

## CROP MAPPING WITH COMBINED USE OF EUROPEAN AND CHINESE SATELLITE DATA

<b>European Leader Investigator</b> Prof. Pierre Defourny Université catholique de Louvain, BELGIUM	<b>Chinese Leader Investigator</b> Dr. Jinlong Fan National Satellite Meteorological Center, CHINA
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### List of Principal Investigators (PIs)

Topic Nr.	PIs	Title
32194_1	Prof. Pierre Defourny, Dr. Jinlong Fan	<i>Crop mapping with time series of high resolution European and Chinese satellite data</i>
32194_2	Dr. Qinghan Dong, Dr. Jinlong Fan	<i>Assessing Crops with PROBA-V and FY-3 MERSI Data</i>

### EXECUTIVE SUMMARY

This proposal is to investigate the methodology of combined use of European and Chinese high and Medium Satellite data to assess the crop and produce the crop maps. The proposal is composed of two sub proposals. One is focusing on the high resolution satellite data and another is focusing on the medium resolution satellite data. 1. Crop mapping with time series of high resolution European and Chinese satellite data. The Sentinel-2 and GF-1/2 are both quite similar instruments onboard European and Chinese satellites, respectively. This proposal aims to take both advantages of Sentinel-2 and GF-1/2 or a better and earlier crop mapping. The team will apply and adapt the crop mapping approach of ESA Sen2Agri project to a Chinese site for a merged time series of Chinese and European satellite images. 2. Assessing Crops with PROBA-V and FY-3 MERSI Data. The Proba-v and FY3-MERSI both have quite similar channels and their own advantages. The new development of this kind of coarse resolution satellite data in Europe and China is providing us a chance to investigate the possibility and the potential of using both PROBA-V and FY-3 MERSI Data for the crop assessment. This proposal is going to focus on the crop condition monitoring, crop drought monitoring and crop mapping with both satellite data. The team will develop the methods to handle both data and then get the information retrieved. In comparison of the resulting maps from both data, the potential and difference will be analyzed. The funds for this proposal will come from the on-going projects and new projects from both sides. The funding for European partner will be partially covered by on-going projects and Dragon 4 program. The funding for Chinese partner will be partially covered by the Natural Science foundation project and Ningxia Meteorological Bureau operation funds.

**ABSTRACT 32194\_1: "Crop mapping with time series of high resolution European and Chinese satellite data"**

**European Principal Investigator**

Prof. Pierre Defourny  
 (Universite Catholique de Louvain,BELGIUM)

**Chinese Principal Investigator**

Dr. Jinlong Fan  
 (National Satellite Meteorological Center,CHINA)

The Sentinel-2 and GF-1/2 are both quite similar instruments onboard European and Chinese satellites, respectively, but both have their own advantages. This proposal aims to take both advantages of Sentinel-2 and GF-1/2, respectively launched in 2015 and 2014, for a better and earlier crop mapping. The team will apply and adapt the crop mapping approach of ESA Sen2Agri project to a Chinese site for a merged time series of Chinese and European satellite images. The data processing and the mapping procedures will be highly automatic. The classification algorithm will be based on machine learning techniques including classification, regression tree and artificial neural networks.

The main objectives are as follows:

- (1) Merge of the Sentinel-2 time series and the GF time series in a perspective of crop type mapping;
- (2) Develop the advanced methods to map the crops with time series of high resolution European and Chinese satellite images;
- (3) Validation and extension of crop mapping approach of ESA Sen2Agri in the oasis area in North west China;
- (4) Improving the Chinese GF satellite data processing and bio-parameter retrieval.

In this proposal, the Ningxia Hui autonomous region will be selected as the study area. The Ningxia Hui autonomous region is in 35°14'-39°23'N and 104°17'-107°39'E, located in Northwest China. The total area is around 66,000 square km with a west to east stretch of 250km and a north to south stretch of 450km. The region is typical temperate and semi-arid zone with annual rainfall of about 200mm. The major landscape in this region is composed of oasis irrigation agriculture in the north, arid grassland in the central part and mountain forest in the south as well as river water, lakes and deserts. The major crops in the irrigated arable land are winter wheat, spring wheat, corn, soy bean, rice. The orchard is also developing very fast in the region. The major fruit trees are grape, apple, apricot and peach. The growing season is between April and October. The region is rather limited in terms of scale but with quite diverse land classes, therefore it is an ideal test site for the optical remote sensing, in particularly for the land classification.

European and Chinese high resolution satellite images will be collected as dense as possible. The data will be mainly used to map the crops in the region. The data in the growing season will be mainly focused and secured but the data out of growing season are also expected to facilitate retrieve the permanent cropland and non-cropped area.

The expected outcomes from this project are three folders. (1)A new methodology will be developed to ingest the time series of multiple sources high resolution satellite data to deliver early crop maps over large area.

(2)The improving methodology of processing the high resolution Chinese satellite data will be developed and has the final data comparable and compatible with similar European satellite data, like Sentinel data. (3) The approach of the crop mapping of Sen2Agri project will be applied in this study area and validated. Finally, two scientific articles with joint authorship are expected to be published.

The funds for this proposal will come from the on-going projects and new projects from both sides. The funding for European partner will be partially covered by on-going projects and Dragon 4 program. The funding for Chinese partner will be partially covered by the Natural Science foundation project and Ningxia Meteorological Bureau operation funds.

**ABSTRACT 32194\_2: "Assessing Crops with PROBA-V and FY-3 MERSI Data"**

**European Principal Investigator**

Dr. Qinghan Dong  
 (Flemish Institute for Technological  
 Research,BELGIUM)

**Chinese Principal Investigator**

Dr. Jinlong Fan  
 (National Satellite Meteorological Center,CHINA)

Low resolution satellite data have been applied to the agricultural monitoring in past more than 20 years. The spatial resolution is one of key factors that decide the quality and accuracy of crop monitoring. The spatial resolution of coarse resolution data is evolving. European satellite Proba-V brought the world a new era for the agricultural monitoring as it is providing the 100m resolution image globally and free of charge. At the same time, the Chinese FY satellite is also start to provide the user with 250 meter resolution data globally and free of charge. The Proba-v and FY3-MERSI both have quite similar channels and their own advantages. The new development of this kind of coarse resolution satellite data in Europe and China is providing us a chance to investigate the possibility and the potential of using both PROBA-V and FY-3 MERSI Data for the crop assessment. This proposal is going to focus on the crop condition monitoring, crop drought monitoring and crop mapping with both satellite data. The team will develop the methods to handle both data and then get the information retrieved. In comparison of the resulting maps from both data, the potential and difference will be analyzed.

This proposal is to assess crops by taking advantages of both Proba-v and FY-MERSI and then to enhance the application of satellite data in the crop assessment.

The main objectives are as follows:

- (1) Develop the methods of assessing crop conditions and stress with the time series Proba-V and FY-3 MERIS data
- (2) Develop the methods of mapping the crops with both Proba-V and FY-3 MERSI data.
- (3) Improve the FY-3 MERSI data processing and product generation in comparison with Proba-V data and product processing methodologies.

In this project, two research sites will be selected, one in North China plain and another in Northeast China. North China plain site is covering about 500 km by 500 km area and the centroid Latitude is 39°08' N and Longitude 115 °40' E. The Northeast China site is covering about 1000km by 1000km area and the centroid Latitude is 45°N and Longitude 127 °40' E. For both sites, the data covering the growing season from the middle March to the end of October will be needed.