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Towards Global Mapping of Irrigated Agriculture

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Accurate information on irrigation extent is fundamental to many aspects of the Earth Systems Science and global change research. These include modeling of water exchange between the land surface and atmosphere, analysis of the impact of climate change and variability on irrigation water requirements/supply, and management of water resources that affect global food security. However, the current extent of irrigated areas over continental to global scales is still uncertain and available maps are derived primarily from country level statistics and maps that are often outdated. Even in locations, such as the US, where the general extent of irrigated areas is known, irrigation-related information exists only in disparate datasets and cannot be easily synthesized into a single continental scale database. To overcome the shortcoming of existing datasets, we developed an irrigation mapping methodology that relies on remotely sensed inputs from MODerate Resolution Imaging Spectroradiometer (MODIS) instrument, an improved classification methodology, and ever increasing continental and globally extensive ancillary sources of gridded climate and agricultural data. The approach is a binary (i.e. irrigated vs. non-irrigated) supervised classification method with a non-parametric decision-tree algorithm. As a first step, climate-based indices provide background information on irrigation potential. To detect the actual irrigation, we use existing datasets on agriculture presence, the temporal evolution of remotely-sensed vegetation greenness and the spatial distribution of spectral indices that are most sensitive to chlorophyll presence. We test our irrigation mapping procedure in a pilot study over the continental US. The results produced a high spatial resolution map of irrigated areas with expected patterns, such as a strong east-west divide with most irrigated areas concentrated on the arid western portion of the country along dry lowland valleys. The final binary irrigation map product has a better than 80 percent classification accuracy with western portion of the country having slightly better estimates than the eastern portion. Improvement of the method includes

estimation of sub-pixel portion of irrigation using remotely-sensed skin temperature measurements.