Mapping Evapotranspiration with the Remote Sensing ET algorithms METRIC and SEBAL under advective and non-advective conditions: Accuracy determination with weighing lysimeters

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Abstract. The Surface Energy Balance Algorithm for Land (SEBAL) is one of several remote sensing-based crop evapotranspiration (ET) models. One advantage that SEBAL has is its minimal requirement for ground-based weather data. However, its downside is that in the presence of advection it may underestimate ET. This is due to the use of a fixed evaporative fraction (EF) for the entire day. The EF value is used to extrapolate instantaneous ET to daily ET values, based on the assumption that EF at time of satellite overpass is the same (remains constant) as for the rest of the day, and therefore can be used to estimate daily ET. METRIC on the other hand, uses the reference ET fraction ETrF, which is a ratio of actual crop ET to alfalfa reference ET. While METRIC has the advantage of better capturing advective conditions, it requires the accurate calculation of reference ET. A study was therefore carried out to compare these two models under advective and non-advective conditions. A total of 12 Landsat 7 ETM+ images (2010-2011) were processed using both models, and ET was estimated for two alfalfa fields near Rocky Ford in Eastern Colorado. Both fields were equipped with precision monolithic weighing lysimeters. The remote sensing estimated daily ET was compared with lysimeter-based ET measurements. Results showed that in calm wind conditions, both models estimated actual ET with an accuracy of 70-95%, while for advective conditions, the accuracy was lower for SEBAL, as low as 47%. The largest errors occurred on windy and hot days when advection was present. Under calm wind conditions there was no significant difference in performance between the two models.

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