Geophysical Research Abstracts
Vol. 20, EGU2018-14138, 2018
EGU General Assembly 2018

Assessing the accuracy of remote sensing models for water rights enforcement and accounting

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It is often stated that "you can't manage what you don't measure". Motivated by the challenges of implementing in-situ monitoring of agricultural water use, remote sensing models increasingly are being used to support water rights enforcement and water use accounting globally. Despite this, to date no study has evaluated the ability of remote sensing models to reproduce accurately observed patterns of field-level irrigation water use across agricultural landscapes. In this talk, we compare estimates of irrigation water application rates derived using state-of-the-art remote sensing models with a unique dataset of multi-year abstraction records for 1,400 individual groundwater irrigated fields in southwest Nebraska overlying the High Plains Aquifer. We demonstrate that remote sensing models reproduce realistically regional-scale average irrigation application rates, but are unable to capture important spatial and temporal heterogeneity in farmers' observed irrigation water use decisions. Specifically, we show that farmers' observed water use decisions vary significantly over both space and time due to differences in individual irrigator behaviour, which can't be explained by biophysical factors such as weather, soil type, crop choice, or irrigation technology. Our findings illustrate the significant challenges for using remote sensing for field-scale water use estimation, and highlight the urgent need for improved in-situ monitoring of irrigation water use in order to ensure efficient and sustainable agricultural water management worldwide.