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Evaluation of a Land–Atmosphere Coupling Metric Computed from a Ground-Based Infrared Interferometer

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Abstract

Land–atmosphere feedbacks are a critical component of the hydrologic cycle. Vertical profiles of boundary layer temperature and moisture, together with information about the land surface, are used to compute land–atmosphere coupling metrics. Ground-based remote sensing platforms, such as the Atmospheric Emitted Radiance Interferometer (AERI), can provide high-temporal-resolution vertical profiles of temperature and moisture. When collocated with soil moisture, surface flux, and surface meteorological observations such as at the Atmospheric Radiation Measurement (ARM) Southern Great Plains site, it is possible to observe both the terrestrial and atmospheric legs of land–atmosphere feedbacks. In this study, we compare a commonly used coupling metric computed from radiosonde-based data with that obtained from the AERI to characterize the accuracy and uncertainty in the metric derived from the two distinct platforms. This approach demonstrates the AERI's utility where radiosonde observations are absent in time and/or space. Radiosonde- and AERI-based observations of the convective triggering potential and low-level humidity index (collectively referred to as CTP-HI_{low}) were computed during the 1200 UTC observation time and displayed good agreement during both the 2017 and 2019 warm

seasons. Radiosonde- and AERI-derived metrics diagnosed the same atmospheric preconditioning based upon the CTP-HI_{low} framework a majority of the time. When retrieval uncertainty was considered, even greater agreement was found between radiosonde- and AERI-derived classification. The AERI's ability to represent this coupling metric well enabled novel exploration of temporal variability within the overnight period in CTP and HI_{low}. Observations of CTP-HI_{low} computed within a few hours of 1200 UTC were essentially equivalent; however, with greater differences in time there arose greater differences in CTP and HI_{low}.

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