Monitoring macrophyte phenology in Lake Inba-numa, Japan based on Sentinel-2 images

*HU LIANG[1]

1. Chiba University, Graduate School of Science and Engineering, Center for Environmental Remote Sensing

Recently, the floating-leaved plants, especially Trapa spp., have been increased in eutrophic lake Inba-numa, Japan. The Trapa spp. can reduce phytoplankton blooms and stabilize a clear water state by storing nutrients. On the other hand, they can also block the water way and cause low dissolved oxygen concentration. In order to understand the processes of growth, senescence and reproduction of Trapa spp., it is necessary to monitor the phenology of Trapa spp. The improved spatial and temporal resolution of latest-generation Earth Observation missions, such as Sentinel-2, has provided new opportunity of remote sensing for mapping land surface phenology in small inland water systems like Lake Inba-numa, however the driving force for the spatial variation of Trapa spp. phenology is still unclear. The aim of this study was first to estimate the Trapa spp. phenology with sentinel-2A,B in years of 2018 and 2019, and then to analyze the mechanism for the spatial variation of Trapa spp. phenology. Phenology metrics including start and end of the growing season (SOS and EOS) were computed from NDVI time series using the software TIMESAT. The SOS in 2018 North Inba-numa and West Inba-numa was ranging from DOY110 to DOY130 and DOY100 to DOY120, the EOS of North Inba-numa and West Inba-numa was ranging from DOY265 to DOY275 and DOY250 to DOY300. Noticeable spatial variations of phenology were observed in Inba-numa. The relationship between the phenology variation, water depth and $K_{d(PAR)}$ (downwelling attenuation coefficient of photosynthetically active radiation) was also analyzed. The water depth data is provided by Geospatial Information Authority of Japan and the $K_{d(PAR)}$ was calculated from Sentinel-2A,B in years of 2018 and 2019 based on the semi-analytical approach for K_d retrieval which was presented by Lee et al. (2013). In general, for water depths up to 2 m, there is no obvious relationship between the phenology spatial variation and water depth, the phenology spatial variation was directly influenced by the $K_{d(PAR)}$. In conclusion, this study is helpful to improve our understanding of seasonal changes in macrophyte growth and help to manage the macrophyte to have a positive effect on water quality.

Keywords: Trapa spp., Lake Inba-numa, Phenology, Water depth, Kd(PAR)

