

Process study on water cycle at east Siberian Taiga

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East Siberian taiga is a unique ecosystem, which is established on permafrost. Climate there is extremely dry (about 250mm of annual mean precipitation). Oxygen and hydrogen isotope ratios of precipitation, soil water, sap water of plants, river, surface water, and atmospheric water vapor were observed in deciduous boreal forest near Yakutsk, Russia, to investigate the water flow in the ecosystem in 1998-2000.

Soil moisture in the active layer of the permafrost (layer which thaws during warm period) showed clear seasonal variation and varied depending on the summer rainfall: soil moisture increased after snowthaw, then decreased when summer precipitation was small. When summer precipitation was very large, soil moisture increased during summer. Namely soil moisture showed large interannual variation.

Isotopic composition of precipitation characteristically changed during spring from low delta value to high delta value, because of the change in the isotopic composition of water vapor. Transpired water by plants, namely, recycling of water from the surface through plants, may contribute the isotopic composition of atmospheric water vapor. Stable isotope ratio of sap water in plants and soil water were different between wet summer and dry summer. Sap water delta values were high during dry summer, and low during drought. This result indicated that rain water was used by plants when plants received enough summer rain, while melt water from permafrost was taken up by plants during drought. Isotopic composition of soil water indicated that water was transported upward in the soil during dry summer, while, rain water percolated downward during wet summer. Soil has a function for a storage of water in the permafrost region, and stored water in the soil can be a direct source of water for vegetation during drought.