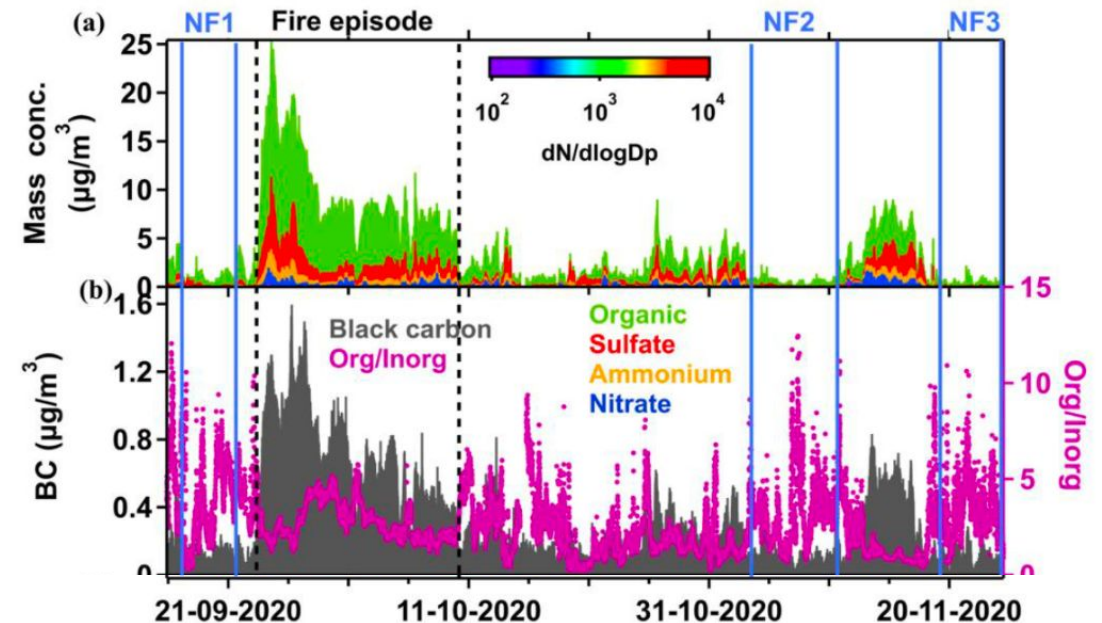
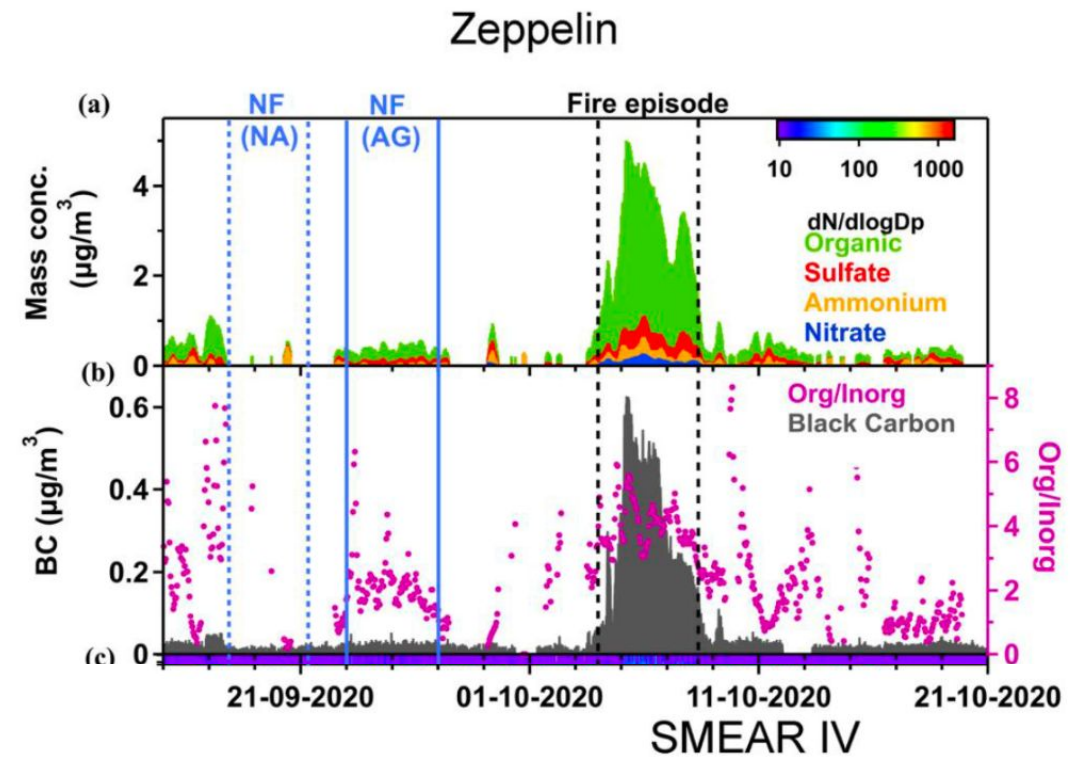
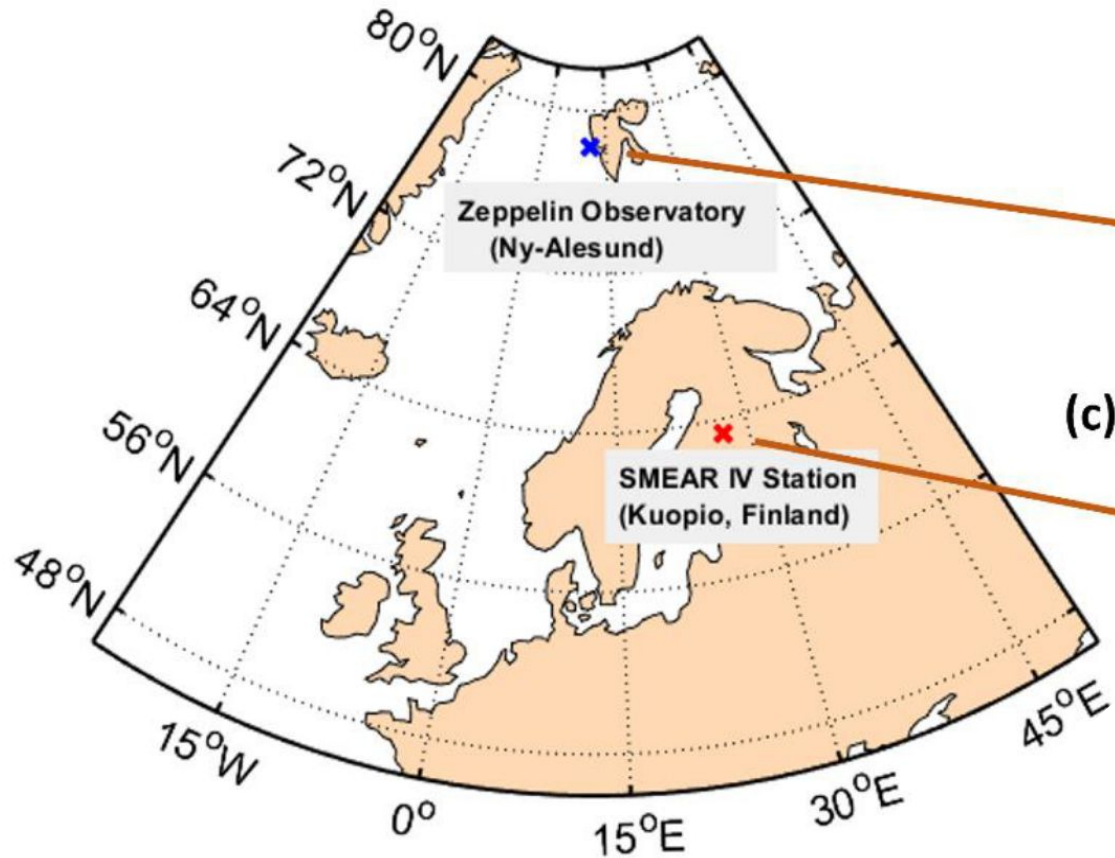


The impact of European fires on aerosol and cloud properties in the Arctic: CHIMERE versus WRF-Chem *(lessons learned)*

Rémy Lapere & Ludovico Di Antonio
LATMOS

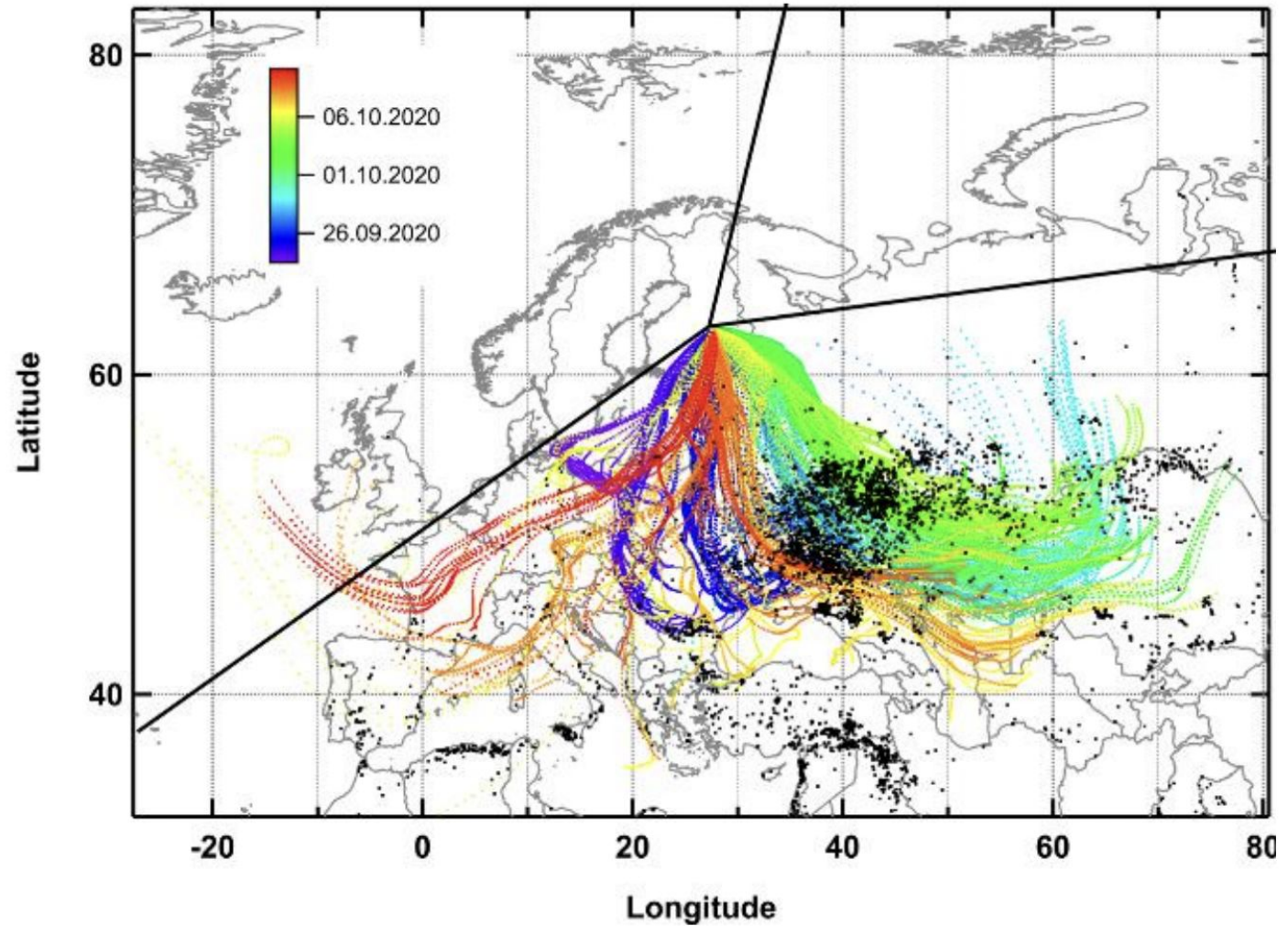
The case study



“Effect of Long-Range Transported Fire Aerosols on Cloud Condensation Nuclei Concentrations and Cloud Properties at High Latitudes”
Kommula et al. (2024)

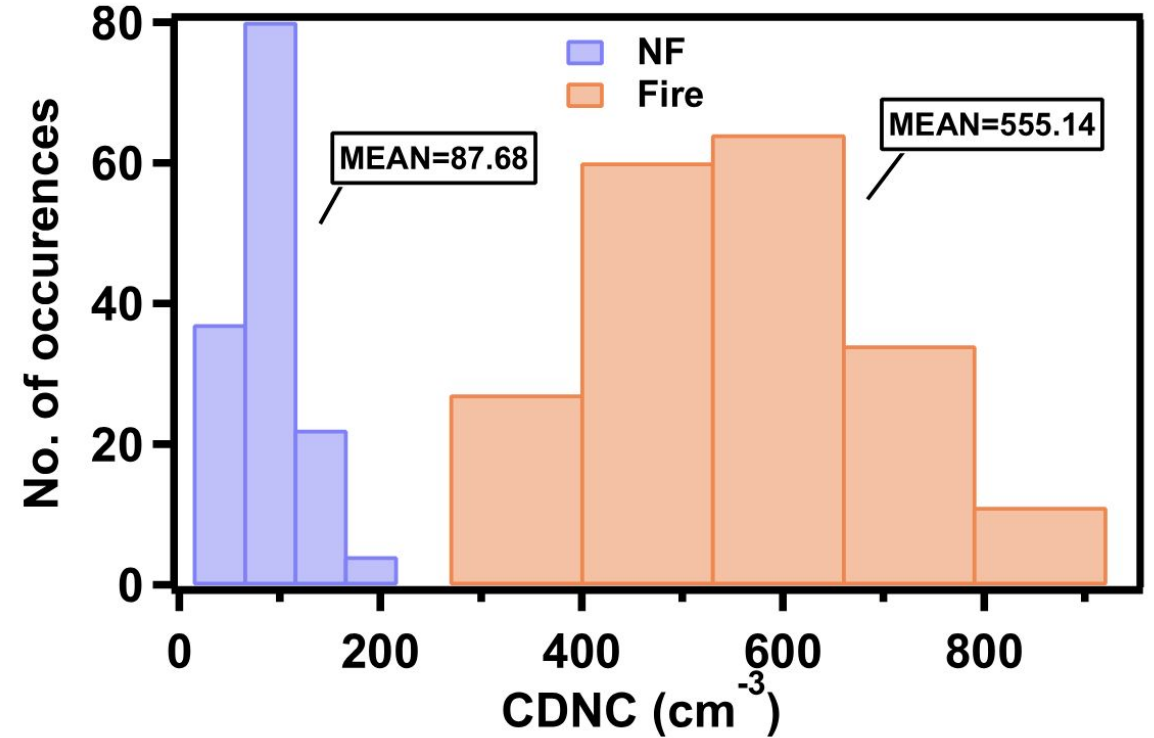
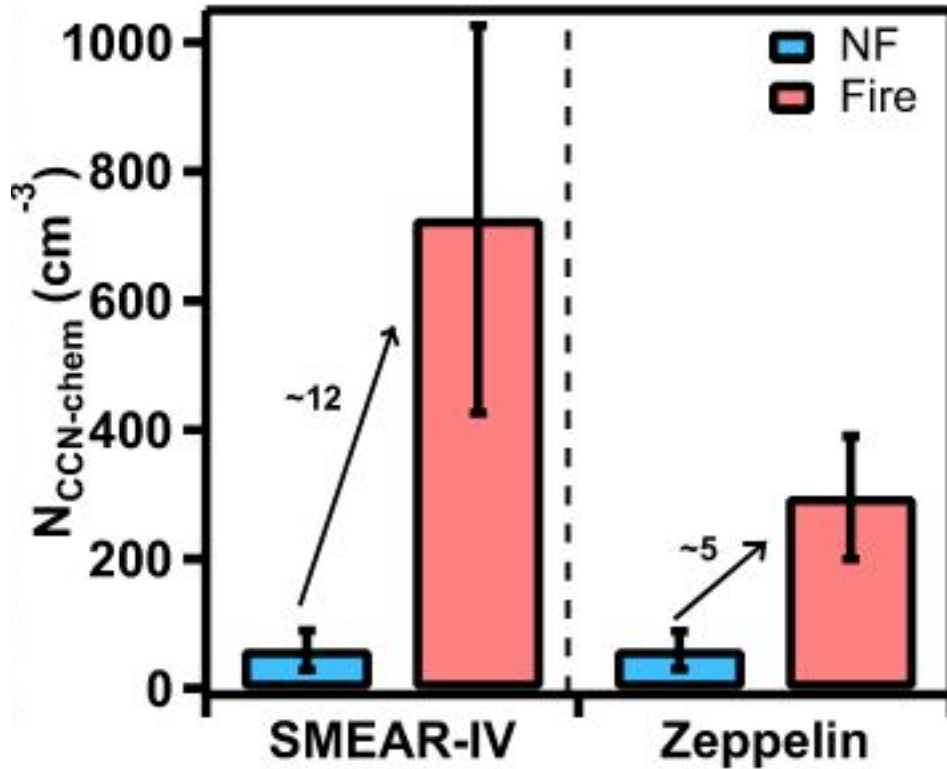
The case study

*“Active **vegetation fires** in **south-eastern (SE) Europe** resulted in a notable **increase** in the number concentration of **aerosols** and cloud condensation nuclei (**CCN**) particles at two high latitude locations ”*



Kommula et al. (2024)

The case study



Large increase in CCN (local measurements) and CDNC (MODIS) during the fire event

Kommula et al. (2024)

Motivation for a modeling study

- Quantify the effect of EU fire emissions on Arctic clouds/radiation
- Identify the processes we need to include/improve in the models
- Quantify deposition in the ocean(?)

The models



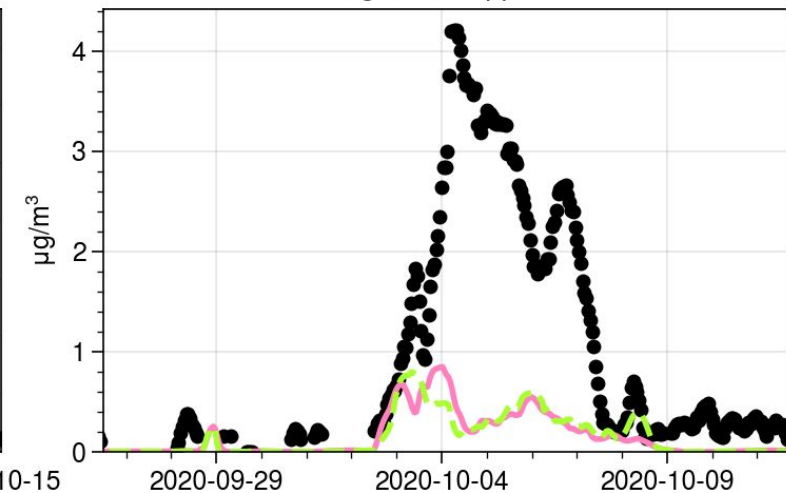
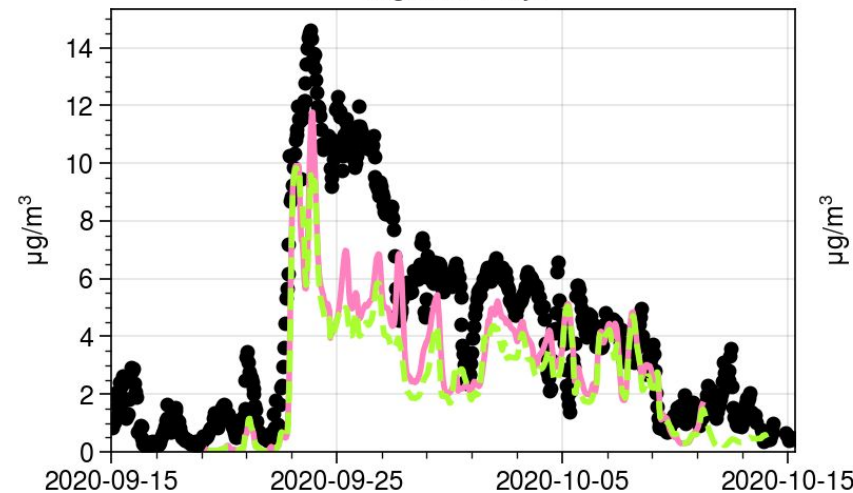
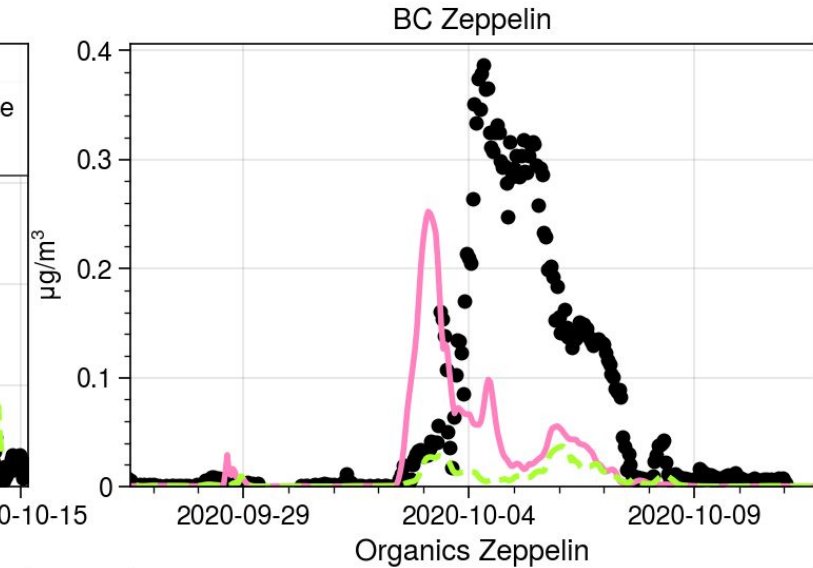
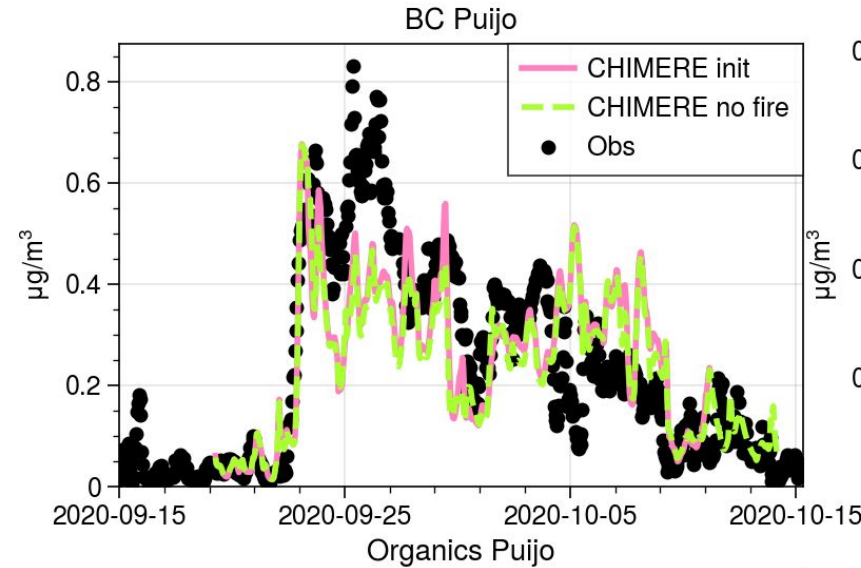
	WRF-CHIMERE	WRF-Chem-Polar
Meteo forcing	ERA5	
Anthropogenic emissions	CAMS	
Fire emissions	CAMS-GFAS / FINN	FINN
Microphysics	Thompson	Morrison / Thompson

First try with default configurations

Transport event @ Puijo ~OK

Zeppelin KO

No effect of fire except BC @
Zeppelin - **but it's an artifact**



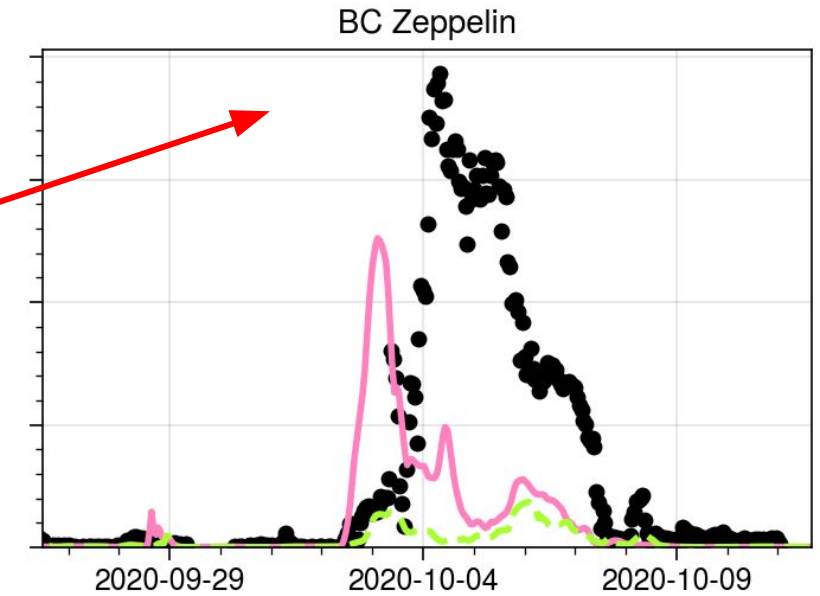
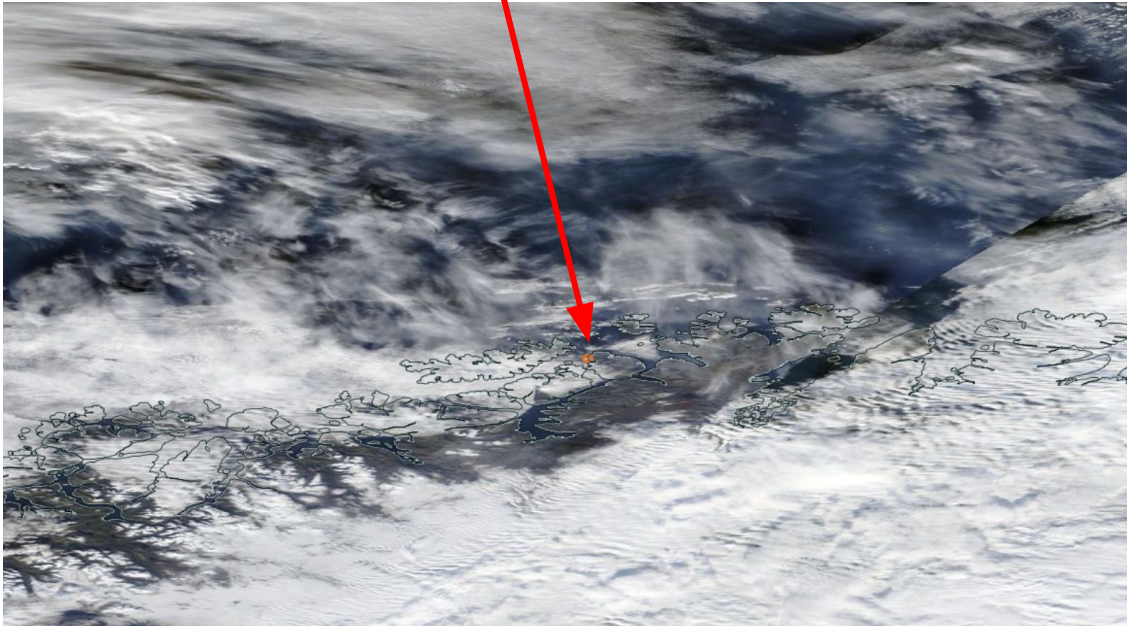
First try with default configurations

Investigation of fire at Hammerfest LNG

The Petroleum Safety Authority Norway (PSA) has investigated a fire which broke out at the Hammerfest LNG plant on Melkøya on 28 September 2020. A digital presentation has been produced to communicate the findings to the industry.

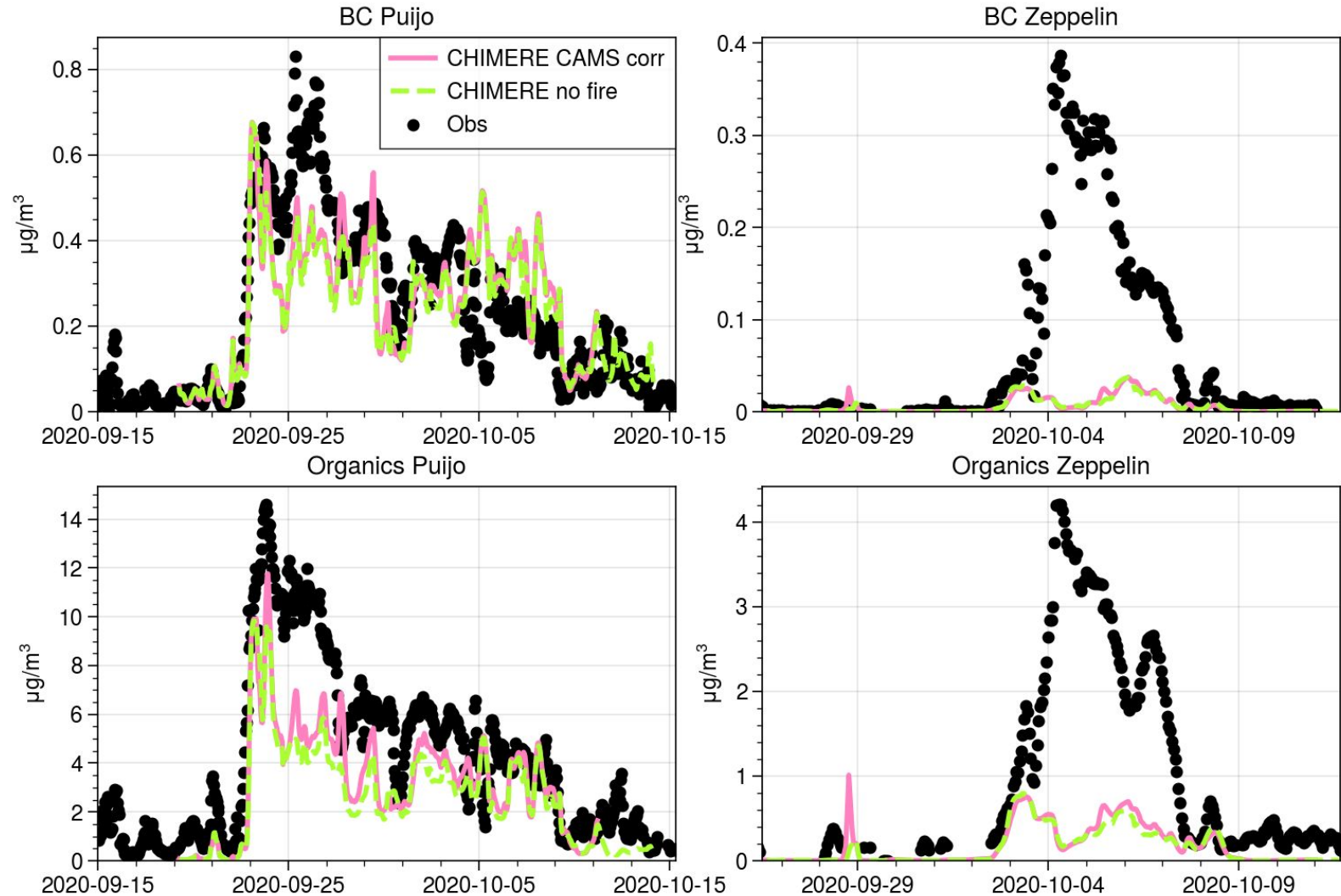
Published: 10 May 2021

Process safety | Barrier management

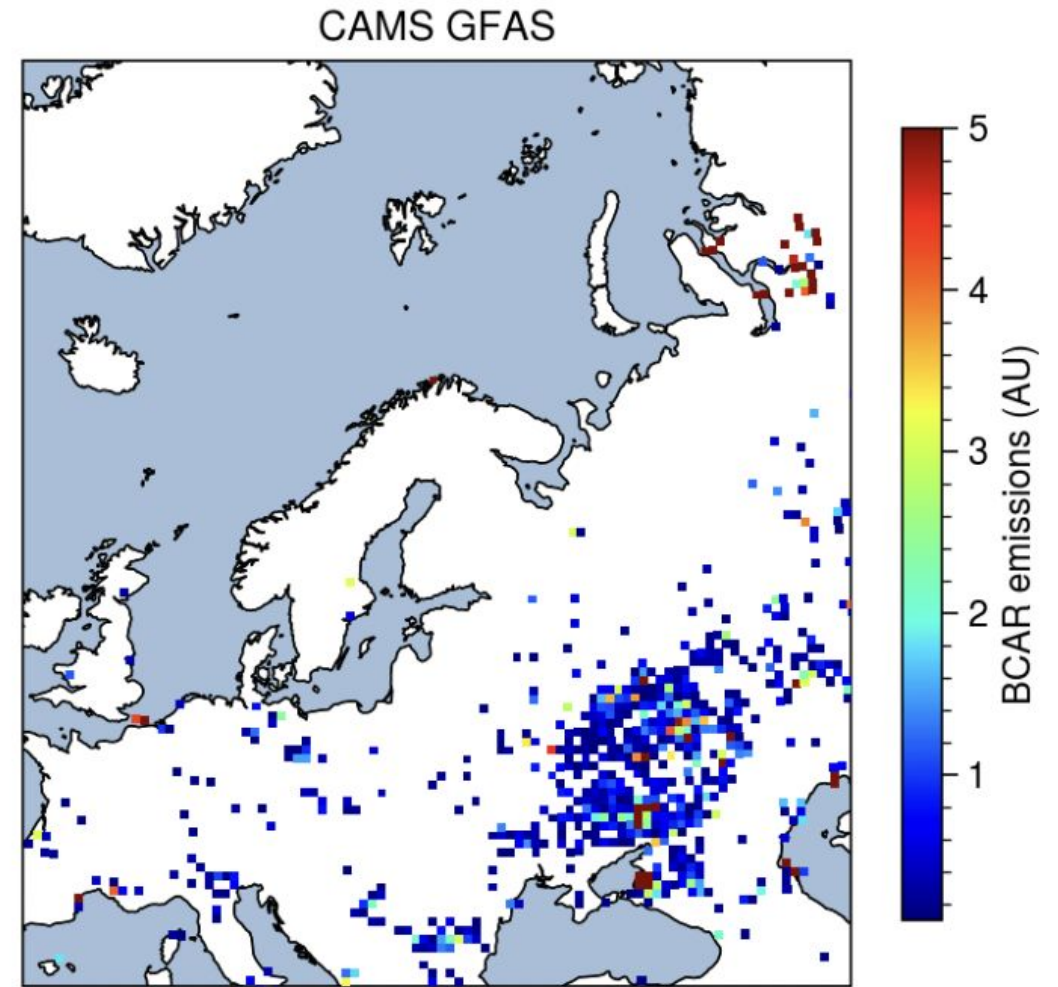
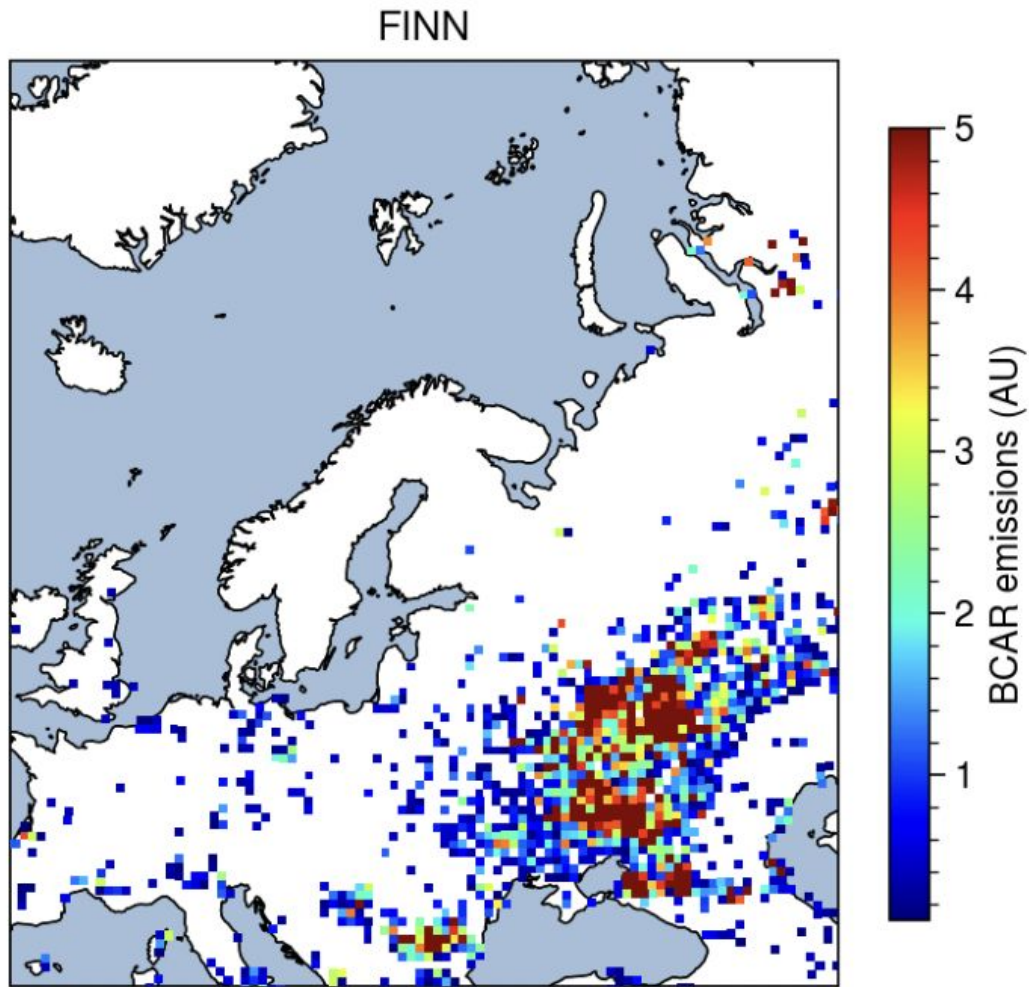


Correction on CAMS-GFAS

Once spurious emissions removed, almost no fire signal



CAMS-GFAS vs FINN



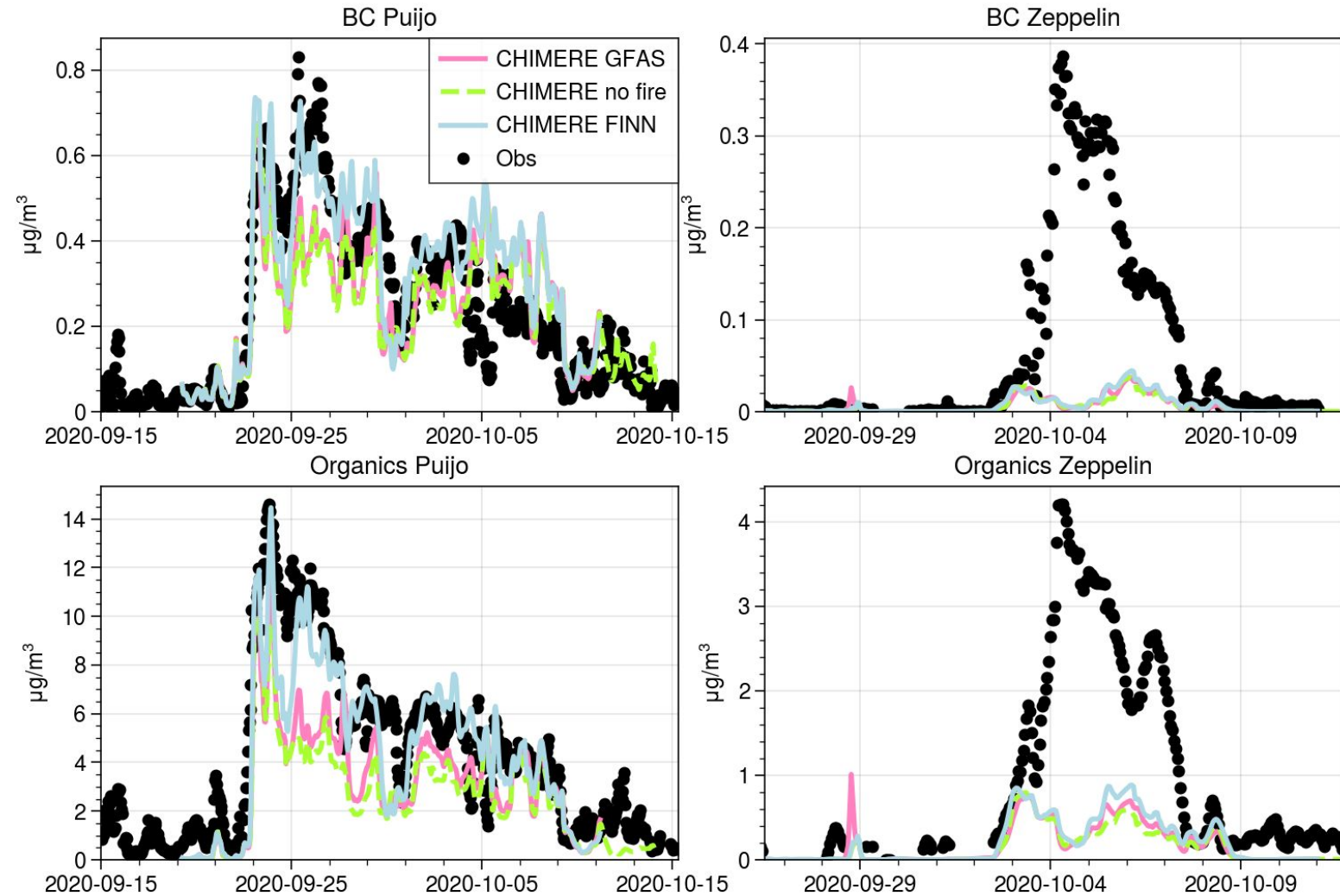
FINN approx. ~10/15 times higher fluxes

CAMS-GFAS vs FINN

Very good @ Puijo

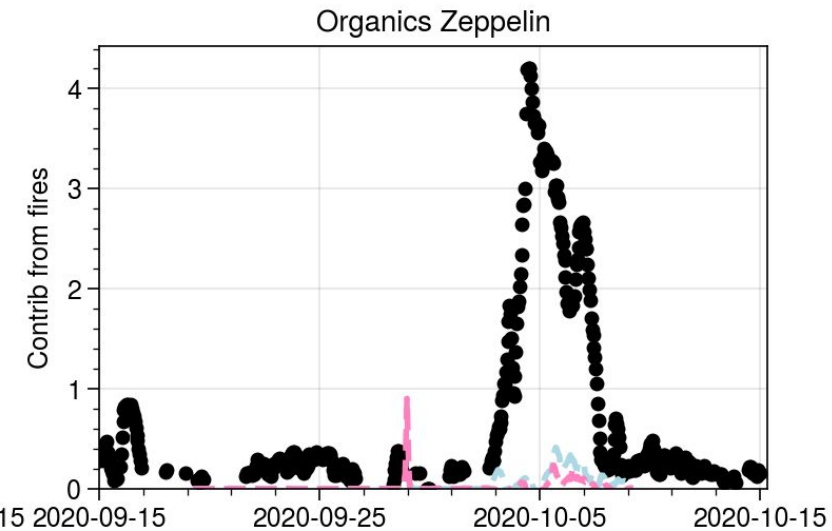
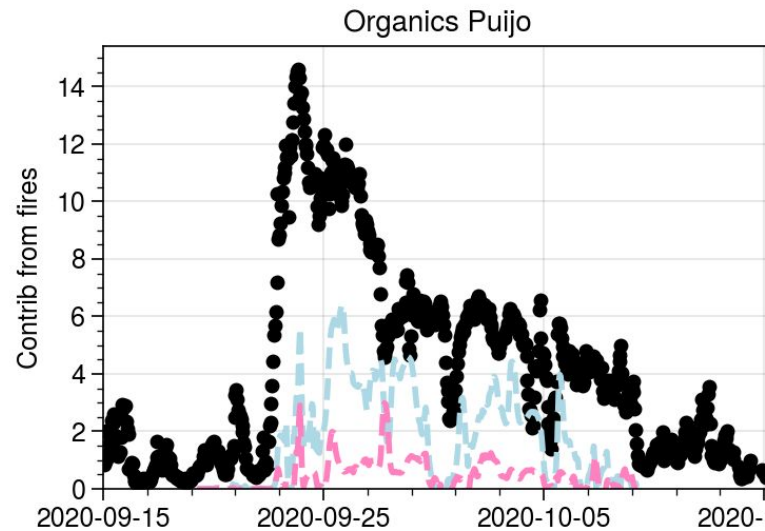
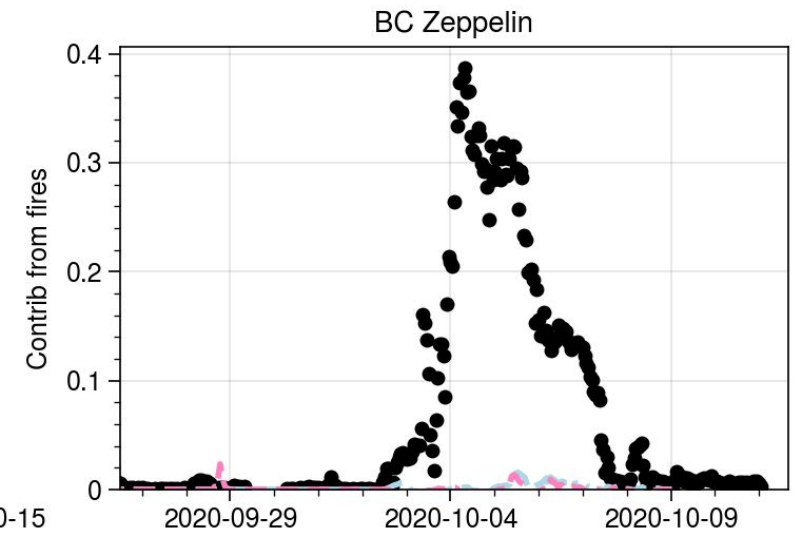
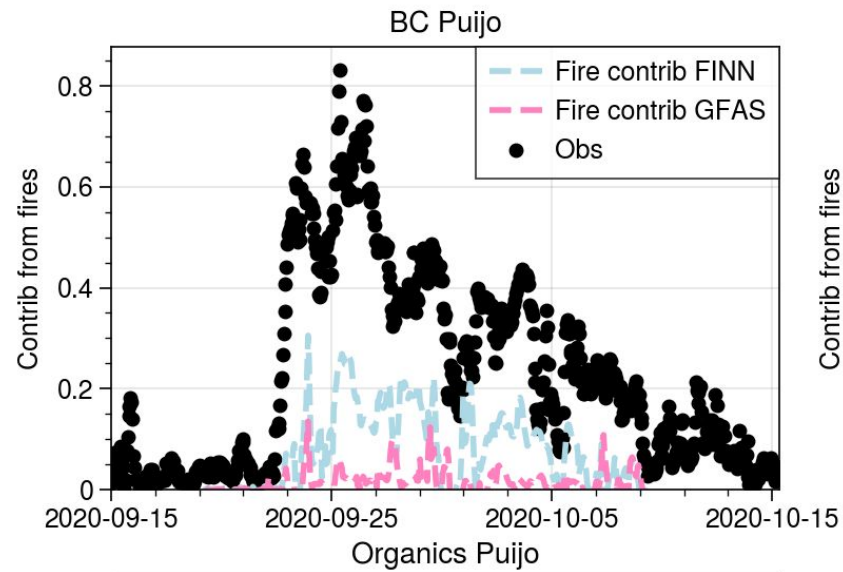
Zeppelin still KO/no fire signal

=> FINN better than GFAS?



CAMS-GFAS vs FINN

Stronger signal in FINN

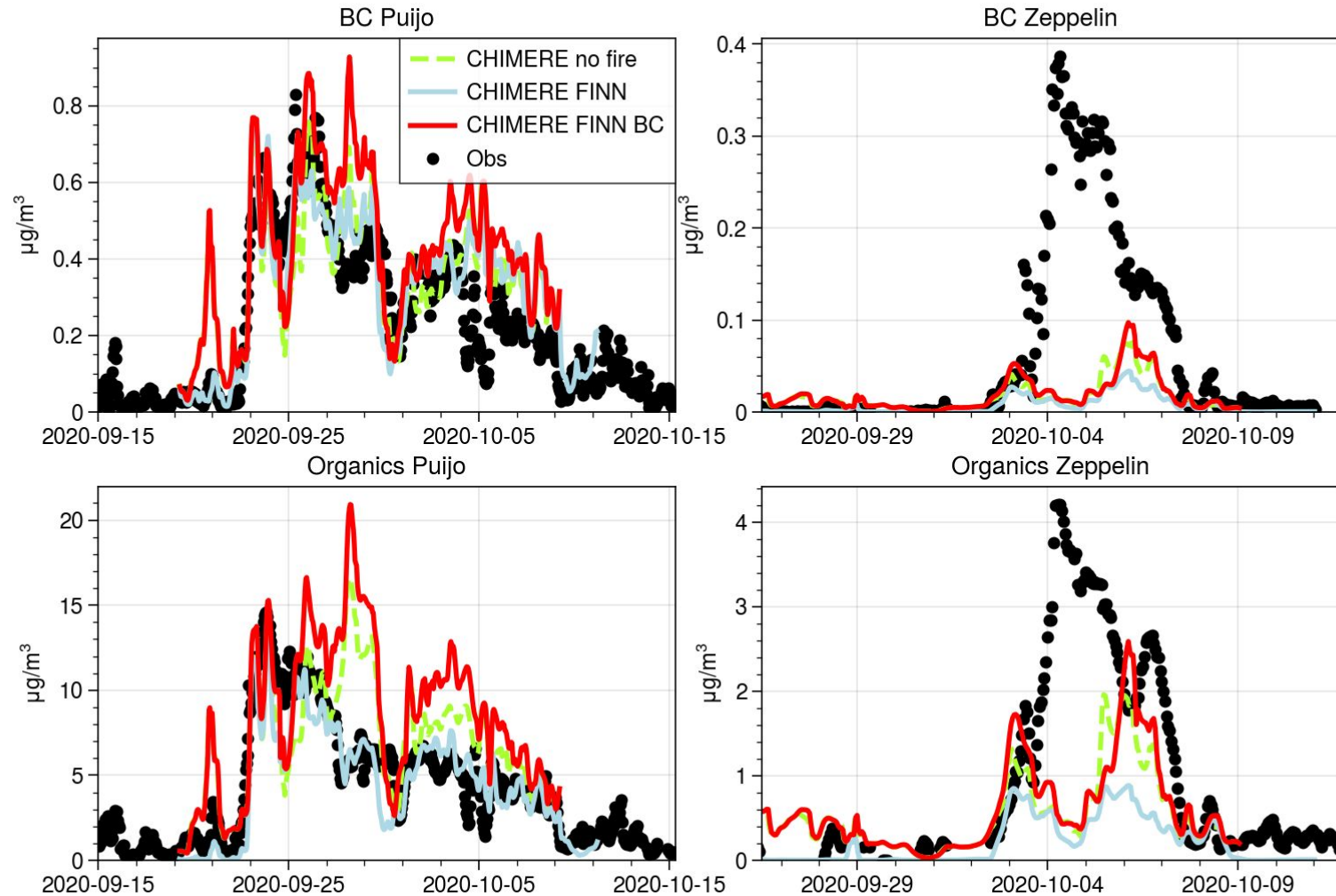


Transport to Zeppelin from elsewhere?

Boundary conditions from CAMS
instead of climato

Improved magnitude at Zeppelin
but over-estimation at Puijo even
w/o fires

=> **Big sensitivity to bound. cond.**

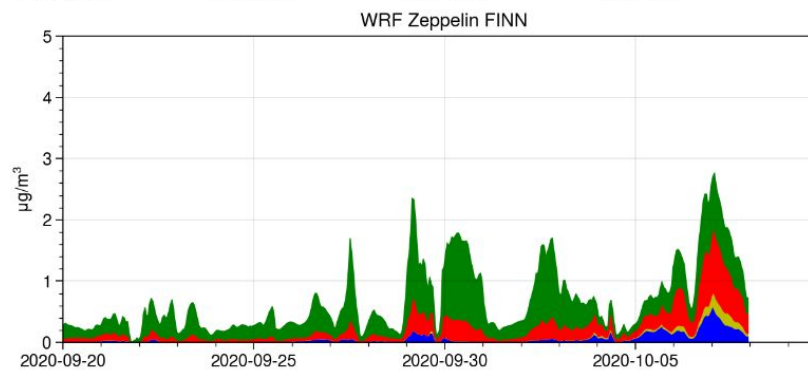
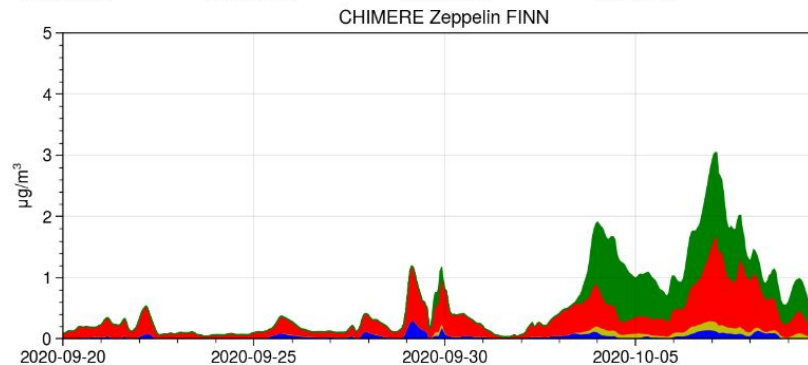
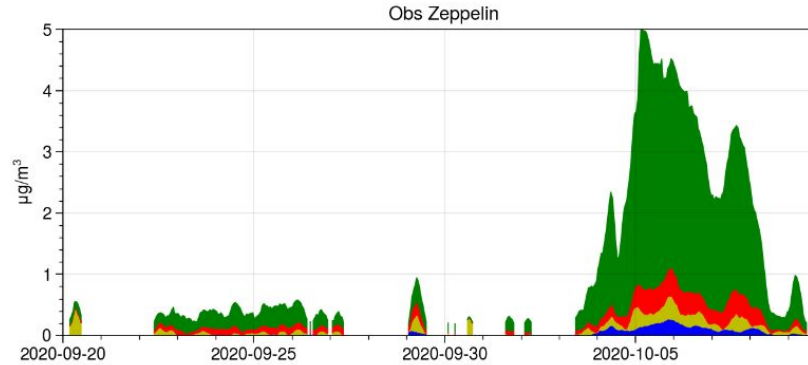
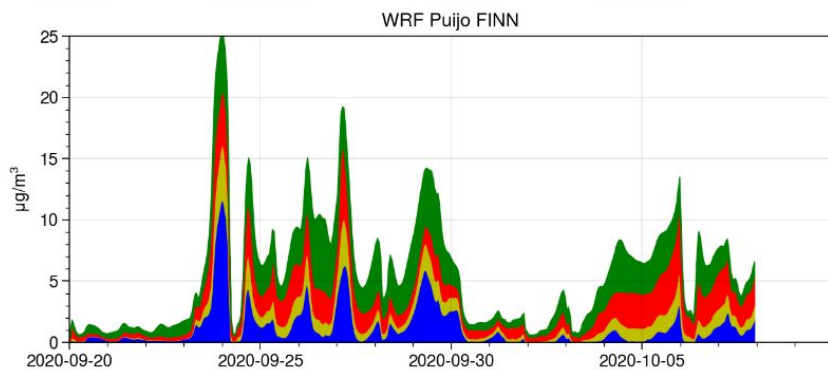
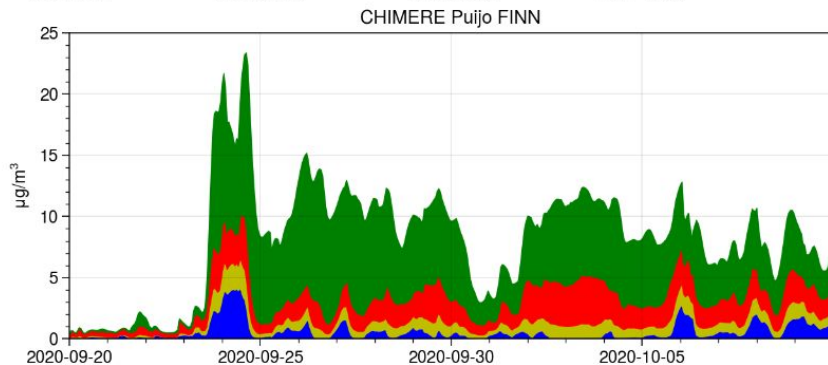
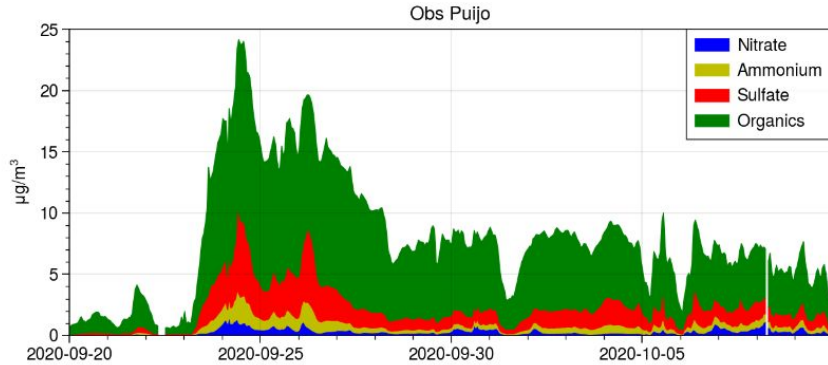


Other tests

Larger domain
Higher resolution
Fire plume injection
Aerosol chemistry
...

All inconclusive...

PM composition

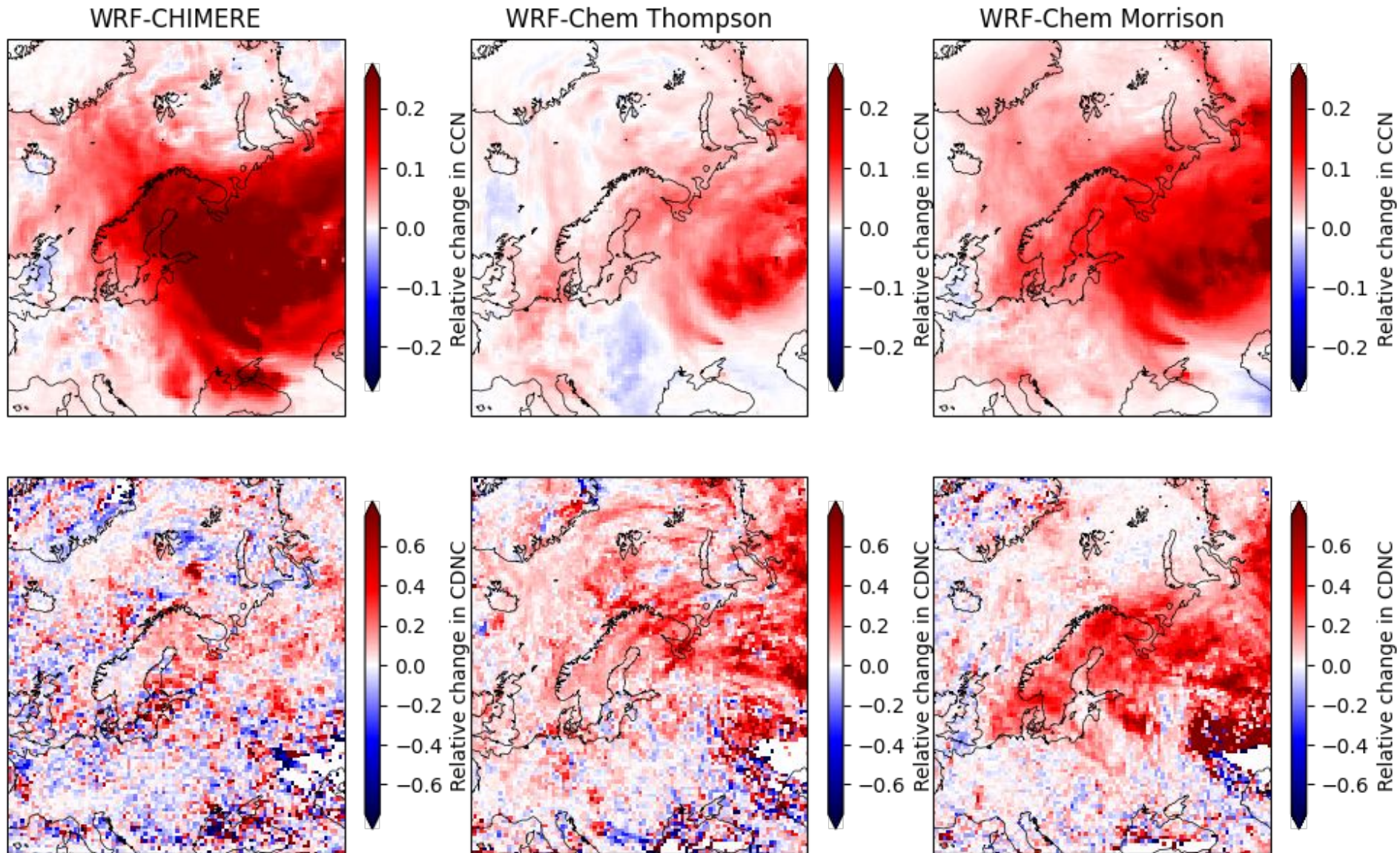


Too much sulfate at
Zeppelin (from
sea-salt?)

Better job by
CHIMERE

=> overall not very
bad but not very good

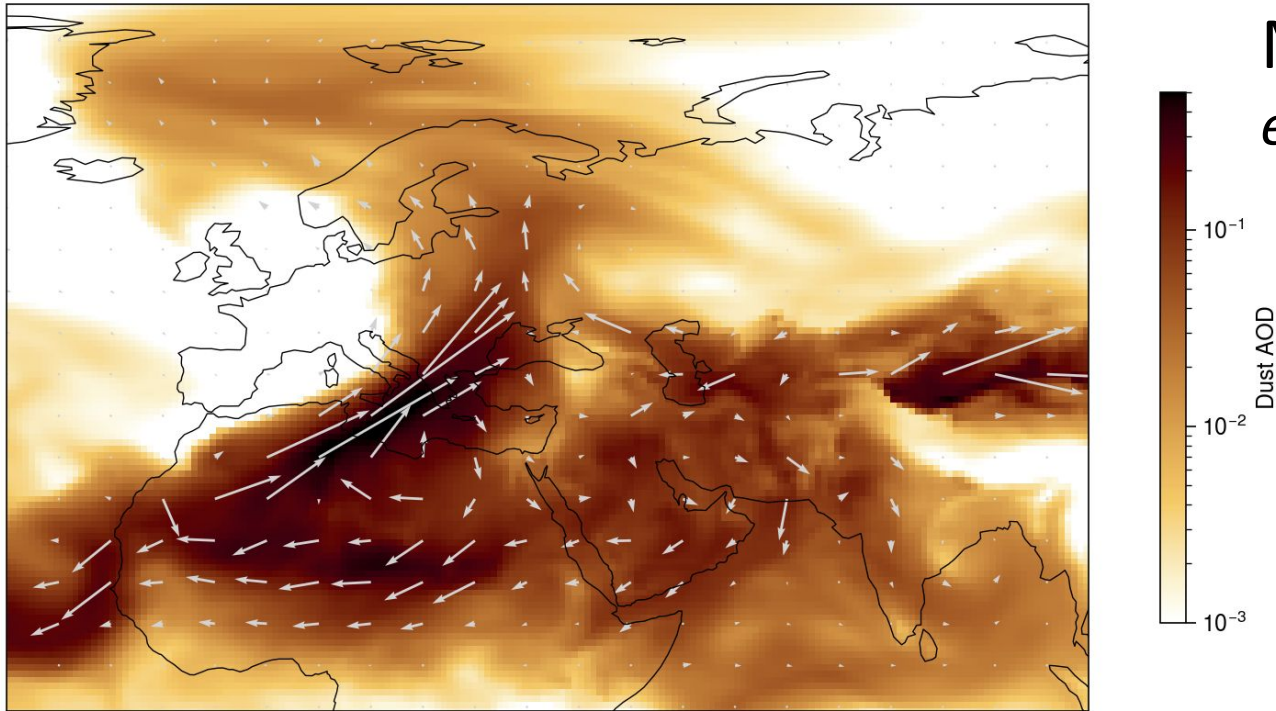
Cloud response to fire emissions



So?

A more general transport event

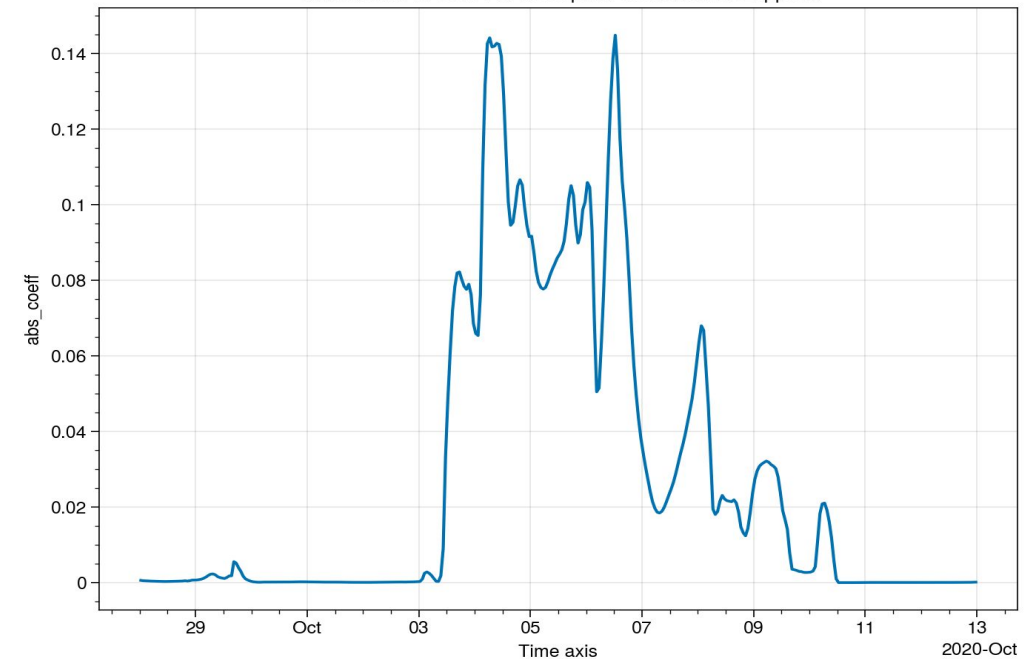
Dust AOD (CAMS) and flux (MERRA2) - 2020-10-05



Major (dust) transport event [Gramlich et al. 2024, Groot Zwaaftink et al. 2022]

Could dust bias BC measurements?

Contribution of DUST to absorption coefficient at Zeppelin



Next steps

1. Study this case as a more general transport case

2. Quantify the role of dust and other compounds

“In our surface observations, a clear influence of biomass burning was revealed (12 %–21 %), as well as mineral dust (25 %–47 %).” Groot et al. (2022)

...

CHIMERE-Polar?

