Key points: Impact of the Ambae, Raikoke and Ulawun eruptions on the stratospheric aerosol layer and climate

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DFG Deutsche Forschungsgemeinschaft German Research Foundation

cnrs

LPC2E Laboratoire de Physique et Chimie de l'Environnement et de l'Espace

LABEX VOLTAIRE

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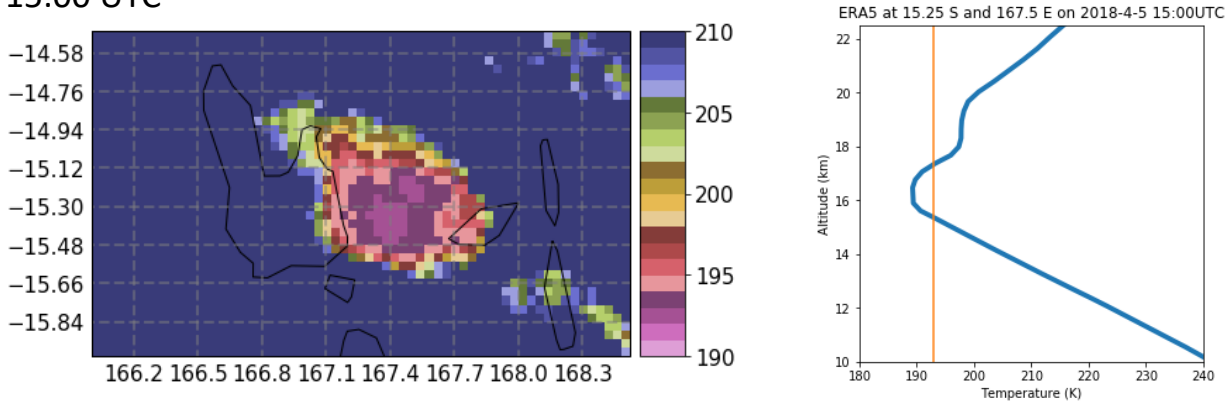
Ambae: Injection altitude estimation (HIMAWARI, ERA5)

5th of April 2018

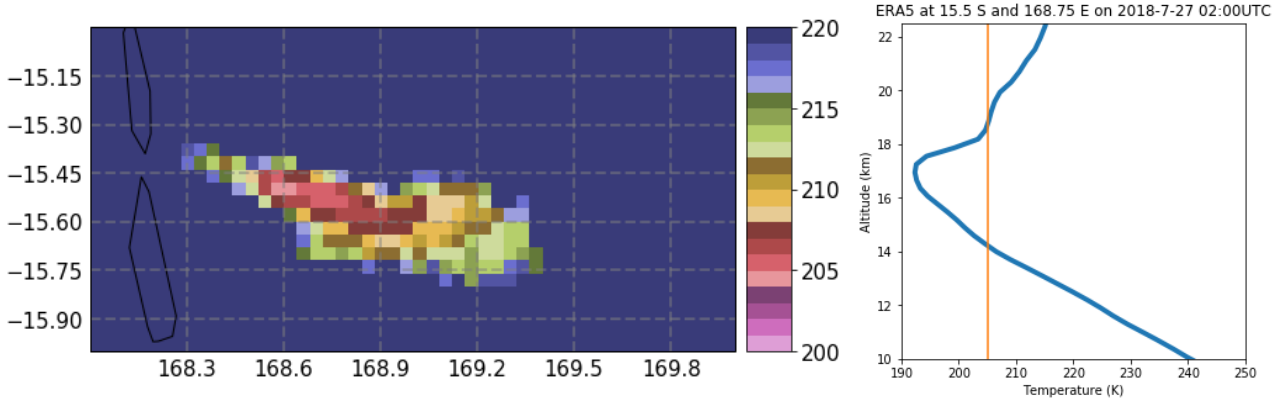
Himawari Brightness Temperature Apr 5th 2018 at 15:00 UTC



- Estimated injection altitude at 17 km as the lower bound

27th of July 2018

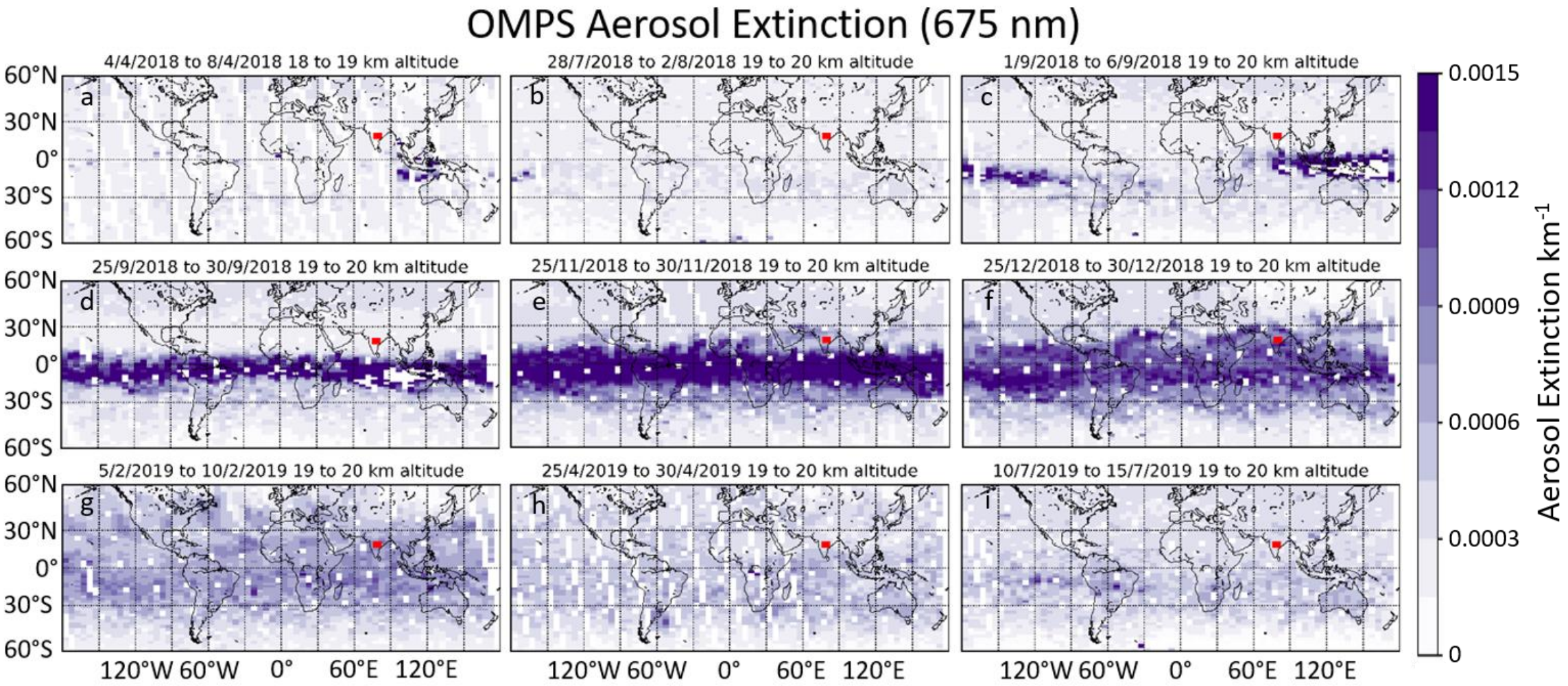
Himawari Brightness Temperature Jul 27th 2018 at 02:00



- Injection altitude at 14 or 18 km

Please see: https://www.essoar.org/doi/10.1002/essoar.10501617.1

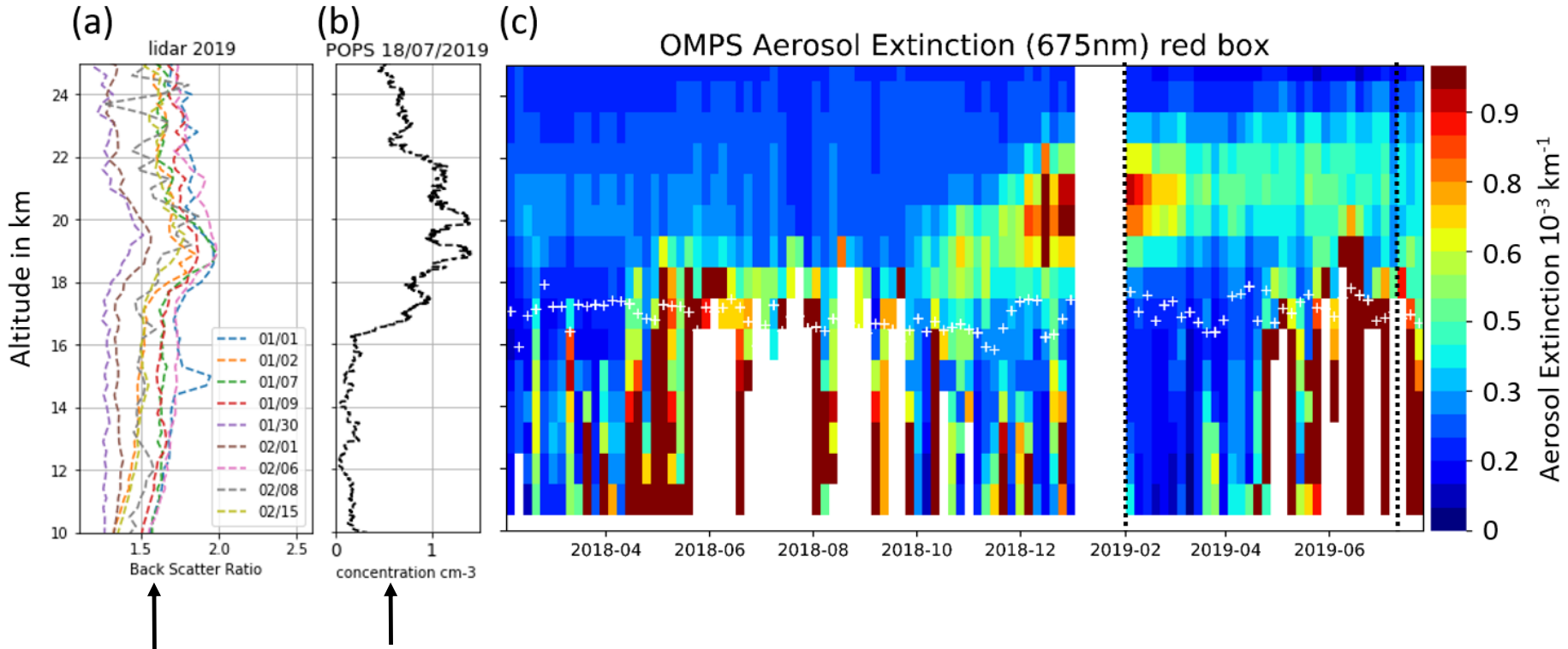
Ambae: Distribution in the lower stratosphere (OMPS)



- The second eruption had a stronger impact on the lower stratosphere
- It was distributed to both hemispheres (within the lower branch of the Brewer-Dobson-Circulation)
- **Red point**: area for comparison with in situ measurements on the next slide

Please see: https://www.essoar.org/doi/10.1002/essoar.10501617.1

Ambae: In situ observations (lidar, POPS, OMPS)



- Enhanced aerosol extinction and concentration observed between 16 and 22 km altitude in mid-July
- One year later: still enhanced aerosols in the lower stratosphere (also within the anticyclone of the Asian monsoon)
  → ATAL masked

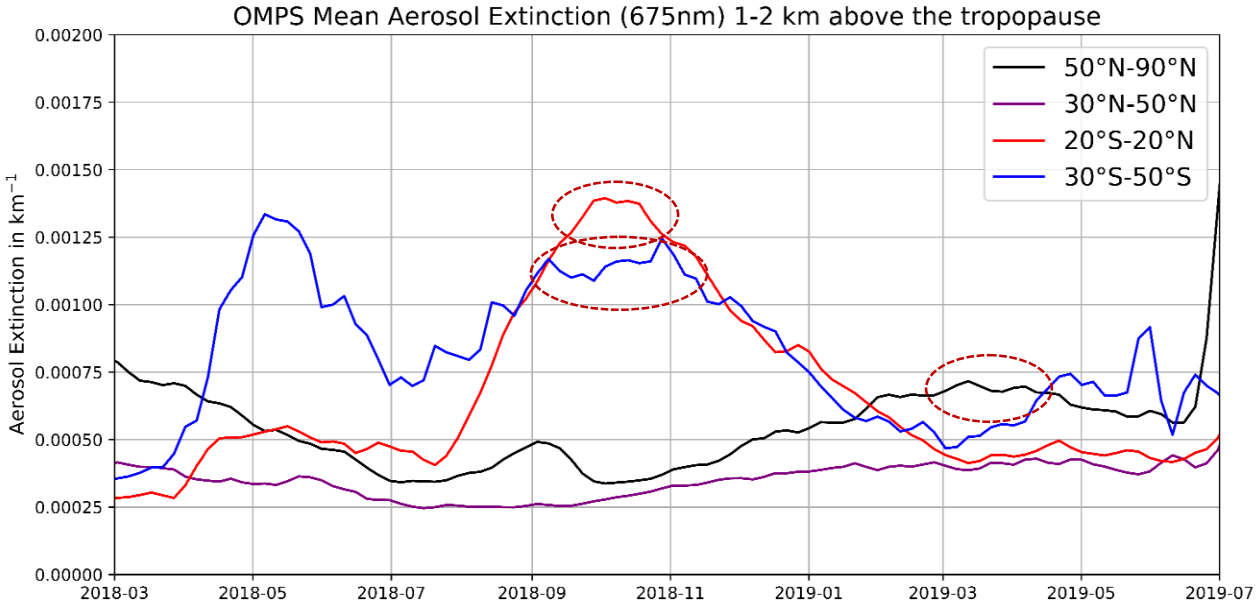
POPS measurements (aerosol concentration, particle sizes 0.15-0.18um) during the BATAL campaign in Jul 2019 in Hyderabad, India

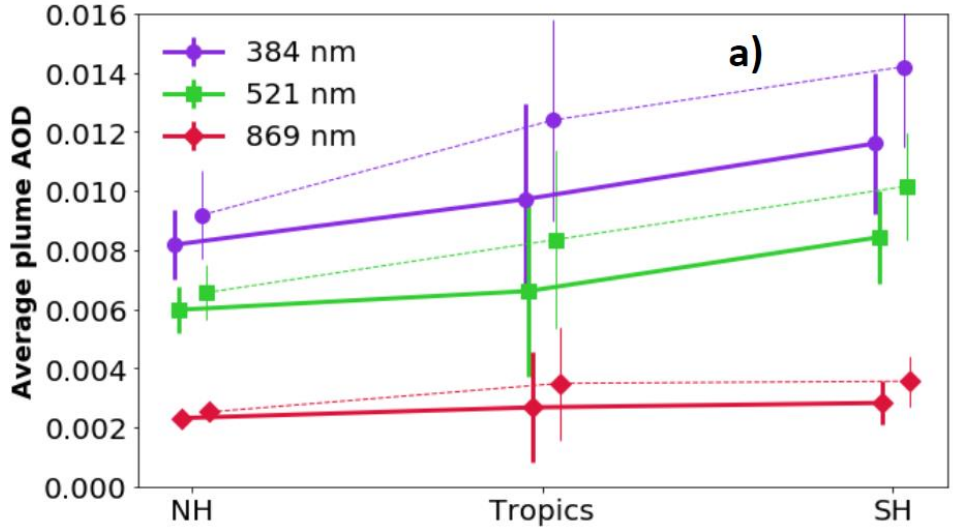
Lidar measurements (Back Scatter Ratio) in Jan/Feb 2019 in Gedanki, India

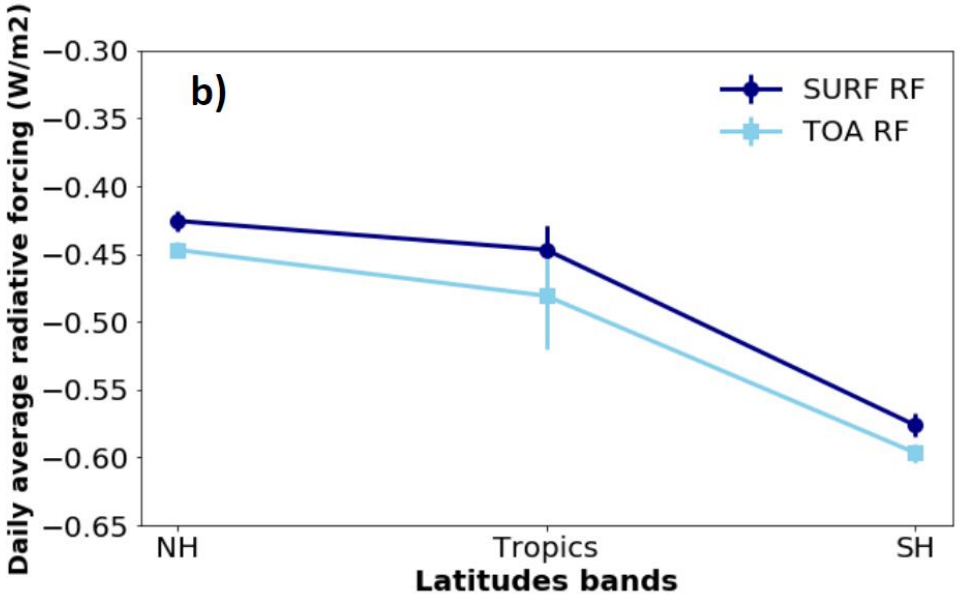
→ In situ observations confirm temporal evolution of the Ambae plume

Please see: https://www.essoar.org/doi/10.1002/essoar.10501617.1

Ambae: Aerosol Optical Depth/ climate impact
(UVSPEC radiative forcing calculations with SAGE III/ISS observations)



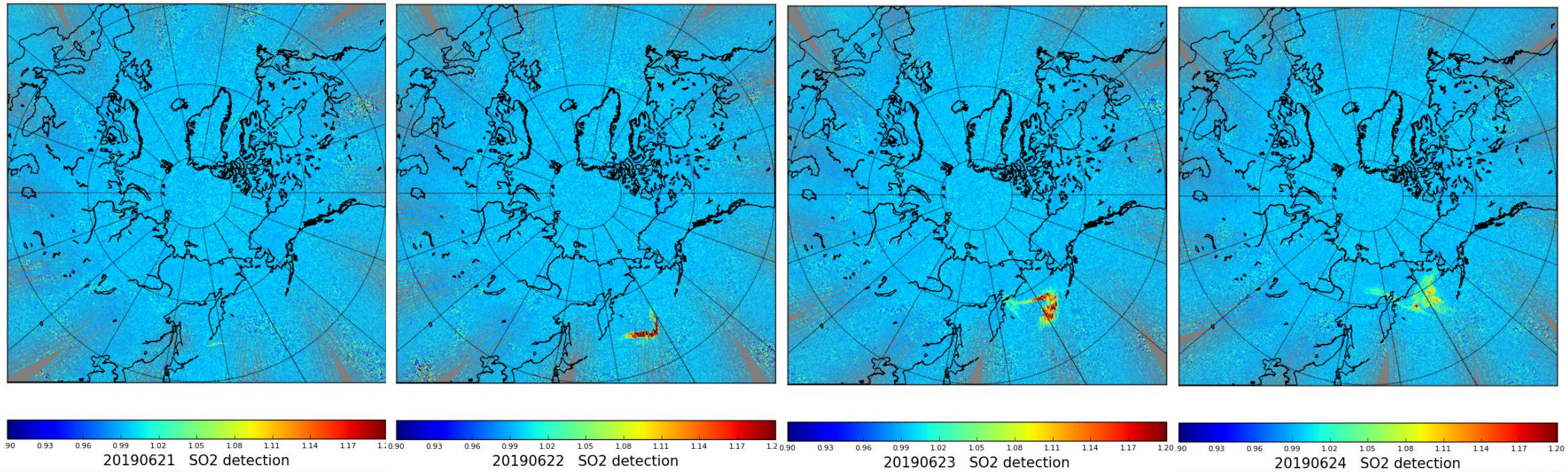


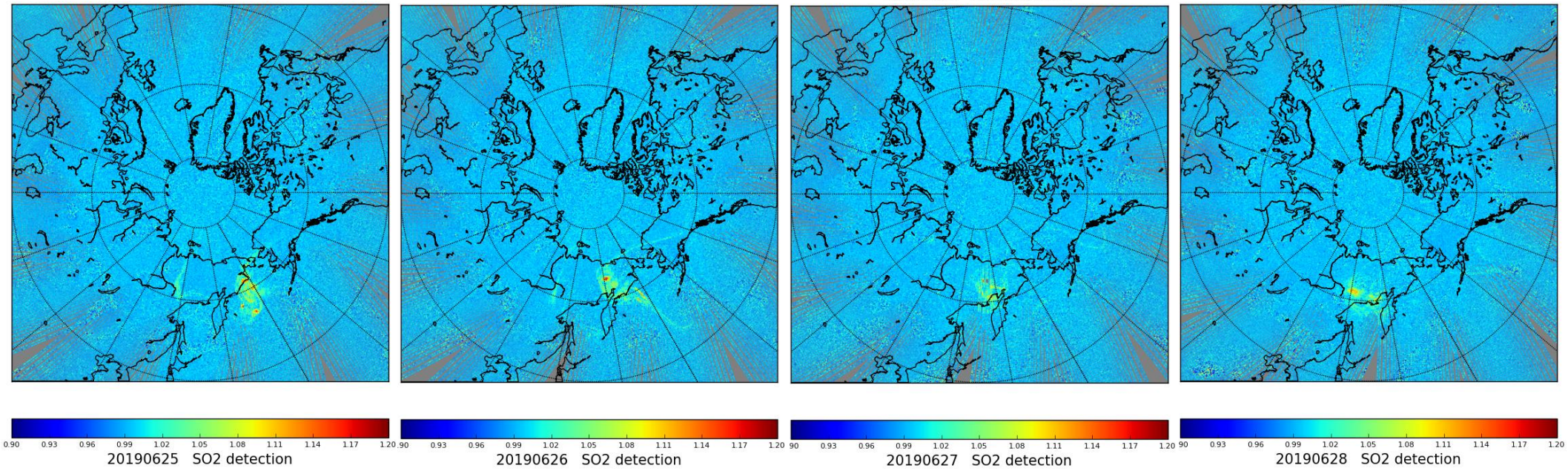


AOD and radiative forcing values calculated with SAGE III/ISS data for time frames chosen from OMPS Aerosol Extinction values in the lower stratosphere (indicated with dashed circles)

Please see: https://www.essoar.org/doi/10.1002/essoar.10501617.1

Early development of the Raikoke SO2 plume: IASI

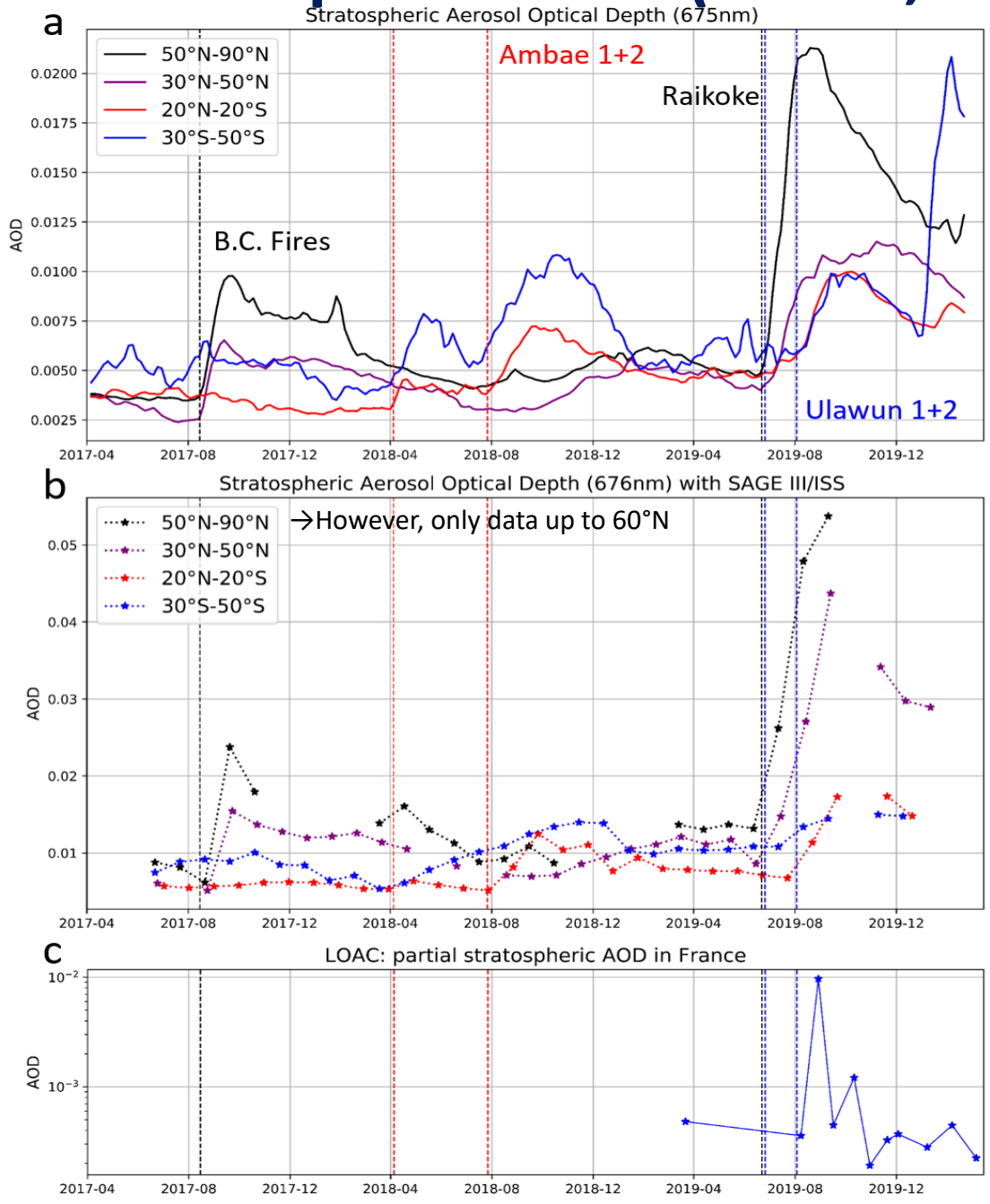




BC Fires, Ambae, Raikoke and Ulawun: stratospheric AOD (OMPS, SAGE III/ISS and LOAC in situ)

So far:

- OMPS and SAGE III/ISS show a very similar AOD evolution (all 4 events show a visible increase in sAOD).
- Highest sAOD following the Raikoke eruption (June 2019), with an increase by a factor of ~3.
- SAGE III/ISS sAOD values are around double as high as OMPS values (missing values above the tropopause).
- LOAC balloon-borne measurements (in France) show increased sAOD values following the Raikoke eruption.



Study is in progress… This is what we are working on:

- Overall global, stratospheric distribution of the Raikoke and Ulawun plumes.
- Comparison of the observational results with a Raikoke/ Ulawun simulation with WACCM
- An additional study of the ‘rough’ transport of the Raikoke and Ulawun plumes with a passive tracer (CLaMS)
- Radiative forcing calculations (as done for the Ambae eruption)

I’m happy to answer your questions.

You can also contact me via email: corinna.kloss@cnrs-orleans.fr
For detailed questions on the radiative forcing calculations, you can contact Pasquale.Sellitto@lisa.u-pec.fr