Evaluation of the spatio-temporal variation of water and energy budget in the eastern Siberia using a land surface model

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A land surface model (LSM) was used to estimate the spatio-temporal variations of water and energy budget in the eastern Siberia, with a ecophysiological parameterization. The coupling of LSM and the parameterization makes it possible to evaluate both the spatial distribution of water and energy and the regional difference in water cycles and in environmental response function. This study presents the characteristics of the spatio-temporal variations of water and energy budgets in the eastern Siberia over the period 1986 to 2004.

The LSM suggested by Yamazaki et al. (2004) was applied to the area of 40-72^{o}N and 90-180^{o}E, with the daily forcing data of 0.5^o scale, which was constructed on the basis of Baseline Meteorological Database of Siberia (BMDS). Solar radiation was estimated Kondo's empirical model based on sunshine length. Diurnal air temperature was approximated by mean, minimum and maximum temperature. When precipitation was occurred, it was constantly fallen on 000, 100, 1200, and 1300h. The diurnal variation in other variables was not considered. The parameters being in conductance model were determined as lumping them obtained from single leaves. The seasonal variation of leaf area index (LAI) was estimated every 10-day by coupling the maximum LAI at each grid produced by MODIS satellite and Jolly et al.'s (2005) phenological model.

Evapotranspiration on the eastern Siberia showed a characteristic distribution, dominated by transpiration and evaporation from the soil surface in boreal forested area and tundra, respectively. The increasing trend of evapotranspiration was significant in warm and humid region. Annual evapotranspiration showed significant correlation to air temperature while was in negative correlation to precipitation. On the other hand, there was a relationship between evapotranspiration and the last day of snow. The early disappearance of snow may increase ecophysiological activities of plants and the conduction of heat and water into the soil, so that evapotranspiration is increased. The relationship between evapotranspiration and the last day of snow was significant in the just channel neighbor of Lena river, particularly along the middle- and upper-stream, in which evapotranspiration is increasing and discontinuous permafrost is distributed. This suggests that the increase of evapotranspiration in Lena watershed is correlated to snow processes (i.e. accumulation and disappearance).