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A Simple method for reference crop evapotranspiration under non-advective conditions suitable for remote sensing applications

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A method is presented to estimate daily reference crop evapotranspiration (ETo) under non-advective conditions from Meteosat Second Generation (MSG) imagery. For this purpose observations of Cabauw in the Netherlands have been analyzed. Due to the climatic conditions and the local water management at this site water stress is very rare, which makes this dataset ideal to assess ETo without advection. The findings of older studies are combined to arrive at a simple formula for ETo, requiring daily global radiation and air temperature as input only. The formula is validated against independent eddy-covariance measurements of actual evapotranspiration. The bias is 3 W m-2 and the root mean square error (RMSE) 7.6 W m-2. The applied Slob-de Bruin estimate of net radiation is tested separately, yielding a bias of 1.4 W m-2 and a RMSE of 9.6 W m-2. In a next step the measured global radiation has been replaced with MSG estimates. For ETo this resulted in a bias of 1.6 W m-2 and a RMSE of 11.7 W m-2. Based on arguments used by Schmidt (1915) a reasonably sound physical justification for the proposed ETo formula is presented. This justifies application of the results outside Cabauw. However, this applies to conditions where advection can be ignored. It is pointed out that in semi-arid regions local advection cannot be ignored. Finally, the ambiguousness of the formal definition of ETo given in the FAO Irrigation and Drainage Paper No. 56 is discussed.