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Predicting surface-specific humidity from radiative temperature and ambient weather for evapotranspiration modelling

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Abstract: Specific humidity (q_s) near a surface is closely related to the evapotranspiration of that surface. Therefore, it is a critical variable for evapotranspiration estimation using the Maximum Entropy Production (MEP) method. However, q_s is generally measured at sparsely distributed weather stations that are located at large height above the evaporating surface making them unsuitable for the MEP method. Hence, a method for assessing the spatial distribution of surface q_s is required. Here, we developed a method for predicting the deviation of surface q_s from the ambient q_s by using surface radiative temperature and ambient micrometeorological variables. The method was tested at five sites with differing vegetation cover type and topography. Three sites were located in a River Murray floodplain near Bookpurnong, and two sites were in a native vegetation catchment near Adelaide (Mt Wison). The results, which are based on a one-year data capture period, show that the relative importance of predictor variables (ambient shortwave radiation, temperature relative humidity, precipitation, and local surface radiative temperature) and model performance vary with time of the day. The most accurate predictions are obtained around midday when the solar radiation flux density is highest. Slope and aspect seem to influence the timing of the best prediction, particularly where topographic variation is significant. The performance of the method also varies with season. This finding serves as a useful guide for predicting spatial variation of surface q_s based on drone images for high-resolution evapotranspiration mapping (presented in a parallel paper in this conference), and for evapotranspiration modelling over greater spatial extent based on satellite remote sensing data.

Keywords: *Surface-specific humidity, micrometeorological variables, seasonal variation*