高緯度陸上の地表面熱水収支の広域変動特性～気候湿潤度を用いた解析～

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Large-scale variations of the energy-water balance on land at high latitudes - Analysis using a wetness index -

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The large-scale distribution of energy-water balance on land was examined using a wetness index (WI) calculated as a ratio of precipitation to potential evaporation (Kondo and Xu, 1997). Potential evaporation was calculated from the energy balance equation at the surface, using a global atmospheric reanalysis data of NCEP (NNRP) from 1951 to 2010. Besides, a global gridded precipitation data (GPCC) for the same period was used.

The global climatological distribution of annual WI, derived from annual precipitation and annual potential evaporation (Fig. 1) agree well with the climate zones of wet and dry, as indicated in Xu et al. (2005); WI higher than unity denotes wet condition, 0.3-1.0 does semi-set, 0.1-0.3 does semi-dry, and less than 0.1 does dry. It is mostly semi-dry in eastern Siberia and western Canada and mostly wet in western Siberia and eastern Canada. The interannual changes in WI in high-latitudinal regions (Fig. 2) roughly agree with the precipitation changes reported in the previous studies (e.g., Trenberth et al., 2007). There are strong positive correlations between WI and precipitation in all regions over the globe. It reveals that the increasing rate of WI to precipitation is higher at high latitudes (Fig. 2). It implies that small changes in precipitation could result in large changes in surface condition at high latitudes.

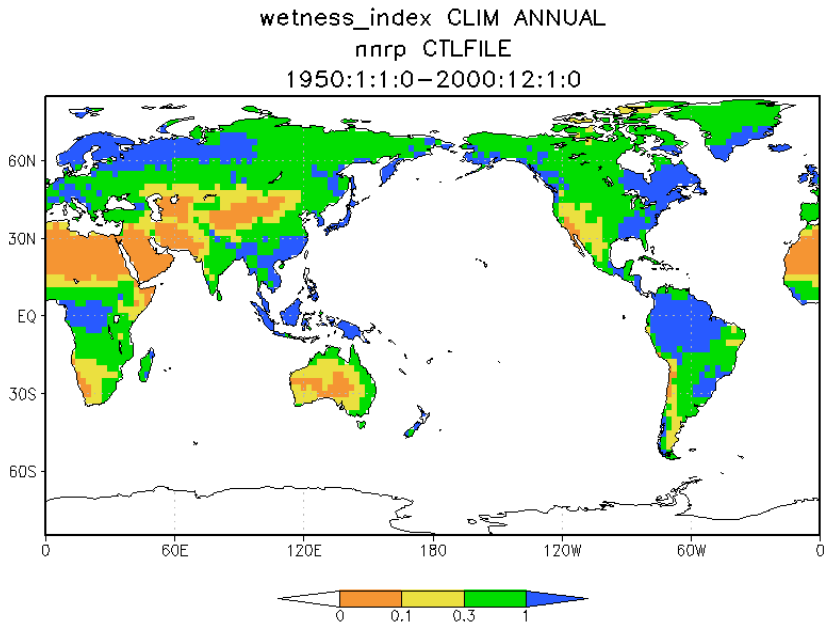

Figure 1. Global distribution of climatological annual WI.

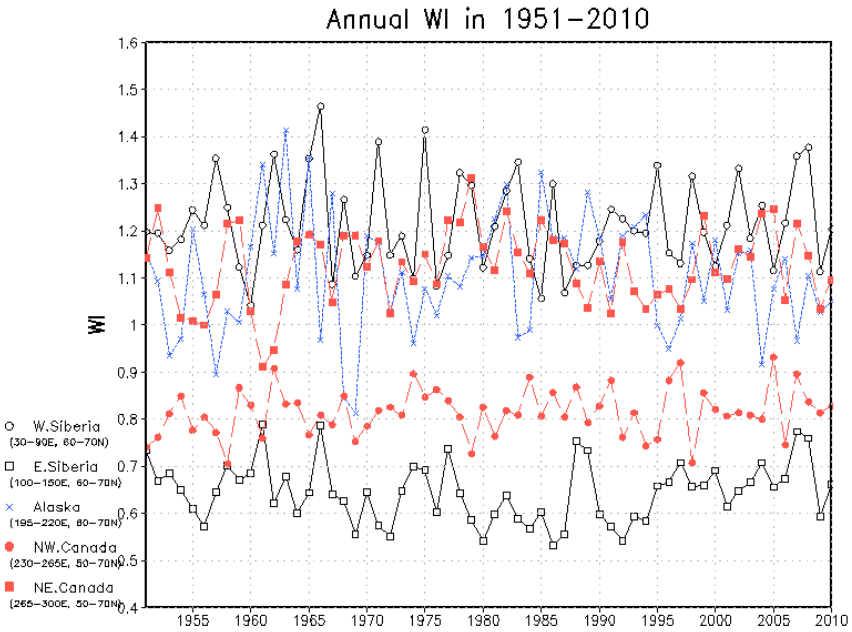

Figure 2. Changes in annual WI from 1951 to 2010 in the regions at high latitudes.

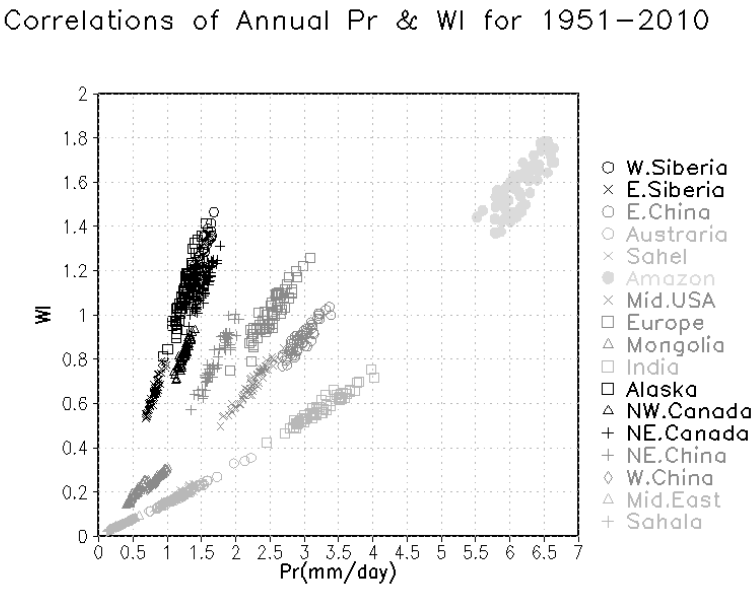

Figure 3. Correlation between annual WI and precipitation for 1951-2010.

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References

Kondo, J. and J. Xu, Potential evaporation and climatological wetness index. Tenki, 44(12), 875-883, 1997.

Trenberth, K.E., P.D. Jones et al., Observations: Surface and atmospheric climate change. In: Climate Change 2007: The physical science bases. Contribution of WG1 to AR4 of IPCC [Solomon, S. et al. (eds.)], Cambridge Univ. Press, Cambridge, UK and New York, NY, USA, 2007.

Xu, J., S. Haginoya, K. Saito and K. Motoya, Surface heat balance and pan evaporation trends in eastern Asia in the period 1971-2000. Hydrol. Pricess., 19(5), 2161-2186, 2005.