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Sigmoid generalized complementary equation for wet surface evaporation at the scale with changing advections

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Understandings the processes and estimating the amount of wet surface evaporation across various scales are crucial to the evaporation research. The Penman (1948) and Priestley-Taylor (1972) equations are derived for a wet patches and an extensive wet surface respectively, with an obviously different effects of advection. However, the evaporation for a wet surface between these two scales is difficult to estimate because of the changing advections. The sigmoid generalized complementary (SGC) equation, which expresses the ratio of actual evaporation (E) to Penman potential evaporation (E_{Pen}) as a function of the proportion of the radiation term (E_{rad}) in E_{Pen}, is used to model the wet surface evaporation process by setting the symmetric parameter to be infinity, and was validated by data from flux sites over a lake site (CN-MLW) from China, a wetland site (US-WPT) from the United State, and a paddy site (JP-MSE) from Japan. The SGC equation robustly describes the growth of E/E_{Pen} upon E_{rad}/E_{Pen} with upper flatness part over the wet surface with significant changing advection effects, and could account for the variation of the Priestley-Taylor coefficient directly. Thus, the SGC equation outperforms the Priestley-Taylor equation with a constant coefficient for estimating wet surface evaporation at the scale with changing advections.