



Monitoring phenology of crops at the parcel scale : combining high and medium spatial resolution data

Henry Rivas (1), Nicolas Delbart (1), Catherine Ottlé (2), Fabienne Maignan (2), and Emmanuelle Vaudour (3)

(1) PRODIG (UMR8586), Université Paris Diderot, Paris, France, (2) LSCE (UMR8212), Orme des Merisiers, Gif-sur-Yvette, France, (3) UMR ECOSYS, AgroParisTech, INRA, Université Paris-Saclay, 78850, Thiverval-Grignon, France

Remotely-sensed vegetation phenology is used here to identify key stages of annual crop development and, in this basis, as an indicator of annual crop type.

Crop monitoring requires both high spatial resolution data (HSR) for observing within sub-parcel scale, and high temporal resolution (HTR) to monitor vegetation changes during along the crop cycle. However, these simultaneous requirements are difficult to fulfill by the same satellite. In temperate areas such as the Versailles Plain, near Paris, France, HRS data have at best a dozen images exploitable per year, even with Sentinel-2 because of cloud cover, while those with medium spatial resolution (MRS) provide daily images, but at the generally mixed pixel scale.

In France, the Land Parcel Identification System (LPIS) is an information system of the crop types declared by farmers, providing reference information about the annual crops cultivated within each agricultural parcel. In this work, the objective was to monitor the phenology of annual crops recorded in the LPIS of 2016, using satellite image time series from HRS Sentinel-2 (10m) and MRS Proba-V (100m) acquired from early to end of 2016 over the Versailles Plain, a small agricultural region (221 km²) cultivated with annual crops.

From the two types of time series, the temporal variations of vegetation indices (NDVI / EVI2) of crops were extracted in order to analyze the crop seasonal variations of winter wheat, winter oilseed rape and maize over 2857 parcels with average size of 6.88 ha. The linear method of spatial disaggregation was applied on the MRS data, using fractions of each crop type in the mixed pixels calculated from the 2016-LPIS.

The temporal responses from HRS data were compared with those of the MRS sub-pixels. Comparisons between both time series revealed significant correlations for the three studied crops (winter wheat = 0.94, winter oilseed rape = 0.74 and maize = 0.79). By improving the temporal frequency of the monitoring, from 13 images for HRS to 25 images for MRS, the disaggregated MRS time series enabled to distinguish the phenological stages of the three studied crops better than the HRS time series.

In conclusion, our method of spatial disaggregation can be used to improve the exploitation of satellite data at MRS in seasonal crop monitoring, especially during the transition periods when the spectral indices of crops are likely to change quickly.