

Estimation of Water Consumption of Winter Wheat in the North China Plain Using Remote Sensing Technology

*Xifang Wu^{1,2}, Yanjun Shen², Akihiko Kondoh³

1. Graduate School of Science and Engineering, Chiba University, 2. Center for Agricultural Resources Research, Institute of Genetics and Developmental Biology, Chinese Academy of Sciences, 3. Center for Environmental Remote Sensing, Chiba University

The North China Plain (NCP) is one of the most important regions of agricultural production in China. Winter wheat is a major crop in this region. Water consumption of winter wheat greatly exceeds precipitation of the same period. Increase of winter wheat yield mainly depends on irrigation. Over-exploitation of groundwater resources for irrigation has resulted in the decline of the groundwater table and severe environmental problems. The objective of this study is to accurately estimate crop water consumption and irrigation water consumption in the study area. A model to estimate actual crop evapotranspiration was established combining Penman-Monteith method with remote sensing data. Estimated actual evapotranspiration of winter wheat between 2001 and 2013 had good consistency with field observed evapotranspiration in Luancheng Station of Hebei Province, Weishan Station and Yucheng Station of Shandong Province (RE= -1.3%, RMSE=54.8mm). Irrigation water consumption also had good consistency with declining rate of groundwater table at hydrological stations of Hebei Plain. Moreover, planting area of winter wheat in Northern Hebei Plain and Southern Hebei Plain had a declining trend from 2001 to 2013. Before and after 2001, decline rate of regional groundwater table of Northern Hebei Plain and Southern Hebei Plain decreased significantly. Thus, decrease of planting area of winter wheat had a significant influence on protection of groundwater resources. The proposed model in this study can also be applied in the estimation of water footprint and irrigation water management in other regions.

Keywords: North China Plain, Evapotranspiration, Remote sensing, Groundwater, Irrigation water consumption