

I CONVEGNO ISTITUTO DI SCIENZE POLARI



Water soluble compounds in the Arctic and Antarctic aerosol

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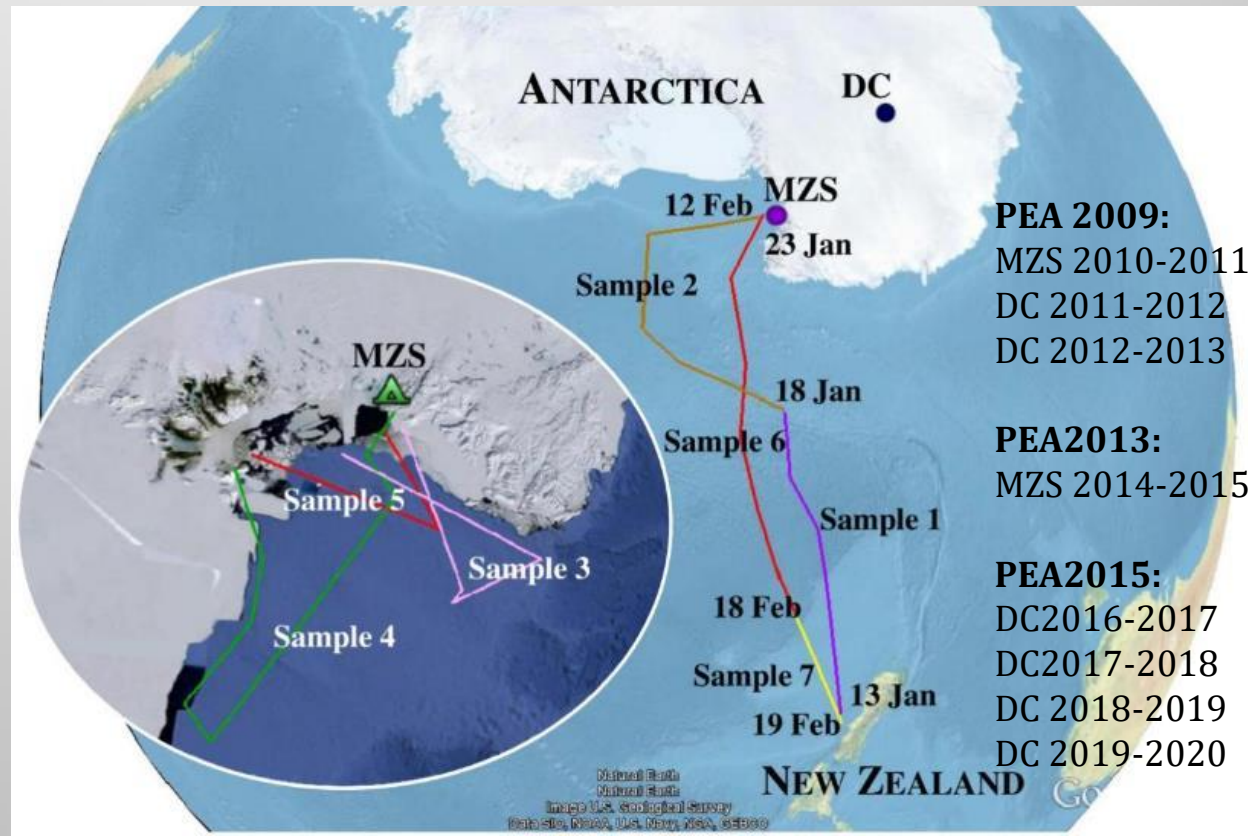
Roma, 22 – 24 settembre 2021

Arctic and Antarctic aerosol samplings

Gruvebadet atmospheric laboratory
close to Ny-Alesund
spring 2010 - now



High volume sampler
with cascade impactor
6 particle size ranges
10.0–7.2, 7.2–3.0, 3.0–1.5, 1.5–0.95, 0.95–
0.45 μm , <0.49 μm
on quartz fiber filters



Sample collection and processing



sampling

- PM10 high volume air sampler with cascade impactor

+ Internal Standards



2 x Extraction with H₂O



IC-MS

Major ions & carboxylic acids
Sugars (mono and disaccharides, alcohol-sugars anhydrosugars)

HPLC-ESI-MS/MS
L and D-Amino acids
Phenolic compounds

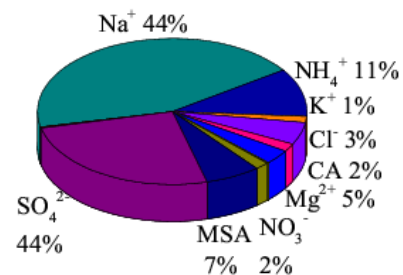


ICP-SFMS Element2
Trace elements
Rare earth elements



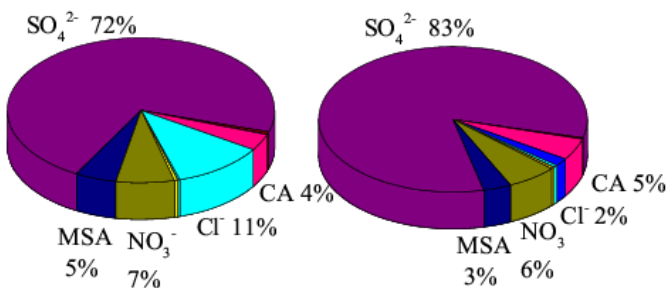
Particle size distribution of inorganic ions in coastal and inland Antarctic aerosol

MZS



DC27

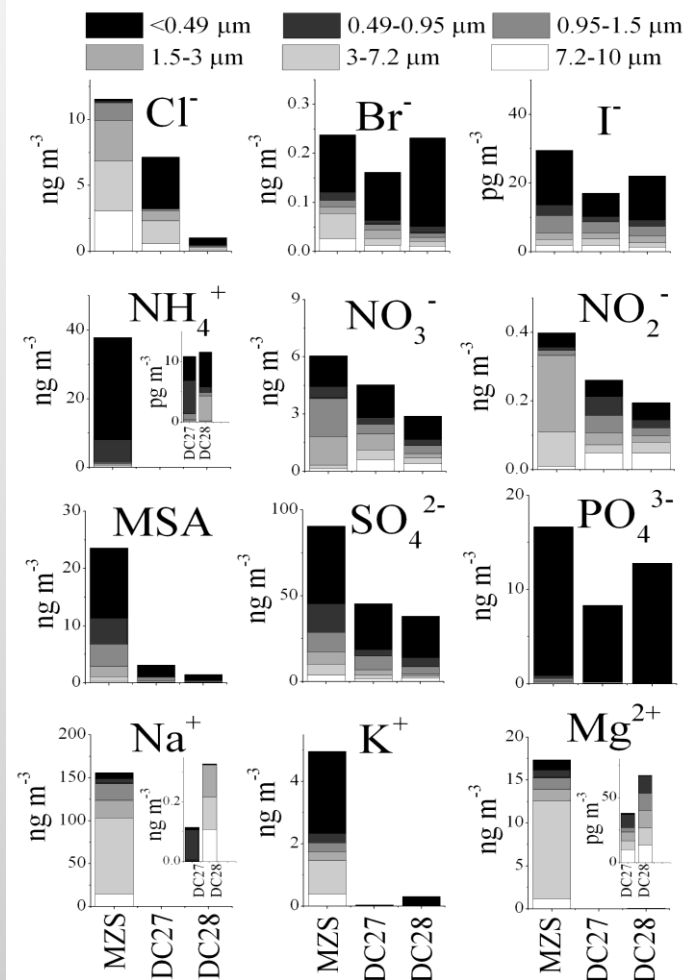
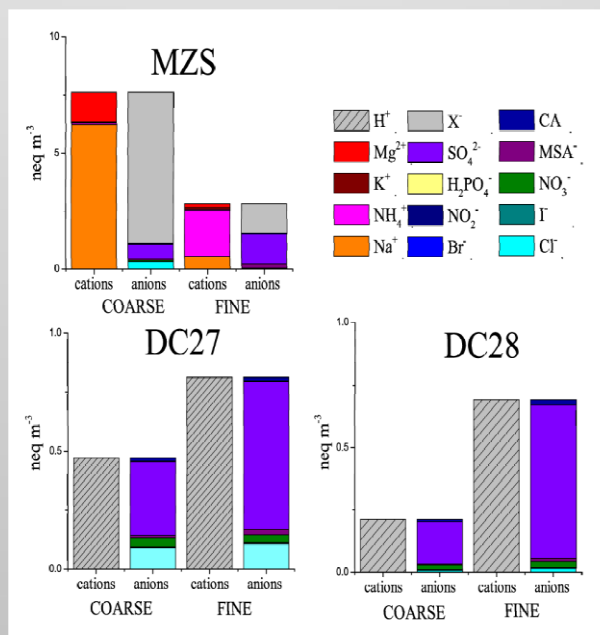
DC28



Campo Faraglione, 3 km south of MZS
Nov 2010-Jan 2011

Concordia Station, Dome C (DC)
Dec 2011 – Jan 2012 (DC27)
Dec 2012 – Jan 2013 (DC28)

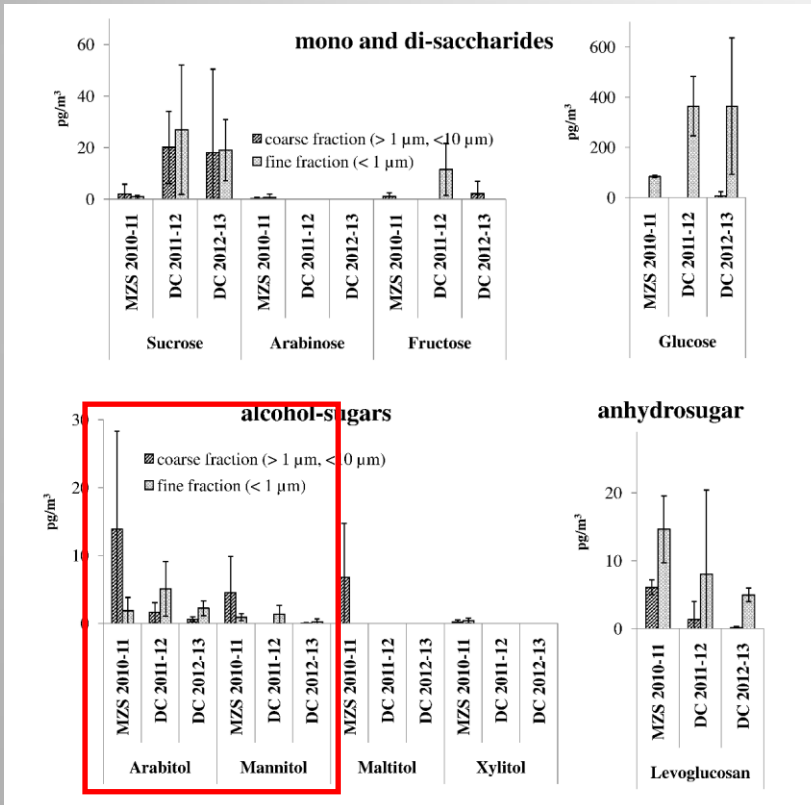
- Aerosol collected near the coast was characterized by sea salt input
- Ion species in aerosol samples collected over the plateau were mainly distributed in the fine fraction due to LRAT



Barbaro et al. *Environmental science and pollution research international* 24.3 (2017): 2724-2733.

Study of sources and transport using sugars as tracers

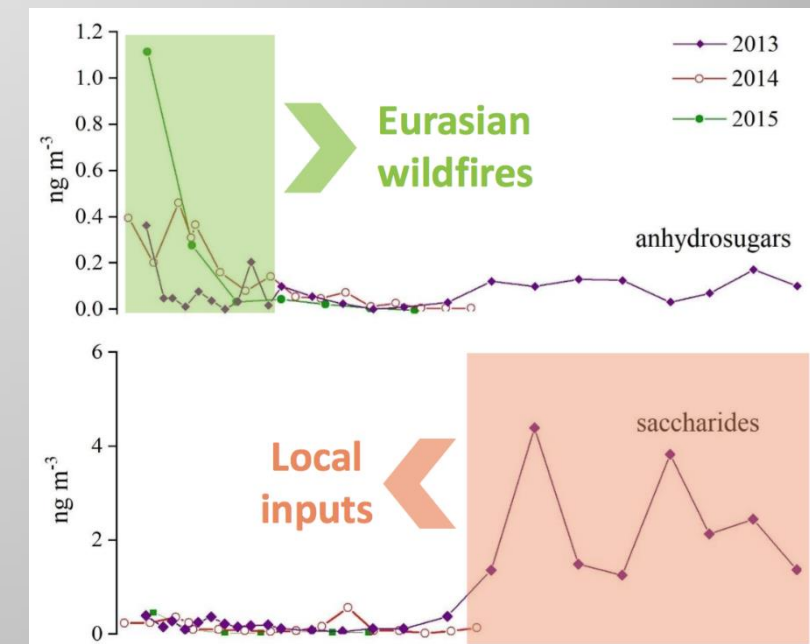
Antarctica



- ✓ The high concentration of alcohol-sugars in the coarse fraction of MZS aerosol confirms the association with PBAP, e.g. from fungal spores.
- ✓ Arabitol and mannitol, produced by fungal spores in ice-free areas, underwent LRAT and:
 - 1) the particles contained sugars can reduce their dimensions
 - 2) only the fine particles underwent the LRAT, increasing their concentration over the Antarctic plateau

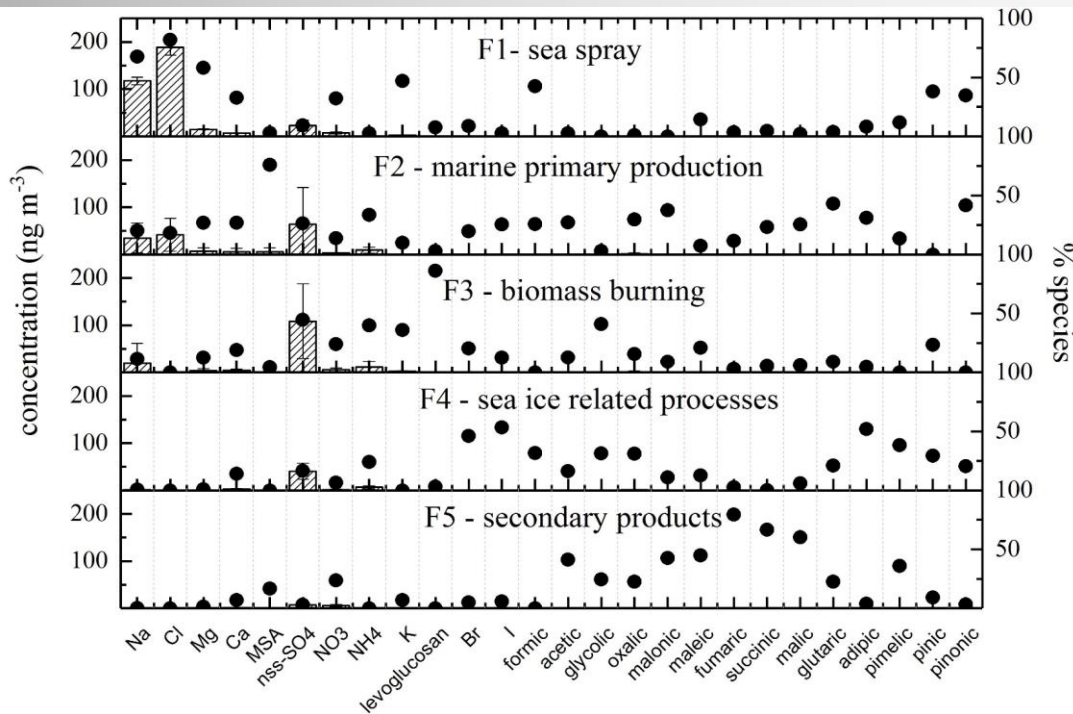
Svalbard

- The study identifies biomass burning and local terrestrial/sea input as sources.
- Depending on seasonality, local inputs can also play an important role in the chemical composition of sugars in Arctic aerosol.

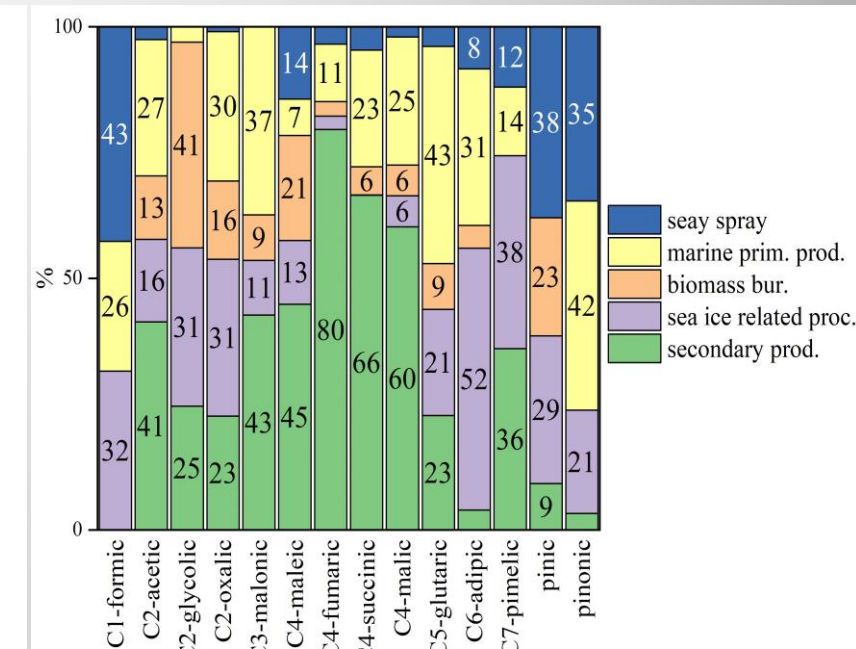
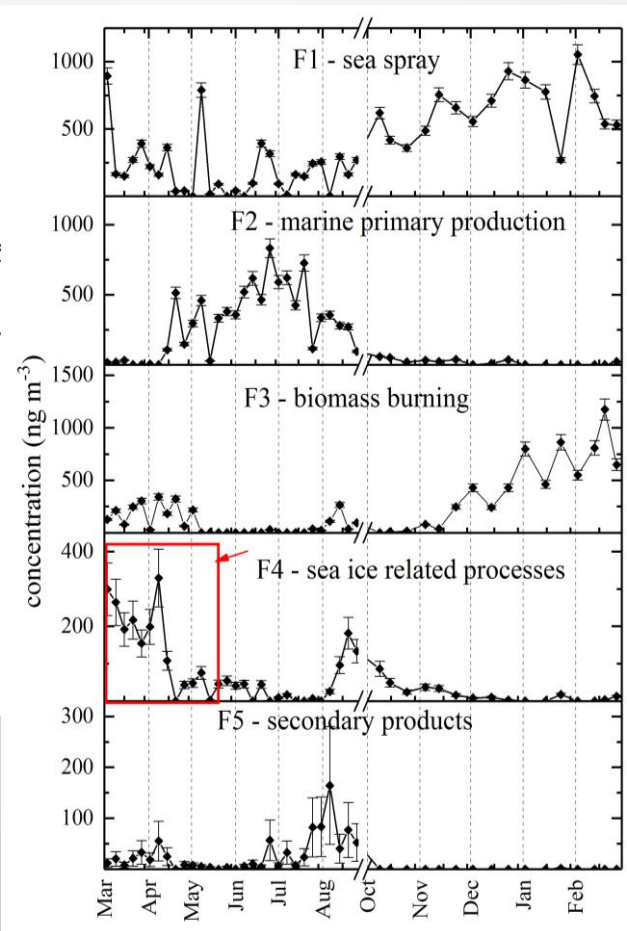


Barbaro, al. *Atmospheric Environment* 118 (2015): 135-144.

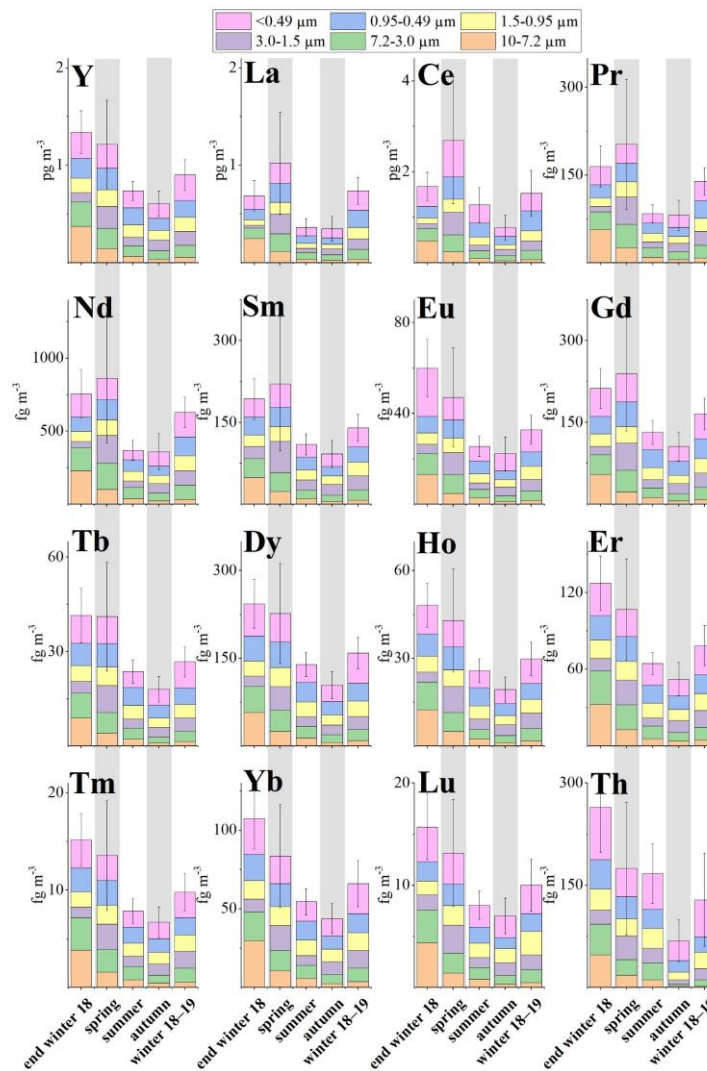
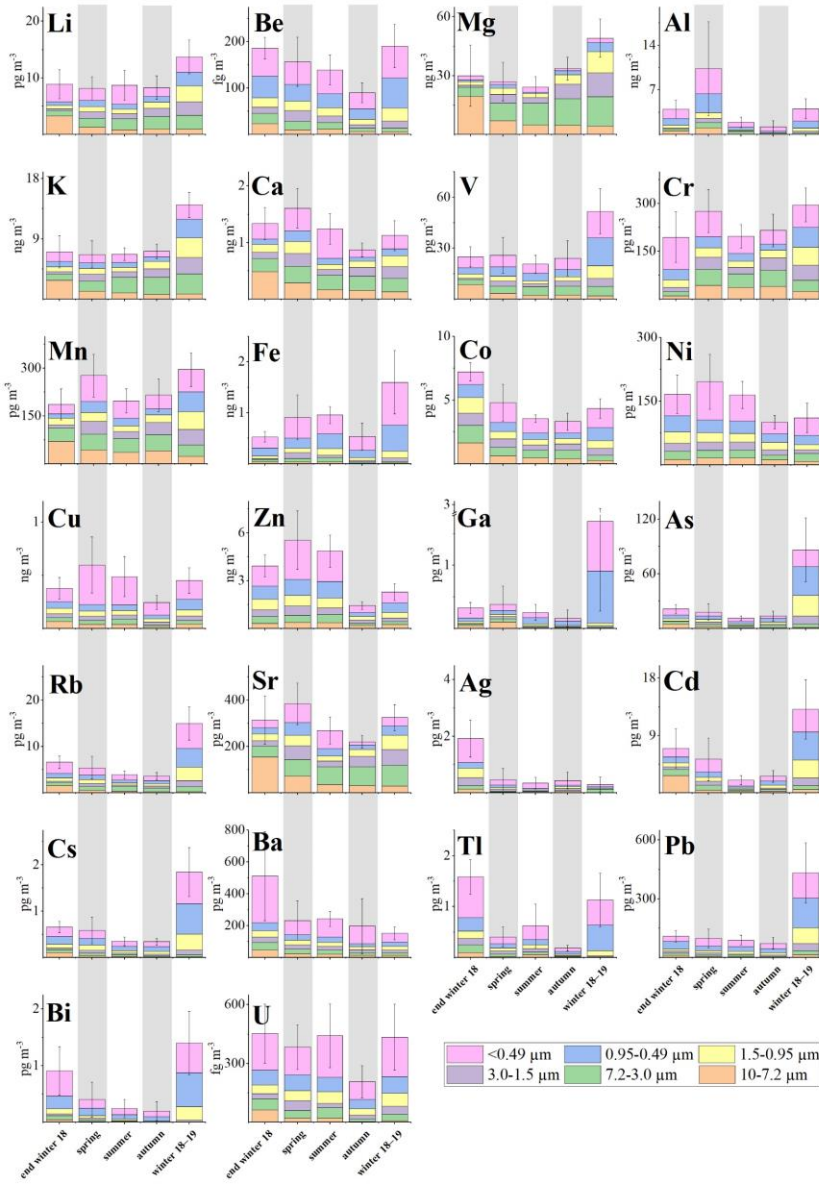
Year-round measurements of size-segregated low molecular weight organic acids in Arctic aerosol



Feltracco, et al. *Science of The Total Environment* 763 (2021): 142954.



A Year-Round Measurement of Water-Soluble Trace and Rare Earth Elements in Arctic Aerosol



- The wsTE and wsREE content, especially in the finest fractions in remote areas, is primarily related to long-range transport and it gives valuable information on (1) the global circulation, (2) the natural sources and (3) the contribution of human activities to aerosol composition.
- A Factor Analysis was applied to the dataset, including levoglucosan and MSA, to assess the possibility of using certain inorganic tracers as indicators of specific transport events or circulation regimes.



Future prospective

Programma di Ricerche in Artico

Boundary layer Evolution Through Harmonization of Aerosol measurements at Ny-Ålesund research stations BETHA-NyÅ

BETHA-Ny Å aims to investigate how the Arctic Boundary Layer can influence aerosol properties, affecting Arctic Amplification. Following the SESS recommendations, BETHA-NyÅ will harmonize aerosol measurements at two stations located at different altitudes.

Available long-term datasets will also be considered in the analysis. Different source apportionment approaches will apply to the datasets to individuate anthropogenic and natural aerosols transported from the middle latitude over the Arctic.



THANKS FOR YOUR ATTENTION

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