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Upper air teleconnections to Ob River flows and tree rings

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The Ob River, one of the world's greatest rivers, with a catchment basin about the size of Western Europe, contributes 12% or more of the annual freshwater inflow to the Arctic Ocean. The input of heat and fresh water is important to the global climate system through effects on sea ice, salinity, and the thermohaline circulation of the ocean. As part of a tree-ring project to obtain multi-century long information on variability of Ob River flows, a network of 18 sites of Pinus, Larix, Populus and Salix has been collected along the Ob in the summers of 2013 and 2014. Analysis of collections processed so far indicates a significant relationship of tree-growth to river discharge. Moderation of the floodplain air temperature regime by flooding appears to be an important driver of the tree-ring response. In unraveling the relationship of tree-growth to river flows, it is important to identify atmospheric circulation features directly linked to observed time series variations of flow and tree growth. In this study we examine statistical links between primary teleconnection modes of Northern Hemisphere upper-air (500 mb) circulation, Ob River flow, and tree-ring chronologies. Annual discharge at the mouth of the Ob River is found to be significantly positively related to the phase of the East Atlantic (EA) pattern, the second prominent mode of low-frequency variability over the North Atlantic. The EA pattern, consisting of a north-south dipole of pressure-anomaly centers spanning the North Atlantic from east to west, is associated with a low-pressure anomaly centered over the Ob River Basin, and with a pattern of positive precipitation anomaly of the same region. The positive correlation of discharge and EA is consistent with these know patterns, and is contrasted with generally negative (though smaller) correlations between EA and tree-ring chronologies. The signs of correlations are consistent with a conceptual model of river influence on tree growth through air temperature. Future work aims at combining the tree-ring samples from living trees and remnant wood to reconstruction to quantitiative reconstruction of annual flow over the past millennium.