Theme: O06. Stable isotopes in dendrochronology
Presentation Type: Oral

SPRUCE TREE-RING CARBON AND NITROGEN ISOTOPES COMBINED TO LOOK AT PAST POLLUTION IN NORTHEASTERN ALBERTA

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In northeastern Alberta (Canada), the NOx and SO2 emissions from the Lower Athabasca Oil Sands (OS) district, and power plants (PP) started in 1967 and 1956, respectively. However, the direct air quality monitoring has only been initiated in 1997 and 1985 in these respective contexts. In an attempt to address the gap in emission and deposition monitoring, we developed a retrospective approach combining long d13C-d15N series and response-to-climate modeling. We produced d13C and d15N series extending from 1880 to 2010, using Picea glauca and Picea mariana trees growing in four stands in the OS district and one, in the PP area. The intermediate and long-term d15N series did not vary significantly for two stands with poor soil drainage. The d13C and d15N trends inversely correlated in the three other stands, and statistical analyses for the pre-operation calibration periods (1910-1961 and 1900-1951) allowed developing transfer functions and predicting the natural d13C and d15N responses to climatic conditions for the operation periods. The measured series all depart from the modeled natural trends, depicting anomalies which can be nicely reproduced by multiple-regression models combining local climatic parameters with acidifying emissions. Our preliminary interpretation is that the concomitant SO2 and NOx inputs to the studied sites generated effects in the foliar and root systems, possibly lower stomatal conductance and increased ectomycorrhizal activities. The approach tested here in two distinct diffuse pollution contexts permits to define objective criteria for interpreting anthropogenic impacts on local air-soil-plant C and N cycles.

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ENSO FLAVORS IN A TREE-RING δ18O RECORD OF TECTONA GRANDIS FROM INDONESIA

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The area surrounding Indonesia plays a key role in the global climate system because of the enormous heat and moisture exchange that occurs between the ocean and atmosphere. The climate in Indonesia is dominated by the equatorial monsoon system and has been linked to El Nino-Southern Oscillation (ENSO) events, which often result in extensive droughts and floods over the Indonesian archipelago with profound impacts on the populations of that region. Here, we evaluate the influence of rainfall variability on a 108-year long (1900-2007) tree ring δ18O record from teak (Tectona grandis) trees growing in a lowland rain forest in Central Java, Indonesia. We assess the potential of annually resolved oxygen (δ18O) isotope records to improve our understanding of the Asian monsoon variability. Climate response analysis with regional, monthly rainfall data reveals that the tree ring δ18O record is significantly correlated to rainfall and reveals dry and rainy season signals. Further, we investigate ENSO-related signals in the tree-ring δ18O record. Our study reveals a clear influence of Central Pacific ENSO events, while no clear signal of Eastern Pacific (canonical ENSO) events can be detected. These results are consistent with the distinct precipitation teleconnections of the two ENSO flavors in that region, and illustrate the importance of considering ENSO flavors when interpreting paleo-climate proxy records in the tropics. Previous work by the authors has identified key locations that could provide paleo-climate records able to distinguish between the two ENSO flavors. The results presented here demonstrate the applicability of tree-ring stable isotope records for this special purpose.

Theme: O01. Tropical dendrochronology
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