Free troposphere wintertime gas-phase composition using CI-APiTOF

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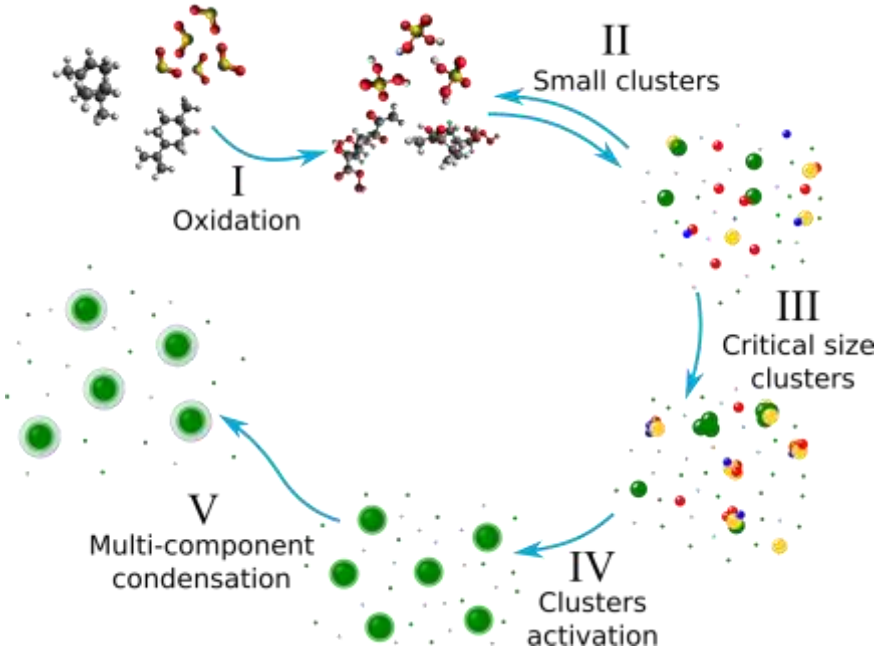
New Particle Formation

- Aerosol has an impact on **Health** and **Climate**,
- Aerosol can **Scatter/Absorb** light and plays as **Cloud Condensation Nuclei**
- 50% of the CCN is produced via **Gas to Particle Conversion**,
- New particle formation occurs in the **Planetary Boundary Layer** and in the **Free Troposphere**,
- New particle formation **measurements** in free troposphere are **scarce**.

New Particle Formation

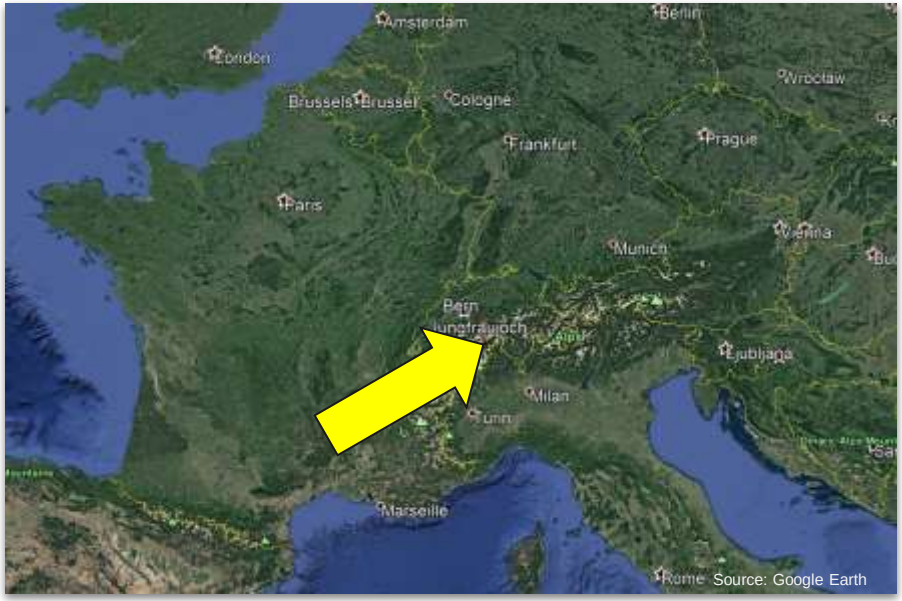
I. Oxidation of gas species,
II. Formation and evaporation of small cluster,
III. Passing of the energy barrier,
IV. Cluster activation,
V. Further growth



Kulmala et al. (2017)

Jungfraujoch High Altitude Research Station 3580 m

- **JFJ** (3466 m) is a **saddle** that connects the **Jungfrau** (4158 m) and the **Mönch** (4107 m)
- **Aletsch Glacier** is the largest alpine glacier



Jungfraujoch High Altitude Research Station 3580 m

- **1841** ascent by Louis Agassiz (modern glacial theory)
- **1896 - 1912** Adolf Guyer-Zeller - construction of the railway
- **1922** first scientific measurement
- **1931** research station
- **1950** telescope cupola
- Up to now 50 scientific projects took place
- Global Atmosphere Watch (GAW)
- Swiss National Monitoring Network for Air Pollution (NABEL)

NUCLACE campaigns

- Long-term campaign
  - APiTOF, nano-SMPS
- 2 Intensive campaigns
  - Winter time (January - March)
  - Gas-phase molecules
  - Naturally charged molecules and clusters
  - Particle number and size distribution

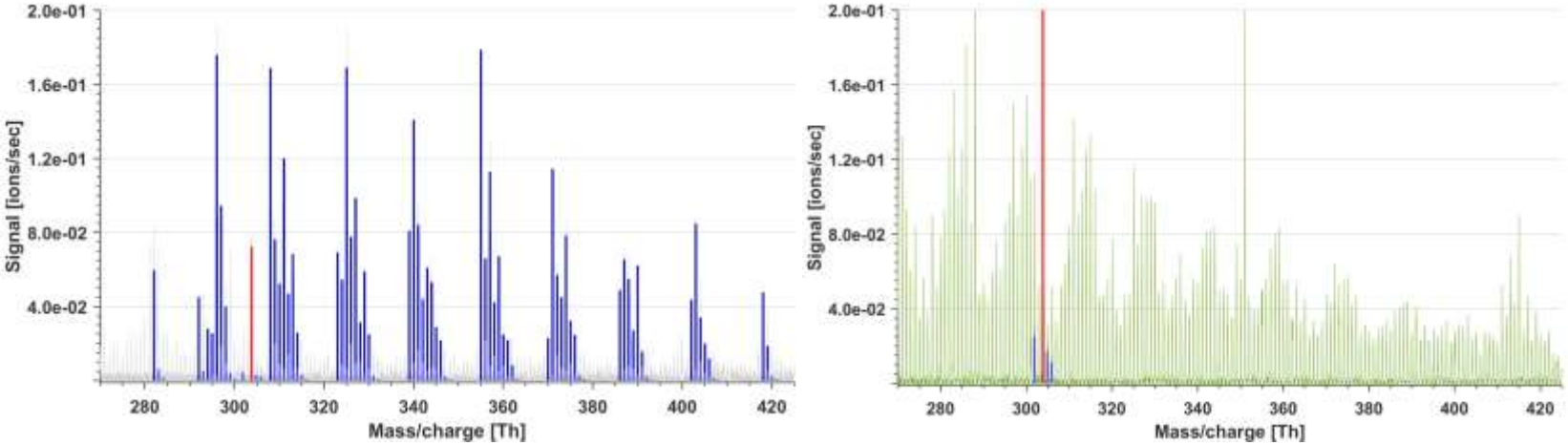
Bianchi et al. (2016)
Tröstl et al. (2016)
Frege et al. (2017)

Average Temperature - 16 ℃

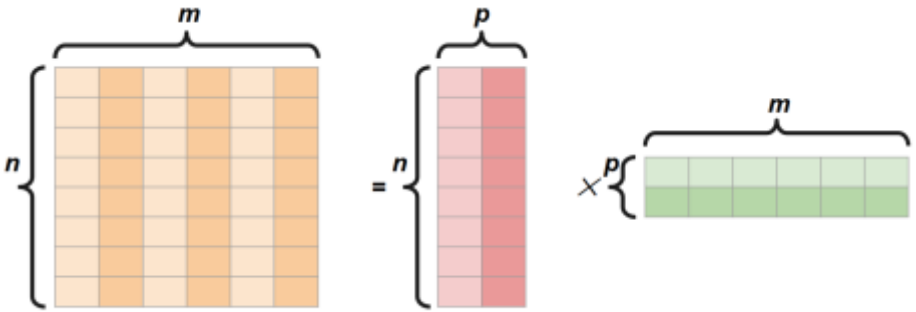
Sunrise 7:30

Sunset 18:30

Nitrate CI-APiTOF



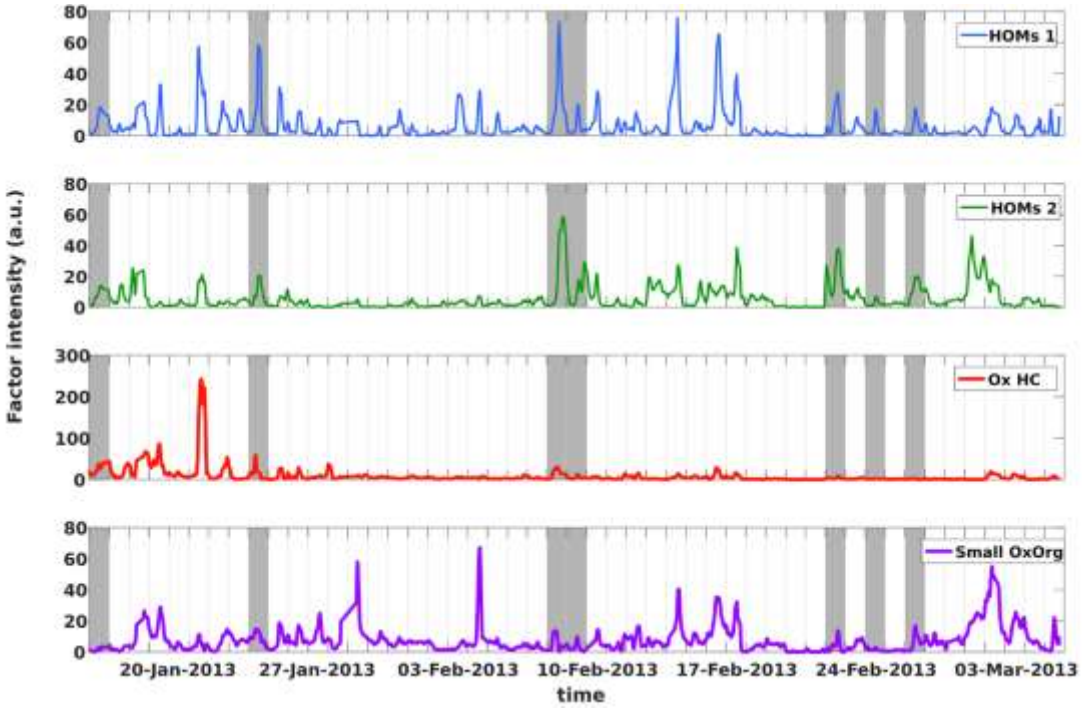
Methods - Positive Matrix Factorization



Paatero et al. (1994)
Ulbrich et al. (2009)
Canonaco et al. (2013)

- CI-APiTOF 2 months - 30 min res.
- Unit Mass Resolution
- 200 - 499 *m/z* Mass Range
- Unconstrained Factors
- Factors *p* were tested in a range from 3 to 10
- A 4 Factors solution was accepted

Results - Factor Time Series



Conclusion

- PMF is a useful tool to disentangle mass spectra taken in a complex ambient matrix.
- PMF profiles can be link to photochemical regimes and NPF/non-NPF days.
- Unit mass resolution does not allow a full understand chemistry (high resolution data can lead to peak overfitting).
- Our approach can be a valid method to develop a parametrization and a useful screening tool for big data sets.

Thanks to

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  - Paul Scherrer Institut
  - University of Helsinki
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- Empa
- FHNW

and thank you for your attention!

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