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Differences in water balance for hydrological response units defined from mobile measurements of soil and crop parameters

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Variability in vegetation indices like the ratio vegetation index (RVI) and leaf area index (LAI) for a uniformly managed agricultural field can be associated with differences in plant available water and thus, differences in evapotranspiration (ET) and deep percolation (D). This variability has important implications for field scale water balance and water and fertilizer use efficiencies of the vegetation. Characterizations of the water balance often do not account for field scale heterogeneity arising from the spatial variability of soils and vegetation. In this study we evaluated differences in modelled ET and D from six hydrological response units (HRU) defined for a 25 ha sandy soil agricultural field in Western Denmark. The HRUs were identified by clustering a high resolution soil and vegetation sensory data. Crop development and soil water content were monitored during one growing season for each HRU and a soil water balance model applied to infer ET and D. It was shown that the easily measured RVI could be used to estimate LAI by linear regression with local measurements for each HRU. The local RVI to LAI regression was further validated by measurements made on the entire field with the MobilLas mobile canopy sensor. Differences in modelled ET for the growing season ranged from 10-35 mm between HRUs and were attributed to differences in water content at field capacity (FC) and maximum LAI. Differences in modelled D ranged from 5-25 mm and were also associated with differences in FC attributed to variation in the silt and soil carbon contents of HRUs. In summary, the investigated HRUs revealed differences in ET and D supporting the use of this approach to understand the field scale variation of the water balance and possibly optimize water and fertilizer use efficiency.