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How does climatic factors influence the timeliness of groundwater irrigation at the household level in the North China Plain?

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The timeliness of irrigation that measures whether the water delivery timing match the growth needs of the crop and the expectations of the farmers has important effect on agricultural production. Despite considerable discussion of the importance of the timeliness of irrigation, the least attention has been paid to the timeliness of groundwater irrigation through the eyes of the farmers. Moreover, existing studies do not quantitatively analyze how climate factors affects the timeliness of irrigation, especially using data from field surveys. Therefore, there is a great deal of value in examining the effects of climate factors on the timeliness of groundwater irrigation at the household level.

The purpose of this study is to examine how climate factors influence the timeliness of groundwater irrigation from the farmers' perspective in the North China Plain (NCP). Specifically, this study has the following objectives. Firstly, the changes in climate in the sample areas over the past 30 years are described, and the changes in the timeliness of groundwater irrigation from farmers' perspective are tracked. Secondly, econometric models are constructed to explore the effects of climate variables and socio-economic factors on the timeliness of groundwater irrigation. Thirdly, based on quantitative analysis results, several policy implications are provided for policy makers.

The socioeconomic data used in this study come from the China Water Institutions and Management survey (CWIM) conducted over years. The county-level monthly mean temperature and monthly total precipitation are provided by the National Meteorological Information Center in China. Data analysis shows that, over the past few decades, farmers have experienced a decreasingly timeliness of groundwater irrigation, measured by the ratio of instances the number of times that the delivery of irrigation water matched farmers' expectations to the total number of irrigations during the crop growing season. Econometric estimation results show that both long-term average weather conditions (mean temperature and total precipitation) and current year weather are related to the timeliness of groundwater irrigation. An increase in the average temperature adversely affects the timeliness of groundwater irrigation whereas a rise in precipitation can improve the timeliness of groundwater irrigation. Moreover, the effects of weather factors differ between villages pumping from different types of aquifers with larger impacts in villages that pump solely from shallow aquifers. Findings from this study will help policy makers design strategies to adapt to climate change as well as making several additional contributions to the literature.