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Evapotranspiration Partitioning at Field Scales Using TSEB and Multi-Satellite Data Fusion in The Middle Reaches of Heihe River Basin, Northwest China

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Abstract: Daily evapotranspiration (ET) and its components of evaporation (E) and transpiration (T) at field scale are often required for improving agricultural water management and maintaining ecosystem health, especially in semiarid and arid regions. In this study, multi-year daily ET, E, and T at a spatial resolution of 100 m in the middle reaches of Heihe River Basin were computed based on an ET partitioning method developed by combing remote sensing-based ET model and multi-satellite data fusion methodology. Evaluations using flux tower measurements over irrigated cropland and natural desert sites indicate that this method can provide reliable estimates of surface flux partitioning and daily ET. Modeled daily ET yielded root mean square error (RMSE) values of 0.85 mm for cropland site and 0.84 mm for desert site, respectively. The E and T partitioning capabilities of this proposed method was further assessed by using ratios E/ET and T/ET derived from isotopic technology at the irrigated cropland site. Results show that apart from early in the growing season when the actual E was reduced by plastic film mulching, the modeled E/ET and T/ET agree well with observations in terms of both magnitude and temporal dynamics. The multi-year seasonal patterns of modeled ET, E, and T at field scale from this ET partitioning method shows reasonable seasonal variation and spatial variability, which can be used for monitoring plant water consumption in both agricultural and natural ecosystems.

Keywords: evapotranspiration partitioning; TSEB; data fusion

1. Introduction

Approximately one-third of Earth's land surface is occupied by semiarid and arid regions, where limited water resources makes it very challenging to provide industrial, agricultural, and ecological water use requirements. In many of these regions, most of the pressures on water resources is driven by evapotranspiration (ET) or water use by irrigated agriculture, which consumes