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Towards improved ET estimations for a semi-arid agricultural area, using remote sensing and processed based hydrological modelling

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The study to be presented, follows a diagnostic approach to assess the estimation of actual ET over a complex and highly diverse agricultural area. We use a process-based and spatially distributed hydrological model to estimate ET, which integrates detailed soil-vegetation dynamics, and compare the results to remote sensing derived ET data.
The Soil and Water Assessment Tool (SWAT) model is set up to simulate ET of an entirely managed meso-scale irrigation scheme, in the semi-arid Punjab region of Pakistan, which is characterized by diverse and small scale cropping patterns and a high temporal and spatial climate variability. Remote sensing derived ET data, based on the Surface Energy Balance Algorithm (SEBAL), is used for comparison and to assess spatial ET variability.
The estimation of actual ET in this diverse and complex hydrological setting differs between both approaches. The study shows clearly that:
• Temporal variability of ET is captured well by the remotely sensed data, but shows lower accuracies during wet seasons when cloud cover reduces the reliability of remote sensing data.
• During seasons with homogeneous crop types, i.e. low spatial heterogeneity, remote sensing and model estimates show a satisfactory match.
• During seasons when crop patterns are highly diverse, the remote sensing and modelled ET deviate significantly, due to scaling challenges. Especially for small-scale agricultural areas, the scaling of remote sensing data to a mean ET value per model unit (here: hydrological response units) cannot resolve the SWAT ET variability when crop patterns are highly diverse.
• A correction of the remote sensing data, based on a crop coefficient based agricultural model, increases the spatial variability of the remote sensing ET.
• Using this modified ET product a better match between modelled and remote sensing ET can be achieved, while maintaining the large scale heterogeneity from the remote sensing data and the small scale heterogeneity from the modelled data.
The study discusses the reasons behind the mentioned differences in ET estimations and shows that a higher spatial variability of remotely sensed ET data can be achieved if detailed crop characteristics are taken into account.