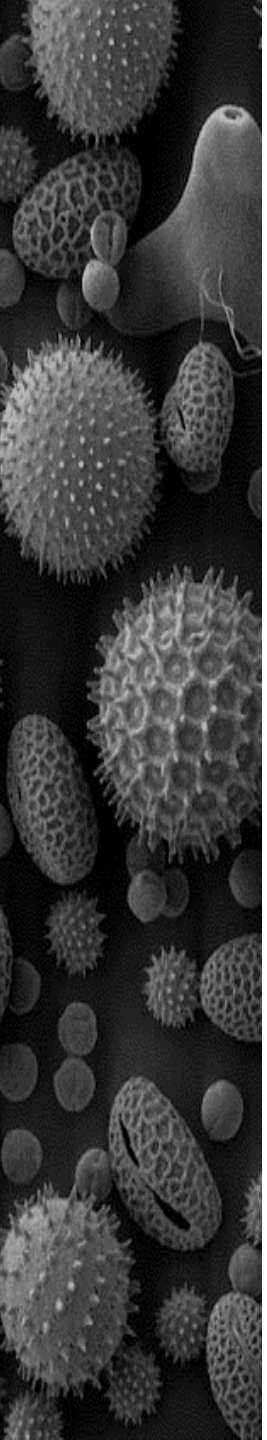


Bacterial and Fungal Composition and their Chemical Interaction in Free Tropospheric Air and Snow over an entire Winter Season at Mount Sonnblick, Austria

N. Els[1], M. Greilinger[2,3], M. Reisecker[4], R. Tignat-Perrier[5], A. Kasper-Giebl[2], B. Sattler[1], M.Olefs[3], C. Larose[5]

[1] Institute of Ecology, University of Innsbruck, Austria

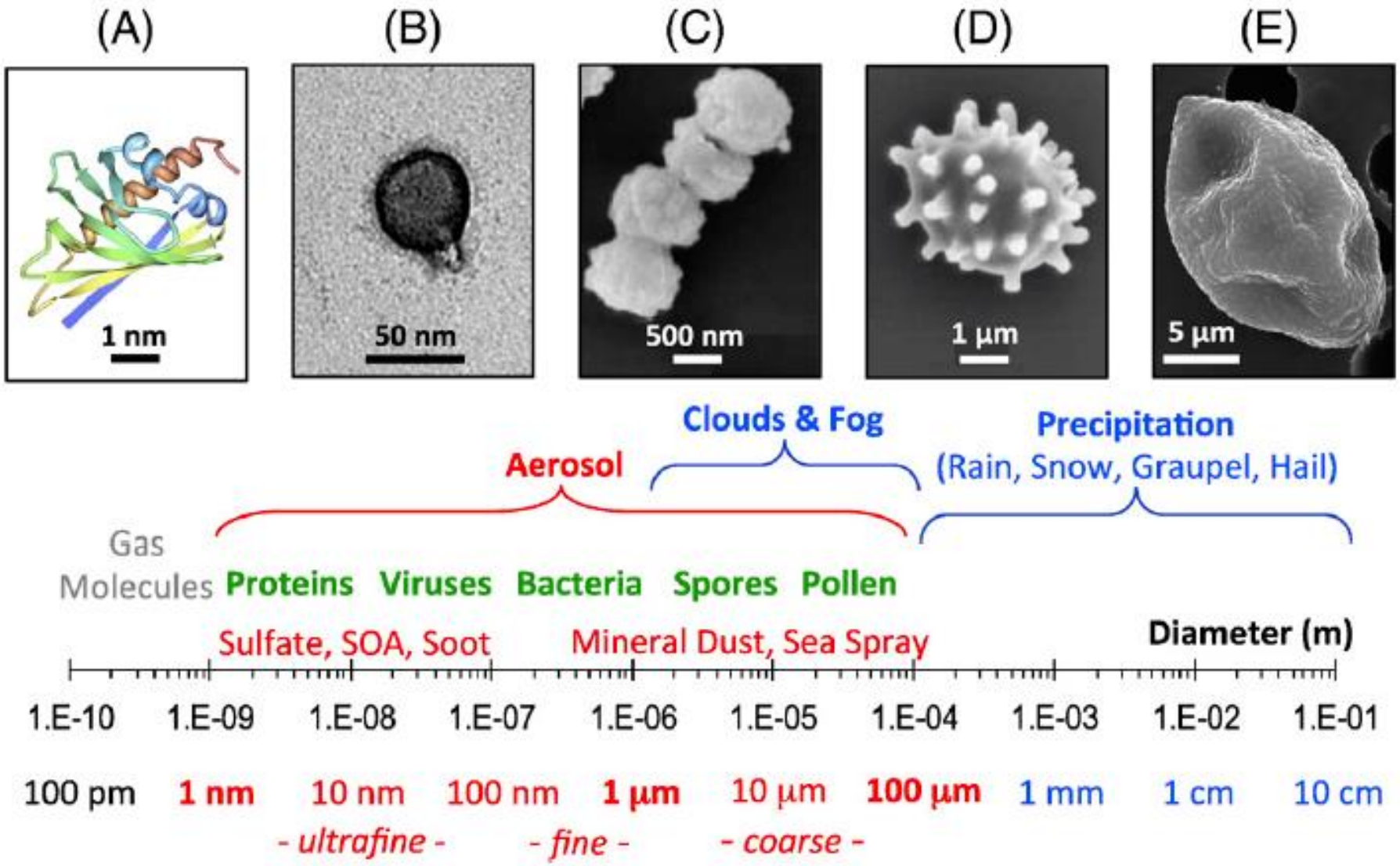
[2]Insitute of Chemical Technologies and Analytics, Vienna University of Technology, Austria

[3] Zentralanstalt für Meteorologie und Geodynamik, ZAMG, Vienna, Austria

[4] Avalanche Warning Service Tyrol, Department of Civil Protection, Federal Government of Tyrol, Austria

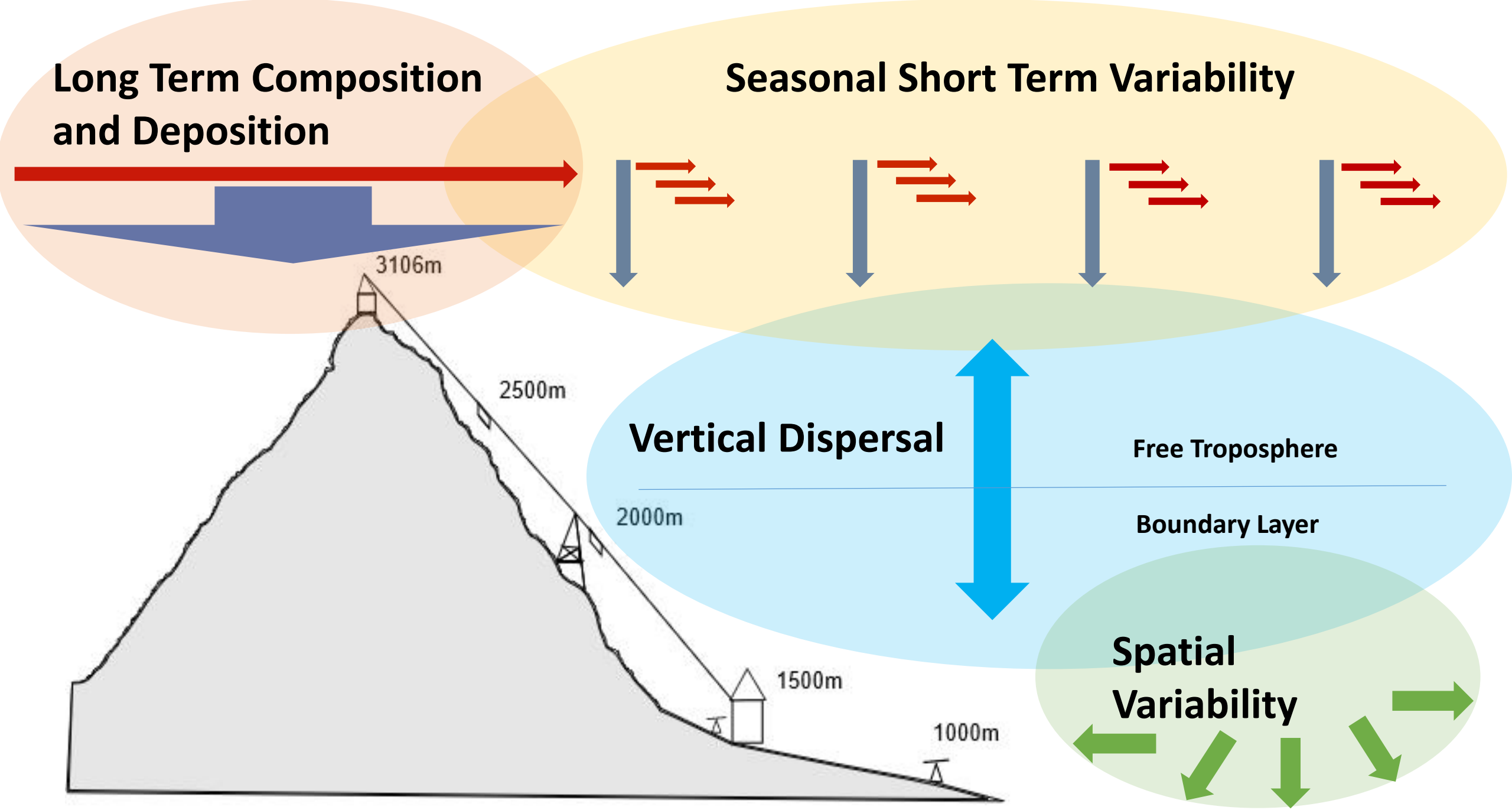
[5] Environmental Microbial Genomics Group, Laboratoire Ampère, École Centale de Lyon, France

Primary Biological Aerosols



(A) Protein
(B) Virus
(C) Bacteria
(D) Fungal Spore
(E) Pollen

Fröhlich-Nowoiski et al., 2016


Long Term Composition and Deposition
Seasonal Short Term Variability
3106m
2500m
Vertical Dispersal
Free Troposphere
2000m
Boundary Layer
1500m
1000m
Spatial Variability

Motivation

We know that

Air mass origin and **microbial composition** are strongly coupled

Air mass origin and **chemical tracers** are strongly coupled

Strong **seasonal variability** of air microbial composition

Motivation

We don´t know

We know that

Air mass origin and **microbial composition** are strongly coupled

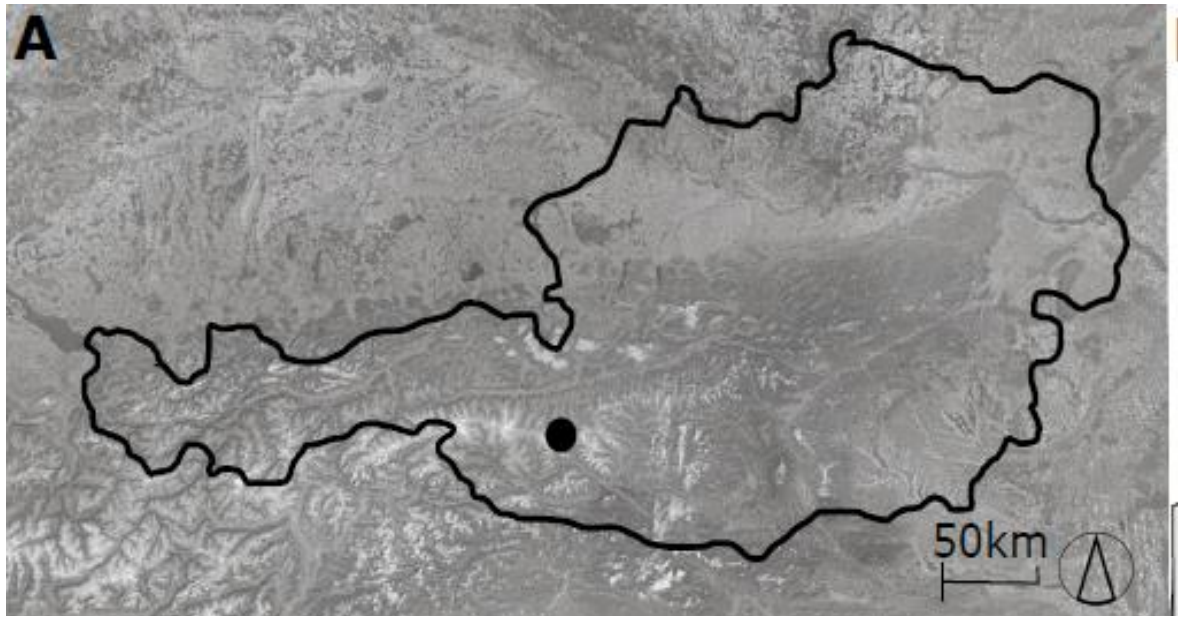
Air mass origin and **chemical tracers** are strongly coupled

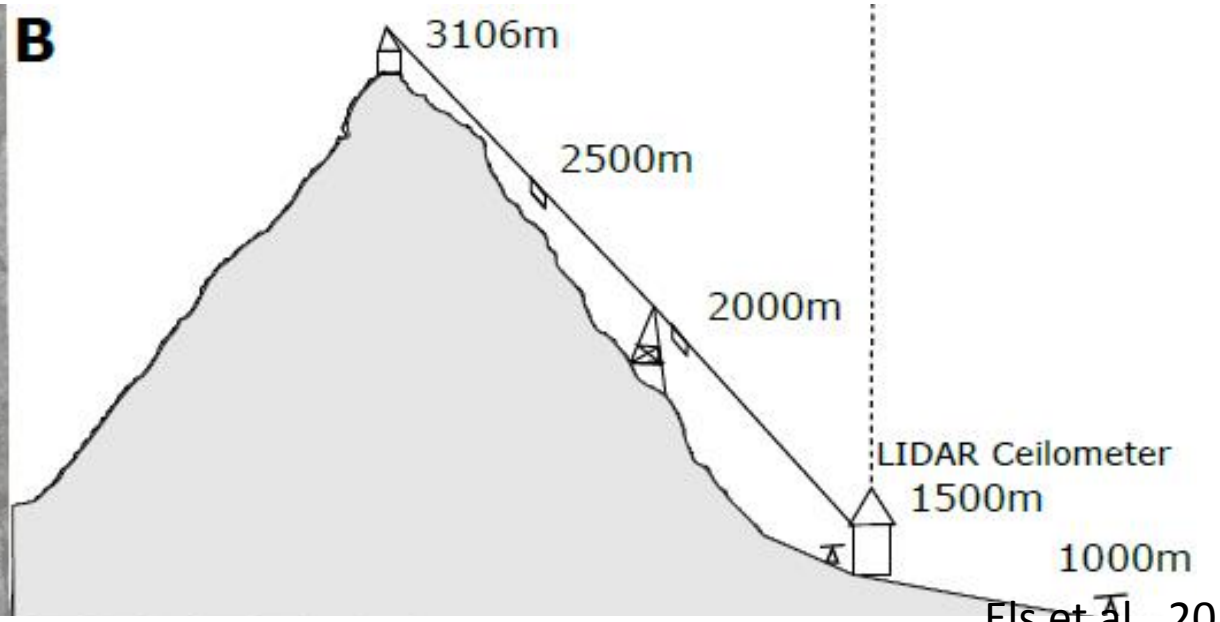
Strong **seasonal variability** of air microbial composition

Is the microbial composition in **air** and **snow** related to **chemical tracers** ?

Are the **same** chemical tracers driving **air** and **snow** microbial composition ?

Sonnblick Observatory, 3106m asl (Global Atmosphere Watch)





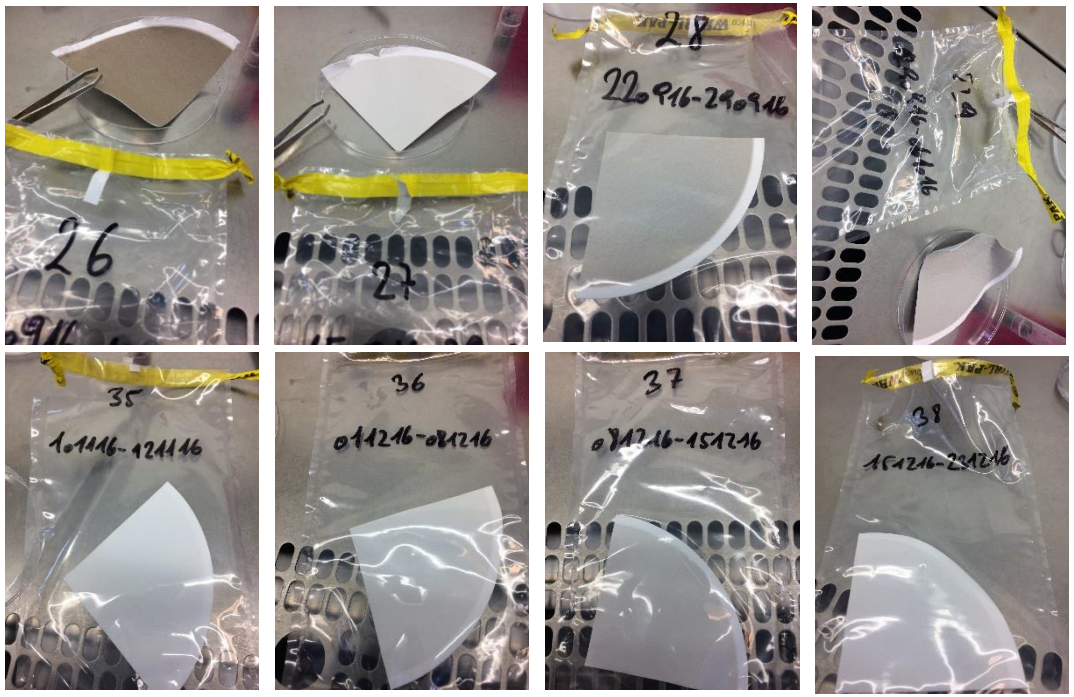
Els et al., 2019

Methodical Approach

PM10 Quartz Filters
High Volume Sampler

weekly filters

ca.323m³ air/filter



Air Sampling

Snow Sampling

DNA Extraction

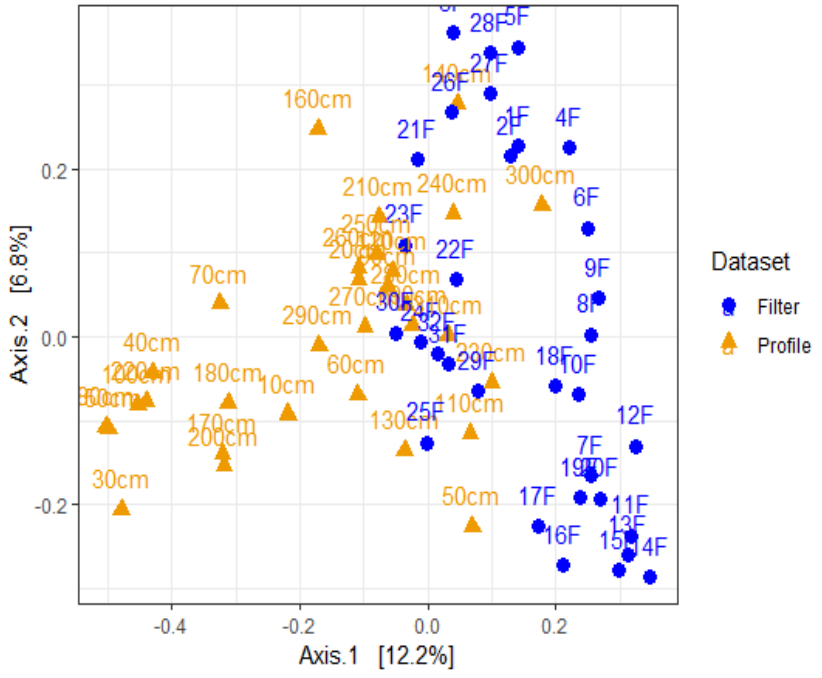
Sequencing

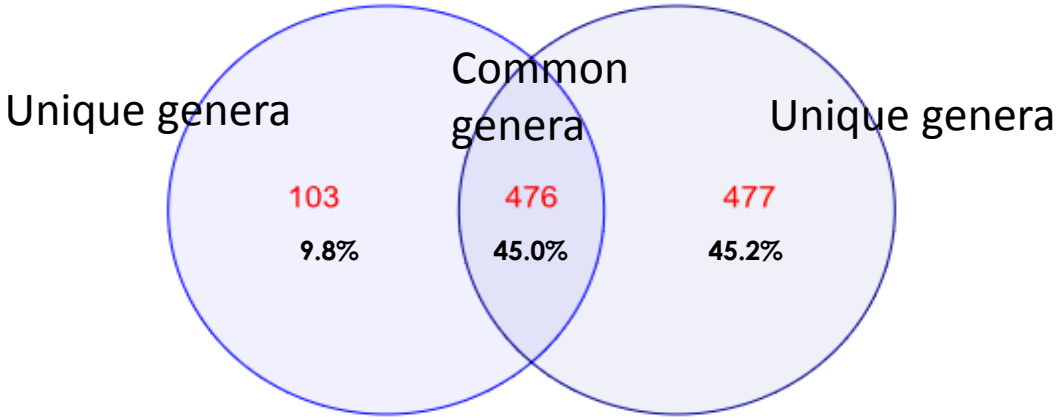
Database comparison

Late season snow pack
10 cm steps

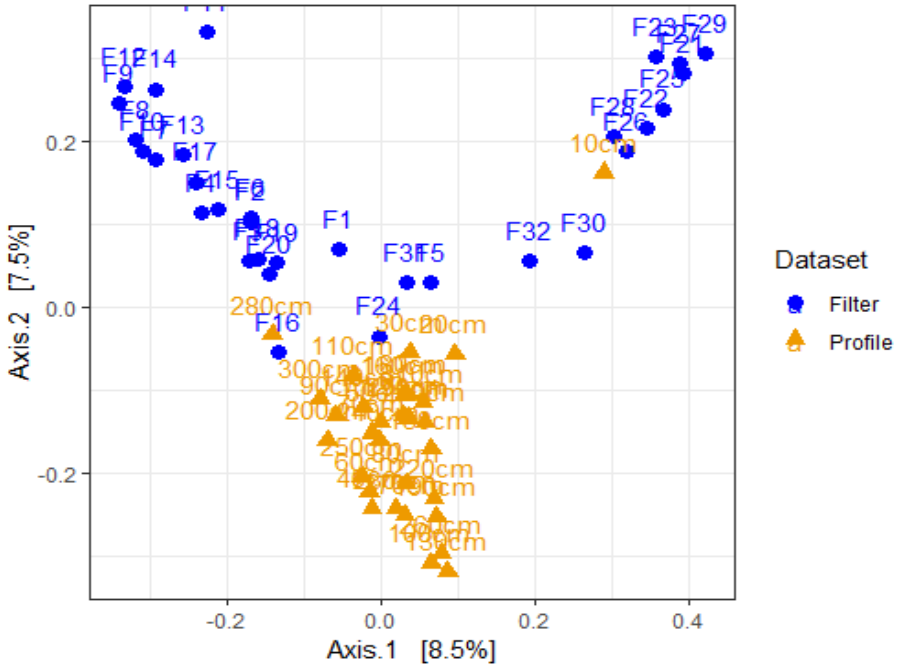
Microbial Data

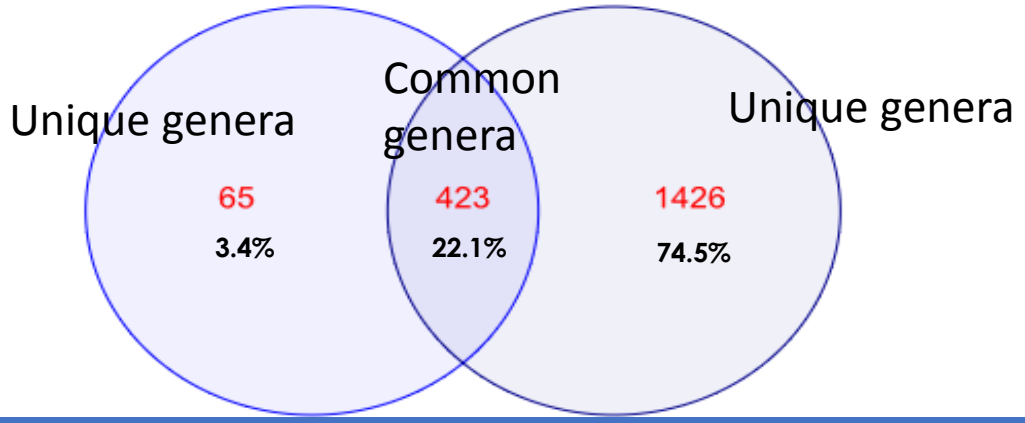
Bacteria



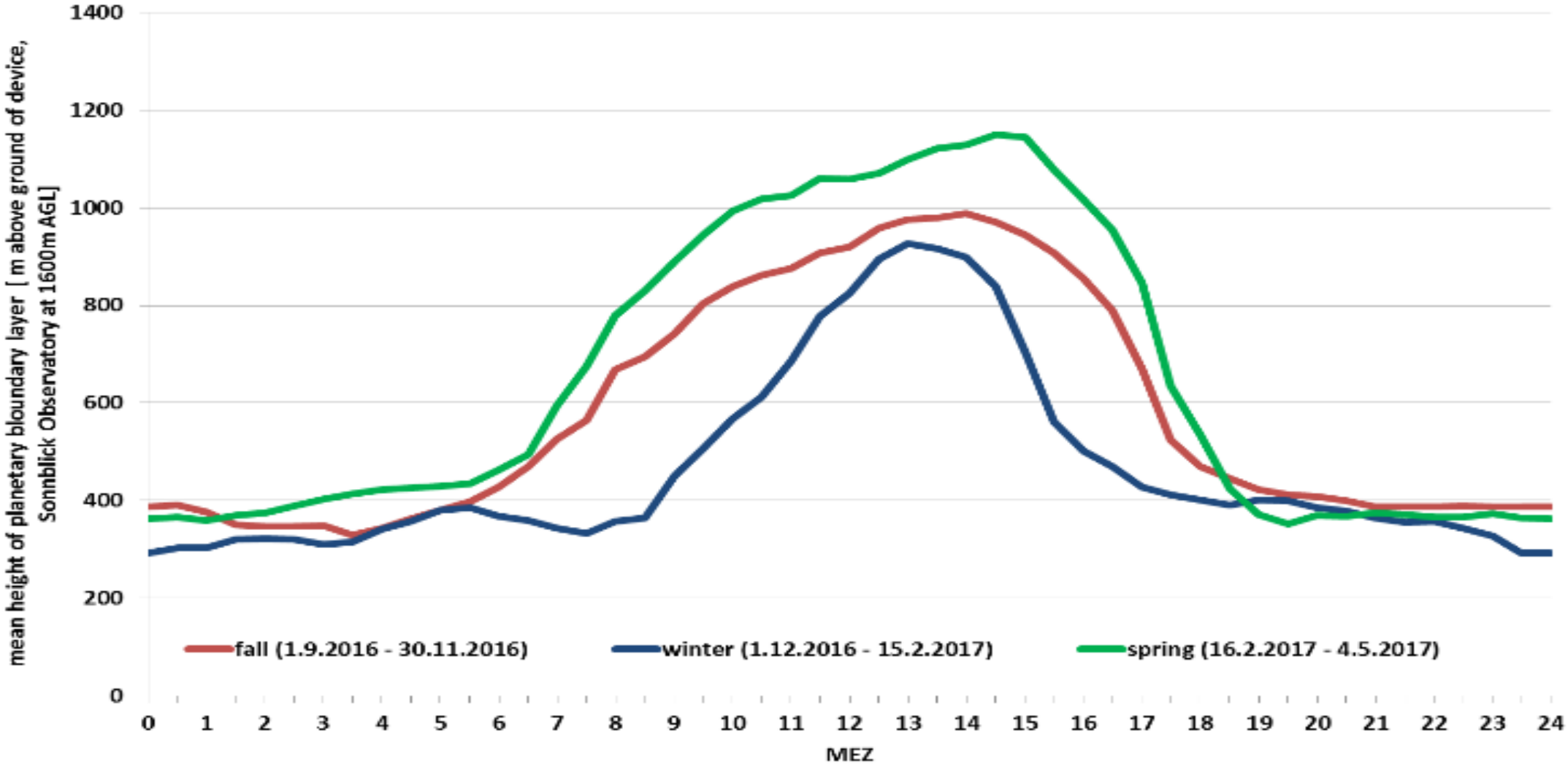


Fungi

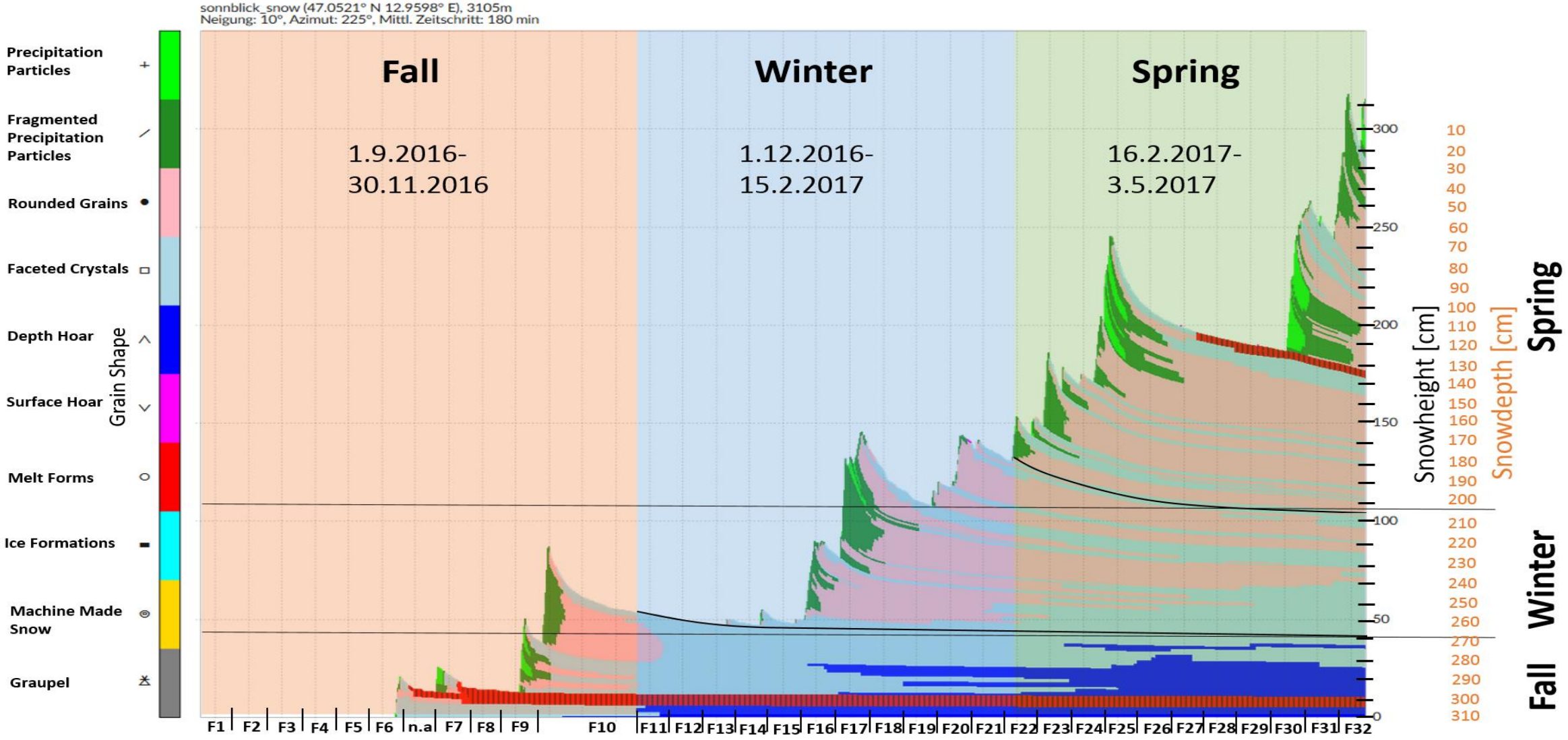




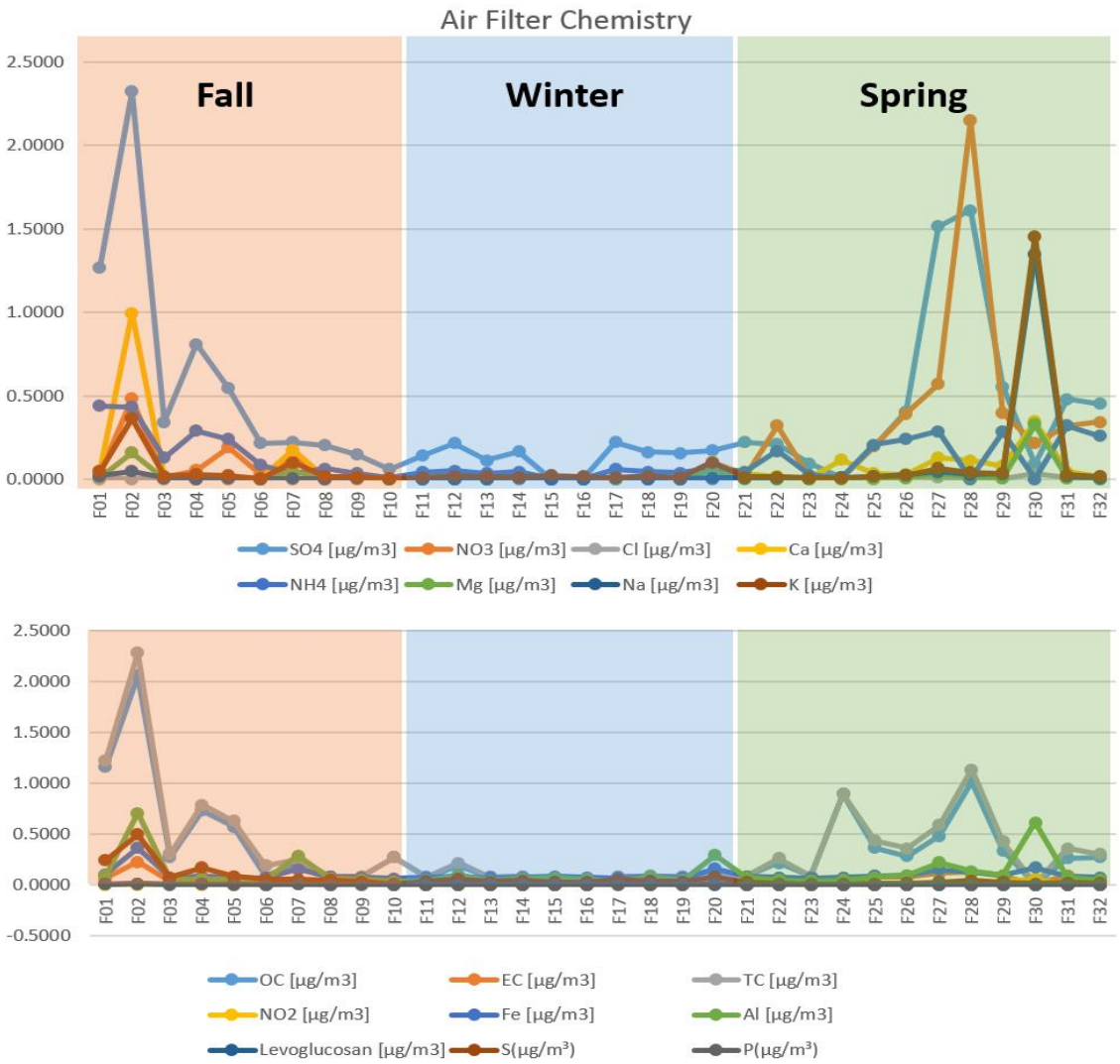
Boundary Layer Dynamics

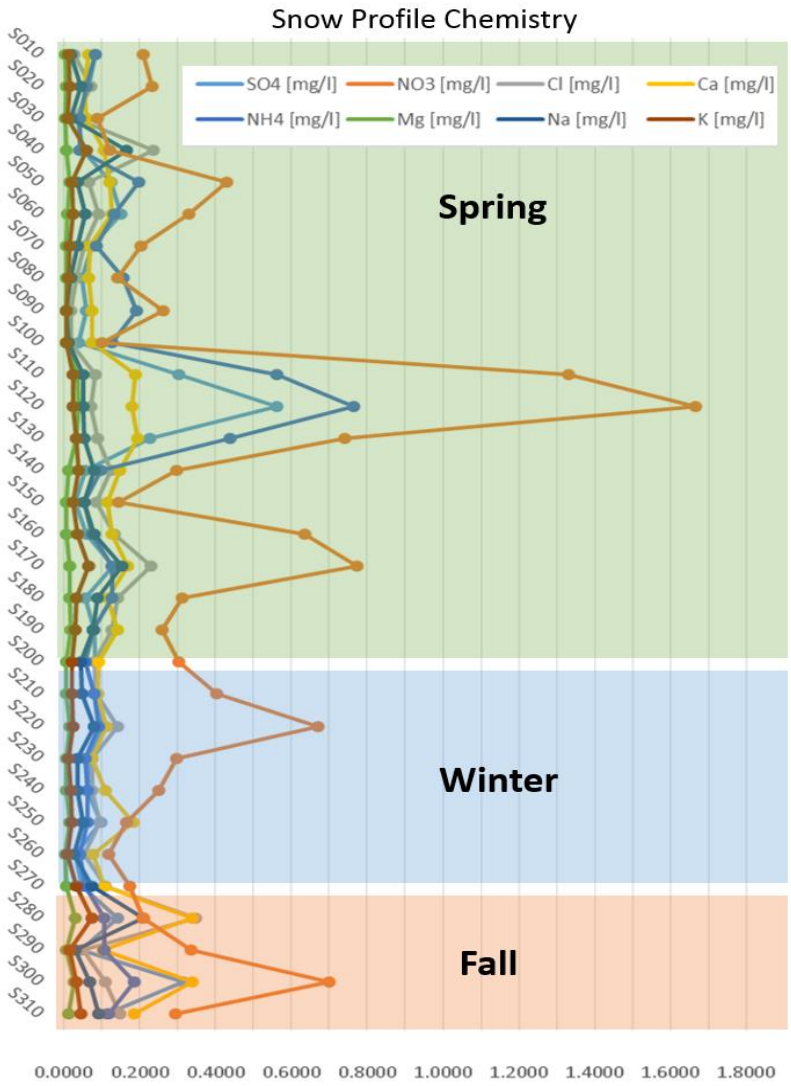


SNOWPACK Modelling

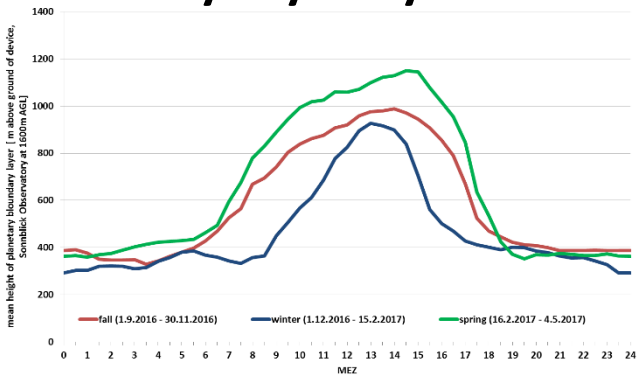


Chemical Data

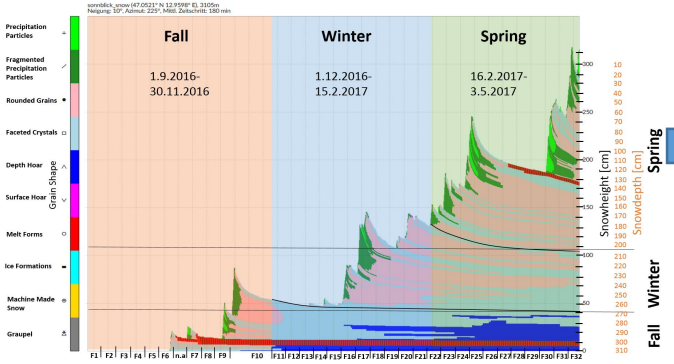




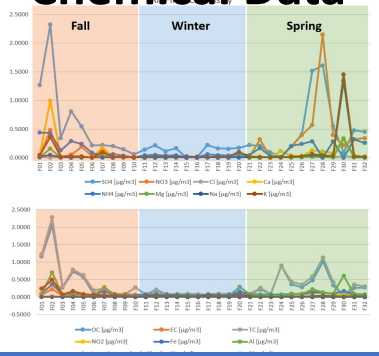
Boundary Layer Dynamics

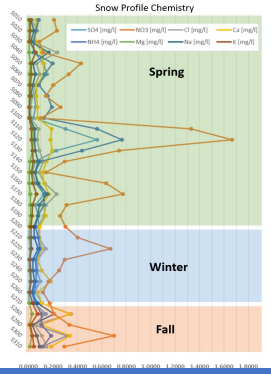


SNOWPACK Modelling



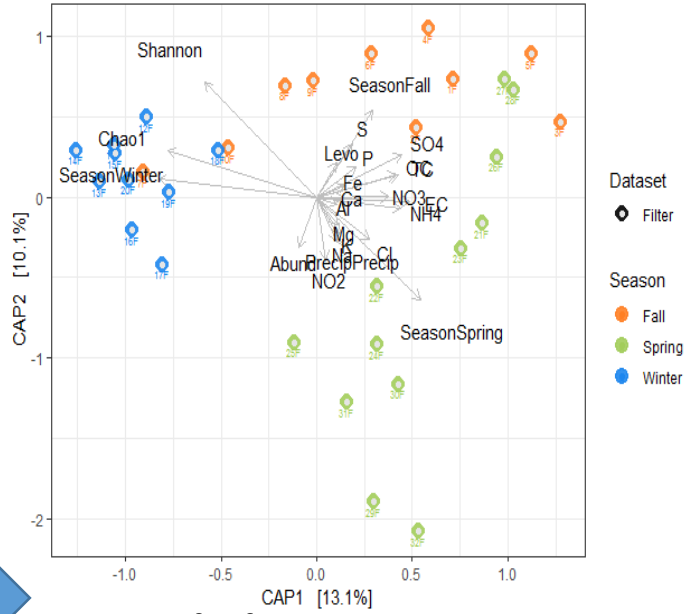
Chemical Data



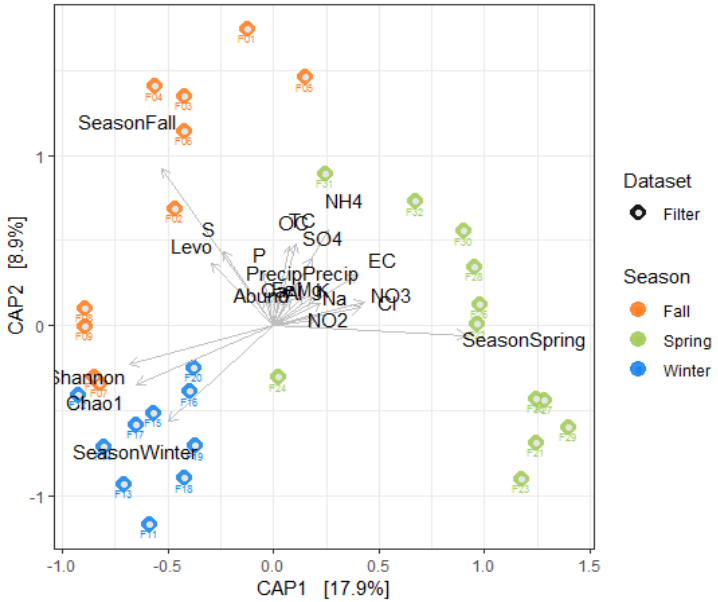


Data Integration

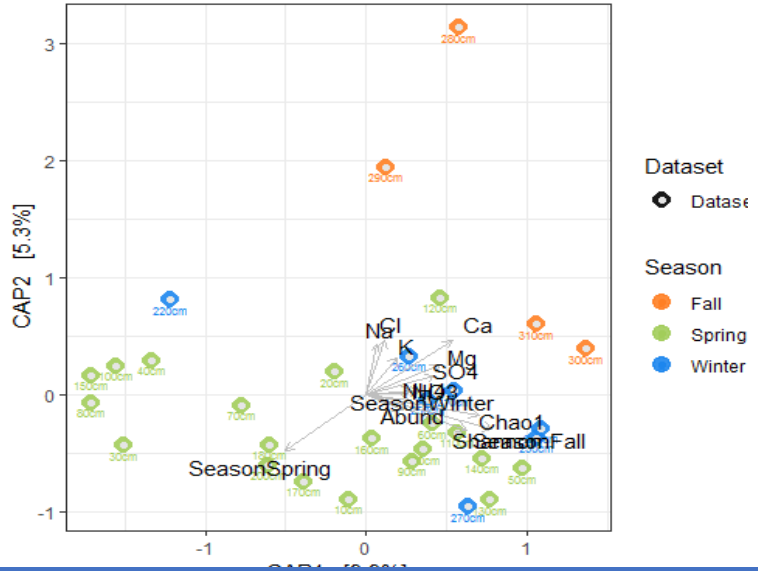
Bacteria in Air



Fungi in Air



Bacteria in Snow



Fungi in Snow

First Results

Chemical tracers are more related to **air** than to **snow microbial** composition

Season is more important than chemistry

Snow does **not** serve as a **proxy** for **air** microbial and chemical composition

First Results

Chemical tracers are more related to **air** than to **snow microbial** composition

Season is more important than chemistry

Snow does **not** serve as a **proxy** for **air** microbial and chemical composition

! **Not** directly **applicable** to alpine boundary layer conditions

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Beyond the planetary boundary layer: Bacterial and fungal vertical biogeography at Mount Sonnblick, Austria

Nora Els, Kathrin Baumann-Stanzer, Catherine Larose, Timothy M. Vogel, Birgit Sattler

Bioaerosol ground emissions

Scavenging effects at the boundary layer

One site study