ASSESSING CROP WATER PRODUCTIVITY FROM FIELD TO REGIONAL SCALE

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First a short description is given of the hydrological problems, with a particular focus on groundwater, that affect agriculture in humid and temperate climates such as that of the Netherlands as well as in semi-arid climates.
This is followed by an overview of the transient flow modeling of water and solute flow in heterogeneous soil-root systems under a variety of boundary conditions with a focus on the linkage between water use by the crop, and daily crop growth and crop yield, i.e. the so-called 'water productivity' relationship.
Then the agreement between long-term predictions made with dynamic land capability models and field measurements are discussed in the context of model utility to establish design criteria for drainage systems for both humid as well as for semi-arid areas.
Then a review is given how to scale up from the field scale to the regional scale. Up-scaling from fields to a region can be done by identifying areas that are *homogenous* with respect to soil and hydrological properties. Effects of *spatial heterogeneity* can be further analyzed by running a field scale model for all combinations of soil-water-crop and weather combinations i.e.*simulation units* for the areas under investigation. The aggregation of the various simulation units can be performed in a GIS-environment by overlaying the thematic maps of spatial variables like weather, land use, soil, irrigation, groundwater level and groundwater quality. In order to analyze water productivity at regional scale the output of the independent model runs can finally be synthesized with the help of post-processors and GIS.
On the other hand earth observation satellites provide nowadays interesting information about degree of vegetation cover, leaf area index, crop type, crop yield, crop water stress and crop water use. This information can be regularly obtained under cloud-free conditions for different spatial and time resolutions. Consequently, the accuracy and reliability of spatial aggregation of representative input parameters, evapotranspiration *ET* and biomass simulated by distributed modelling can be *compared* with data obtained by satellite for different spatial and temporal scales. Once the combined use of model predictions and satellite data is verified, it will be possible to analyze the water productivity of an entire region of interest in detail and to provide specific recommendations for improvement.

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