

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

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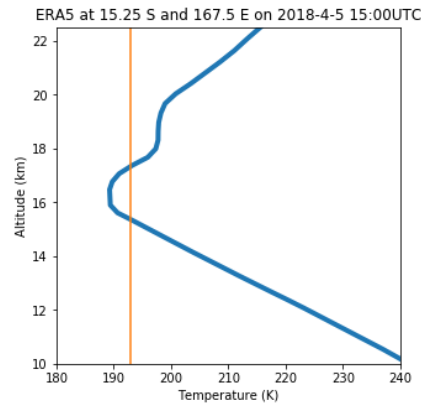
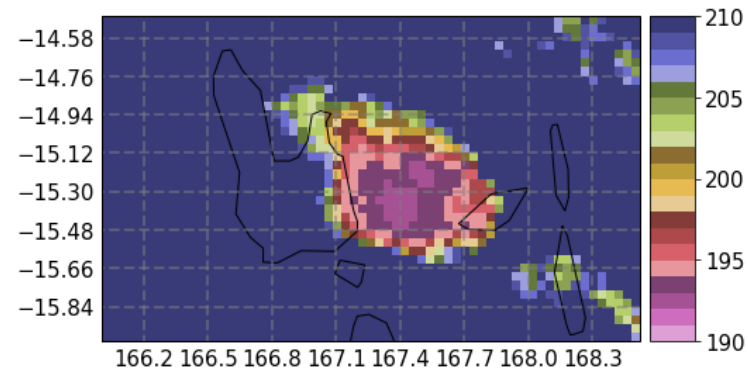
1: CNRS, LPC2E, Orléans, France; 2: LISA, CNRS, Paris, France; 3: LMD, CNRS, Paris, France; 4: SSA, Hampton, USA; 5: NASA, Hampton, USA; 6: NARL, Gedanki, India; 7: TIFR, Hyderabad, India



Ambae: Injection altitude estimation (HIMAWARI, ERA5)

5th of April 2018

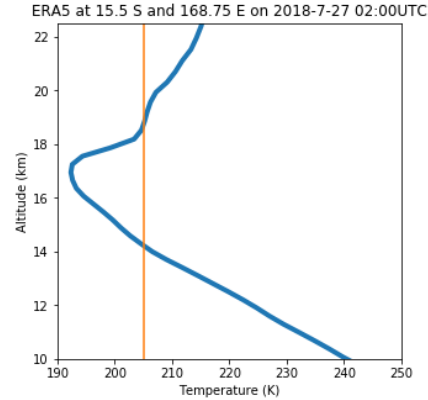
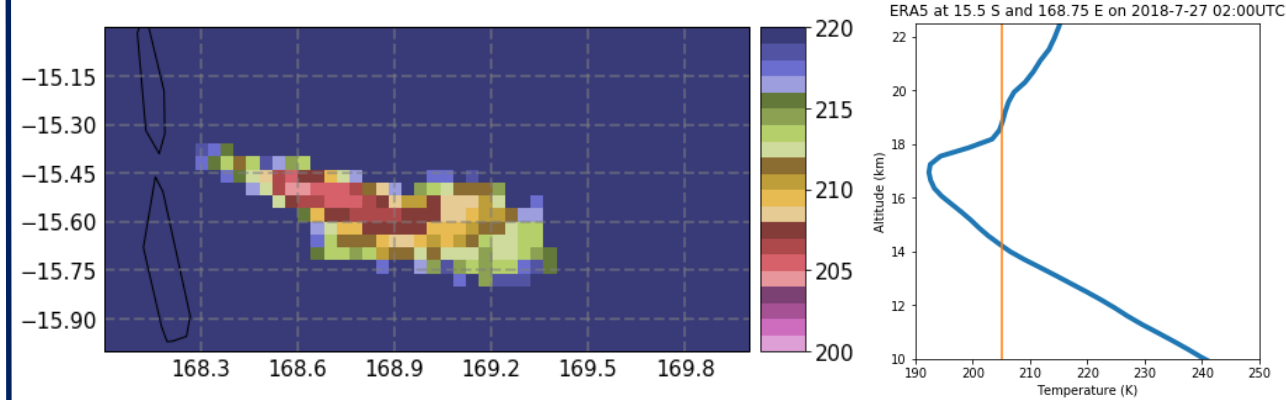
Himawari Brightness Temperature Apr 5th 2018 at 15:00 UTC



- Estimated injection altitude at 17 km as the lower bound

27th of July 2018

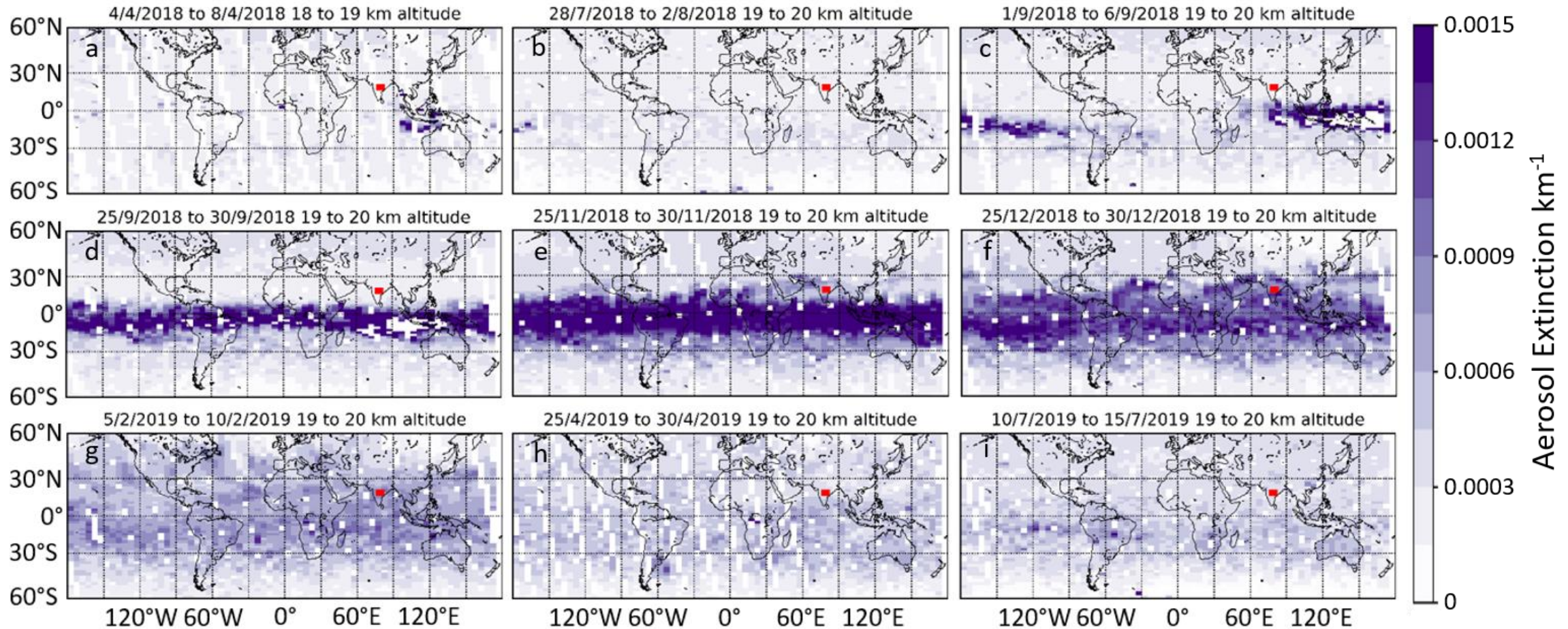
Himawari Brightness Temperature Jul 27th 2018 at 02:00



- Injection altitude at 14 or 18 km

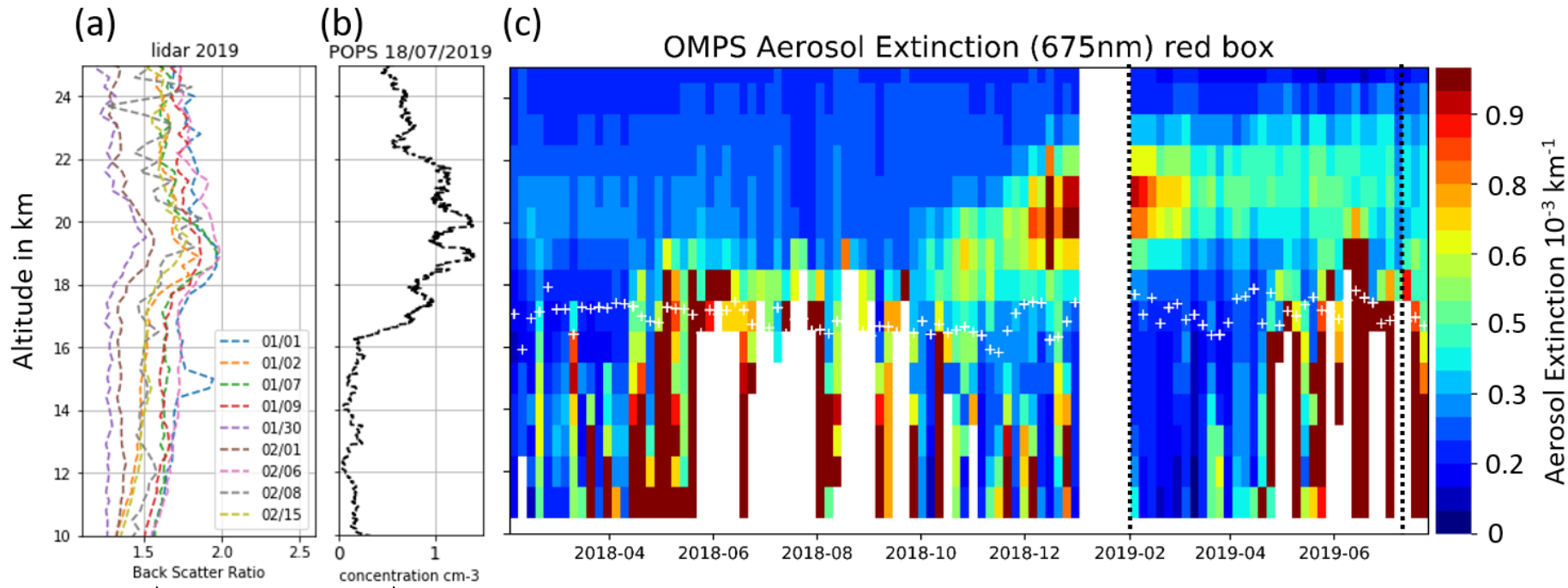
Ambae: Distribution in the lower stratosphere (OMPS)

OMPS Aerosol Extinction (675 nm)



- 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

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



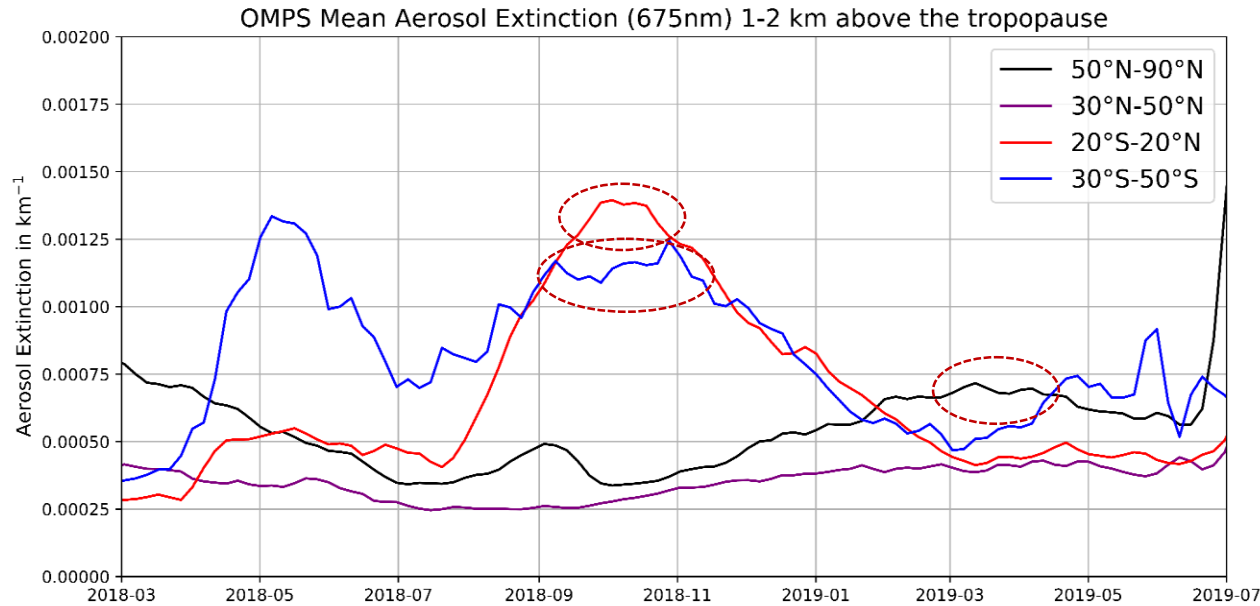
- Enhanced aerosol extinction and concentration observed between 16 and 22 km altitude in mid-July
- One year later: still enhanced aerosols in the lower stratosphere (also within the anticyclone of the Asian monsoon)
→ ATAL masked

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

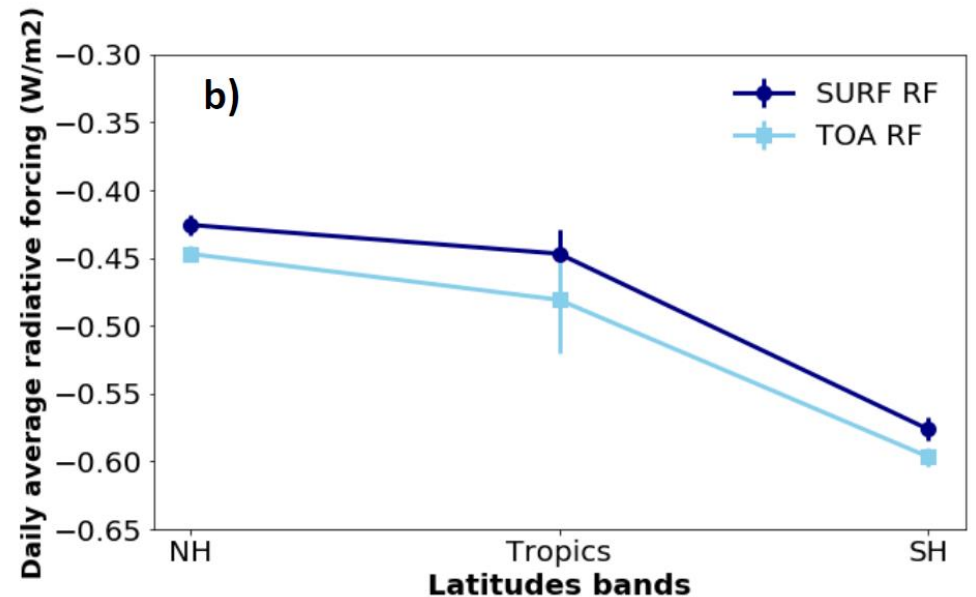
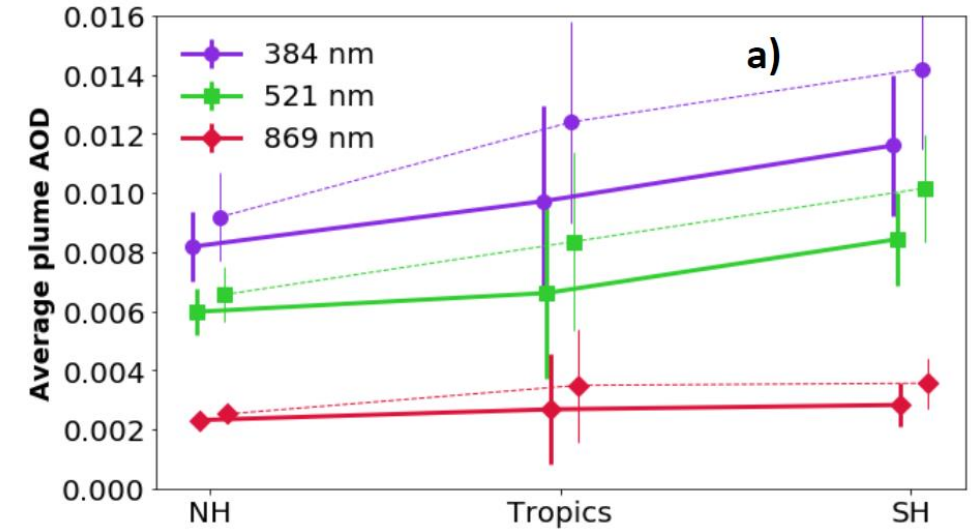
Lidar measurements (Back Scatter Ratio) in Jan/Feb 2019 in Gedanki, India

→ In situ observations confirm temporal evolution of the Ambae plume

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

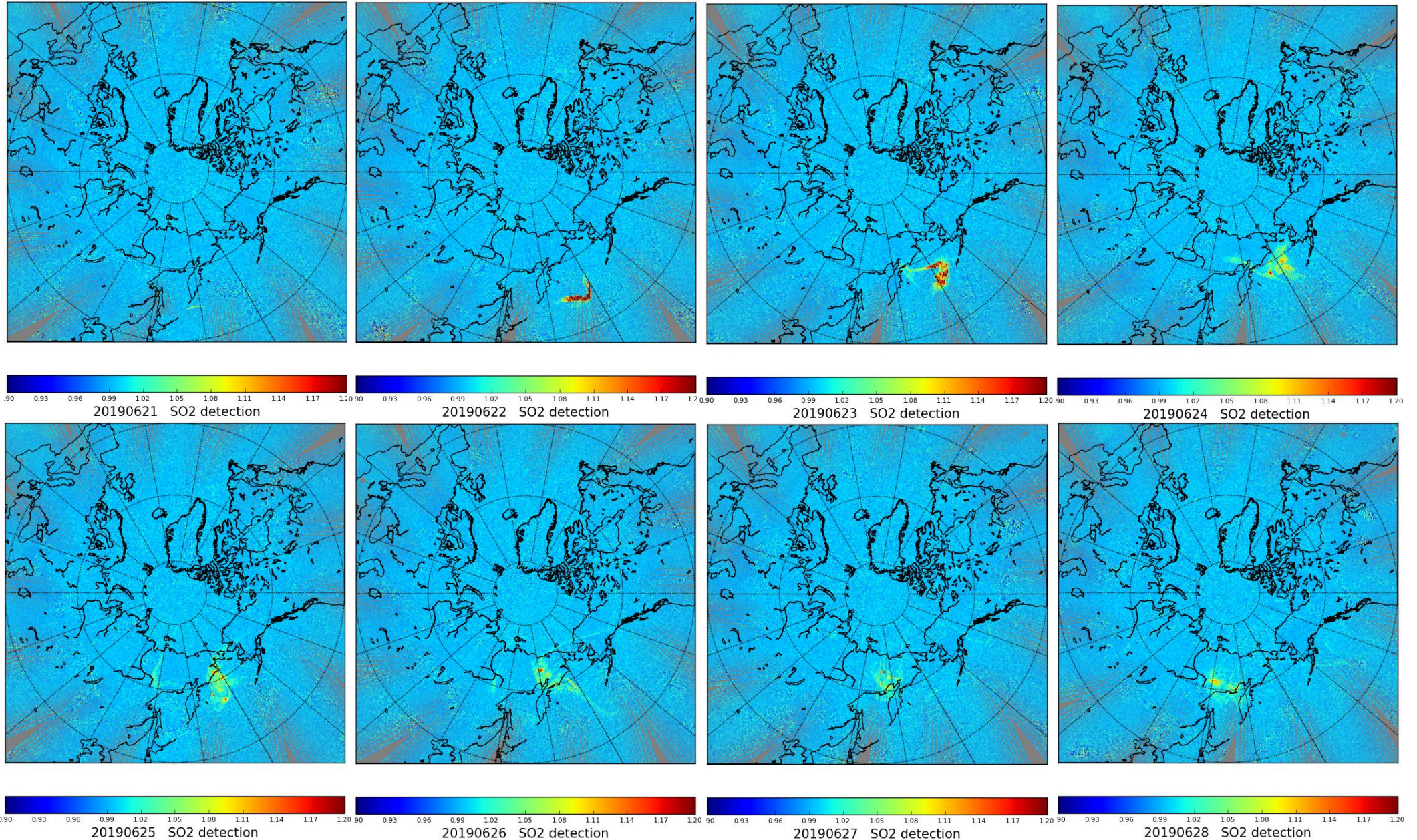


AOD and radiative forcing values calculated with SAGE III/ISS data for time frames chosen from OMPS Aerosol Extinction values in the lower stratosphere (indicated with dashed circles)



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

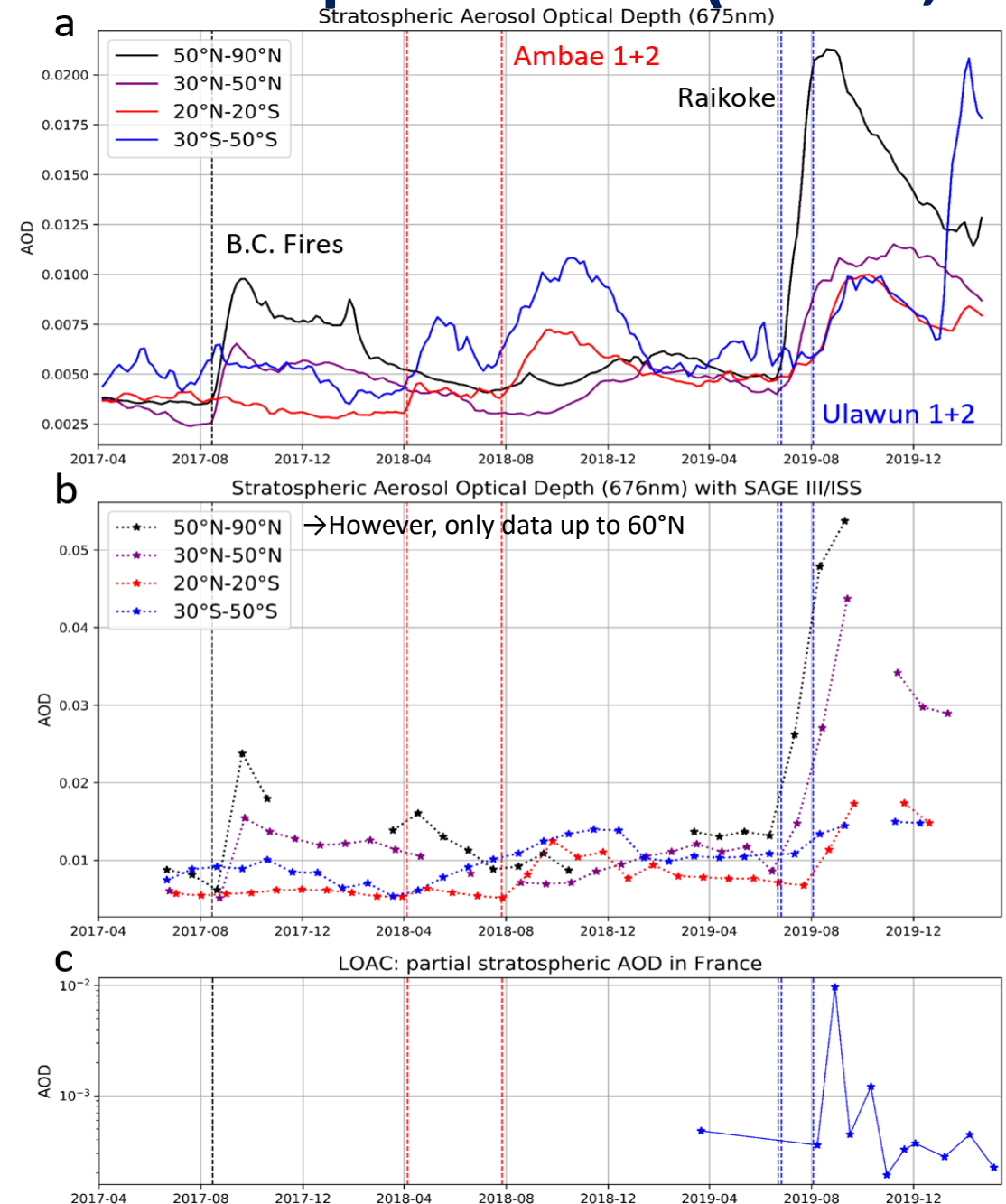
Early development of the Raikoke SO2 plume: IASI



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