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Evaluation of Large-scale Surface Wetness Variations in Northern High Latitudes During 1980-2010

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Large-scale surface wetness is evaluated by a wetness index (WI), calculated from GPCC precipitation divided by potential evaporation (Ep) using ERA interim data during 1980-2010. The climatological distribution of annual WI agrees with that of surface soil moisture (SSM) in ERA interim. Annomalies of annual WI also have strong relation with that of SSM in each region; the correlation coefficient between SSM and WI is higher than that between SSM and precipitation. Therefore WI corresponds to SSM for climatology and year-to-year variations.

The linear trends of WI, Ep and precipitation are calculated, with an attempt to decompose the factors of WI trend into those of Ep and precipitations. In high latitudes of Eurasia and eastern Canada, the increasing precipitation trends are canceled by the increasing Ep trends, resulting in little WI trends. In central Asia, western North America and Alaska, the decreasing precipitation trends and the increasing Ep trends lead to the decreasing WI trends. The precipitation variations dominate the WI variations in most regions. For example in Alaska, the decreasing precipitation trend contributes 72% to the decreasing WI trend and the increasing Ep trend does 27%. On the other hand, there are some regions where the Ep trend is important for the WI trend. For example in monsoon Asia, the precipitation trend is small and contributes only 3% to the decreasing WI trend, while the increasing Ep trend does 99%.

Consequently, it is shown that WI corresponds to surface soil moisture and indicates surface wet/dry conditions, and that the contributions of precipitation and Ep to its trends are quantified. Further analyses will be applied to the outputs of global climate models (GCMs) to evaluate reproducibilities of the surface energy-water balances in those GCMs.

Keywords: surface wetness, large-scale variations, reanalysis data