A monitoring strategy for agricultural water use in Saudi Arabia

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Agricultural presence, particularly from center-pivot irrigation fields, has increased significantly in Saudi Arabia during the past 30 years. The impact on its groundwater resources has been quantified, at large scales, using GRACE data. Meanwhile, national water management offices rely on local information supplied by farmers to evaluate the extent and intensity of irrigation of fields. Importantly, GRACE data cannot provide this level of information, but does provide an estimation of the total groundwater use. In this study, we show that a combination of higher-resolution satellite data (30 m or higher) and a land surface model can be used to get the extent and intensity of irrigation, and estimate the groundwater use from these fields. A first nation-scale implementation of this model is being used to estimate the individual water use from over 30, 000 center-pivot irrigation fields. We used Landsat 8 data, meteorological data from a Weather Research Forecasting (WRF) model reanalysis, the two-source energy balance model (TSEB) and the Community Atmosphere Biosphere Land Exchange (CABLE) model. Preliminary results over a largely developed agricultural region in Saudi Arabia (Al Jawf; over 3000 fields) shows a total abstraction of 3.1 km^3 for the year 2015, with peak consumption during April and August. This study will provide detailed local information for water management agencies to evaluate the impact of its decisions.