Ukrainian Crop Growth Monitoring With The Chinese Meteorological Satellite Data

Li Yuxuan[1], MeiShiguangQiliang [1,2],Lv Jin[1], SuQiaomei[2], Jinlong Fan[1]

1 National Satellite Meteorological Center, China
2 Taiyuan University of Technology, Taiyuan China

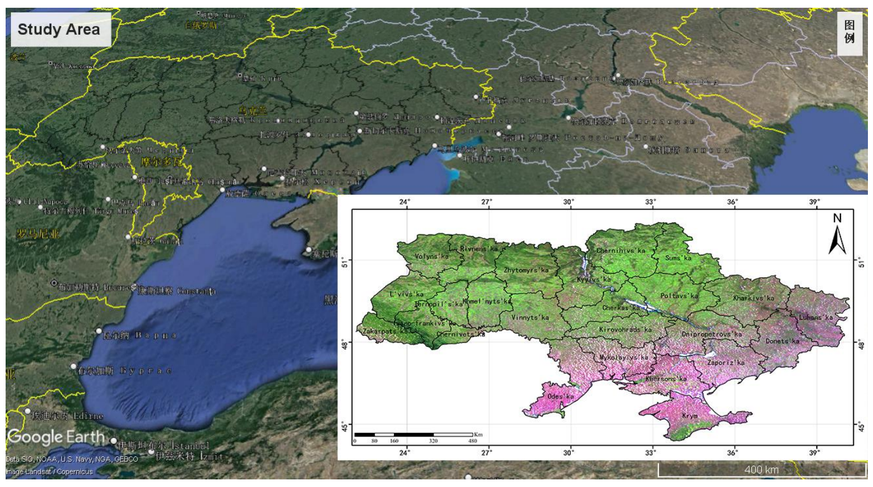
Introduction

The crop growth condition in the spring of 2022 in Ukraine was attracted the attentions from agricultural community in the world. Thanks to the global coverage of the second generation FENGYUN polar orbiting satellite, the normalized difference of vegetation index NDVI retrieved from FY3C VIRR and FY3D MERSI were used to monitor the crop growth condition in Ukraine. The NDVI difference model between the current value and the historical mean in the past few years and the time series of NDVI at present and the historical mean were used to closely monitor the changes of the crop vegetation from March to June when was the winter crop growth season in 2022.

Study Area and Data

Ukraine is located in the eastern part of Europe, within the range of longitudes 21-38 East and latitudes 44-53 North. The country is rich in agricultural resources, with 41.5 million hectares of agricultural land, accounting for 70% of the country's land area. The geographical location of Ukraine is shown in Figure 1, which is one of the images of FY-3C.

The remote sensing data in this paper use the 1km spatial resolution data from the C (referred to as FY-3C) and D (referred to as FY-3D) stars of the Wind Cloud 3 meteorological satellites, which were developed independently in China. The Fengyun-3C medium-resolution spectral imager (FY-3C/VIRR) has multi-spectral and high sensitivity features. It is especially suitable for large-scale and large-scale crop growth monitoring, and plays an important role in crop growth monitoring and crop yield



Methods

In terms of crop growth monitoring methods, this paper uses a difference model that can reflect the interannual variability of crop growth for real-time monitoring and evaluation of crop growth in Ukraine at the decadal scale.

$$\Delta NDVI(t) = (NDVI(t) - NDVI_{\text{当年}}) \times 10000 + 10000$$

In this paper, the growth condition is classified into five classes based on normal distribution: poor, poor, normal, good and good.

Table 1 Evaluation criteria for monitoring results

Classification criteria	Growth class
Δ NDVI =20000	No Data
-10000< Δ NDVI<-1000	Worse
-1000< Δ NDVI<-500	Poor
-500< Δ NDVI<500	Normal
500< Δ NDVI<1000	Favorable
1000< Δ NDVI<10000	Good

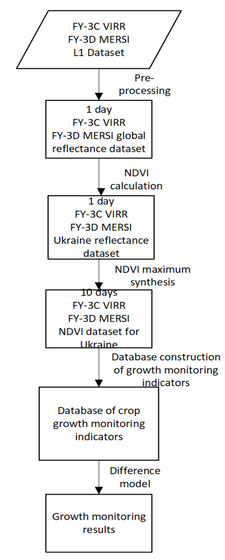


Fig. 2 Technical flowchart

Results

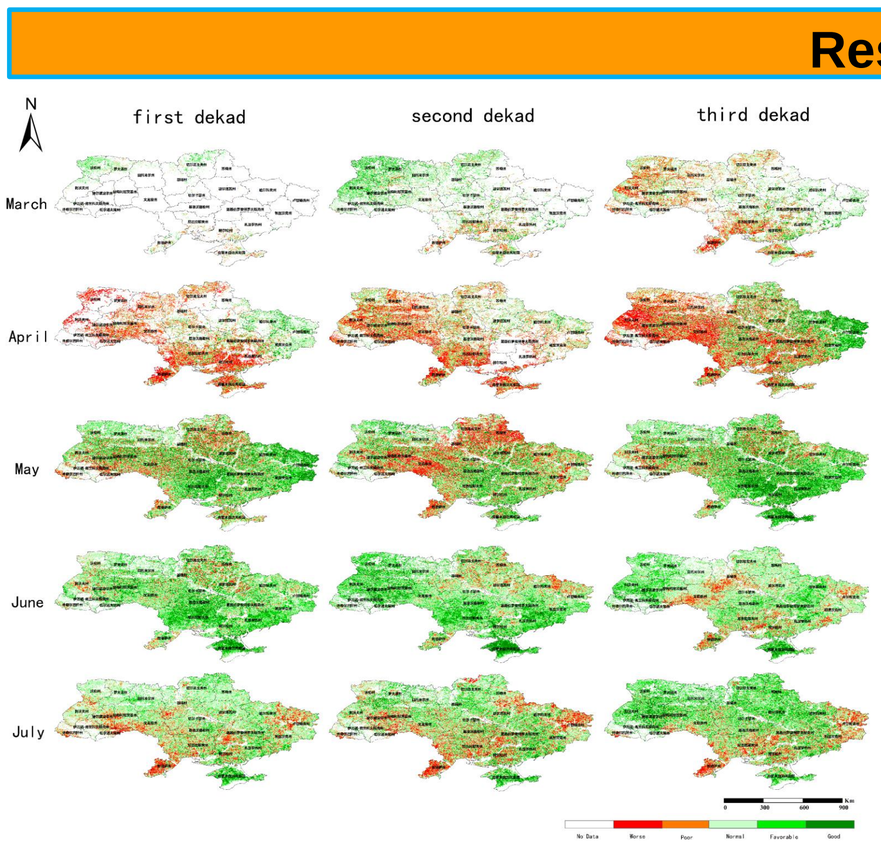


Fig 3 Crop growth monitoring map of Ukraine （FY-3C）

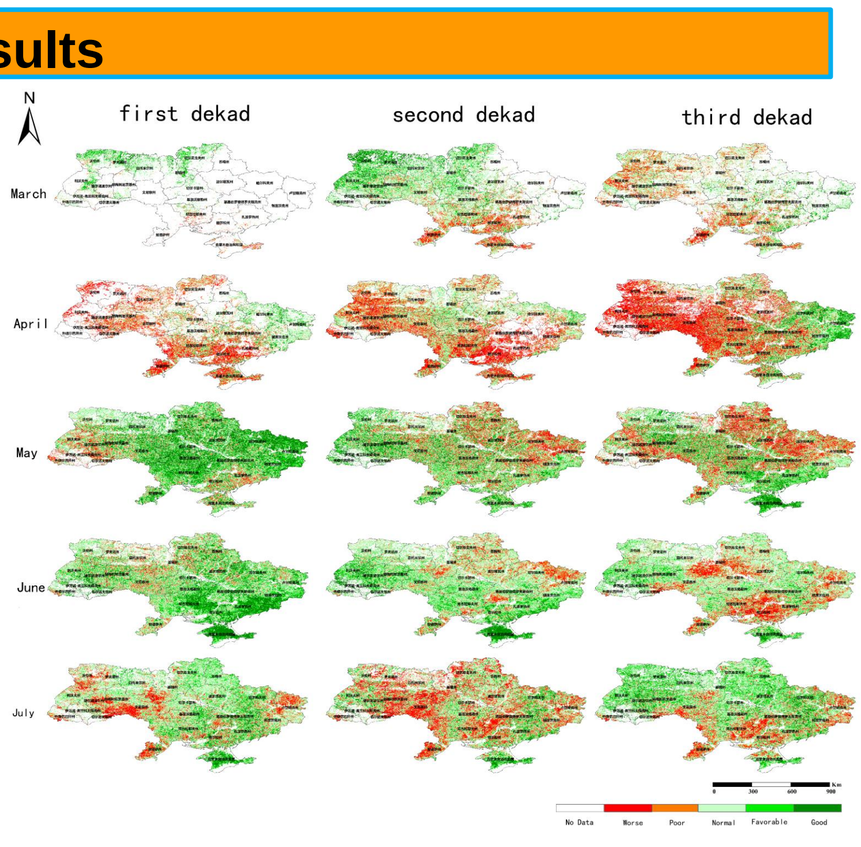


Fig 4 Crop growth monitoring map of Ukraine （FY-3D）

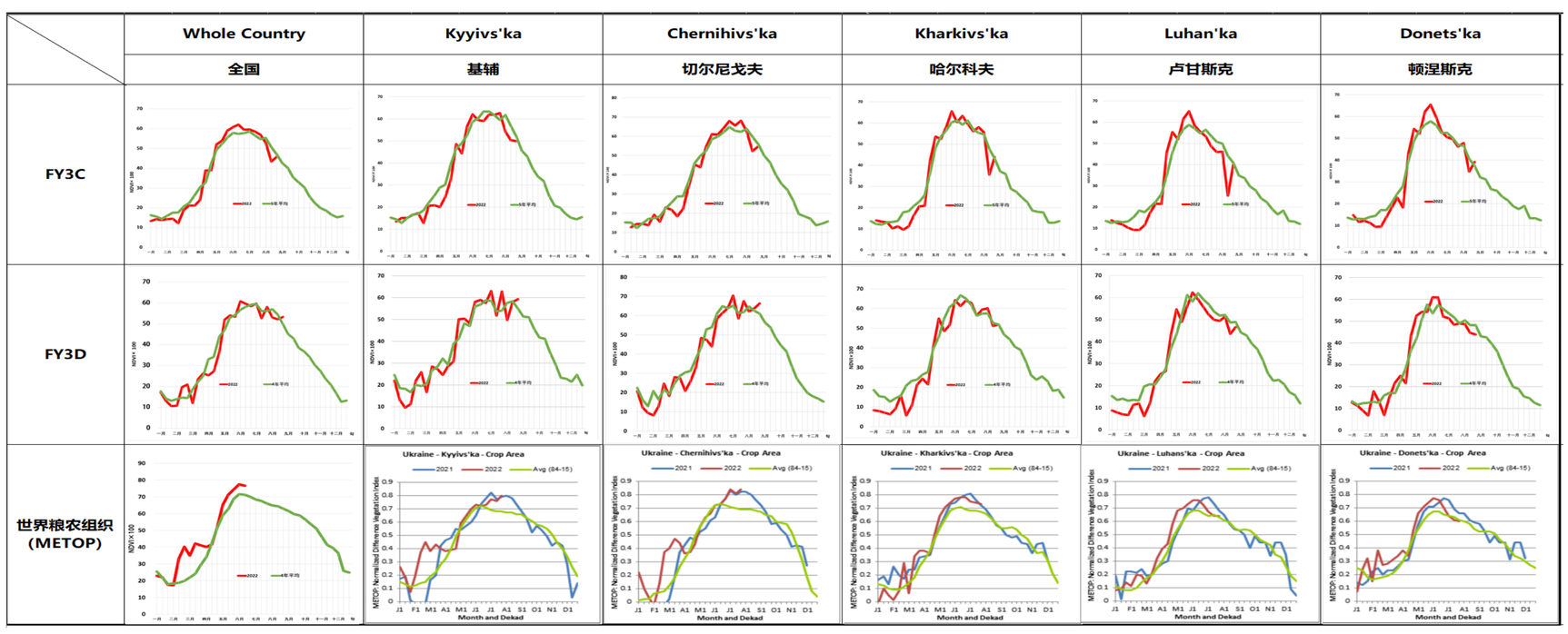


Fig. 5 FY-3D, FY-3C and METOP weather satellites Time series curve of vegetation index of agricultural crops in Ukraine affected by war

Conclusions

Using NDVI as a monitoring indicator, the NDVI difference model was constructed based on the effective use of existing domestic Fengyun-3 meteorological satellite data to conduct interannual crop growth comparison studies. The crop growth in five representative regions of northern and eastern Ukraine is not significantly different from the average of the past years, and even better than the average of the past period. Thus, it seems that the growth of winter crops in Ukraine has not been seriously affected by the war.

Aknowledgement： ：
We are grateful to NSMC for providing FY-3 satellite data for this study.
We are also grateful to NSMC for hosting two of us in summer this year.