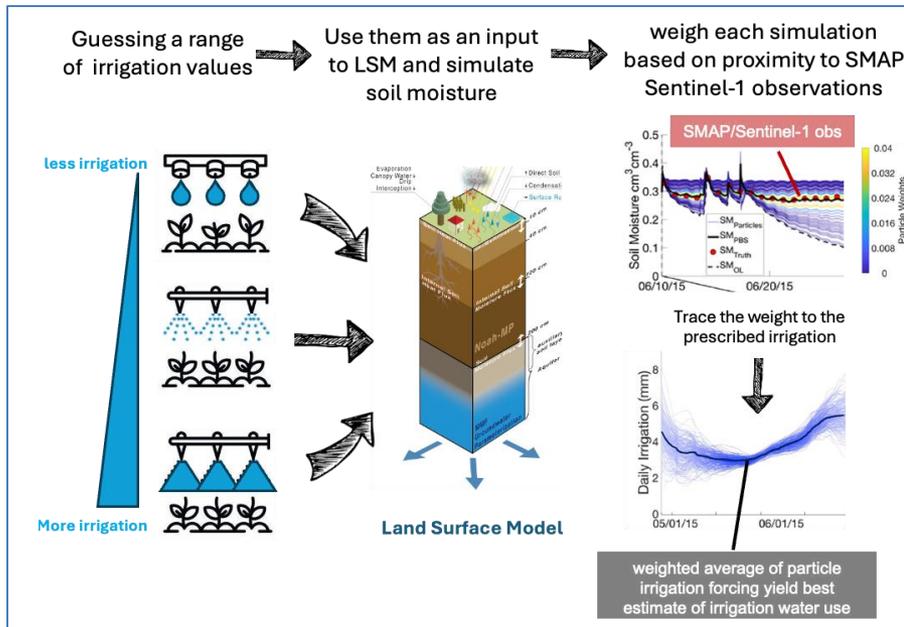


Quantifying the irrigation water use by assimilating SMAP/Sentinel-1 soil moisture observations



Problem: Irrigation accounts for the majority of freshwater consumption globally. However, modeling irrigation water use (IWU) is challenging due to the complexities introduced by human decision-making. Assimilating soil moisture data from SMAP/Sentinel-1 (SMAP-S1) can help capture these human-driven dynamics at finer scales, improving IWU estimation.



Finding:

- Assimilating ~weekly SMAP-S1 soil moisture with a particle batch smoother (PBS) estimates significantly lower irrigation for non-irrigated vs. irrigated pixels
- Irrigation is underestimated by 18.6%, likely due to losing part of the signal in SMAP-S1 1 km retrievals.
- Synthetic studies demonstrate that knowing irrigation timing can greatly enhance simulation accuracy, achieving a 3% bias and an $R^2=0.95$.

Impact: This study eliminates the need for heavily parameterized irrigation modules, which often fail to capture human decision-making, by testing an alternative SMAP-S1 DA method using PBS algorithm to estimate irrigation, the largest human intervention in the water cycle.