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Investigating the influences of different wind functions on estimated evaporation using generalized nonlinear complementary principle

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Abstract: Although the physics of evaporation is well understood, its estimation remains a challenge at the catchment or regional scale. Among available methods for estimating regional evaporation, the complementary principle is the most practical method that is based only on routine meteorological observations. In this study, the influences of two different parameterization schemes for wind function in the generalized nonlinear complementary relationship, i.e. one is based on the similarity theory and the other one is Penman method, are investigated. The sensitivities of estimated evaporation to different parameters and assumptions of wind functions are examined analytically and tested against observed eddy flux observations at four different sites with contrasting climate regimes and vegetation covers. Results show that two different wind functions and their parameters have different influences on the bias in estimated evaporation. The wind function based on the similarity theory results in significant errors when the basic assumptions are violated. The parameters of the wind function proposed by Penman are found to be dependent on vegetation cover types. This study highlights that different parameterization schemes of wind function and their parameters have different influences on the accuracy of estimated evaporation using the generalized complementary relationship and more studies are required to generalize spatial variability of the parameters in different wind functions.
Key words: generalized complementary relationship, wind function, evaporation, sensitivity and uncertainty, parameterization scheme