EGU21-12140
https://doi.org/10.5194/egusphere-egu21-12140
EGU General Assembly 2021

Composition and concentrations of aerosol precursor gases in the sub-Arctic boreal forest

Tuija Jokinen, Katrianne Lehtipalo, Kimmo Neitola, Nina Sarnela, Totti Laitinen, Markku Kulmala, Tuukka Petäjä, and Mikko Sipilä
Institute for Atmospheric and Earth System Research (INAR), University of Helsinki, Finland (tuija.jokinen@helsinki.fi)

One way to form aerosol particles is the condensation of oxidized atmospheric trace gases, such as sulfuric acid (SA) into small molecular clusters. After growing to larger particles by condensation of low volatile gases, they can affect the planets climate directly by scattering light and indirectly by acting as cloud condensation nuclei. Observations of low-volatility aerosol precursor gases have been reported around the world but long-term measurement series and Arctic data sets showing seasonal variation are close to non-existent. In here, we present ~7 months of aerosol precursor gas measurements performed with the nitrate based chemical ionization mass spectrometer (CI-APi-TOF). We deployed our measurements ~250 km above the Arctic Circle at the Finnish sub-Arctic field station, SMEAR I in Värriö. We report concentration measurements of the most common new particle formation related compounds; sulfuric acid, methanesulfonic acid (MSA), iodic acid (IA) and highly oxygenated organic compounds, HOMs. At this remote measurement site, surrounded by a strict nature preserve, that gets occasional pollution from a Russian city of Murmansk, SA is originated both from anthropogenic and biological sources and has a clear diurnal cycle but no significant seasonal variation, while MSA as an oxidation product of purely biogenic sources is showing a more distinct seasonal cycle. Iodic acid concentrations are the most stable throughout the measurement period, showing almost identical peak concentrations for spring, summer and autumn. HOMs are abundant during the summer months and due to their high correlation with ambient air temperature, we suggest that most of HOMs are products of monoterpene oxidation. New particle formation events at SMEAR I happen under relatively low temperatures, low relative humidity, high ozone concentration, high SA concentration in the morning and high MSA concentrations in the afternoon. The role of HOMs in aerosol formation will be discussed. All together, these are the first long term measurements of aerosol forming precursor from the sub-arctic region helping us to understand atmospheric chemical processes and aerosol formation in the rapidly changing Arctic.