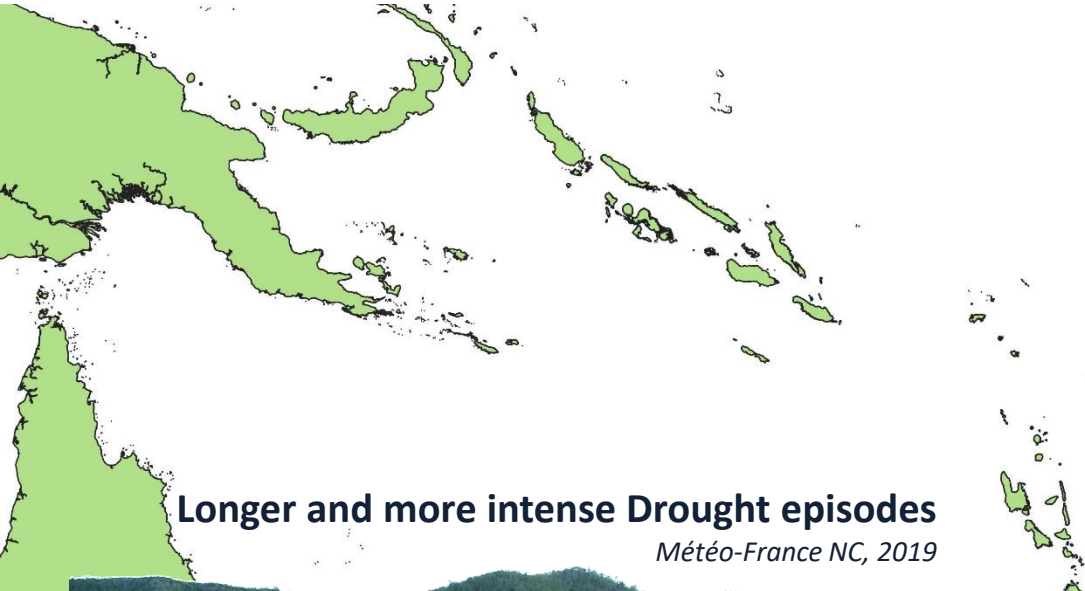


24 May 2022 - Vienna  
*Hydrological Sciences*

# Monitoring of agricultural drought from remote sensing products and in-situ meteorological data

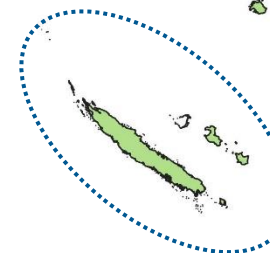
*M. Neuhauser, T. Tilak, C. Point-Dumont, A. Peltier*

# Drought and Resilience in New Caledonia



**Longer and more intense Drought episodes**

*Météo-France NC, 2019*

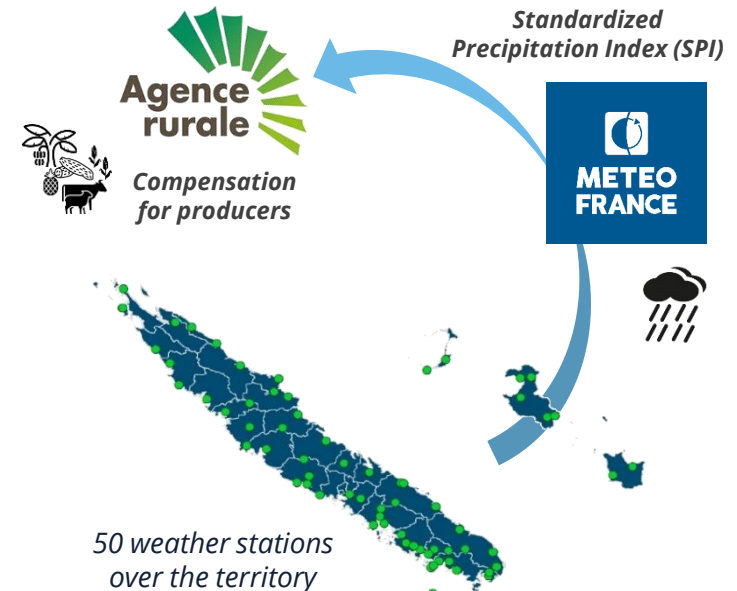


**Impacts on :**  
Biodiversity  
Agricultural crops  
Water ressource



The Rural Agency and **Meteo France** facing the Drought Hazard :

- **Detection** of meteorological drought
- **Purchase of drought food** for farmers
- **Compensation** for producers



**BUT...**

- Incomplete spatial coverage
- Rainfall deficit  $\neq$  plant water stress

# The System



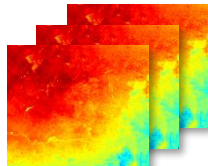
## Complementary Earth Observation data



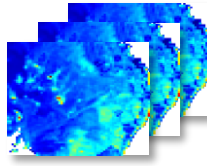
SPATIALIZED = localization



Vegetation  
(Optical)



Surface Temperature  
(Thermal)



Soil Moisture  
(Microwave)



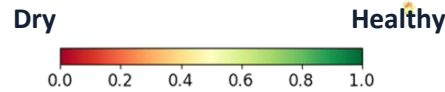
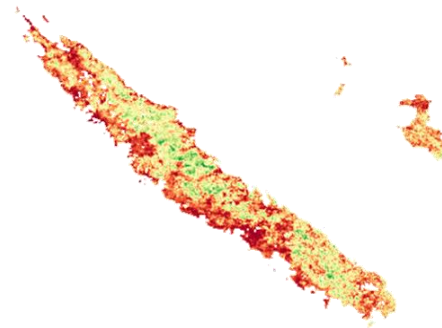
HISTORICAL = quantification



Expert meteorological data:  
 precipitation, evapotranspiration

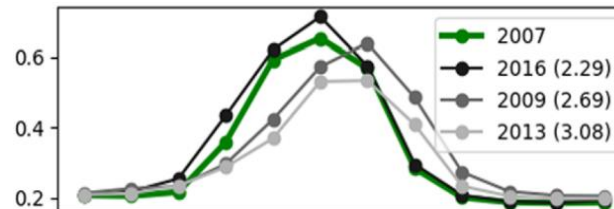
## Agricultural Drought Indicator

Anomalies of surface indices



## Forecast indicator

Long-range probabilistic forecast system



Le Page et Zribi (2019)

## User platform





# The Products

*3 operating scales :*

**Administrative**



**Thematic**



**Intra-parcel**

# The Products

3 operating scales :

Administrative



Thematic



Intra-parcel



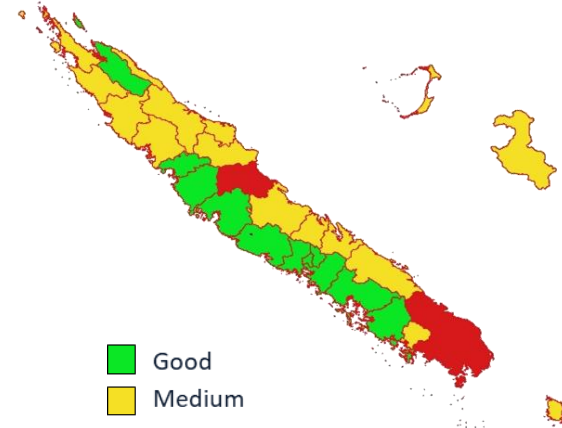
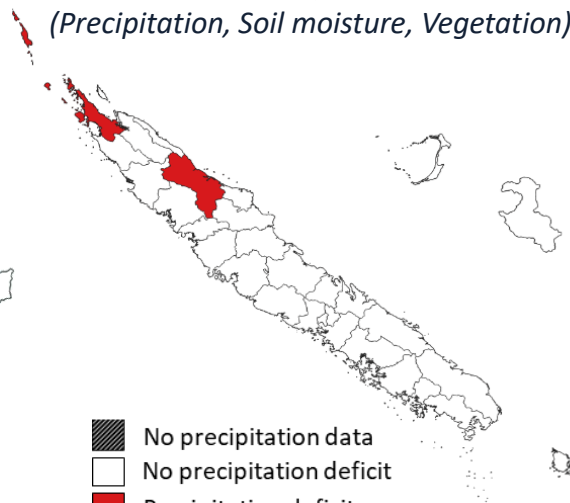
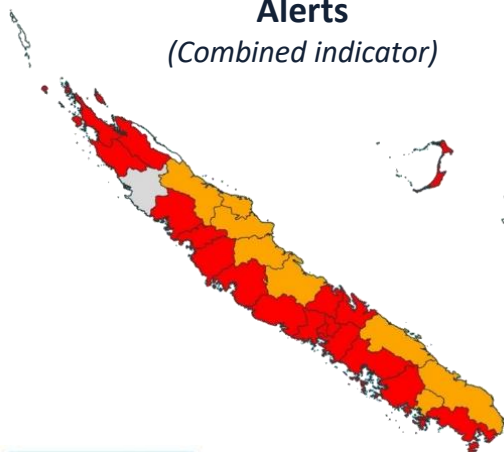
**Alerts**  
(Combined indicator)



**Detailed products**  
(Precipitation, Soil moisture, Vegetation)



**Confidence Index**  
(Data quality + Correlation with SPI)



- No Data
- No Alert
- Watch
- Warning
- Alert

**At which level ?**

(Sepulcre-Canto et al., 2012)

- ↓ = Precipitation deficit
- ↓ = Soil moisture deficit
- ↓ = Vegetation stress

- ▨ No precipitation data
- No precipitation deficit
- Precipitation deficit

- Good
- Medium
- Bad

# The Products

3 operating scales :

Administrative








Thematic



Intra-parcel



Global Vegetation Drought Indicator (1 km)

-  No Drought
-  Near Normal
-  Moderate Drought
-  Severe Drought
-  Extreme Drought

(Kogan, 1997)



# The Products



*3 operating scales :*

Administrative



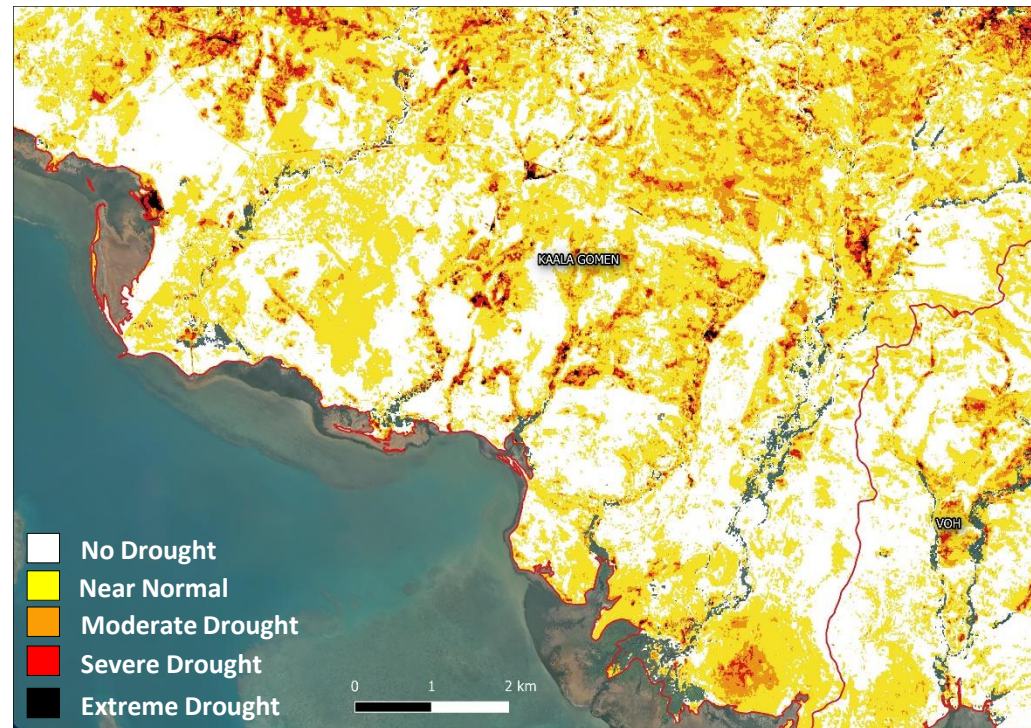
Thematic



Intra-parcel



Local Vegetation Drought Indicator (10 m)



# The Products



*3 operating scales :*

Administrative



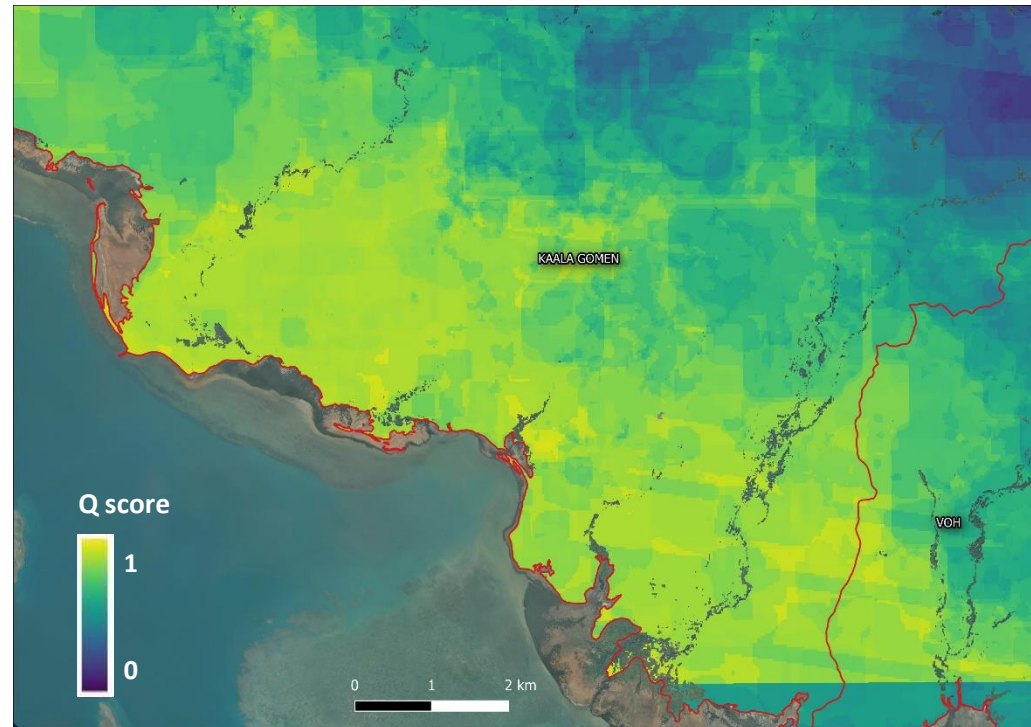
Thematic



Intra-parcel



Confidence Index (10 m)



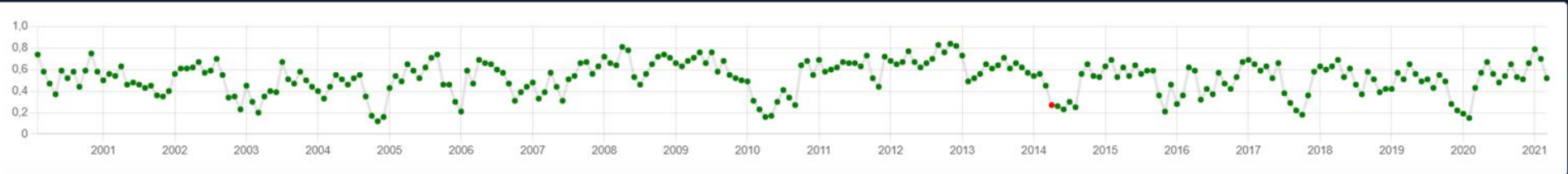


# User Platform

EARTH OBSERVATION 4 DROUGHT MONITORING



Alert   Vegetation Drought Indicators   Forecast Index   Forecast Confidence



**Thank you for  
your attention**

*Any questions ?*

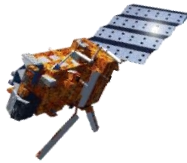
# Methodology

## 1) GLOBAL INDICATOR:

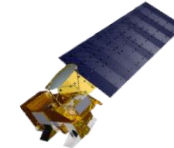
- Global scale
- Combined drought products
- Agricultural drought cause-effect relationship  
*(Sepulcre-Canto et al., 2012)*



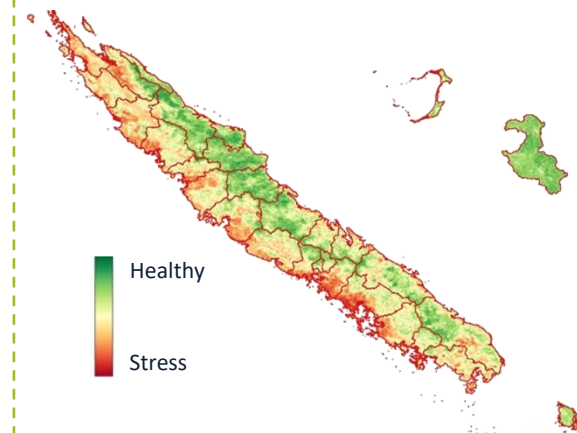
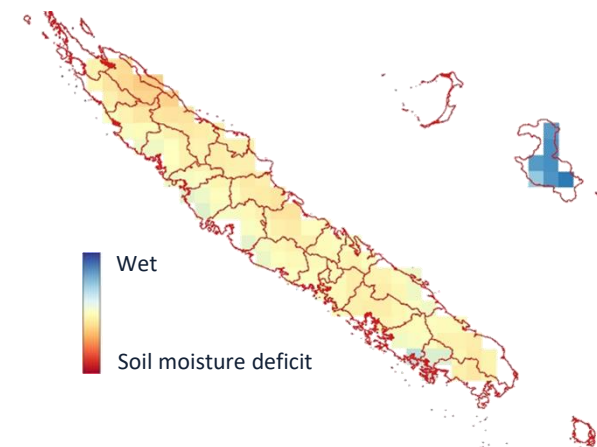
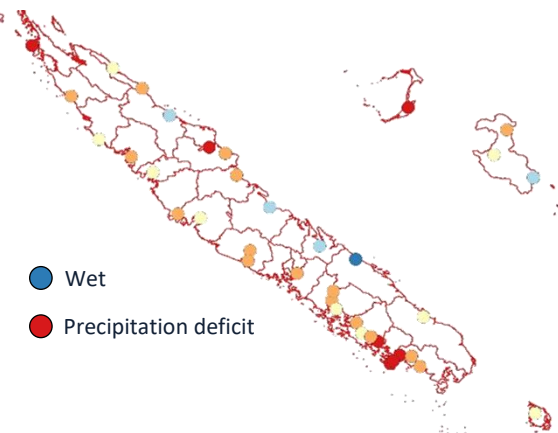
**In-situ data**  
 SPI 3-months  
 50 stations  
 1960 - today



**ASCAT (MetOp)**  
 Anomalies of Soil Water Index  
 12 km  
 2007 - today



**MODIS (Aqua, Terra)**  
 Vegetation Health Index  
 Combined anomalies of NDWI, LST  
 1 km  
 2000 - today



# Methodology

## 1) GLOBAL INDICATOR:

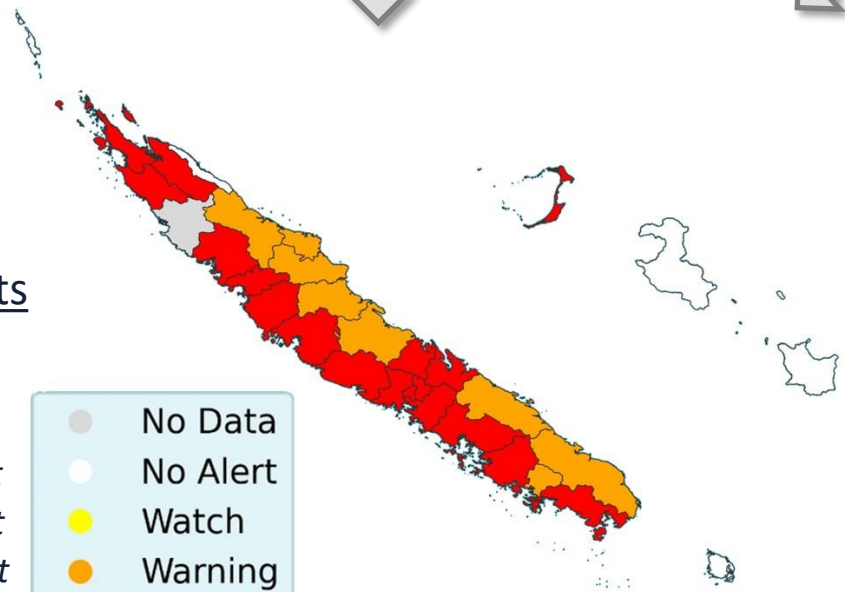
- Global scale
- Combined drought products
- Agricultural drought cause-effect relationship  
*(Sepulcre-Canto et al., 2012)*



### Drought Alerts

*No deficit*  
*Precipitation deficit*  
*Soil moisture deficit*  
*Vegetation stress*

●	No Data
●	No Alert
●	Watch
●	Warning
●	Alert



# Methodology

## 2) LOCAL INDICATOR:

- Local scale
- Updated between 5 and 15 days
- Focus on vegetation stress



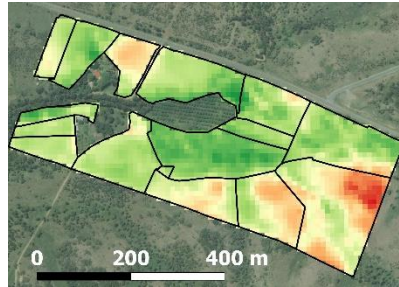
**Landsat** (L7, L8)  
 USGS Level 2 reflectances  
 30 m  
 2000 - today



**Sentinel-2** (2A, 2B)  
 THEIA Level 2 reflectances  
 10 m  
 2016 - today

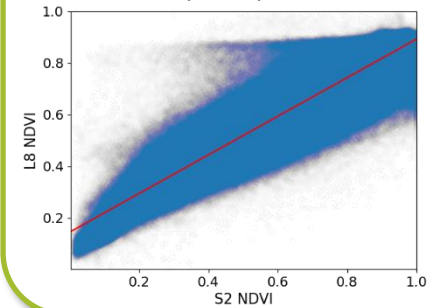
### PREPROCESSING

- Computing NDWI, NDVI
- Clouds filtering and reprojection



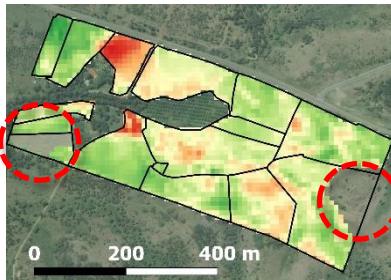
### COMPOSITING

- Radiometric calibration
- 10-day composition



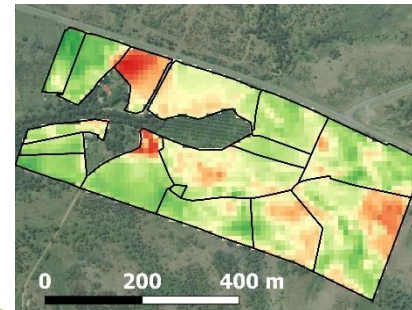
### POSTPROCESSING

- Filtering bare soil, dense vegetation
- From NDVI 10-day composites



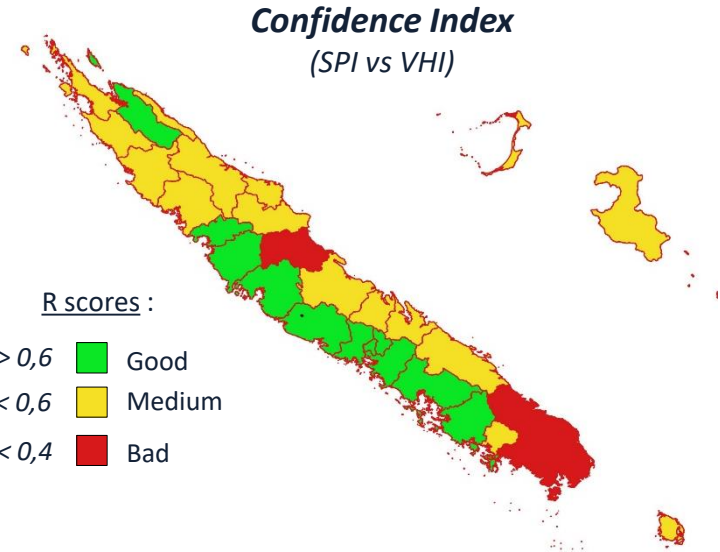
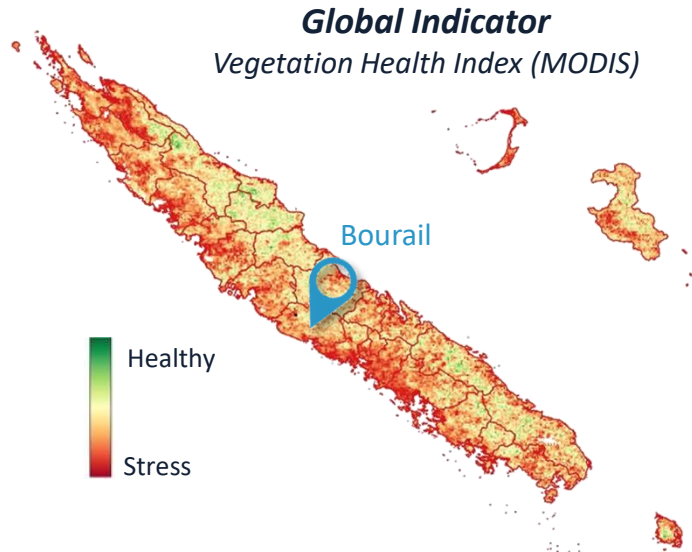
### ANOMALIES

- NDWI Anomalies (*Amri et al., 2011*)



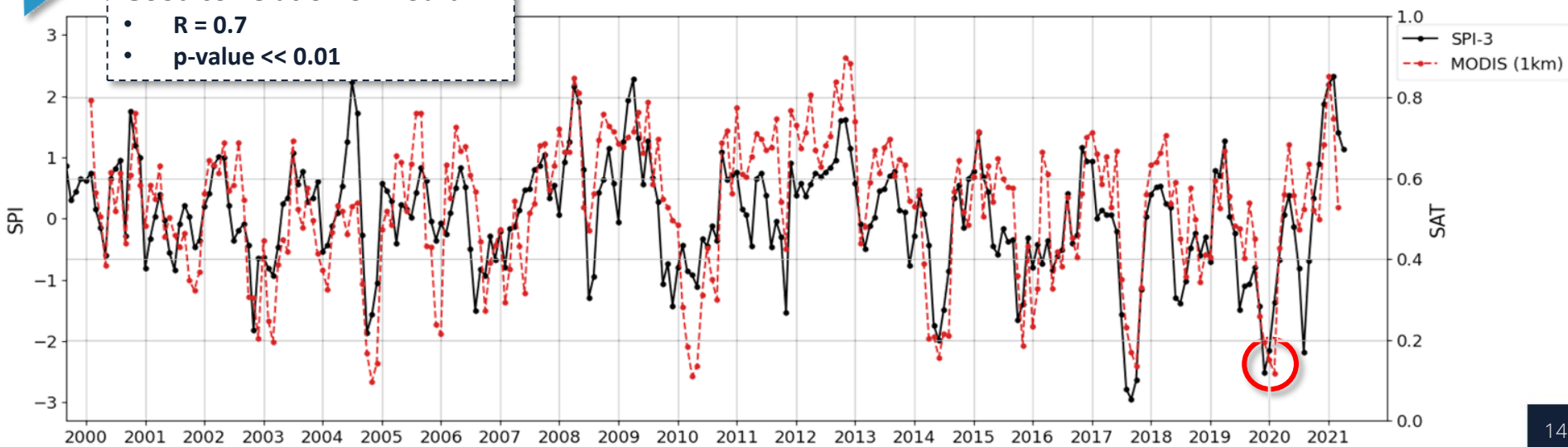


# Some results : November 2019

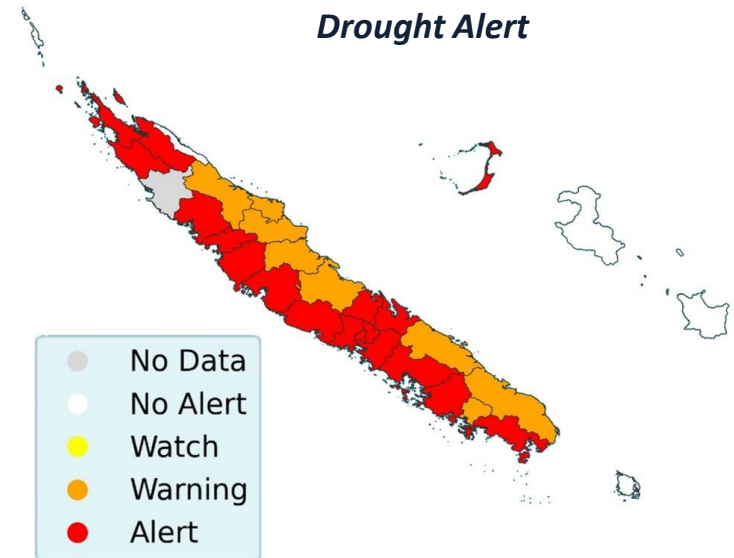
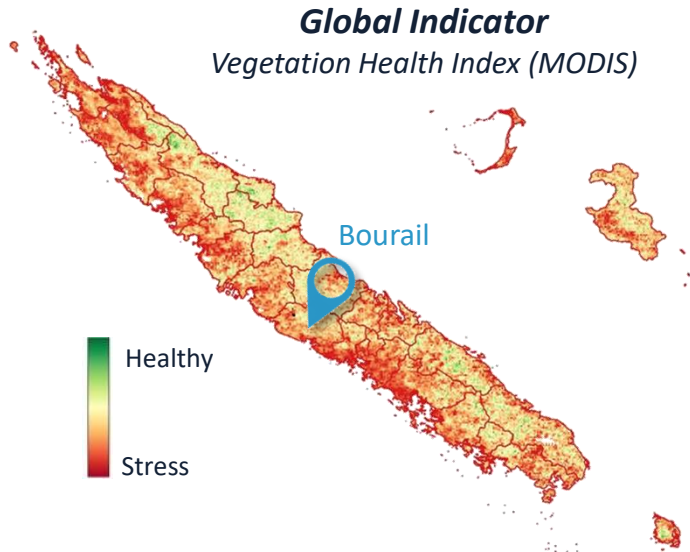


**Good correlation on Bourail :**

- $R = 0.7$
- $p\text{-value} \ll 0.01$

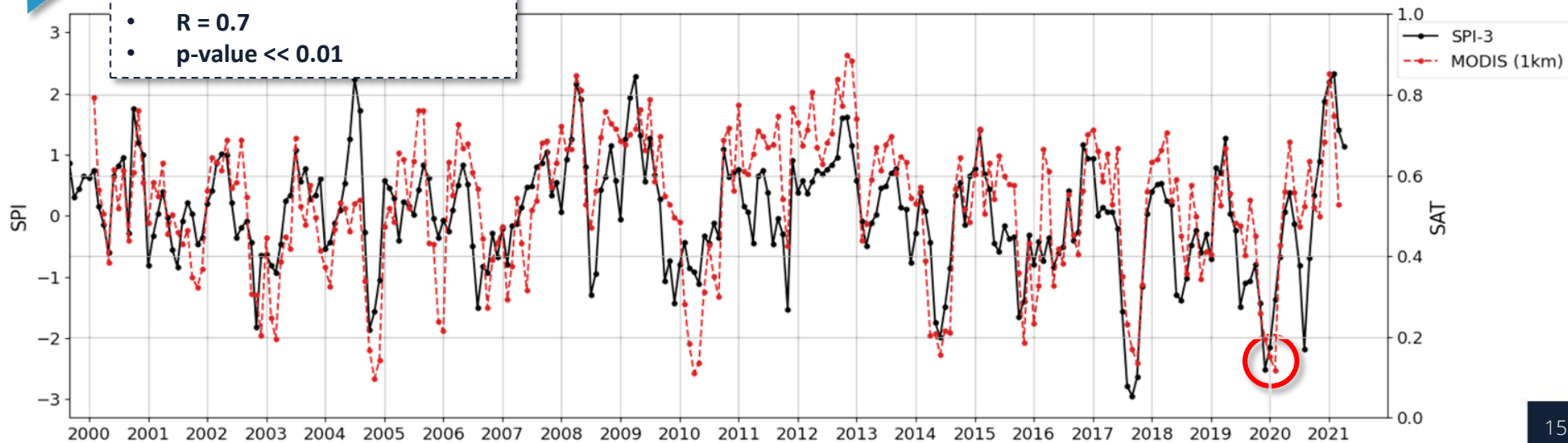


# Some results : November 2019



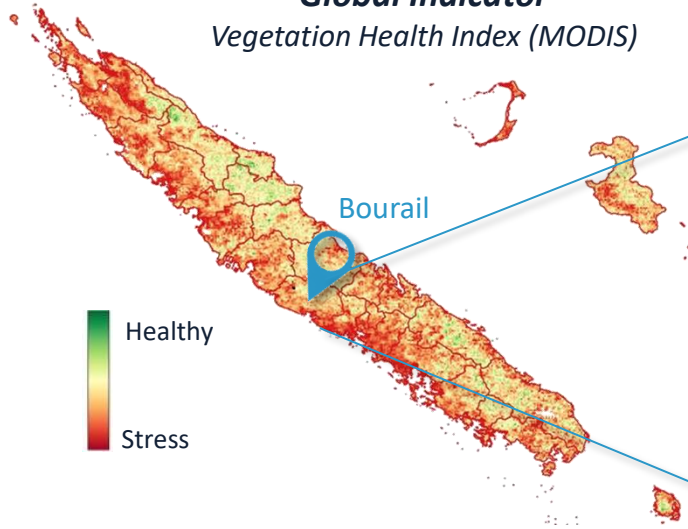
**Good correlation on Bourail :**

- $R = 0.7$
- $p\text{-value} \ll 0.01$



# Some results : November 2019

**Global Indicator**  
Vegetation Health Index (MODIS)



**Local Indicator**  
(Landsat, Sentinel-2)

