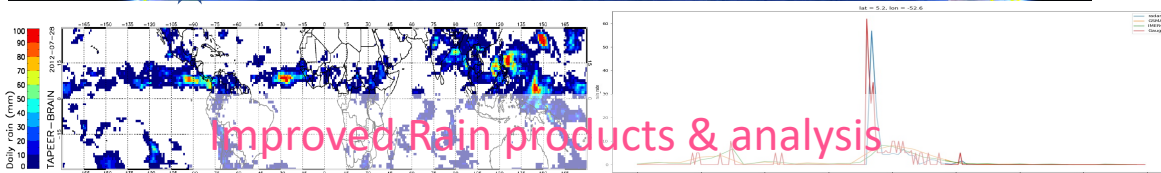
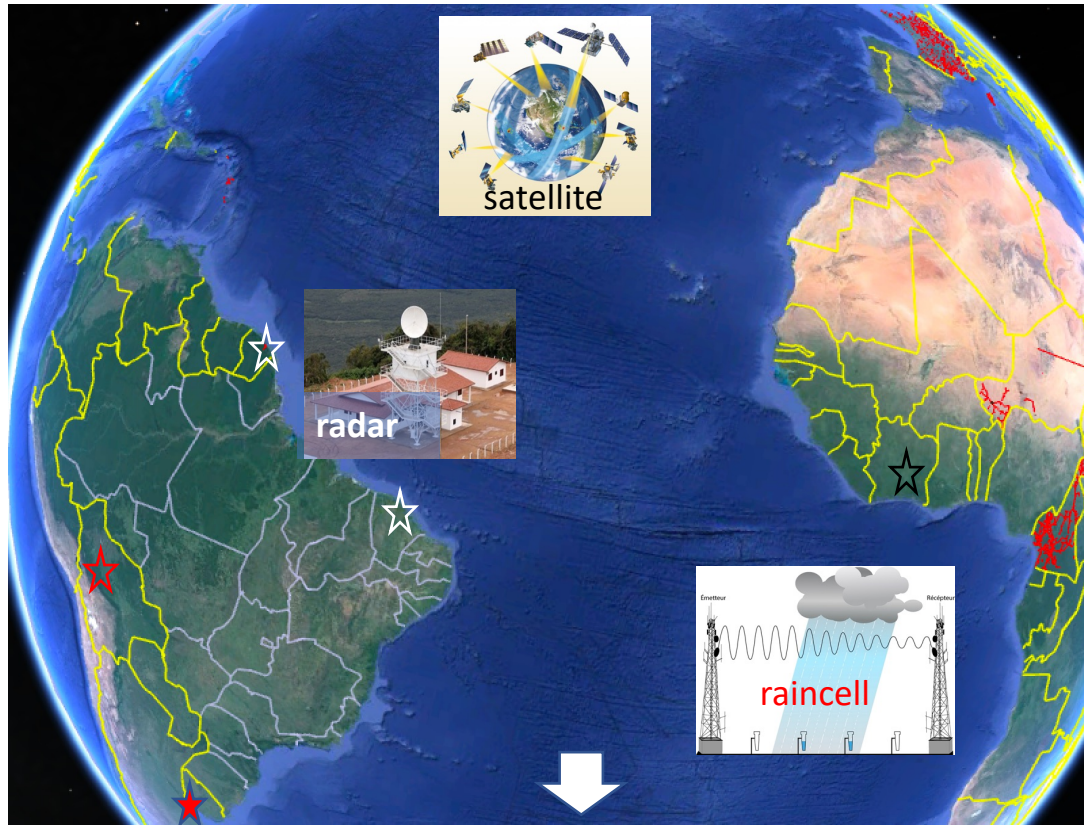
Data Science  
Signal processing  
Numerical methods





# RAINSMORE, FOR 'RAINCELL AND OTHER INNOVATIONS, SATELLITES, TELECOMMUNICATION NETWORKS, RADAR FOR ESTIMATION AND MAPPING OF PRECIPITATION

- An International Research Network (IRN) financed by IRD.
- Coordination M Gosset and M Kacou.



Improved Rain products & analysis

## Combine data for better Rainfall products and analysis

- > innovate with new data
- > innovate with new methods (IA – merging)

RAINSMORE objectives is to gather experts in data science and hydrometeorological sciences, to innovate together.

## RAINSMORE

- gathers scientists from Africa, South America and Europe.
- Several instrumented pilot sites and data.



# SWOT SURFACE WATER & OCEAN TOPOGRAPHY

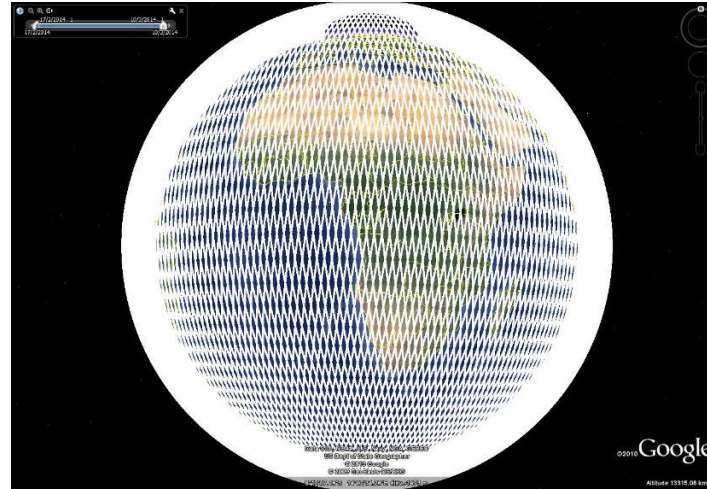
Launch date : Dec 2022 !!



<https://www.aviso.altimetry.fr/en/missions/future-missions/swot.html>

## First global high-resolution mission

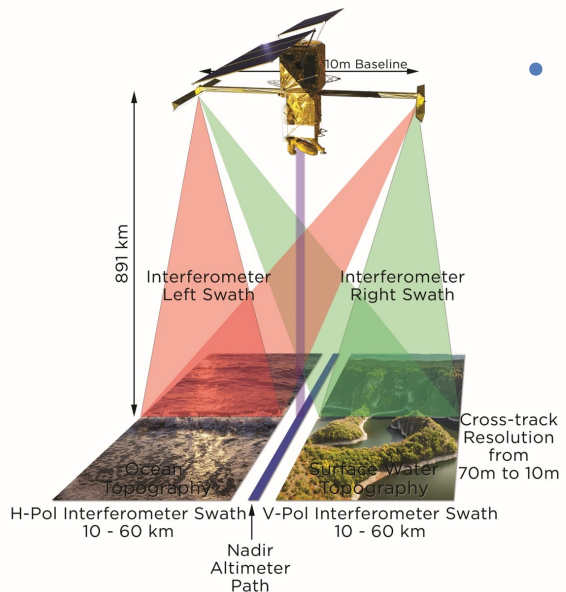
For Hydrology, continental water surface  
Altimetry/mapping mission  
(micro-wave interferometry)



## Swot Hydro Products

- River : 100 m
- Lakes : 250x250 (hope: 100x100)

- A new instrumental concept, with:
  - two 50-km swaths
  - a bi-dimensional image
  - Using interferometry to estimate water height
  - Synthetic Aperture Radar processing
  - a **Ka-band emission source**
  - two synthetic aperture radar (SAR) antennae at opposite ends of a 10 m boom

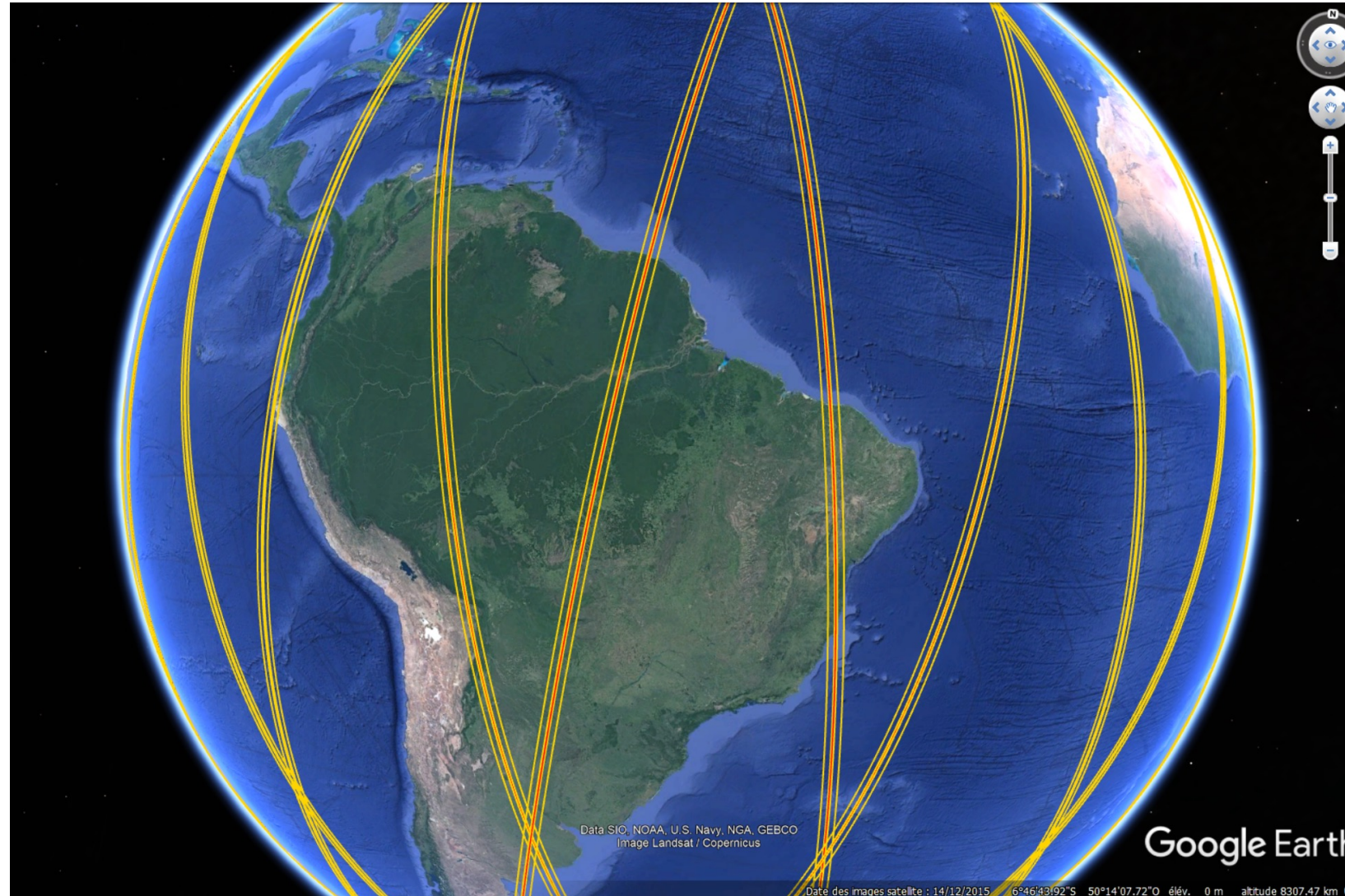




# Fast-sampling orbit (1 day)

A 1-day repeat period, during the initial phase to achieve the Cal/Val objectives **and study rapidly changing phenomena.**

**March-June 2023**



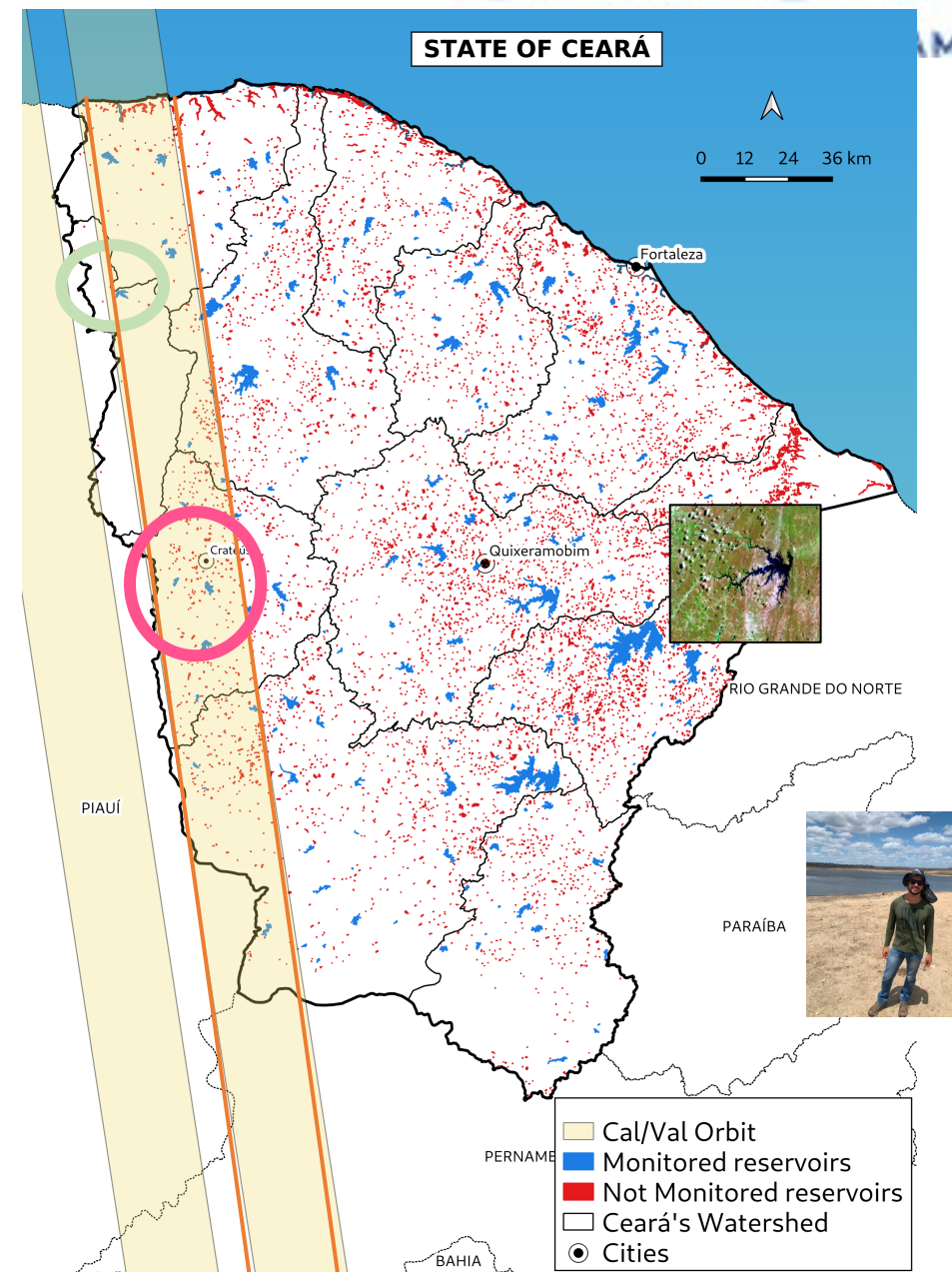
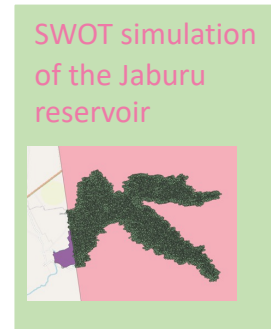
# SWOT NordEste



SWOT EA team

SWOT CAL/VAL site :

- 8 reservoirs equipped in Crateus area
- Preparing the use of SWOT in synergy with other satellites (landsat / Sentinels SAR - Hyperspectrals - altimeters)
- Mapping small reservoirs?
  - Which Methods ?



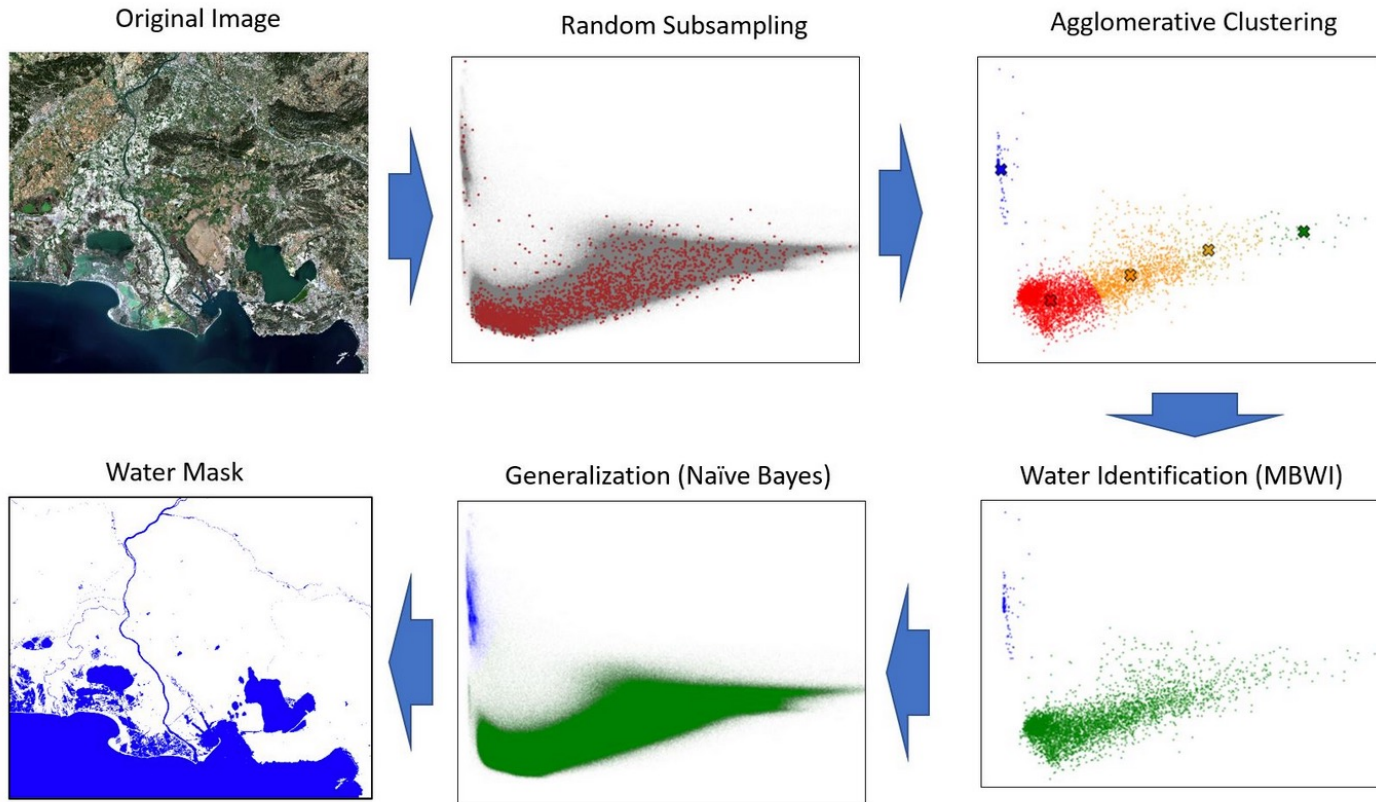


## **This week's Objectives for the water cycle community :**

- Understand better what AI is and can bring in data/image analysis (morning sessions / presentations).
- Start experimenting on some concrete data sets and questions (afternoon hands on)



# Example : hyperspectral images classifications for water surface detection and water volume quantification / monitoring



Water surface detection

A big issue in Ceara

(See Rafael Reis talk this morning )

Can IA techniques help ?

Cordeiro, M. C. R.; Martinez, J.-M.; Peña-Luque, S. Automatic Water Detection from Multidimensional Hierarchical Clustering for Sentinel-2 Images and a Comparison with Level 2A Processors. Remote Sensing of Environment 2021, 253, 112209. <https://doi.org/10.1016/j.rse.2020.112209>.

# Example : Rainfall estimation from satellite / radar / Telecom microwave links

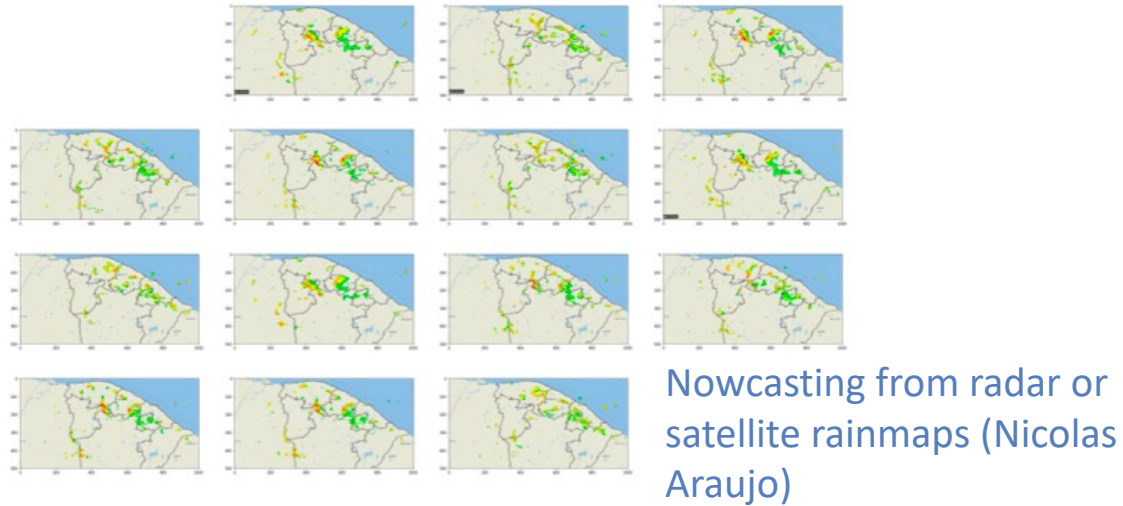
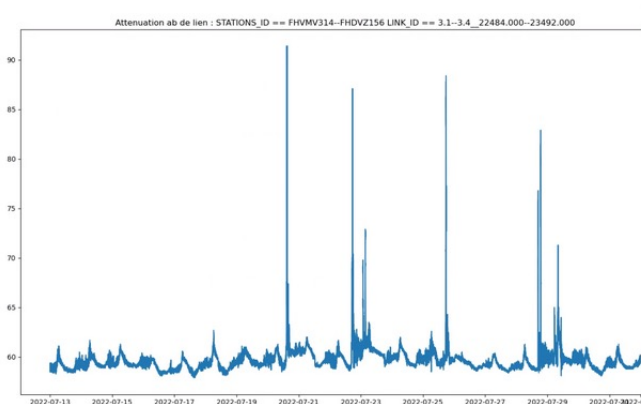


Figure 2. Example of sequence of frames obtained from meteorological radar (Quixeramobim) images from FUNCEME (accessed on April 23rd, 2021).

Detection of rain occurrence and rainfall estimation from microwave attenuation signal Over a telecommunication network (see M Kacou)



- Rainfall estimation
- Rainfall mapping
- Rainfall prediction/now casting

(See Romulo Oliveira and Modeste Kacou talks this morning )

➤ Can IA techniques help ?



## Program : 24 – 28 oct 2022

9-12h public – courses (auditorium + online)

14-17h limited attendance – Hands on (computer lab)

Day 1 24/10 : Introduction to IA / Time series analysis

Day 2 25/10 : Time series Analysis (cont.)

Day 3,4, 5 -26-28/10 : Image analysis/ pattern recognition – supervised and unsupervised classifications.

Day 5 : wrap up.

## Speakers



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