2.076 Vertical characterization of highly oxygenated molecules (HOM) below and above a boreal forest canopy.

Early Career Scientist

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Abstract:

Highly oxygenated molecules (HOMs) play crucial roles in new particle formation (NPF) and secondary organic aerosol (SOA) formation, and hence strongly influence global radiation and climate. Besides the efforts that have been made in understanding HOM formation mechanism, more and more attention has been drawn to the interaction between HOM chemistry and changing atmospheric conditions.

During the Influence of Biosphere-Atmosphere Interactions on the Reactive Nitrogen budget (IBAIRN) campaign, vertical profile measurements of HOMs below and above the forest canopy were performed using two nitrate ion based Chemical Ionization Atmospheric Pressure interface Time-Of-Flight (CI-APi-TOF) mass spectrometers, for the first time in the boreal forest SMEAR II station during September 2016. The HOM concentrations and composition distributions below and above the canopy were similar in the well-mixed boundary layer during daytime. However, during night, even though precursor monoterpene concentrations are elevated, much lower HOM concentrations were observed at ground level, as a result of the formation of a shallow decoupled layer below canopy. The results suggested that near ground HOMs were affected by the changes in the precursors and oxidants, and enhancement of the loss/deposition on surfaces in this layer, while the HOMs above the canopy top were not significantly affected.

One of the main novelties of our study is the detailed measurements of HOM below and above the canopy across a wide range of atmospheric stability conditions. The results highlight the significance of near-ground boundary layer dynamics and micrometeorological processes to the ambient HOMs, and the ground-based HOM measurement are not always representative for the entire boundary layer. This needs to be considered when interpreting measurements that are expected to be influenced by HOM, such as growth rates of new particles.