

Variations in rice cultivation practices in the Senegal River Valley between 2003 and 2014: an analysis based on MODIS time series

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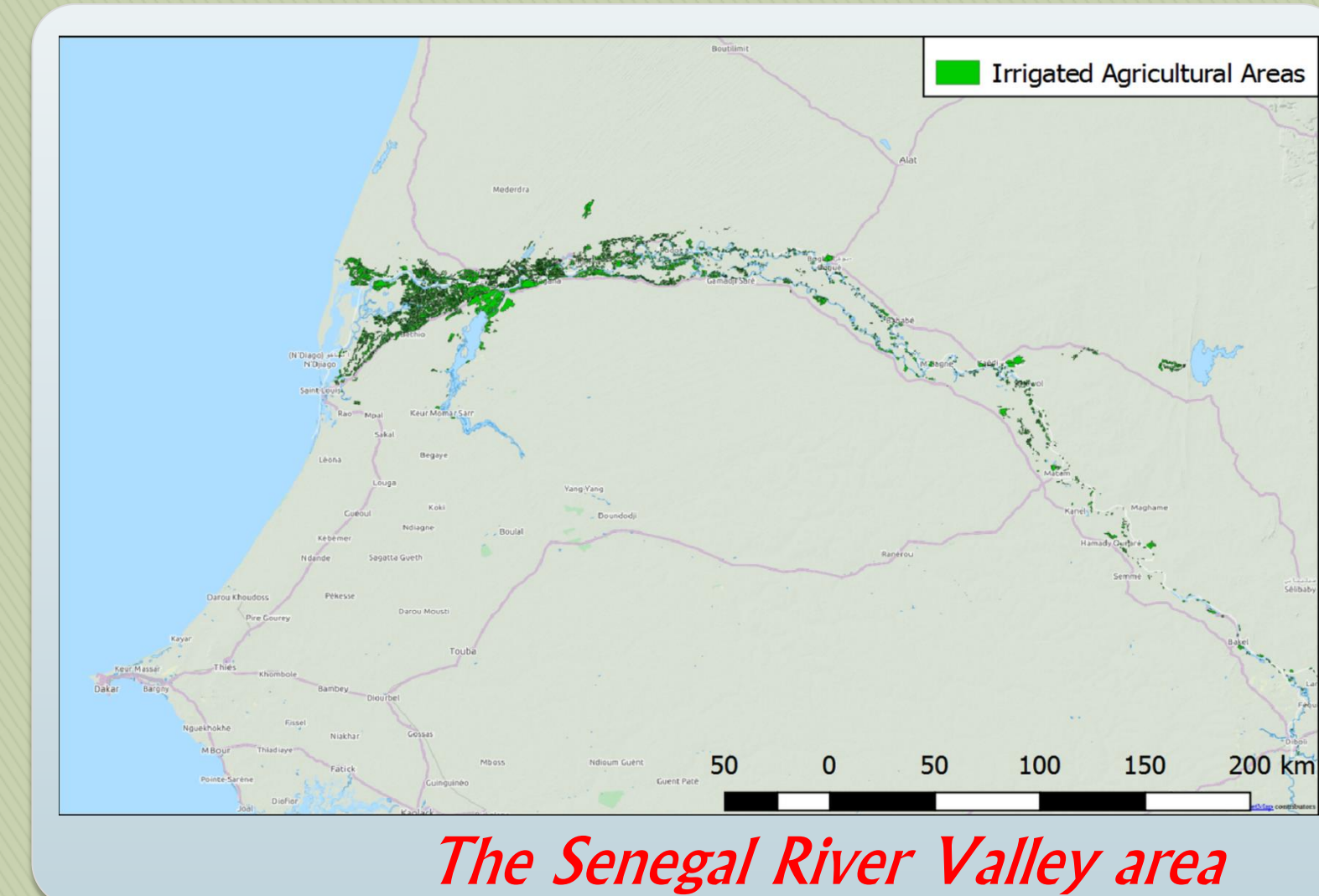


Introduction and Objectives

- Irrigated rice cultivation in the Senegal River Valley **has shifted to from the wet to the dry season in recent years**. Moreover, private and government investments have led to **doubling rice acreage since 2007**.
- Temperature extremes (both hot and cold) during the rice growing season frequently lead to yield losses or failure. **Better knowledge is therefore required** on where and when rice is cultivated and which areas are potentially mostly affected by meteorological extremes.
- Objective of this work was **to analyze the inter-annual variations of agricultural practices in the Senegal River Valley starting from time series of MODIS images**.

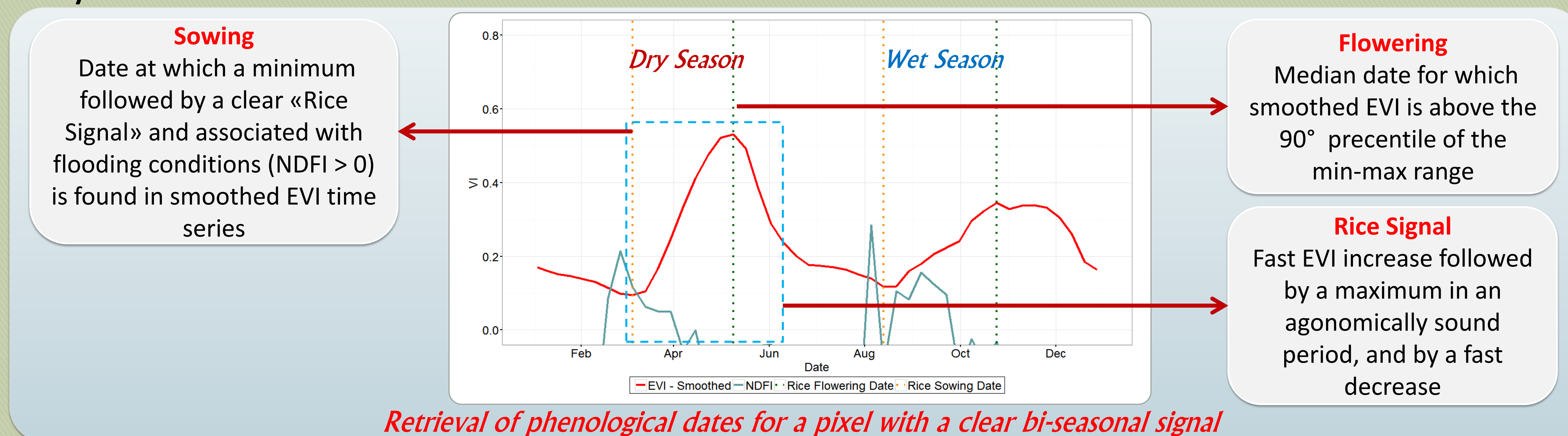
Study Area

- Analysis was conducted on the Senegal River Valley (SRV) area.
- In particular, analysis was focused on areas classified as «irrigated agricultural areas» on the basis of a photointerpretation of 2014 high-resolution satellite imagery conducted by Africa Rice Center personnel.



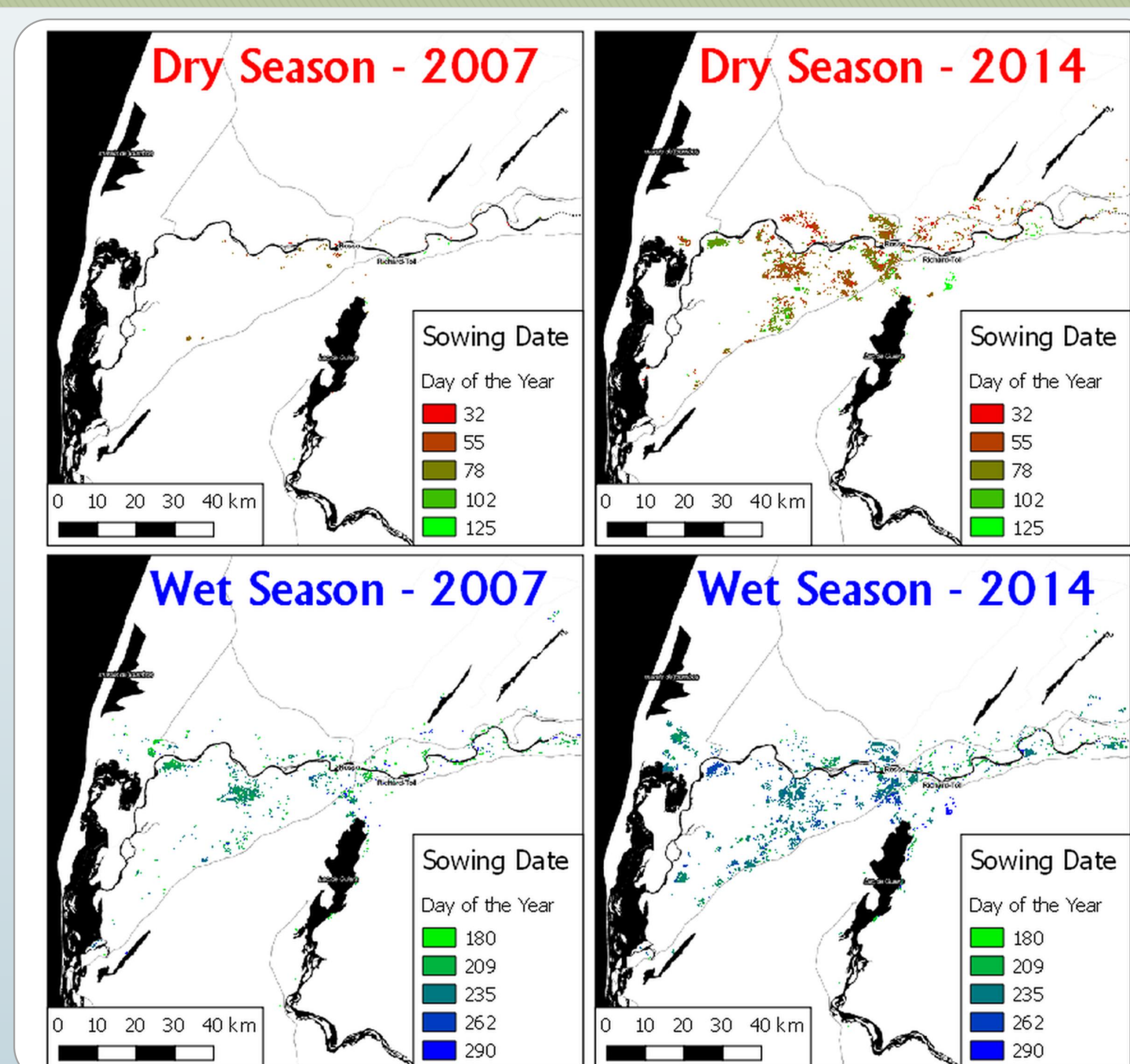
Methods

- Inter-annual variation of agricultural practices** were analyzed applying the PhenoRice algorithm (Boschetti et al., 2014) to 2003-2014 time series of **16-days composite vegetation indexes 250m resolution MODIS data**.
- Images were downloaded and pre-processed using the **MODISTsp “R” package** (<https://github.com/lbusett/MODISTsp>) to derive time series of EVI vegetation index and NDFI flooding index (Boschetti et al., 2009)
- Rice phenological dates were then derived as shown in the figure below. The algorithm is able to **detect multiple growing seasons**, by “splitting” the year into periods defined by the user, and conducting a separate analysis in each period. This allows to **flexibly account for variability in crop calendars and cropping intensity in the different areas of the world**.

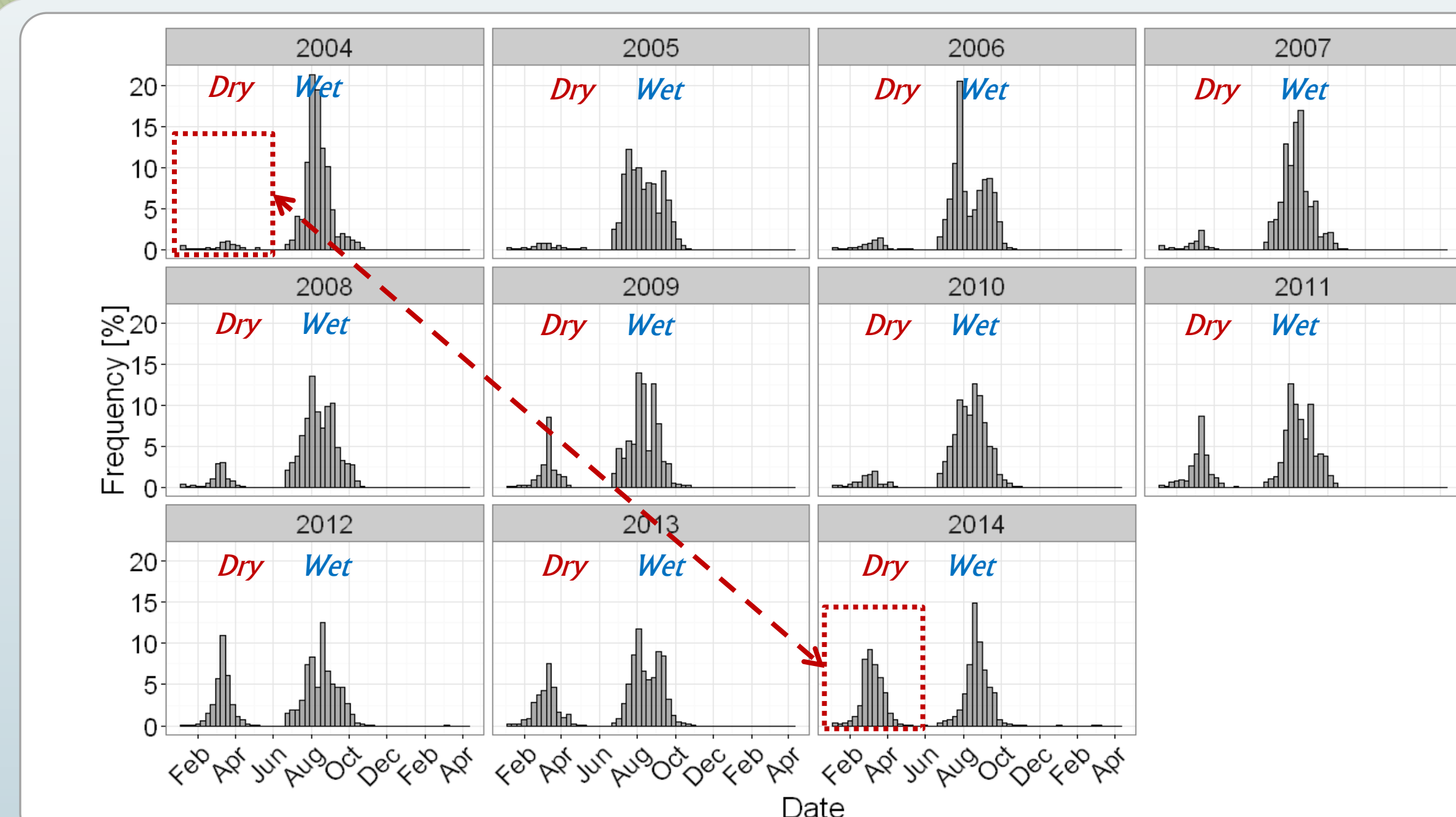


Results

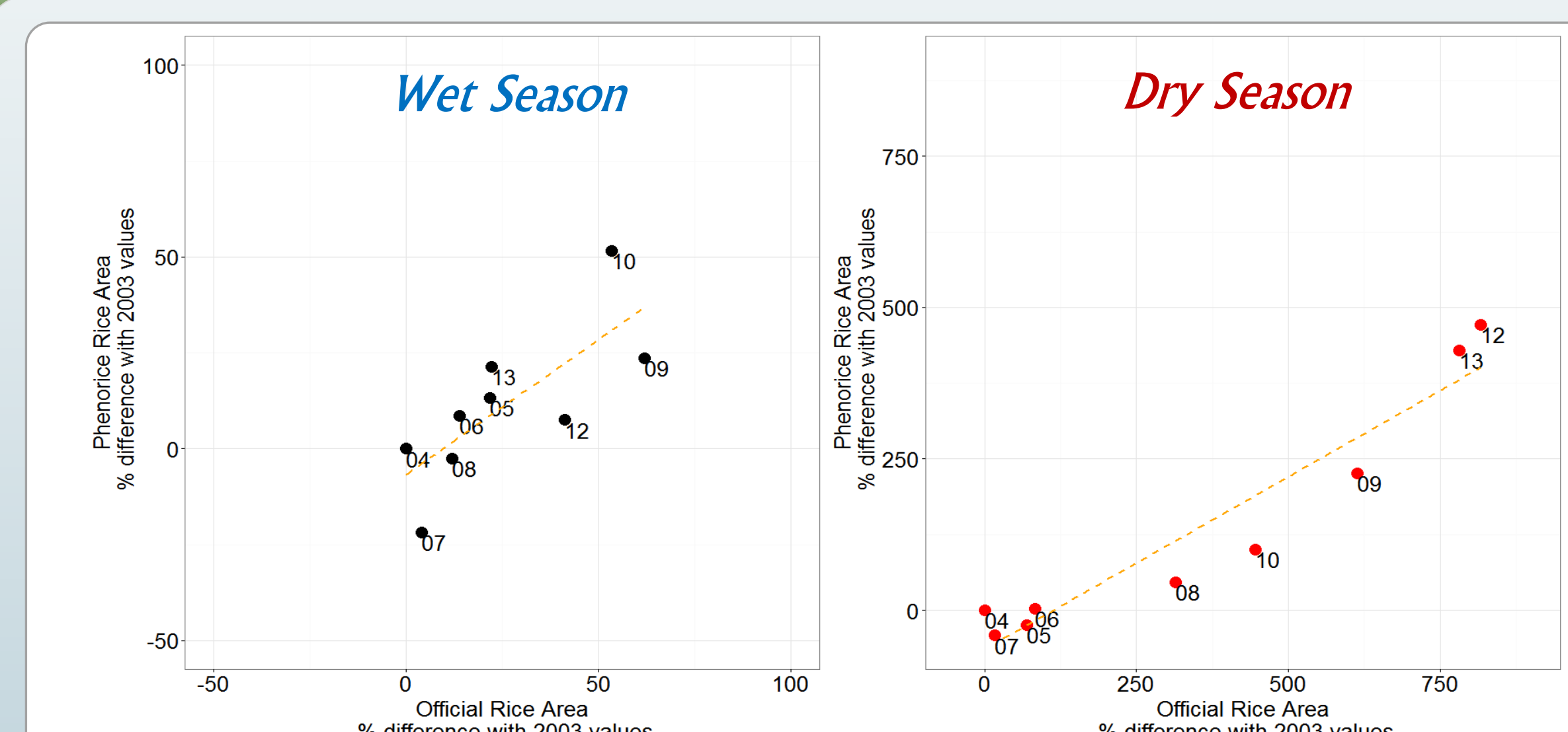
- Results highlighted a **clear shift in cultivation patterns** in the SRV in the last years, with an increase of rice area, in particular in the dry season (Sowing dates between February and April).
- PhenoRice results allowed to easily depict the shifting in SRV area cultivation practices, and **analyze interannual variability** in rice seasonality.



Sowing date maps for 2007 and 2014 on one of the main SRV rice areas



- Comparison with official statistics highlighted that PhenoRice was able to **correctly follow the inter-annual variations** of rice cultivated areas in the two seasons.



Comparison between official and PhenoRice interannual variations of rice area

Conclusions

- Results highlighted the **usefulness of MODIS time series and the PhenoRice algorithm** for detecting shifts in agricultural practices over large areas.
- Phenological maps derived from PhenoRice allow to **highlight the spatial and temporal variability** of rice seasonality, and can be **important input sources for spatialized crop modelling studies**.