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Interannual variation of water balance and importance of soil moisture content for evapotranspiration in an eastern Siberian larch forest over a 7-year period (1998–2006)

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Water vapor, energy fluxes, and environmental conditions were measured in an eastern Siberian larch forest for 7 hydrological years, from 1998 to 2006, to understand the water-balance characteristics and interannual variation (IAV). The partitioning rate into latent heat flux was moderate, accounting for 38–67% of the sum of turbulent heat fluxes in June, July, and August, compared with values measured at mid- and low latitudes. More than 70% of the annual precipitation evaporated during May to September. Annual evapotranspiration, including interception loss, was relatively steady at 169–220 mm compared with the wide range in annual precipitation (111–347 mm year^{-1}). The evapotranspiration rate was 1.49–2.30 mm day^{-1} on a daily basis. This feature is one of the remarkable characteristics of the water balance in eastern Siberian forests in which permafrost exists. The thawing depth of the permafrost quickly deepened since 2004 such that the maximal thawing depth varied from 127 to over 200 cm. At the same time, there was a very large increase in the moisture content of the surface soil. This increase could not be explained by the amount of annual precipitation alone and may have been due to inflow from the deeper thawing layer. The IAV

of evapotranspiration was slight, but the yearly evapotranspiration coefficient (a ratio of evapotranspiration to potential evaporation) ranged from 0.3 to 0.45. Soil moisture content was the most important variable among the factors determining the evapotranspiration coefficient. This result differs somewhat from previous satellite-based findings that air temperature was a major variable for plant activity. This difference might result from the fact that the IAV of soil water content did not correspond to that of the precipitation amount because of the presence of the permafrost. By contrast, the soil water content was strongly affected by precipitation in the previous summer.