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Do oxygen isotopes in tree rings from coastal Alaska record atmospheric circulation patterns?

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Oxygen isotopes in tree-ring cellulose are a promising proxy to reconstruct the dynamics of large-scale atmospheric circulation patterns, which are the drivers of regional to local climate variability (temperature, precipitation and drought). In this project 112-year long (1900-2011) annually resolved tree-ring width (TRW) and tree-ring δ18O chronologies of Tsuga mertensiana from coastal Alaska (Seward, Kenai Peninsula) were developed and tested for their potential to record the origin of oceanic moisture and atmospheric circulation patterns such as the Pacific North American pattern (PNA) and/or the Pacific Decadal Oscillation (PDO). Alaska is one of the most sensitive regions on Earth to climate change of the 20th/21st centuries and thereforeof specific interest in the context of past/pre-industrial climatic variability. Our study site is under a strong maritime influence with high annual precipitation amount and moderate temperatures. Preliminary results of TRW measurements indicate that the main drivers of tree growth are early summer temperatures (May-July) of the current year stimulating photosynthetic activity, and the winter precipitation amount (previous December to current March) providing snow melt water at the beginning of the growth period. We also found a significant positive correlation of tree growth with monthly PNA from the previous December to the current March, whereas PDO correlates significantly with tree growth from April to July of the current year. Measurements of oxygen isotopes of four individual trees are still in progress and out coming results will be shown and discussed in the presentation. We hypothesize that the oceanic moisture from advective precipitation events is the most important factor for oxygen isotope variations in tree rings of our coastal site. We expect to find enhanced climatic signals in δ18O compared to TRW and potential to reconstruct large-scale atmospheric circulation variability in the Gulf of Alaska/North Pacific.