CHASING PRE-INDUSTRIAL AEROSOL AROUND THE GLOBE

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The Atmospheric Interactions group - INTERACT

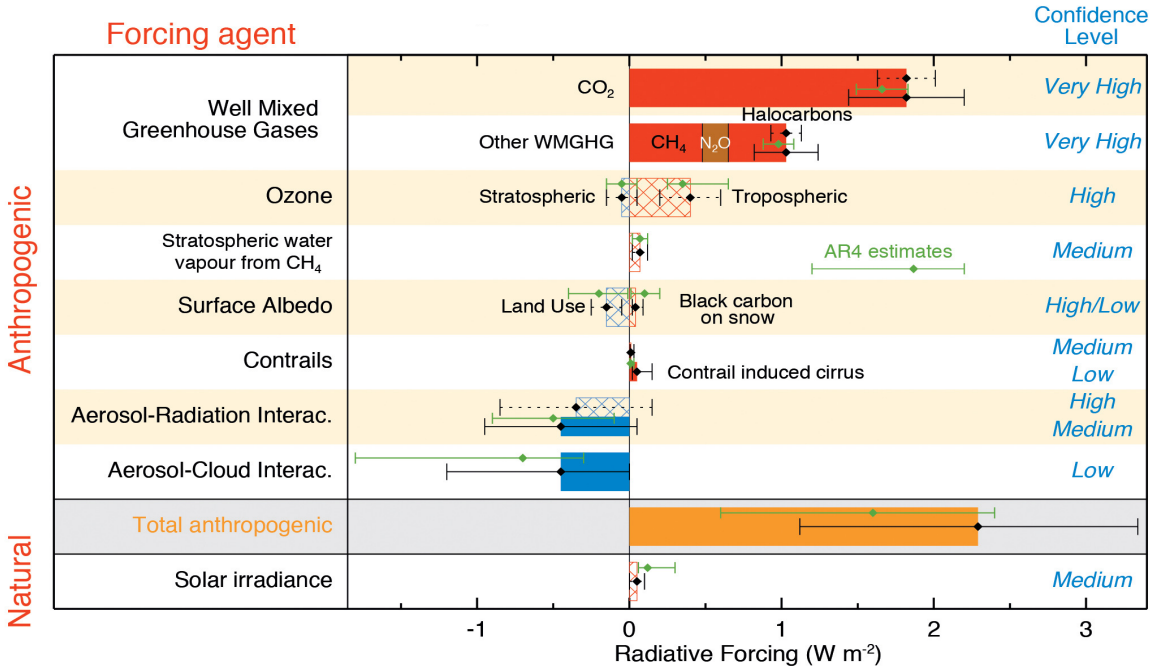
CHAPAs: Chasing Pre-industrial Aerosols – Federico Bianchi 2020-2024

NAPUE: Impact of Nanoplastics Pollution on aquatic and atmospheric Environments – Monica Passananti 2022-2026

Why is chasing pre-industrial aerosol important?

The pre-industrial atmosphere sets the baseline for the quantification of anthropogenic climate change – how do we measure the past?

→2019 StG-ERC “CHAPAs – Chasing pre-industrial Aerosol” – Atmospheric measurements with advanced Mass spectrometers in remote/pristine environment (Alps, Himalaya, Andes, Arctic and more)

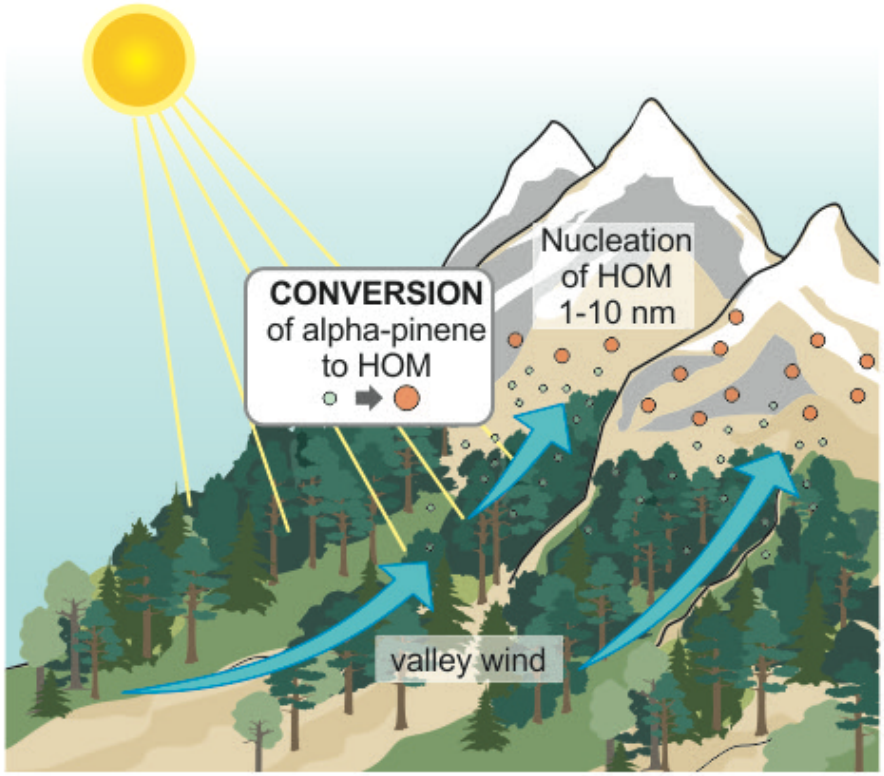


New particle formation in the free troposphere: A question of chemistry and timing

- Highly Oxygenated Organic Molecules directly participate in the NPF process
- HOMs have most probably anthropogenic origin
- Time window of 2-3 days after major PBL contact

Bianchi et al., Science, 2016

The Himalayan aerosol factory

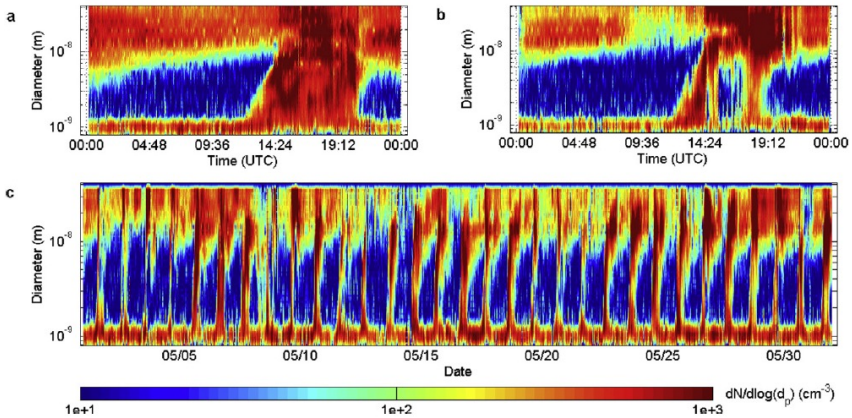


Bianchi et al., Nature Geoscience, 2021

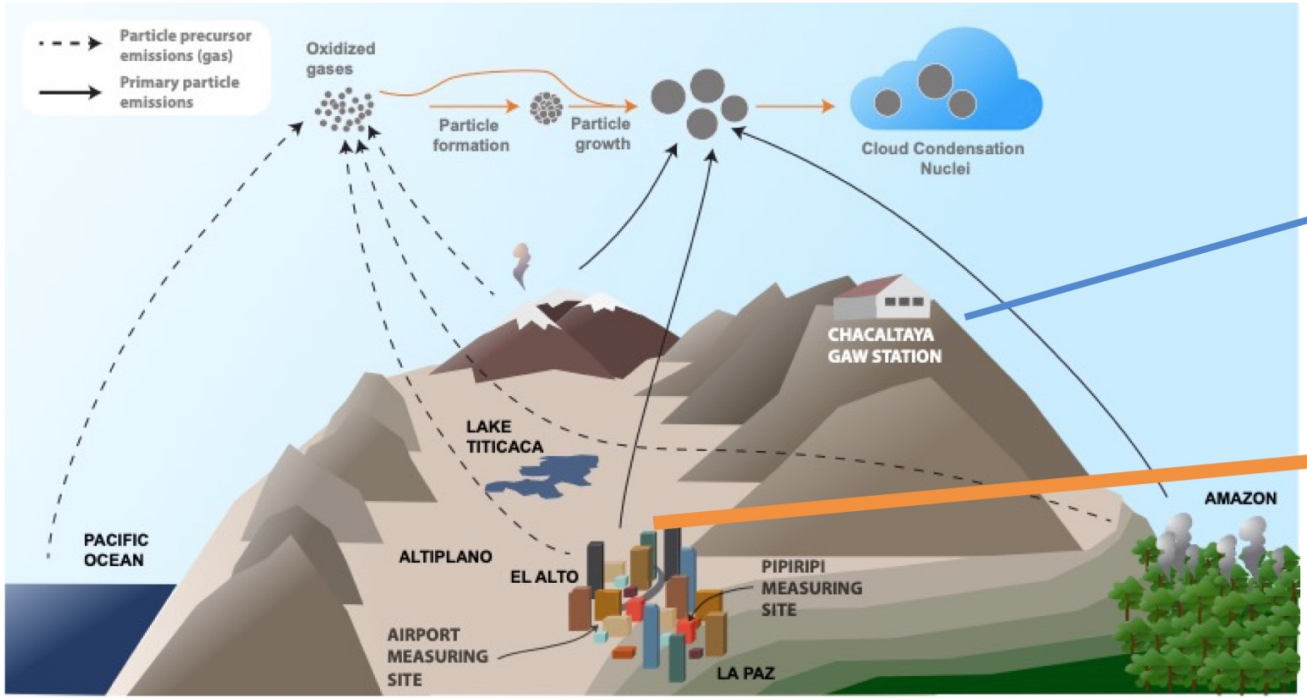
Pre-industrial like? Probably…

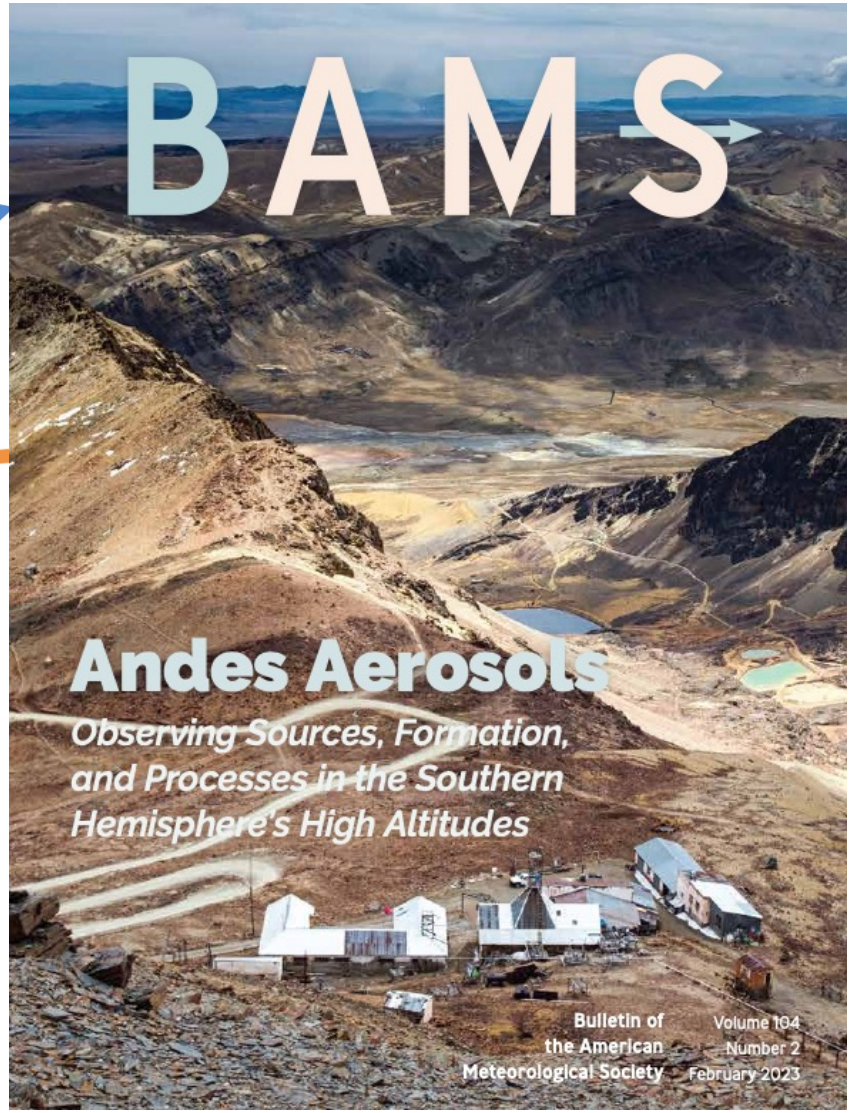
SALTENA Campaign - Southern hemisphere high altitude experiment on particle nucleation and growth

- December 2017 – May 2018, intensive period: April 2018 – May 2018
- Chacaltaya GAW Station (CHC) - Bolivian Andes, 5240 masl



Bianchi et al., 2022, BAMS

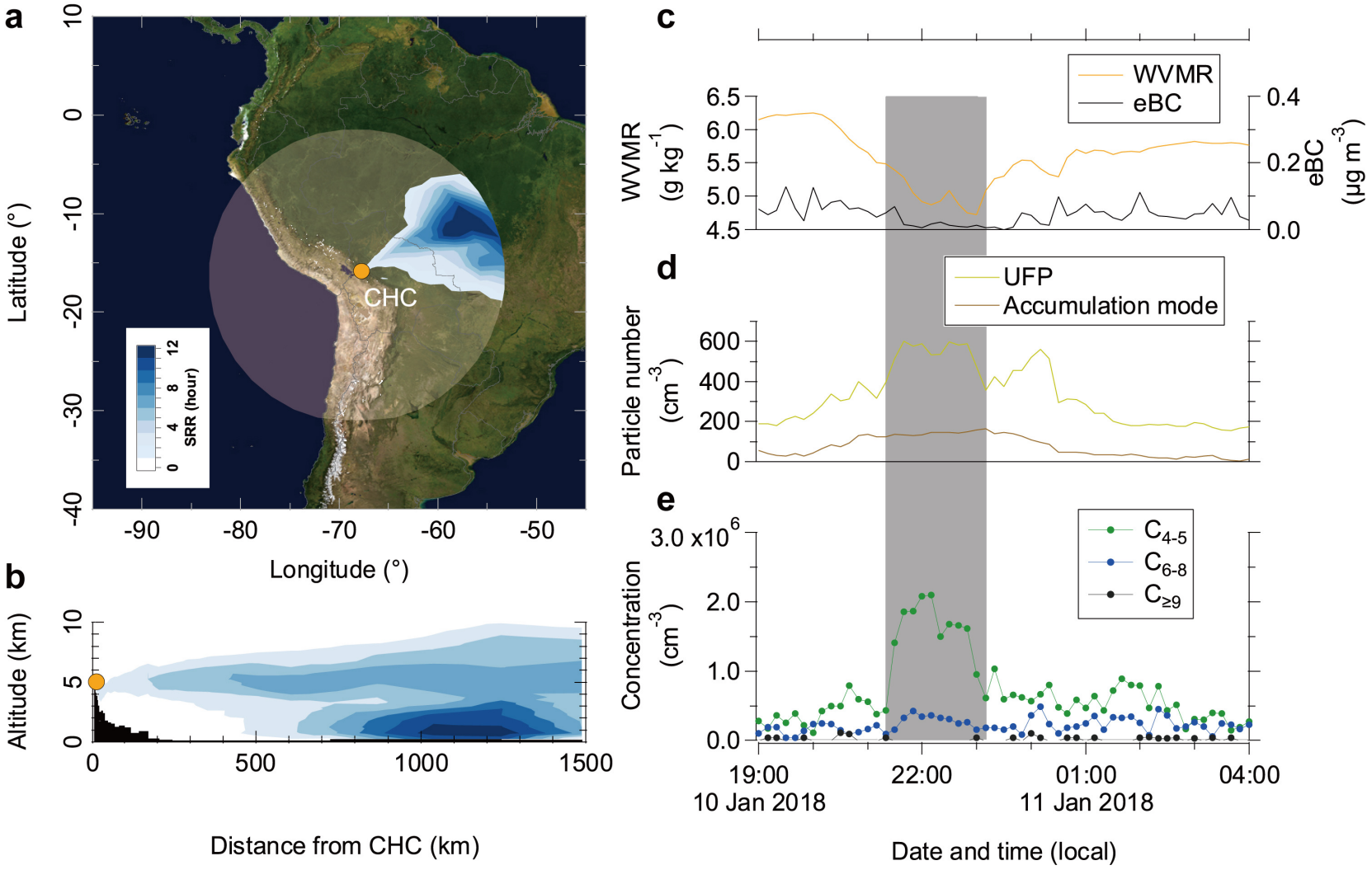




Chacaltaya at 5240 m a.s.l.

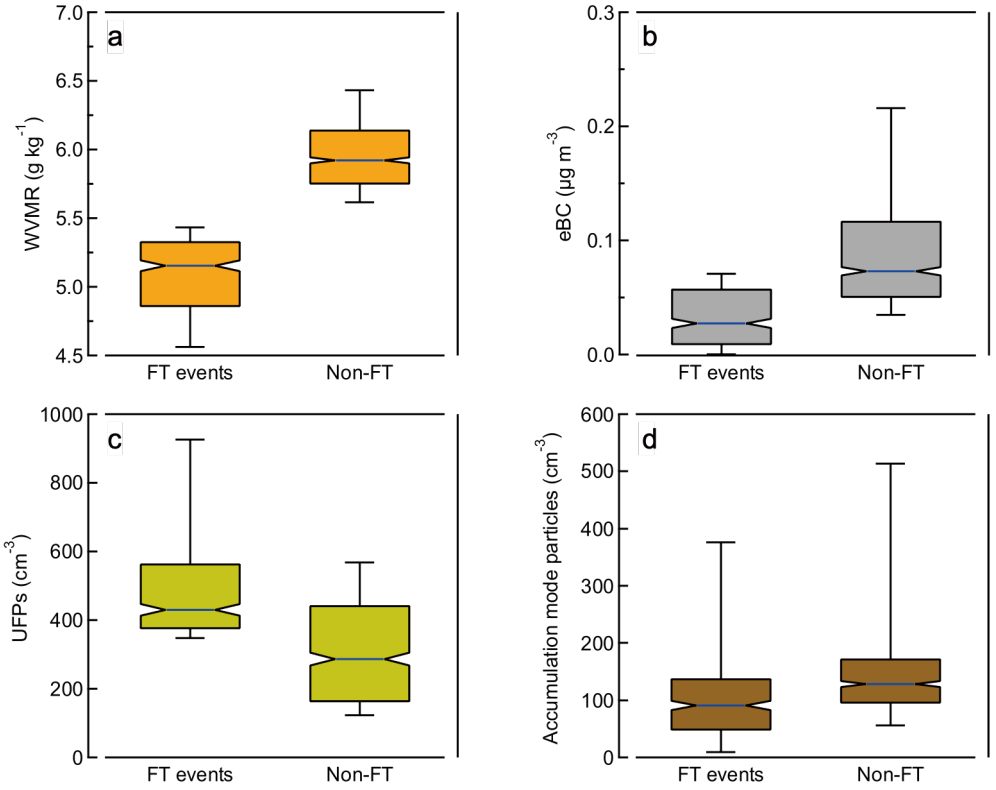
Bianchi et al., BAMS, 2022
Aliaga et al., ACP, 2021
Scholz et al., ACP, 2023

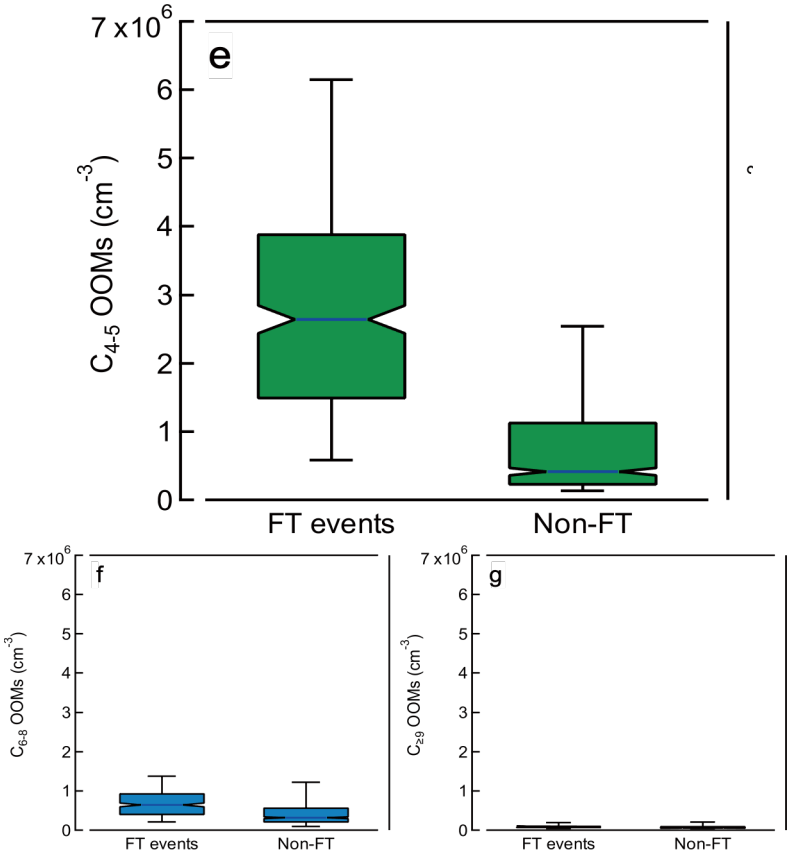
Free tropospheric air from Amazonia



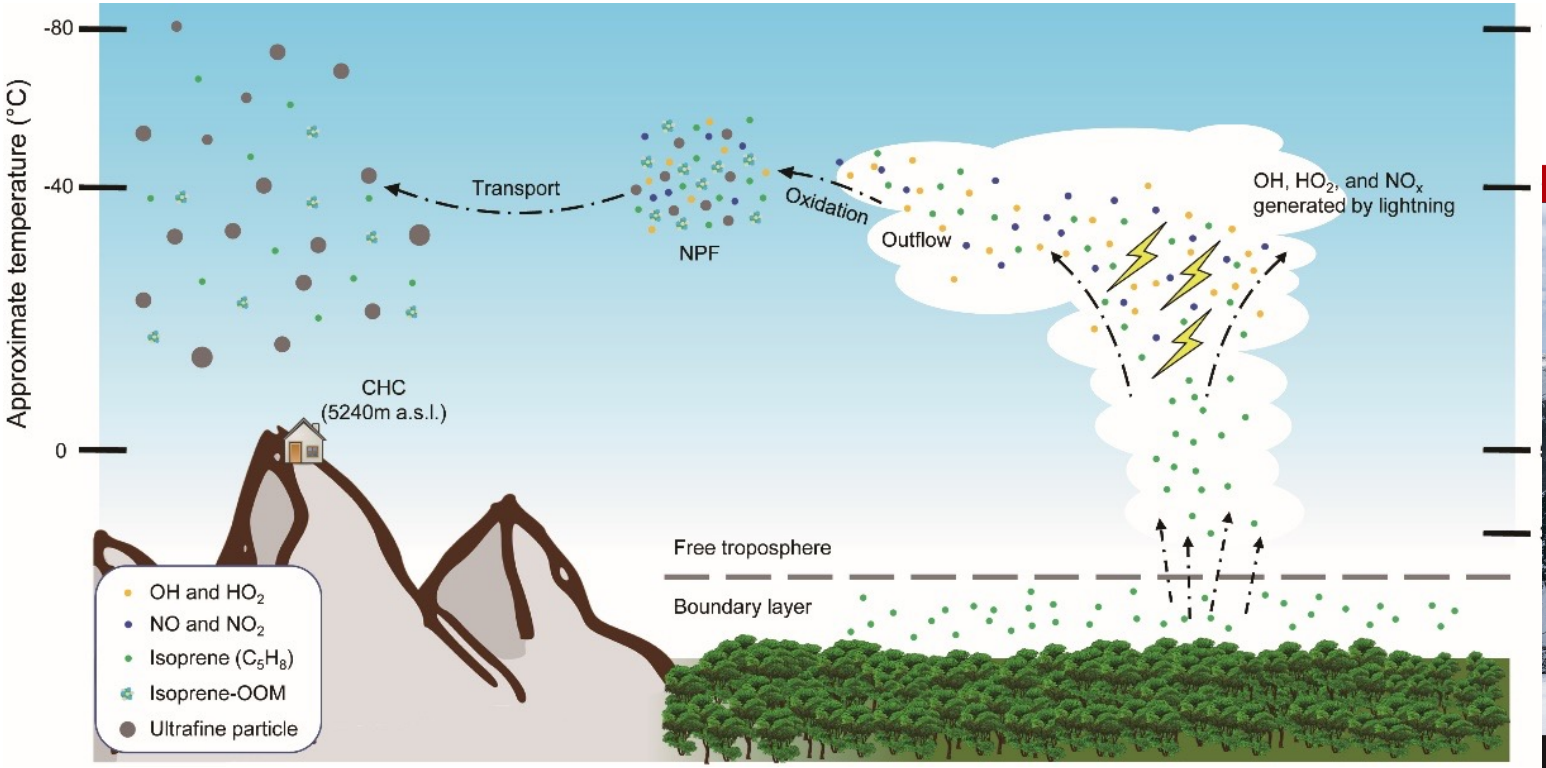
Zha et al., National Science Review, 2024

$C_{4\text{-}5}$ oxidized organic molecules: Another feature of free tropospheric air over Amazonia





Zha et al., National Science Review, 2024

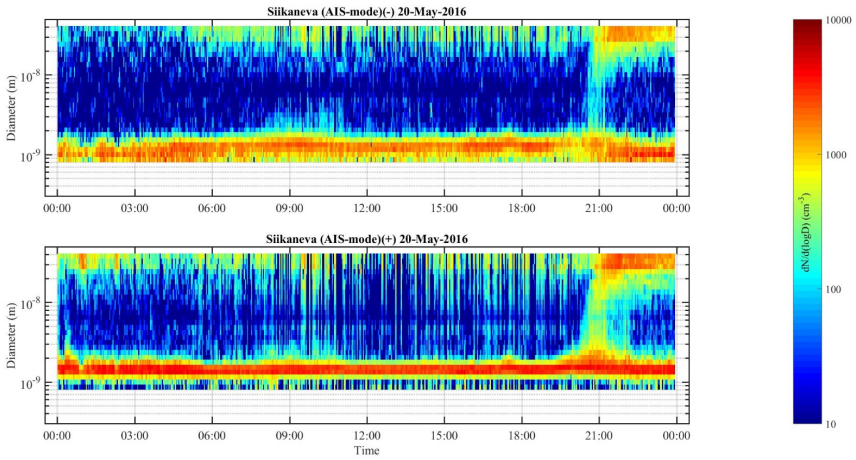


Isoprene emitted by the rainforest, lifted by convective systems, oxidized in the convective outflow and free troposphere, and transported to Chacaltaya. → **Potentially very important for the new particle formation in the tropical free troposphere and pre-industrial too.**

Zha et al., National Science Review, 2024

Siikaneva peatland – night-time nucleation

- **Location:** very close to SMEAR II Hyytiälä forest station, Finland
- **Instrumentation:**
  - CI-API-TOF (neutral SA and HOM)
  - API-TOF (+ and – ions)
  - PTR-TOF (VOCs)
  - NAIS (ions and particles distribution, 0.8-42 nm)
  - PSM (particle #, 1.25-2.5 nm)
  - Meteorology and trace gas (O_3, SO_2)
  - AMS (particulate organics and inorganics)

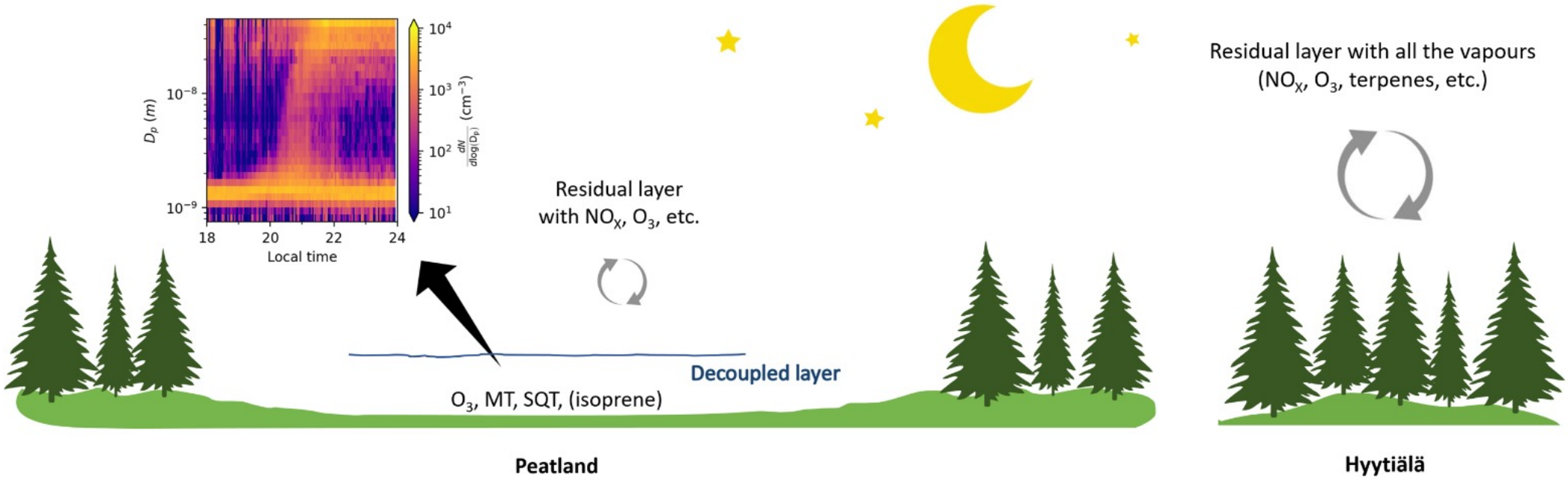


Huang et al., Science Advances, *2024*

The pre-industrial atmosphere hidden inside the "*air pocket*" (i.e., decoupled layer) of Siikaneva peatland

→ *a natural lab experiment*

The present-day atmosphere in the nearby Hyytiälä forests



Pre-industrial

Present-day

Huang et al., Science Advances, *2024*

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Thanks for your attention

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