Monitoring winter wheat spring phenology in the North China Plain using MODIS

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North China Plain (NCP) is one of the most important granaries in China. Crop spring phenology is a sensitive indicator of climate change and crop management. Monitoring of crop spring phenology is of great importance to food security. Winter wheat is the main crop cultivated in the study area. There are few studies that evaluate the performance of different vegetation indices in detecting winter wheat spring phenology in the study area. Moreover, the spatiotemporal variation of winter wheat spring phenology since 2000 is also not very clear. In this study, NDVI, EVI and NDPI derived from MODIS were used to investigate the characteristic of winter wheat spring phenology. The results showed that there was good agreement between the winter wheat spring phenology of satellite-based and the ground observation records. At the spatial scale, winter wheat spring phenology derived from NDVI, EVI and NDPI showed the similar spatial pattern. At the regional scale, winter wheat spring phenology monitored by NDVI, EVI and NDPI all showed a delayed trend during 2001-2017. Furthermore, winter wheat spring phenology was most affected by the average temperature from February to mid-March and the cumulative precipitation from November to mid-March. Winter wheat spring phenology was negatively correlated with temperature and precipitation, and the effect of temperature on winter wheat spring phenology was greater than precipitation. The decrease of the average temperature from February to mid-March and cumulative precipitation from November to mid-March were the main reasons for the delayed trend of winter wheat spring phenology during 2001-2017. In addition, the interannual variation of winter wheat spring phenology in the study area was not only affected by climate factors but also influenced by topography and available water resources.

Keywords: Winter wheat, Spring phenology, North China Plain, Temperature, Precipitation, MODIS