

MADAGASCAR (Antsirabé) site

JECAM/GEOGLAM Science Meeting

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Collaboration with *FOFIFA*

Site Description

- 🇲🇵 Madagascar, central highlands
- 🇲🇵 Topography : Elevation varies between 1400 and 2000 m. The topography varies from hills to plains and shallows
- 🇲🇵 Soils : soil texture is clayey
- 🇲🇵 Drainage class/irrigation : Soil drainage is moderate. Irrigation channels
- 🇲🇵 Climate and weather : subtropical







Site Description

- 🇲🇵 Crop calendar : October – April
- 🇲🇵 Field size : 0,03 ha
- 🇲🇵 Agricultural methods used : Smallholders agriculture. Crop types are rice (irrigated or rainfed) , maize, potato, soybean, sweet potato, carrot, etc + crop associations.

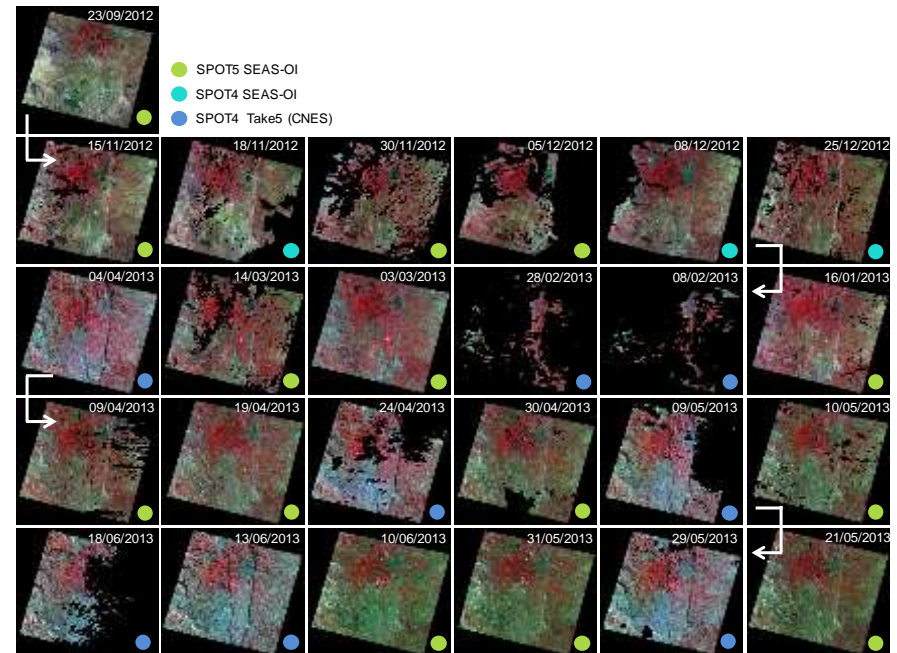


Project Objectives

-  Cropland mapping
-  Crop type identification and Crop Area Estimation
-  Yield assessment
-  **Crop Residue, Tillage**

Earth Observation (EO) Data Received/Used

SPOT4 and SPOT5



- ASTRIUM Defense
- Optical
- 25 scenes in 2012 / 2013, 22 scenes in 2013 / 2014
- Obtained free from SPOT4/Take5 program (CNES) and from Reunion island acquisition station.

Earth Observation (EO) Data Received/Used

Pléiades



- ASTRIUM Defense
- Optical
- 8 images to cover the study area (50 x 50 km) in jan-march (2013 and 2014)
- Cloud-coverage is challenging (especially in 2014)
- Paid by GEOSUD (french program)

Earth Observation (EO) Data Received/Used

DEIMOS

- Optical
- 4 scenes tasked and acquired (oct 2013 – jan 2014).
- Cloud coverage is challenging
- Paid by GEOSUD (french program)

In situ Data 2013 (2014)

🇺🇸 At the peak of the growing season, about **400 (1020) GPS waypoints** describing the **type of crop** (or non crop), **associated crop**, location in toposequence, water regime (irrigated / rainfed) were collected.

🇺🇸 Data on observed **yields** (biomass and grain) **on 100 (130) fields cultivated with rice** (irrigated or not), as well as sowing and harvest dates. « On the fly » field selection (not planned). 2 x 1m² / field.

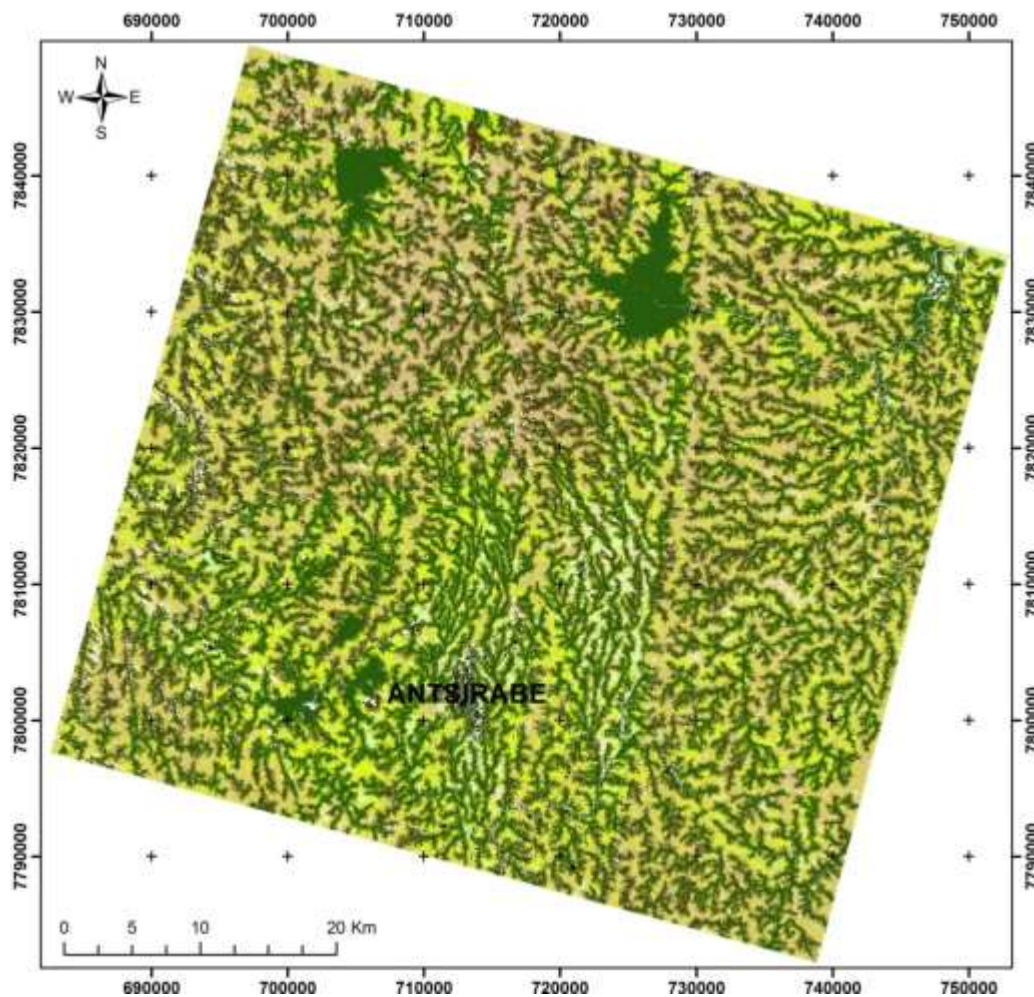


Collaboration

- **FP7-SIGMA** (Stimulating Innovation for Global Monitoring of Agriculture and its Impact on the Environment in support of GEOGLAM) – Prime: VITO
- **TOSCA – CNES “Syst-Cult”** (Characterizing cropping systems and their productivity using multi-source remote sensing data and data mining for food security) – Prime : Cirad
- **Champion user of ESA’s “S2 Agri”** (use of Sentinel-2 time series to monitor agriculture) – Prime : UCL

PRELIMINARY RESULTS (1/3) : Cropland mapping

- Shallows : crop
- Shallows : non crop
- Downslope : crop
- Downslope : non crop
- Slope : crop
- Slope : non crop
- Upland : crop
- Upland : non crop



Vintrou et al., 2014

PRELIMINARY RESULTS (2/3) : Crop type mapping

Data Mining and Knowledge Discovery

- ▣ Discovering new and usefull knowledge from huge data
- ▣ Data mining is the application of specific algorithms for **extracting patterns** from data.
- ▣ Challenge: Spatio-temporal and heteregenous data
- ▣ Several steps: Data preprocessing (integration and cleaning), Data Mining (pattern extraction), Pattern validation
- ▣ For what? clustering, classification, summarization ...

PRELIMINARY RESULTS (2/3) : Crop type mapping

Comparison of classification methods based on (1) spectral attributes, and (2) data mining-derived attributes

		Classic method	Data mining method
RAINFED RICE	Omission error	58%	51%
	Commission error	63%	56%
IRRIGATED RICE	Omission error	36%	36%
	Commission error	15%	28%
MAIZE	Omission error	42%	38%
	Commission error	56%	42%
OTHER CROPS	Omission error	67%	54%
	Commission error	62%	53%
OVERALL ACCURACY		50%	56%

The + of Data-mining :

- ▣ You can put all the data you have (if the data are not relevant, the algorithm will skip them),
- ▣ Once the data base is ready, it is almost instantaneous

Importance of the toposequence in the image processing :

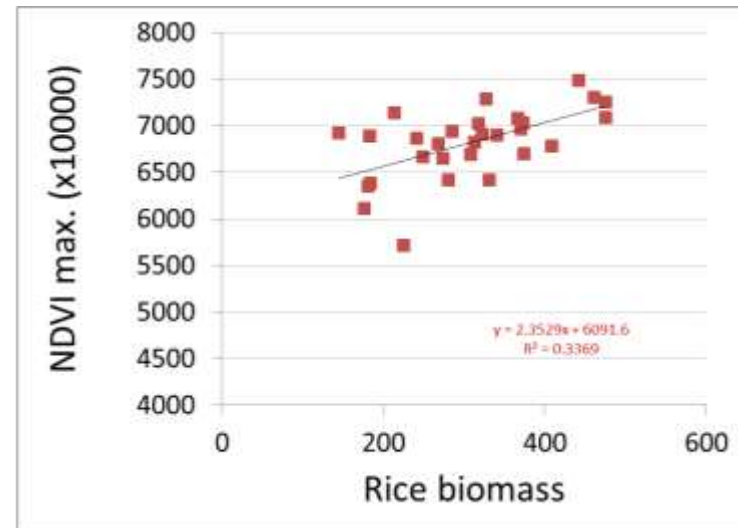
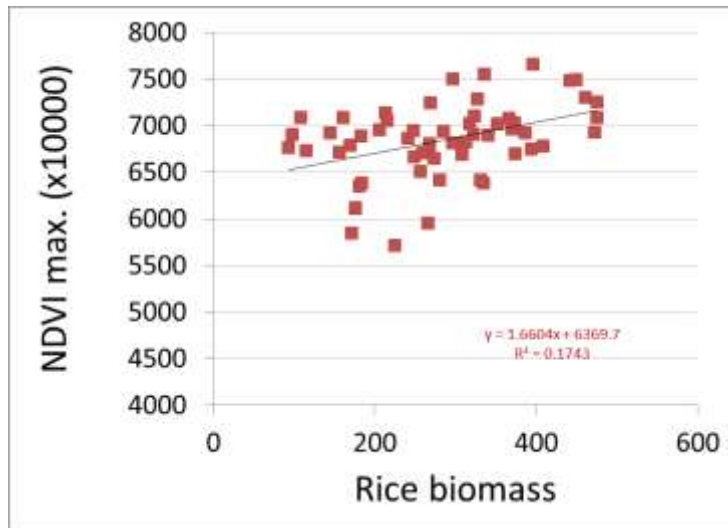
- ▣ -> need to incorporate in the image classification, the main driving factors of the cropping systems (when possible), especially for traditionnal agricultural systems (where there is no environmental « correction »).

Vintrou E., V. Lebouregois, **A. Bégué**, D. Ienco, M. Teisseire, S. Dupuy, F.R. Andriandrahona, 2014. Identifying cropped areas in small growers agricultural regions using data mining for food security. *ESA Sentinel-2 for Science Workshop*, 20-22 May, Frascati (Italy), 8 p.

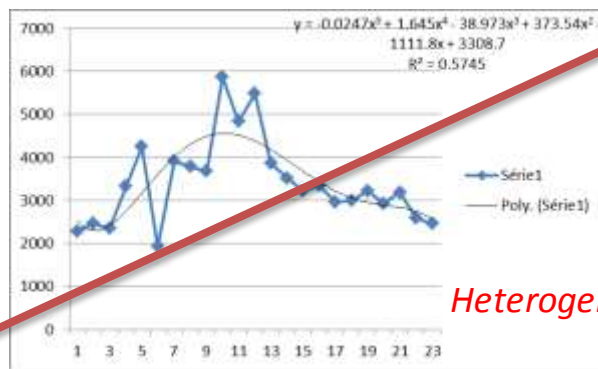
PRELIMINARY RESULTS (3/3) : Rice biomass assessment



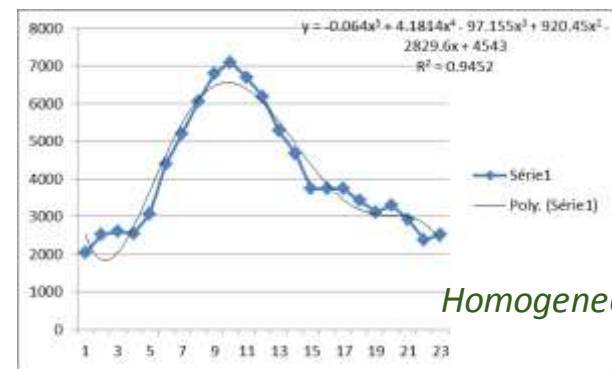
PRELIMINARY RESULTS (3/3) : Rice biomass assessment



Field selection using Duveiller's method (based on time series) :



Heterogeneous TS



Homogeneous TS

Research Plans for Next Growing Season

- Will you hold the course, or modify the approach?

No

- Do you anticipate ordering the same type/quantity of EO data next year?

+ SAR data

Thank you for your attention...

