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Towards operational evapotranspiration estimation over the Netherlands at plot scale resolutions

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In the past years remote sensing data has become more important in water resources management for the Netherlands. Remote sensing techniques provide the possibility of a completely integrated water resources management system for controlling water levels in the rivers and risk analysis of the water sheds and dikes. However only a small part of the available techniques (such as determining the land use and the estimation of precipitation) is currently used, due to limiting factors within the remote sensing products. Within the SAT-Water consortium of several Dutch water boards the focus was to increase the usage of such remote sensing data for operational water monitoring.

Within the water cycle evapotranspiration (ET) provides the largest sink of water. It is therefore is vital importance for operational water monitoring systems. However applying these evapotranspiration monitoring over the Netherlands is limited due to a mismatch between sensor footprints and average plotsizes. The average plot size in the Netherlands is around ∼30x30m. While remote sensing sensors exist that provide such resolutions, they are in general not used for daily evapotranspiration monitoring; most of these available ET products use satellite sensors (such as MODIS) with a resolution of 250x250m.

The goal of the presented research is therefore to 1) develop operational production of daily ET estimations and 2) investigate the disaggregation of this daily evapotranspiration estimation. Specifically the goal was to produce gap-free evapotranspiration estimations on 250x250m resolution.
This was accomplished by not only using observations from the orbiting MODIS sensor but also integrating geostationary (15 minute) observations by the SEVERI sensor. These combined products were then used for estimating the land-surface fluxes at high temporal resolution using the SEBS model. In addition to the higher number of cloud-free observation (provided by SEVIRI), the HIRLAM meteorological model was used to fill the gaps for pixels that were completely cloud cover for the whole day. Afterwards a disaggregation methodology was developed in order to scale this the 250x250m product to higher (8x8m, 30x30m) resolutions. In this step remote sensing observations (of Formosat and Radarsat-2) of plant type, growth stage and water stress were used. The presentation will describe the merging of MODIS and SEVIRI observations, the synergies between SEBS and HIRLAM, the production of daily evapotranspiration, and the disaggregation to higher resolutions.