

# Record growth of stratospheric aerosols from 2019 Raikoke eruption with sulfate-coating of submicronic ash

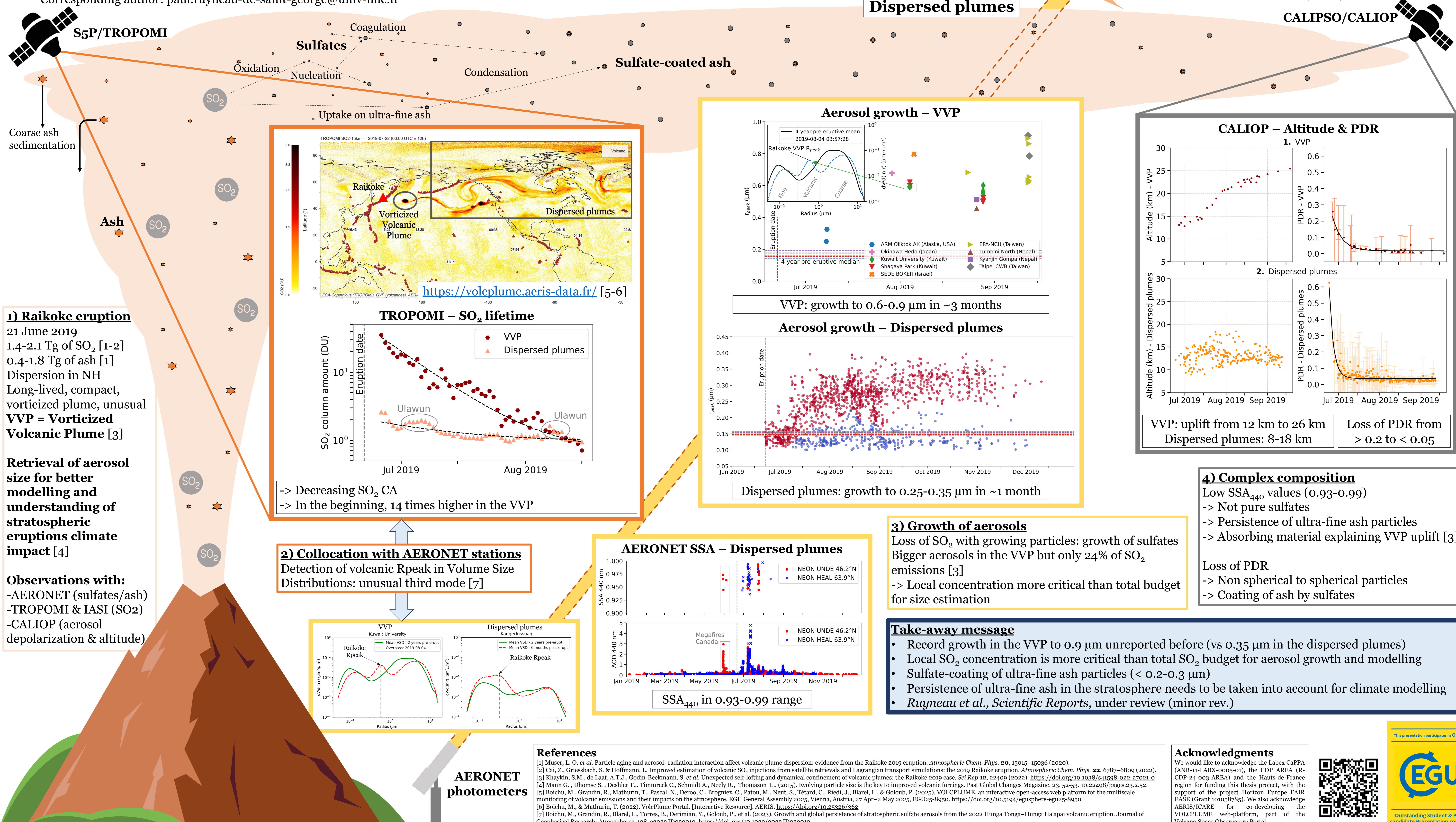
Paul Ruyneau de Saint-George<sup>1\*</sup>, Marie Boichu<sup>1</sup>, Joris Bonnat<sup>1</sup>, Raphaël Grandin<sup>2</sup>, Philippe Goloub<sup>1</sup>, Théo Mathurin<sup>3</sup>, Nicolas Pascal<sup>3</sup>

1 – Univ. Lille, CNRS, UMR 8518 – LOA – Laboratoire d'Optique Atmosphérique, F-59000 Lille, France

2 – Université Paris Cité, Institut de Physique du Globe de Paris, CNRS, F-75005 Paris, France

3 – AERIS/ICARE Data and Services Centre, CNRS, CNES UMS 2877, Univ. Lille, France

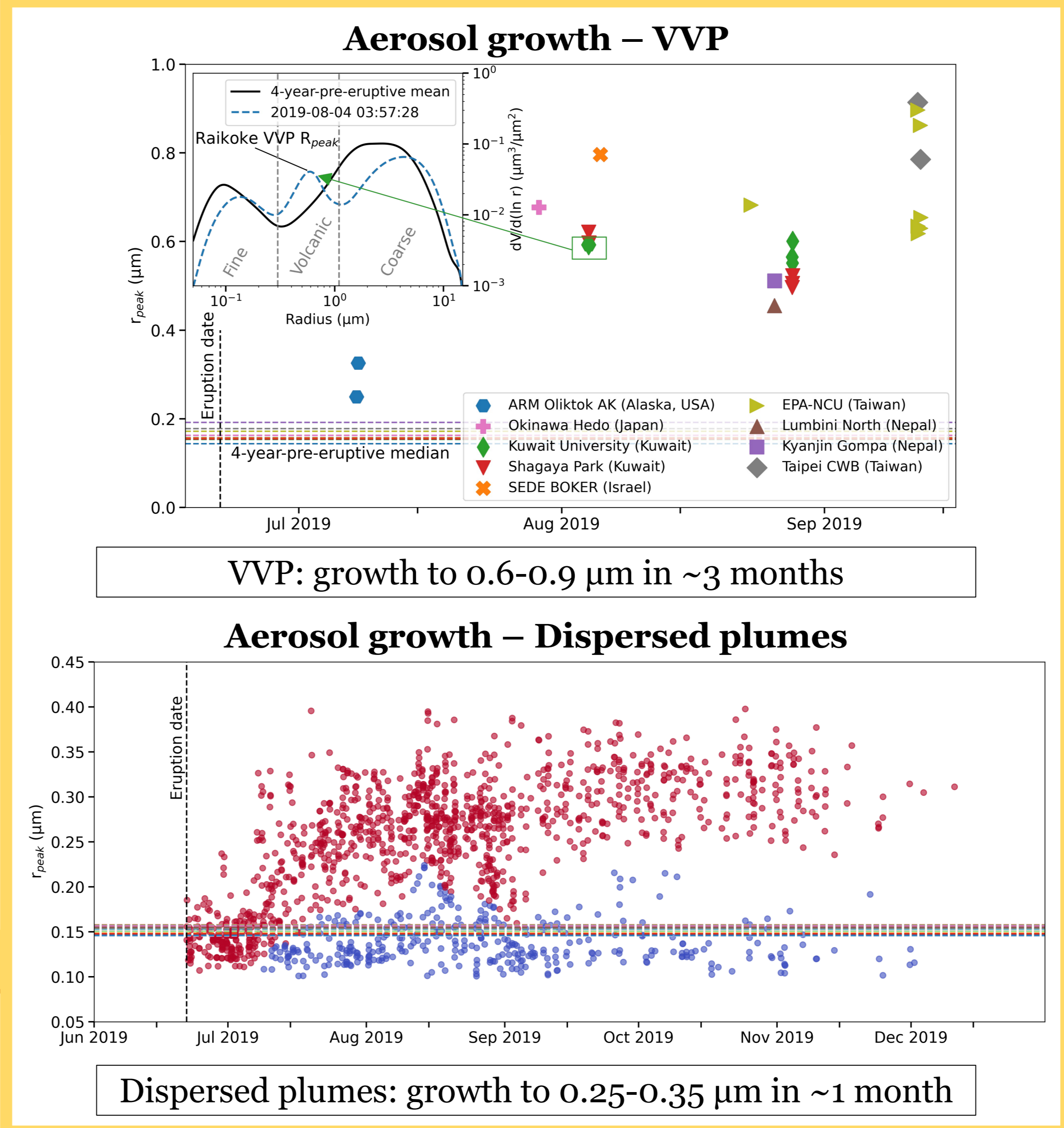
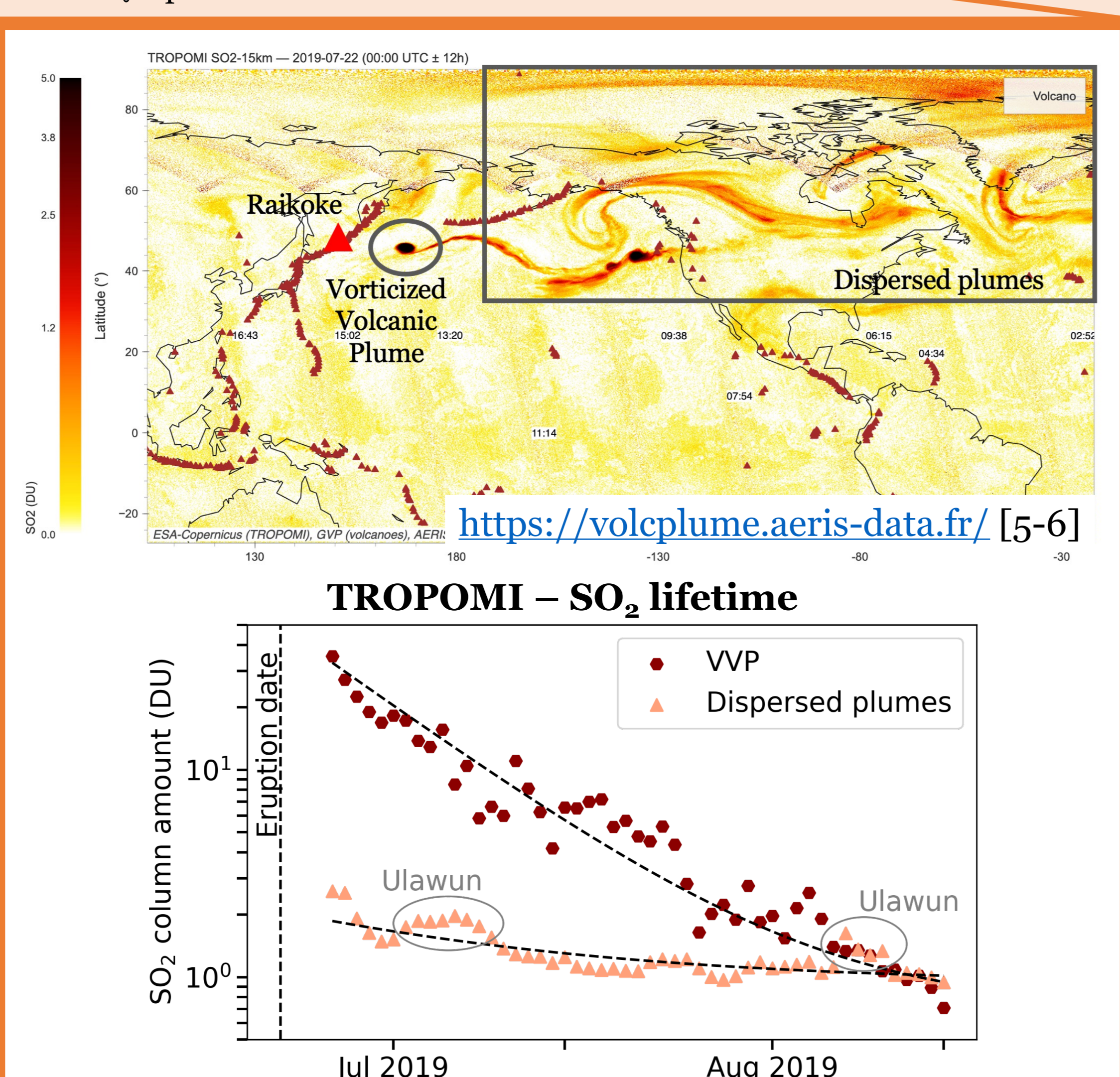
\*Corresponding author: paul.ruyneau-de-saint-george@univ-lille.fr



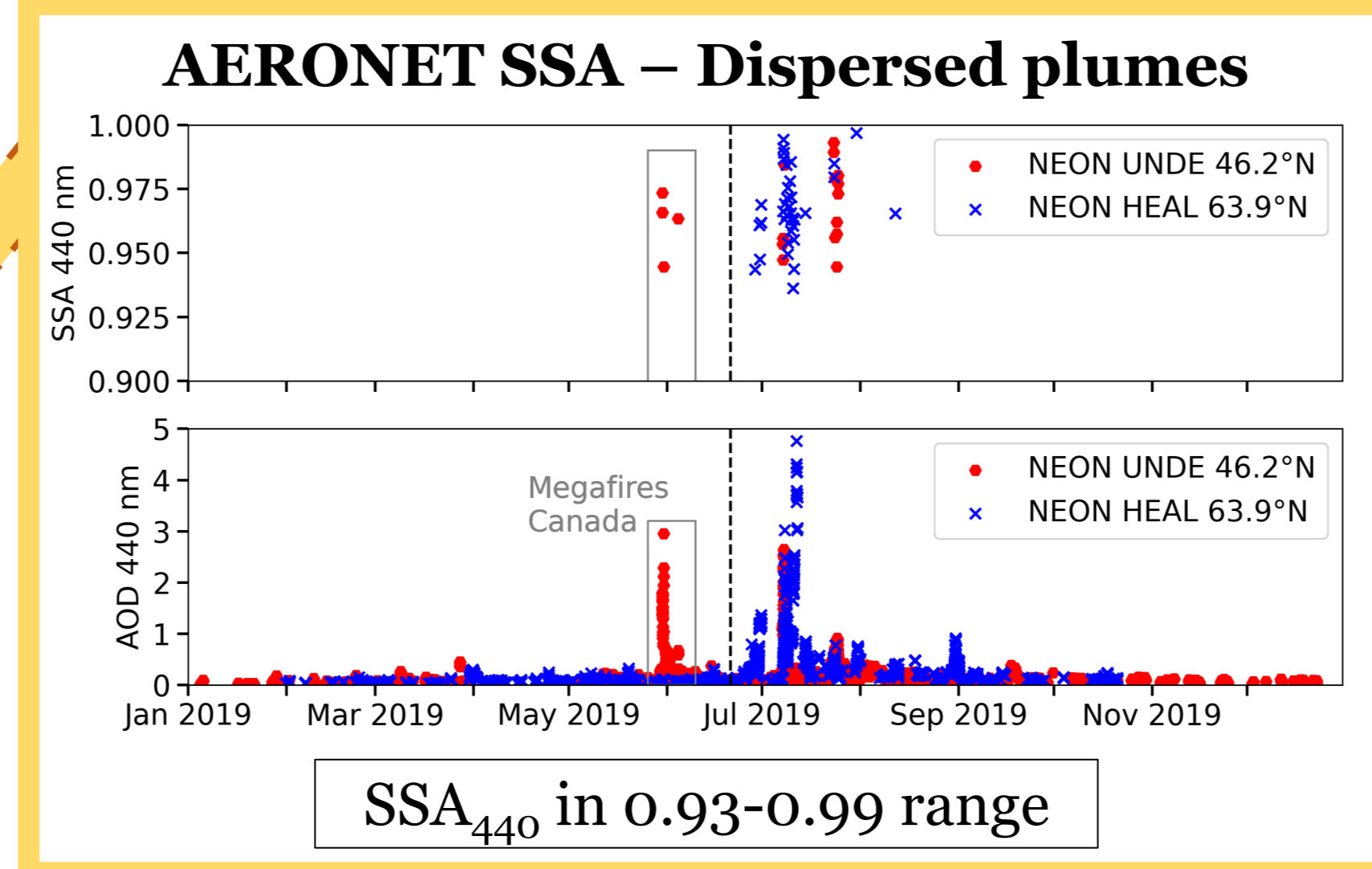
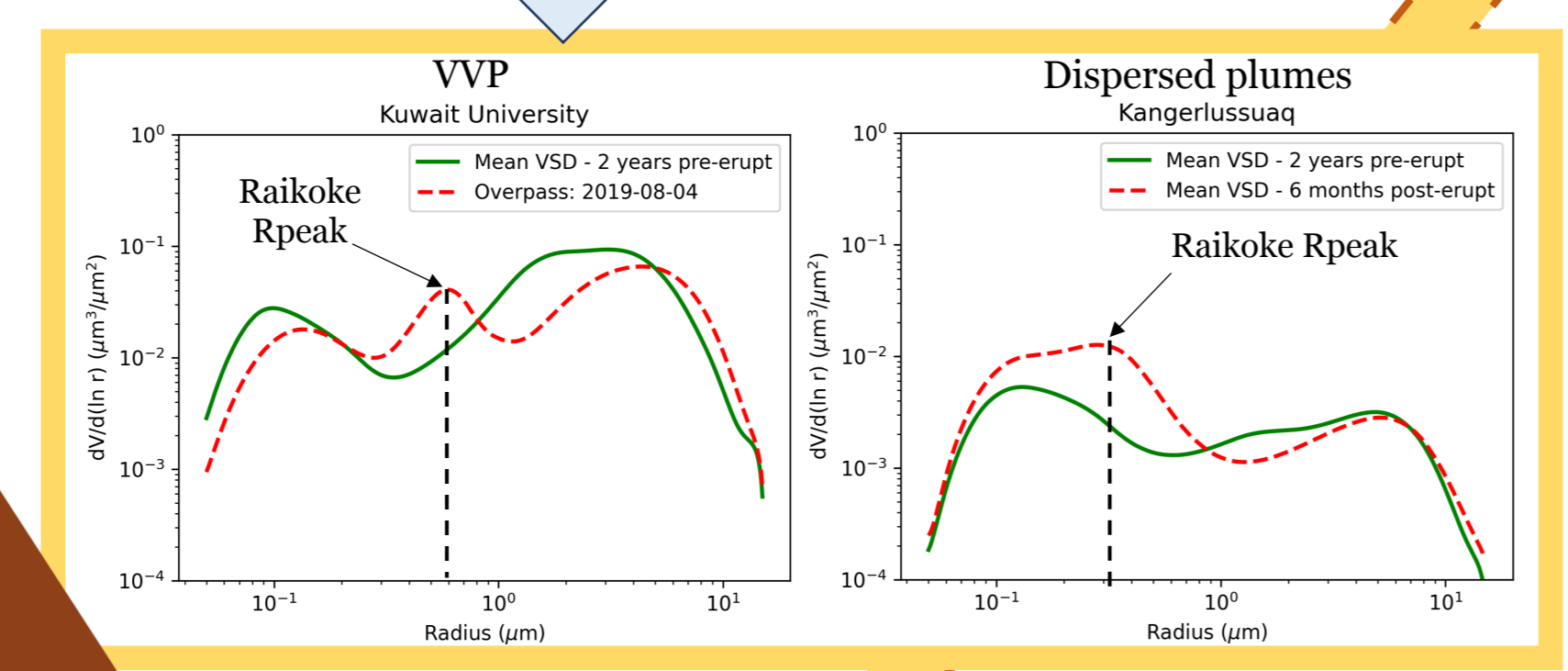
**1) Raikoke eruption**  
 21 June 2019  
 1.4-2.1 Tg of SO<sub>2</sub> [1-2]  
 0.4-1.8 Tg of ash [1]  
 Dispersion in NH  
 Long-lived, compact, vortimized plume, unusual VVP = Vortimized Volcanic Plume [3]

**Retrieval of aerosol size for better modelling and understanding of stratospheric eruptions climate impact [4]**

**Observations with:**  
 -AERONET (sulfates/ash)  
 -TROPOMI & IASI (SO<sub>2</sub>)  
 -CALIOP (aerosol depolarization & altitude)



**2) Collocation with AERONET stations**  
 Detection of volcanic Rpeak in Volume Size Distributions: unusual third mode [7]



**3) Growth of aerosols**  
 Loss of SO<sub>2</sub> with growing particles: growth of sulfates Bigger aerosols in the VVP but only 24% of SO<sub>2</sub> emissions [3]  
 → Local concentration more critical than total budget for size estimation

**4) Complex composition**  
 Low SSA<sub>440</sub> values (0.93-0.99)  
 → Not pure sulfates  
 → Persistence of ultra-fine ash particles  
 → Absorbing material explaining VVP uplift [3]  
 Loss of PDR  
 → Non spherical to spherical particles  
 → Coating of ash by sulfates

**Take-away message**

- Record growth in the VVP to 0.9 μm unreported before (vs 0.35 μm in the dispersed plumes)
- Local SO<sub>2</sub> concentration is more critical than total SO<sub>2</sub> budget for aerosol growth and modelling
- Sulfate-coating of ultra-fine ash particles (< 0.2-0.3 μm)
- Persistence of ultra-fine ash in the stratosphere needs to be taken into account for climate modelling
- Ruyneau et al., *Scientific Reports*, under review (minor rev.)

**References**

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