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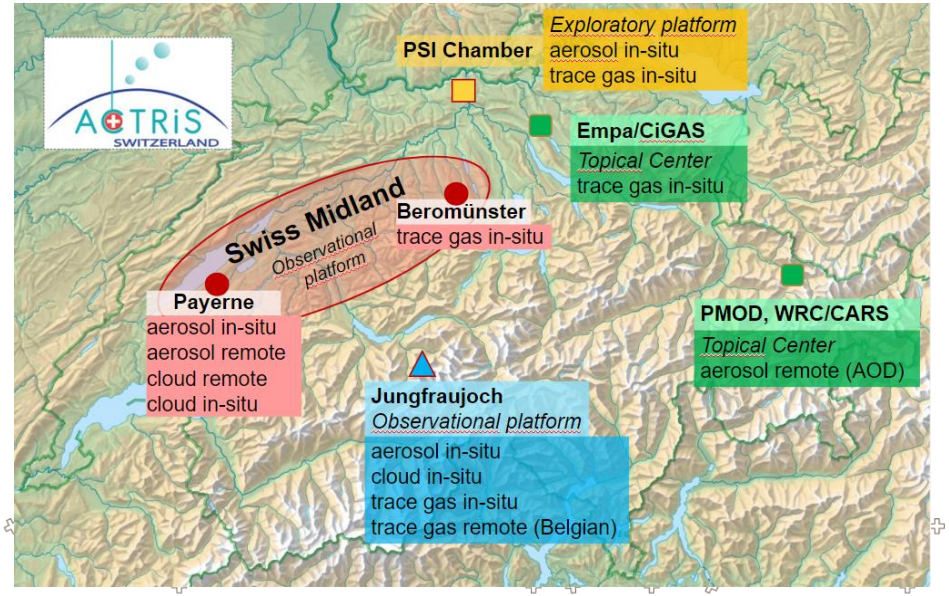
Aerosol R&D @ MeteoSwiss

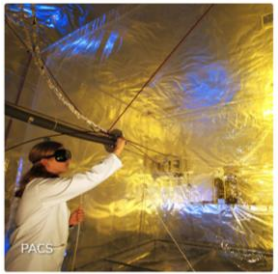
M. Collaud Coen, G. Martucci, M. Hervo, A. Haefele

in close collaboration with PSI/LAC research group from C. Mohr

ACTRIS Switzerland and GAW

Aerosol, **C**loud and **T**race gas **R**esearch Infra**S**tructure
European **R**esearch Infrastructure **C**onsortium





Aerosol measurements @Pay and JFJ

Optical properties:

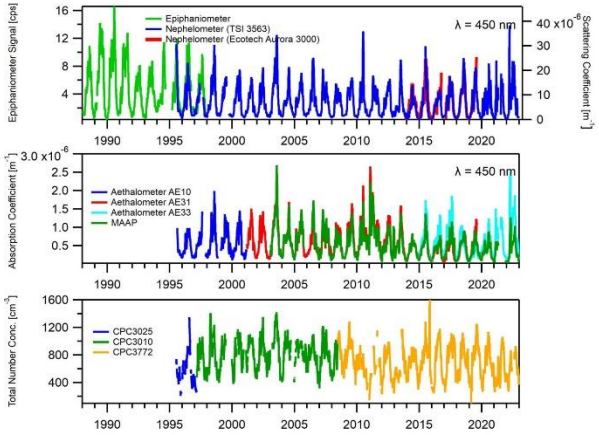
Scattering and backscattering coefficients
Absorption coefficient
Extinction coefficient
Single scattering albedo
Ångström exponents

Physical properties:

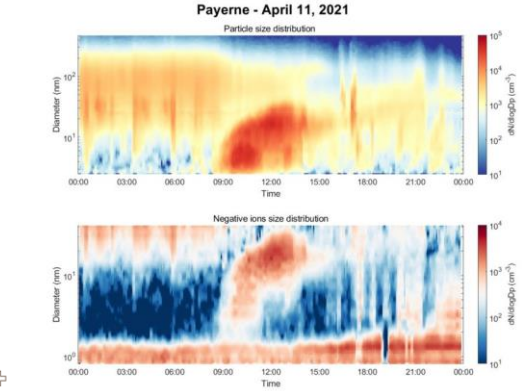
Number concentration
Size distribution (10 nm-10 µm)
Cloud condensation nuclei
Ice nuclei

Chemical properties:

Organics
SO4, NO3, NH4, Chl, BC



@JFJ since 1995



@PAY since 2019

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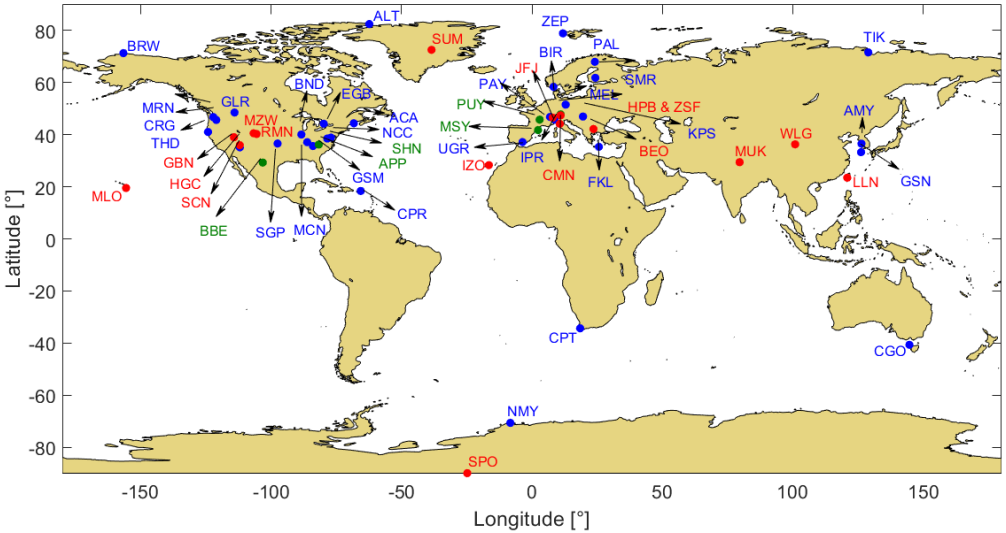
Multidecadal trend analysis of aerosol optical properties

52 remote stations (GAW/IMPROVE)



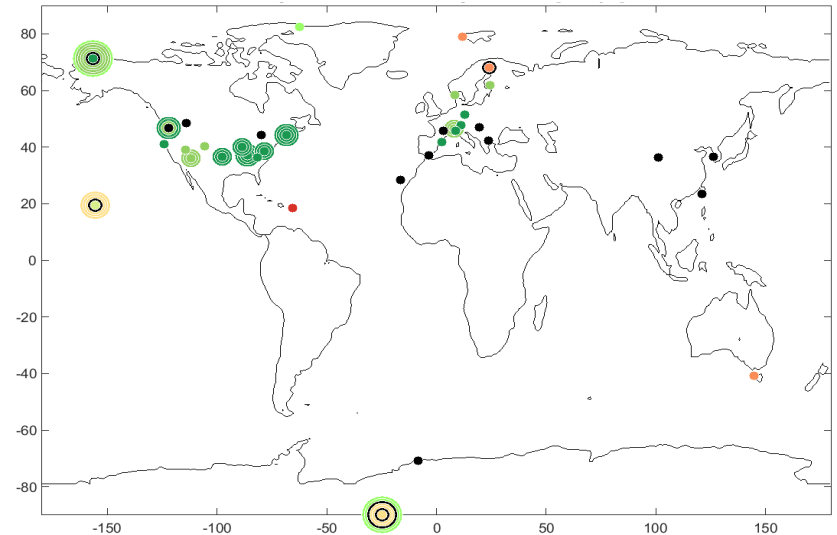
Lack of information from many WMO regions, particularly in Africa

MeteoSwiss

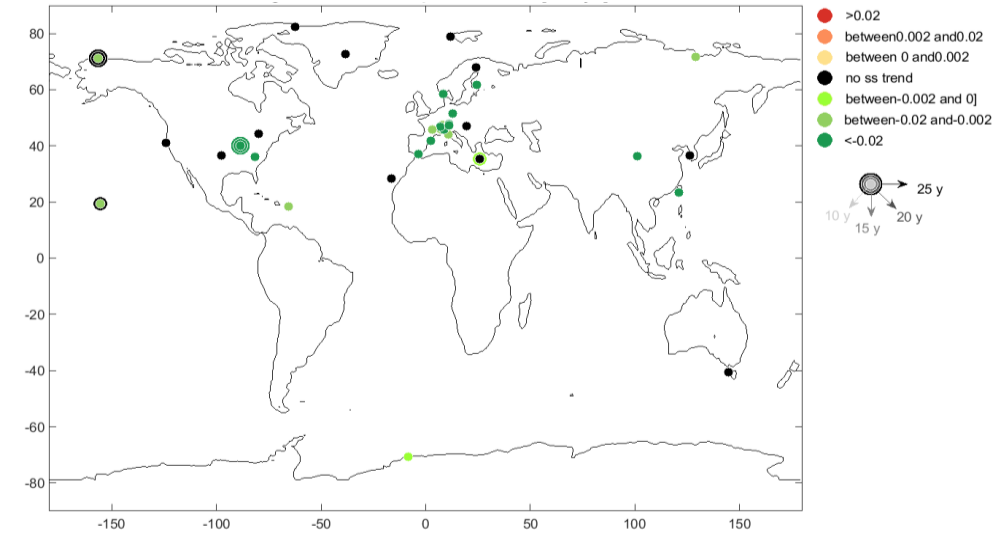
Collaud Coen et al., 2021

Present day (2016-2018) scattering/absorption trend

Scattering coefficient trend [Mm^{-1}/y]



Absorption coefficient trend [Mm^{-1}/y]



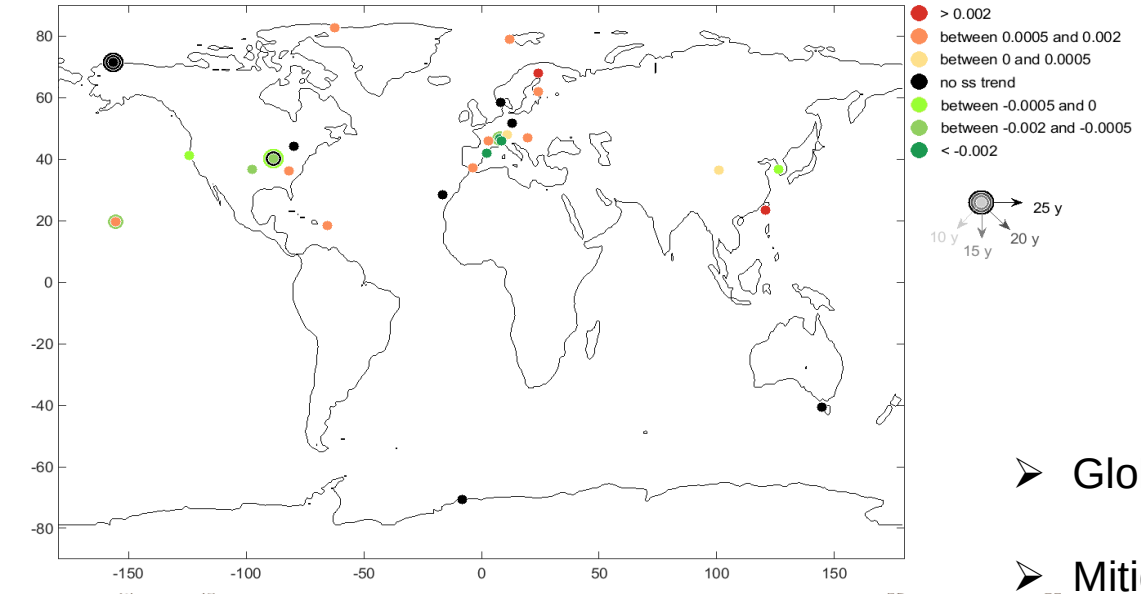
54% ss negative trends (Europa, North America)
14% ss positive (polar regions, coastal stations)
32% not ss

64% ss negative (also in Asia)
36% not ss

Collaud Coen et al., 2021

Present day single scattering albedo trends

SSA= scattering/(scattering + absorption)



22% ss negative trend
(North America and Western Europa)
52% ss positive trend
26% not ss trend

- Global decrease of the aerosol load
- Mitigation strategies can lead to nowadays decreasing SSA

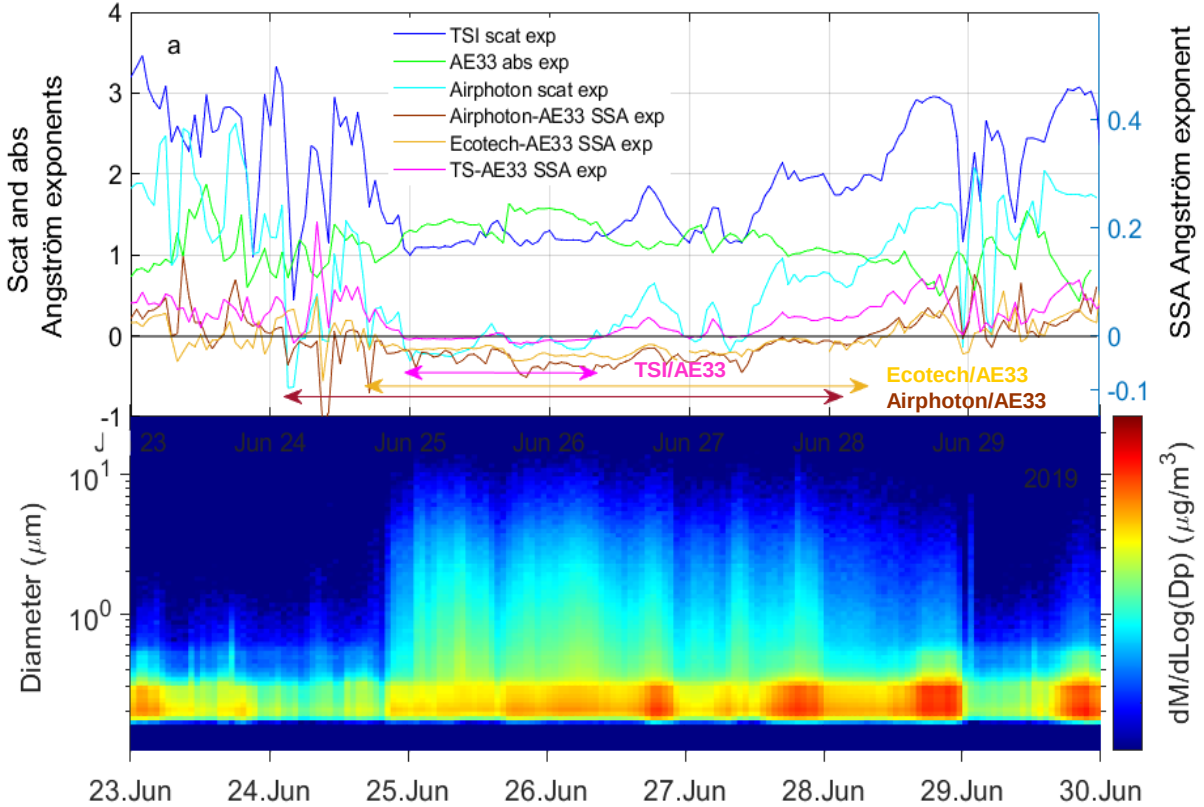
MeteoSwiss

Collaud Coen et al., 2021

SDE detection based on SSA wavelength dependence

Nephelometer's wavelengths
TSI : 450-700 nm
Ecotech (Aurora 3000) : 450-635 nm
Airphoton : 460-630 nm

Aethalometers:
AE31: 370-950
AE33: 370-950



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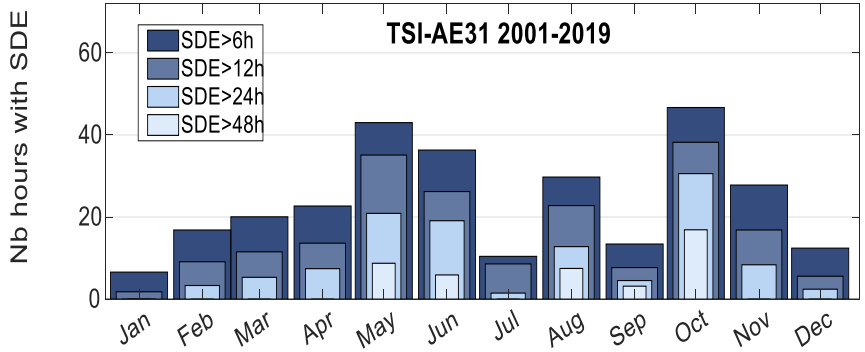
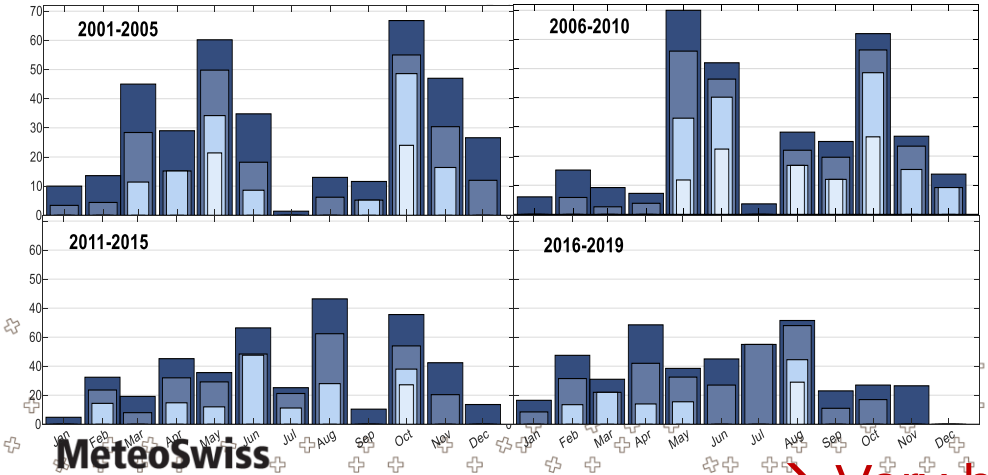
Collaud Coen et al., 2004

SDE 5-20 y. climatology

Nb hours with SDE/year





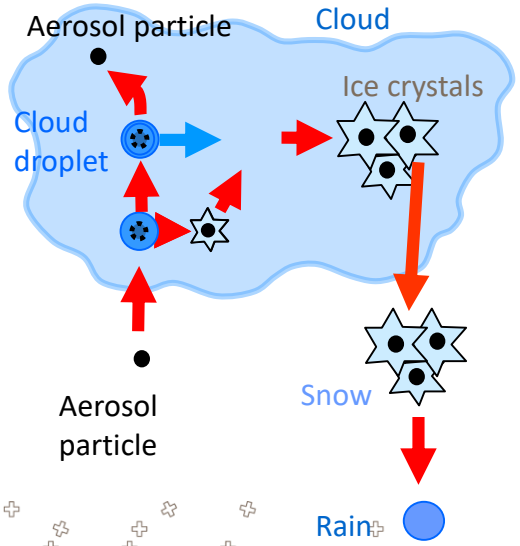
March 2022

MeteoSwiss

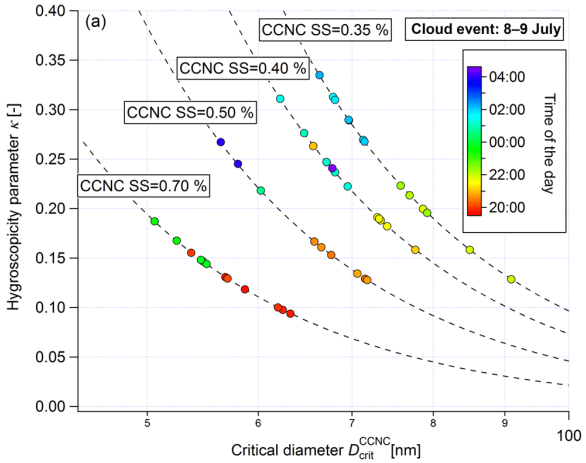
→ Very high interannual variability

Cloud formation @ Jungfraujoch

The Wegener-Bergeron-Findeisen process

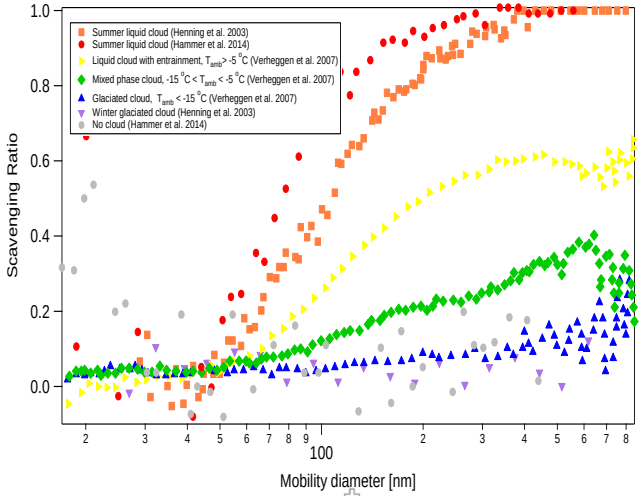


Aerosol hygroscopicity vs diameter



Motos et al., 2019

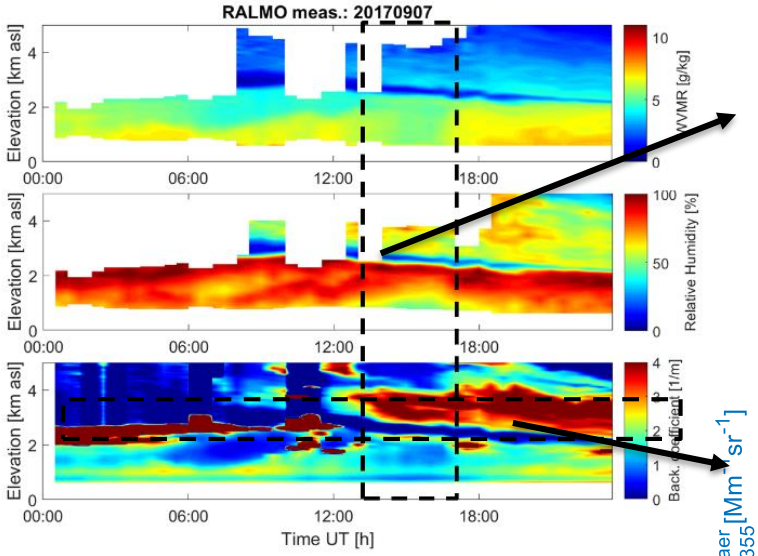
Scavenging ratio vs diameter



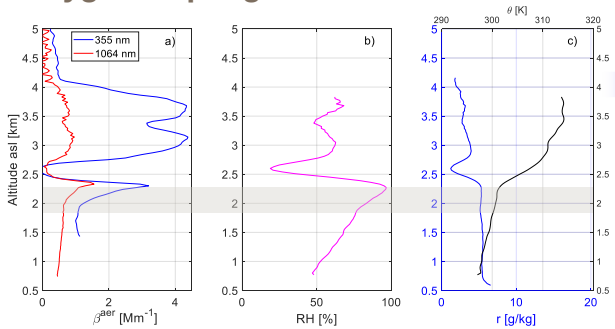
Bukowiecki et al., 2015

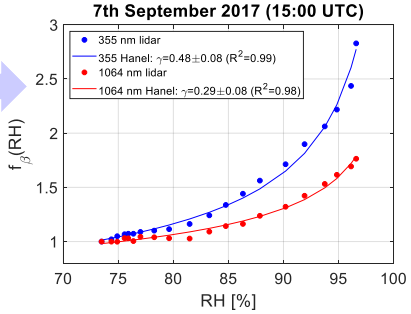
Hygroscopic growth by REM at Payerne

- Ralmo has shown its capability to monitor aerosol hygroscopic processes in time and in altitude

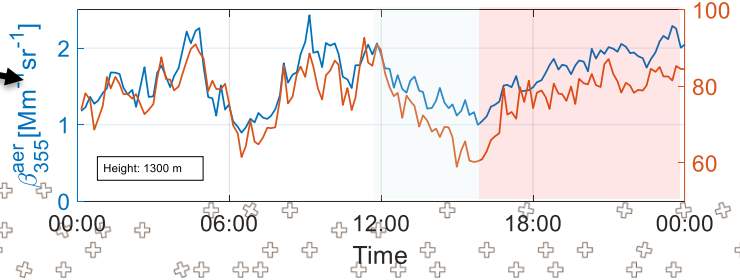


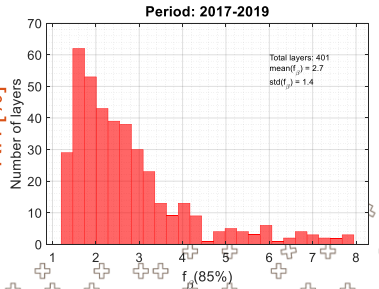
Hygroscopic growth - in the vertical





Hygroscopic growth - in time



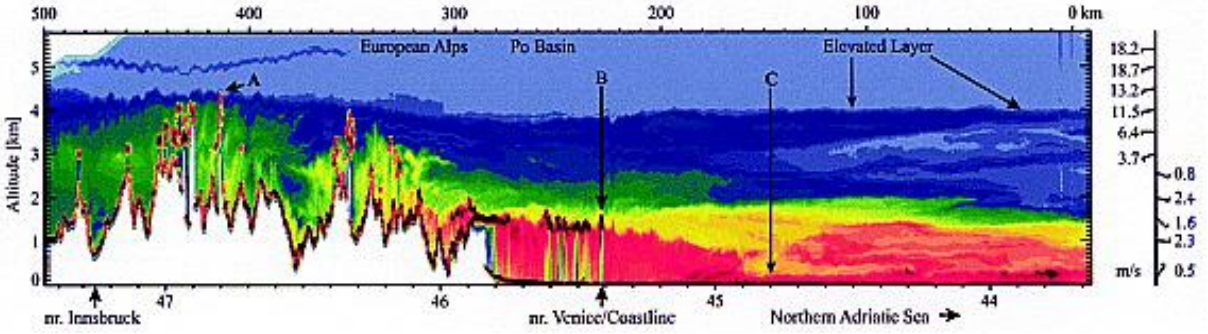


Navas-Guzmán et al., 2019

MeteoSwiss

Evidence of ABL influence in the Alps

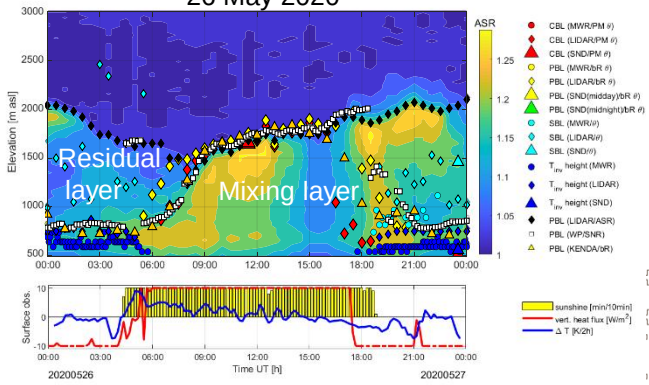
Airborn LIDAR measurement of aerosol backscatter



Nyeki et al., 2002

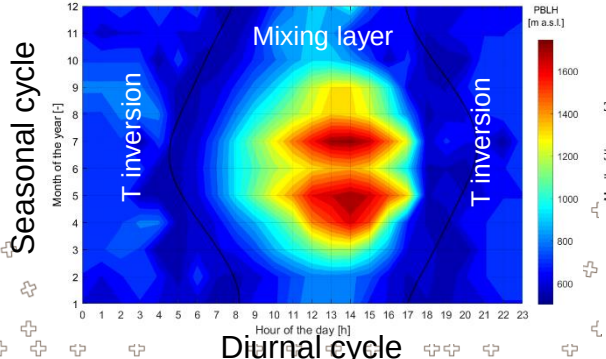
ABLH @ Payerne

26 May 2020



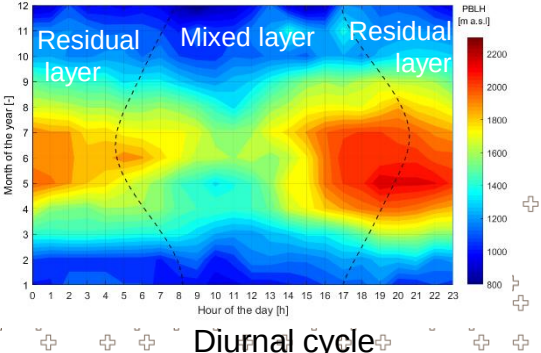
10 y climatology of ABLH @ Payerne

Based on T profiles



Diurnal cycle

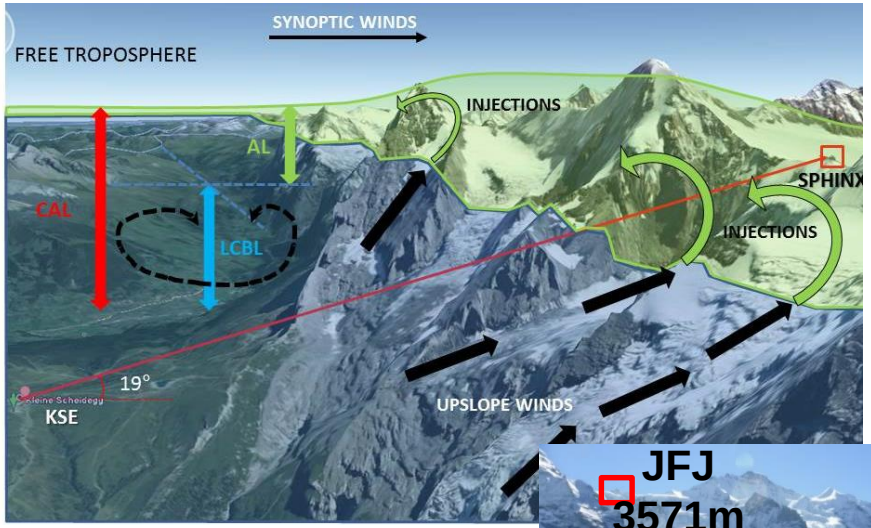
Based on aerosol profiles



Diurnal cycle

CBL and AL influence in complex terrain

Along valley winds @ Meiringen



Y. Poltera et al., 2017

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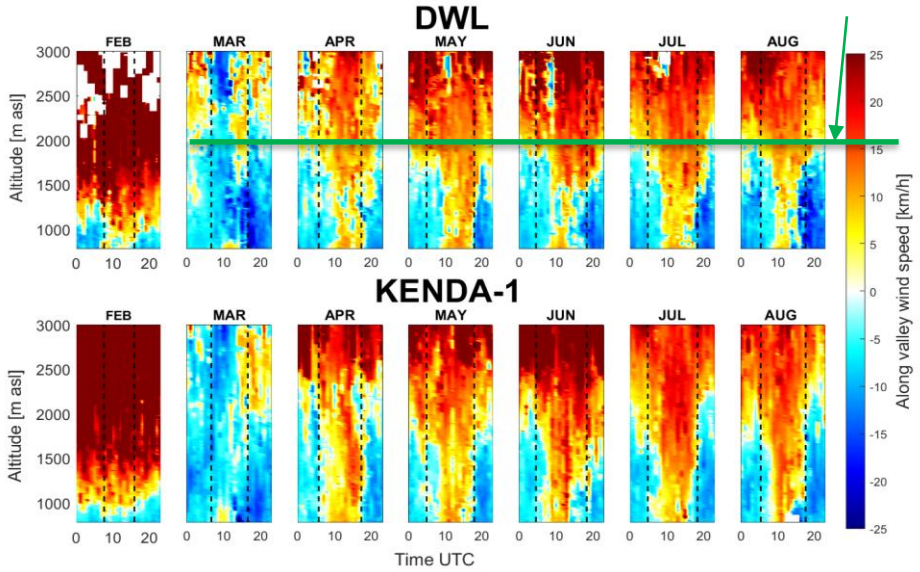
Ridge height



Down-valley wind

Up-valley wind

Bugnard et al., 2023


Thank you for your attention

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