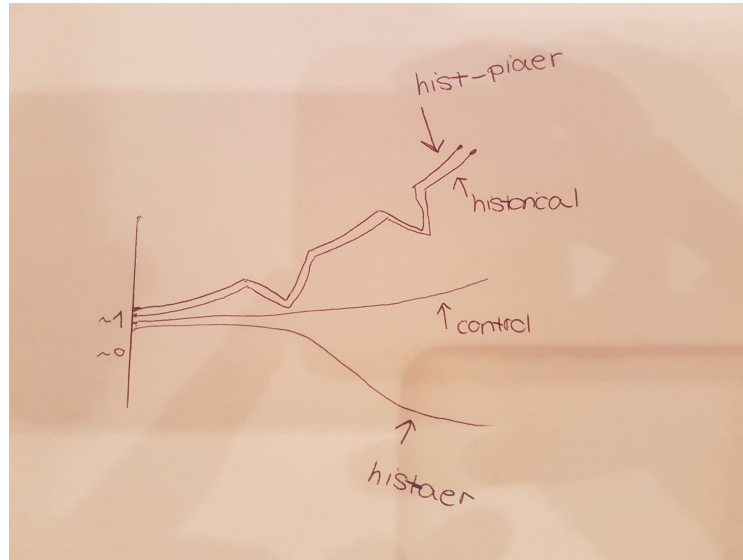


Aerosol optical depth

- Compare station observations against model data
- Calculate model aerosol optical depth trends and comparing with observation trends
 - Look at the regional trends, i.e Asia/Europa
- co-variations between observed AOD trend and model radiative forcing
 - Calculating forcing efficiency

Aerosol forcing on temperature



(Stine and Johan et al., 2019)

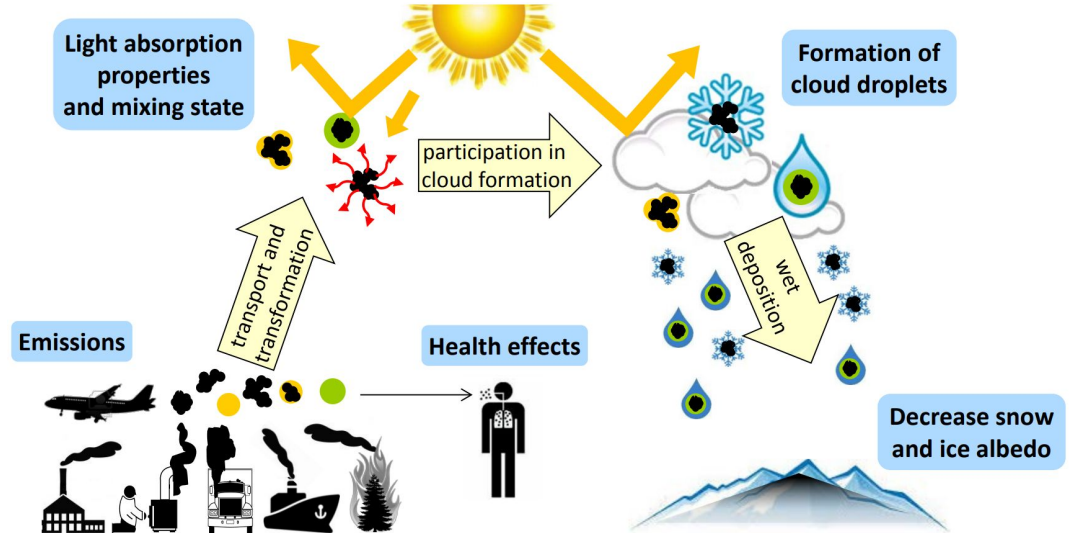
Temperature

- What is the aerosol forcing in the MIROC6 and how did it evolve over time?
- How is the temperature anomalies trend in model and observations?
- How large is the aerosol forcing compared to i.e GHG-forcing?

Arctic wildfires and black carbon forcing

'Unprecedented': more than 100 Arctic wildfires burn in worst ever season

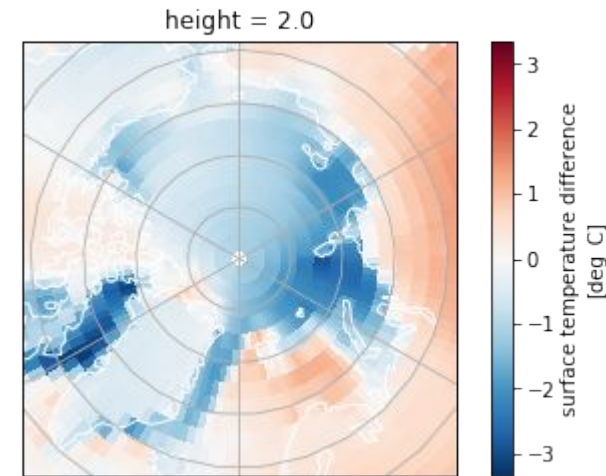
Huge blazes in Greenland, Siberia and Alaska are producing plumes of smoke that can be seen from space



source: PSI

- With a warming climate, the polar regions are predicted (and observed) to see the greatest amount of warming of any global region
- With new understanding of feedbacks, sensitivity of the Arctic to temperature changes and external forcing is being continuously updated
- Predicted trends in important climatic features (temperatures, sea ice extent, etc.) are now being exceeded by observations
- Black carbon forcing remains greatly uncertain (between 0 and 2 W/m², IPCC AR5)

Arctic wildfires and black carbon forcing



Model comparison data:

- NorESM2-LM pre-industrial control (PI) and PI minus black carbon

Observational data:

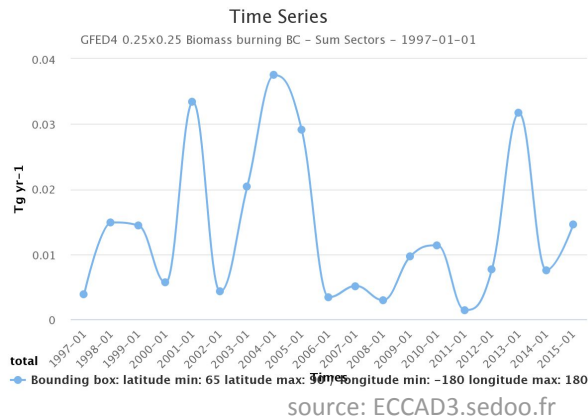
- Collection 6 MODIS Aqua
- MODIS Terra current fire estimates
- Surface BC concentration at Zeppelin

Inputs:

- GFED: Global Fire Emissions Database (large update of magnitude between GFED3 and GFED4)

Questions:

- What are the estimates for black carbon emissions from wildfires in future climate scenarios? How have estimates changed?
- What is the forcing from black carbon in pre-industrial modeling (no anthropogenic biomass burning)?



Organic, sulphate and total AOD in CAMS reanalysis and CMIP6

- ECMWF CAM reanalysis
 - Period: 2003-2018
 - AOD for aerosol (total), sulphate, organic aerosols
 - Ångström exponent total aerosol
- CMIP6
 - CESM2 WACCM
 -

Questions to be answered

- Difference between model and reanalysis? Why
- Is there a seasonal variation (winter/summer)
- Regional variation?
 - Arctic
 - NH mid-latitudes
 - Tropics
 - SH mid-latitudes
 - Antarctica
- Results from reanalysis- Tropics and NH

Model evaluation of atmospheric sulfur processes

1. Are observed trends in SO₂ concentration, sulfate aerosols, and sulfate wet deposition captured in the models?
2. Is the lifetime of sulfate aerosols changing?
3. Do natural and anthropogenic aerosols have different lifetimes?

