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Monitoring crop phenology in Mato Grosso (Brazil) using remote sensing data

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OBJECTIVE

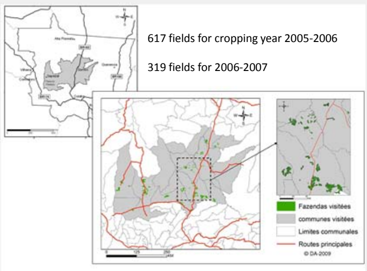
The general objective of this paper is to test the potential of MODIS satellite data to detect vegetation dynamics over agricultural land in Mato Grosso (Brazil). We especially focus on the estimate of the sowing dates of soybean crops.

CONTEXT

In Mato Grosso, agricultural practices are evolving rapidly and their monitoring (e.g. sowing dates) becomes a relevant issue (Arvor et al., 2011). If we can accurately detect the dates of vegetation start of season, then we can estimate the sowing dates used by farmers, which in turn can be linked to crop yields data.

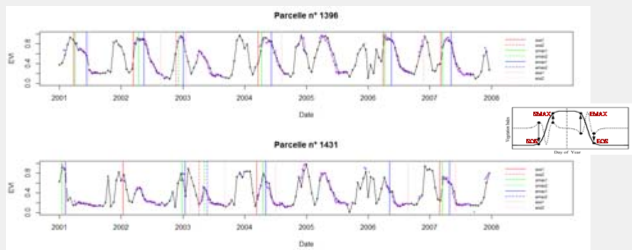
DATA

• Field data



• Satellite data: MODIS products

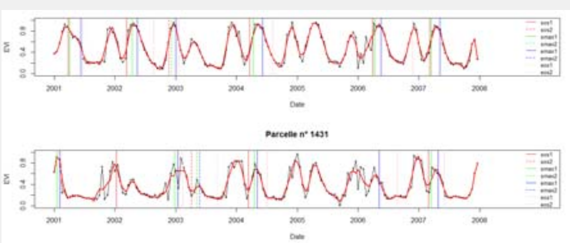
- **MCD12Q2 :** Land Cover Dynamics Yearly L3 Global 500m
- **MCD43A4 :** Nadir BRDF-Adjusted Reflectance 16-Day L3 Global 500m
- **MOD13Q1 :** Vegetation Indices 16-Day L3 Global 250m.



EVI MOD13Q1 (in black) and MCD43A4 (in purple) time series. Phenological indicators provided by MCD12Q2 on fields 1396 (soybean+ cotton) and 1431 (soybean + maize) for years 2001 to 2007.

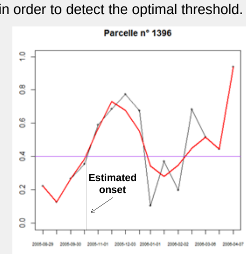
METHODOLOGY

1) MOD13Q1 EVI time series (black line) were smoothed with the Savitzky-Golay filter (window size 3x3) in order to eliminate noise (smoothed time series in red).



2) A threshold-based methodology was implemented to estimate the vegetation onset on phenological cycles. The threshold is incremented, from 0.1 to 0.8, in order to detect the optimal threshold.

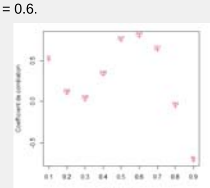
Threshold = 0.4

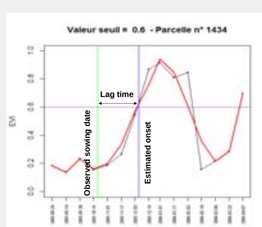


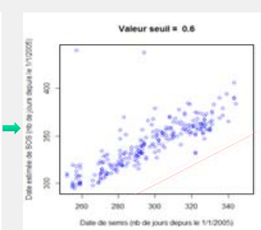
RESULTS

The best correlations (R=0.8) between "sowing dates" observed in the field and "onset estimates" are obtained with a threshold value = 0.6.

The low correlations obtained for thresholds between 0.1 and 0.4 can be explained by the fact that at the beginning of the crop cycle, vegetation indices irregularities occurred due to soil work or erratic vegetation regrowth.







CONCLUSIONS

- The Land Cover Dynamics MCD1Q2 product is not operational for Mato Grosso due to a large cloud cover affecting the MCD43A4 data.
- The Vegetation Indices 16-Day MOD13Q1 EVI time series can be used to estimate sowing dates.
- A simple threshold-based methodology proved to be efficient.

PERSPECTIVES

- Check if the lag time between the "sowing date" and the "onset estimate" is constant through time (other years) and space (other areas).
- Test new methods to detect other phenological indicators.
- Check the usability of MCD1Q2 product on other areas less affected by cloud cover.

REFERENCES

D. Arvor, M. Jonathan, M. Simoes, V. Dubreuil, L. Durieux, 2011. Classification of MODIS EVI time series for crop mapping in the state of Mato Grosso, Brazil. International Journal of Remote Sensing, 32 (22), 7847-7871.

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