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Celebrating 5 years of LAP/AUTH involvement in S5P/TROPOMI studies

**MariLiza Koukouli, for the LAP/Auth team;
Katerina Garane, Dimitris Karagkiozidis,
Konstantinos Michailidis, Marios Mermigkas,
Andreas Psefrogkas, Ioanna Skoulidou,
Kelly Voudouri, Dimitris Balis,
and many more!**

LAP/AUTH Ground-Based Monitoring



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- **Single Brewer** spectrophotometer (#005, 1982-)
- **Double Brewer** spectrophotometer (#086, 1993-)
- **UV Radiometers** and **Pyranometers** (1991, 1993 & 1998-)
- **Aerosol Lidar** (2000-)
- **CIMEL** sunphotometer (2003-)
- **NILU-UV** network (2004-)
- **MAX-DOAS** spectrophotometers (2011-)
- **Pyrheliometer** (2017-)
- **FTIR** (2019 -)
- **Sky Camera** (2018-)



Using S5P in monitoring the ozone layer



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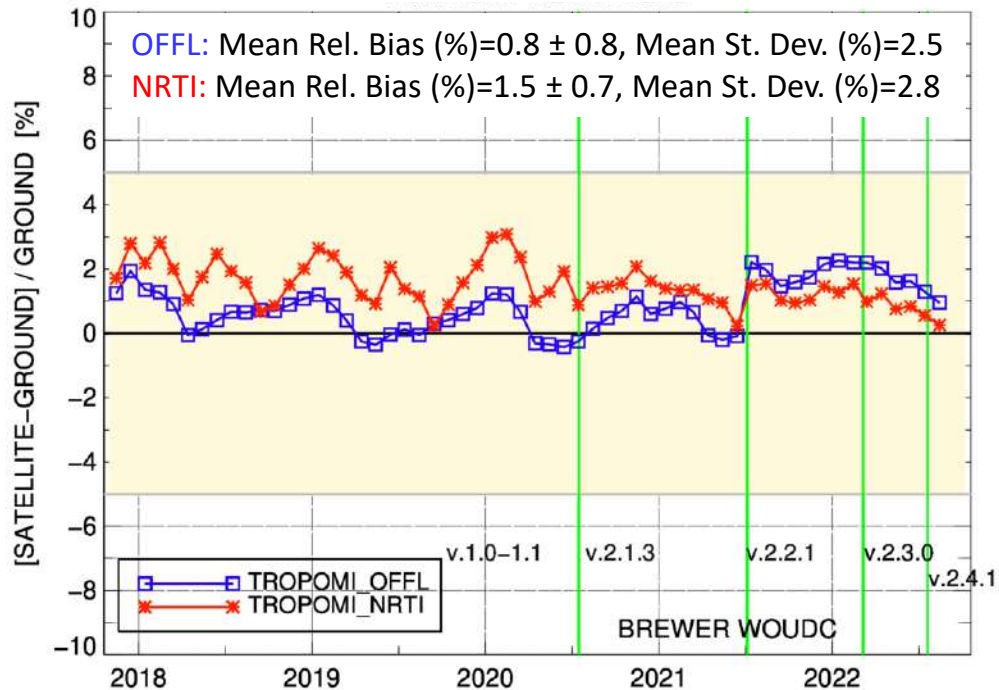


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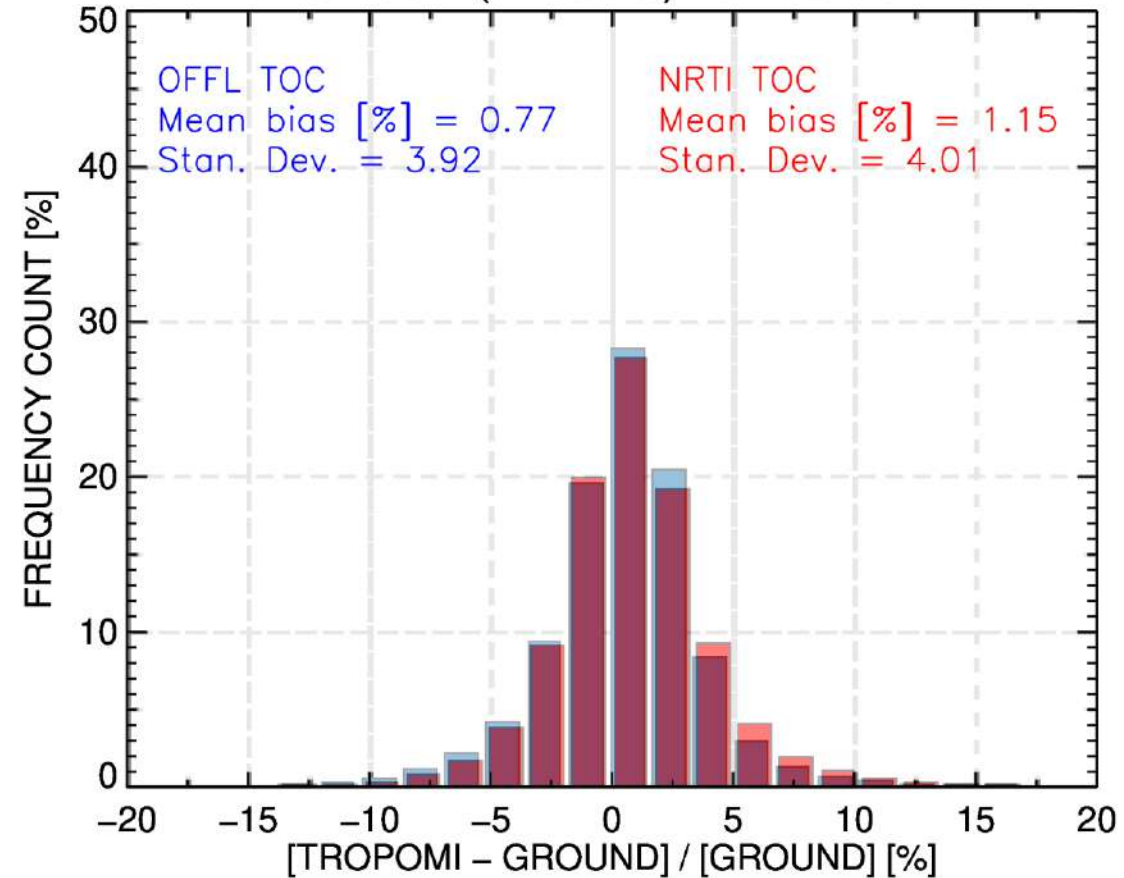
Garane, K., et al., TROPOMI/S5P total ozone column data: global ground-based validation and consistency with other satellite missions, *Atmos. Meas. Tech.*, 2019.

Northern Hemisphere



Both Hemispheres

DOBSON (WOUDC) vs TROPOMI



14:30-14:45 Talk by Katerina Garane | Geophysical validation of Total Ozone retrievals from TROPOMI/S5P against ground-based observations and consistency to other satellite sensors

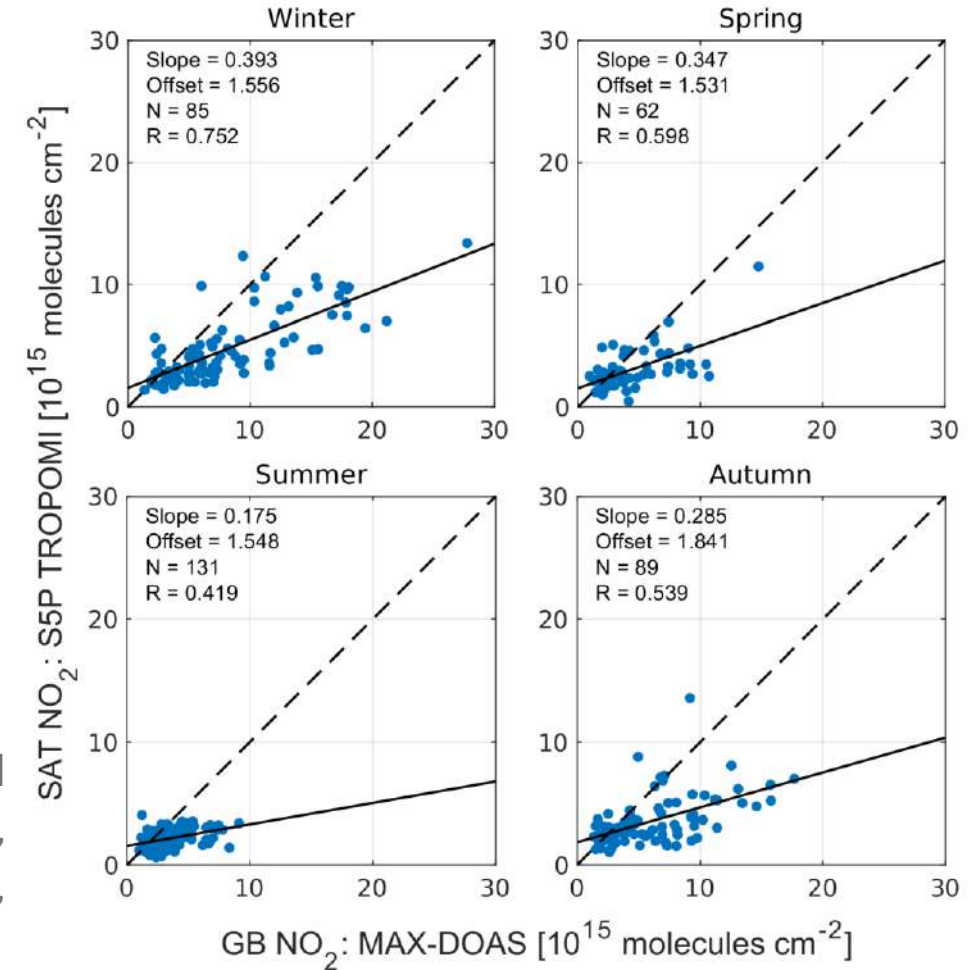
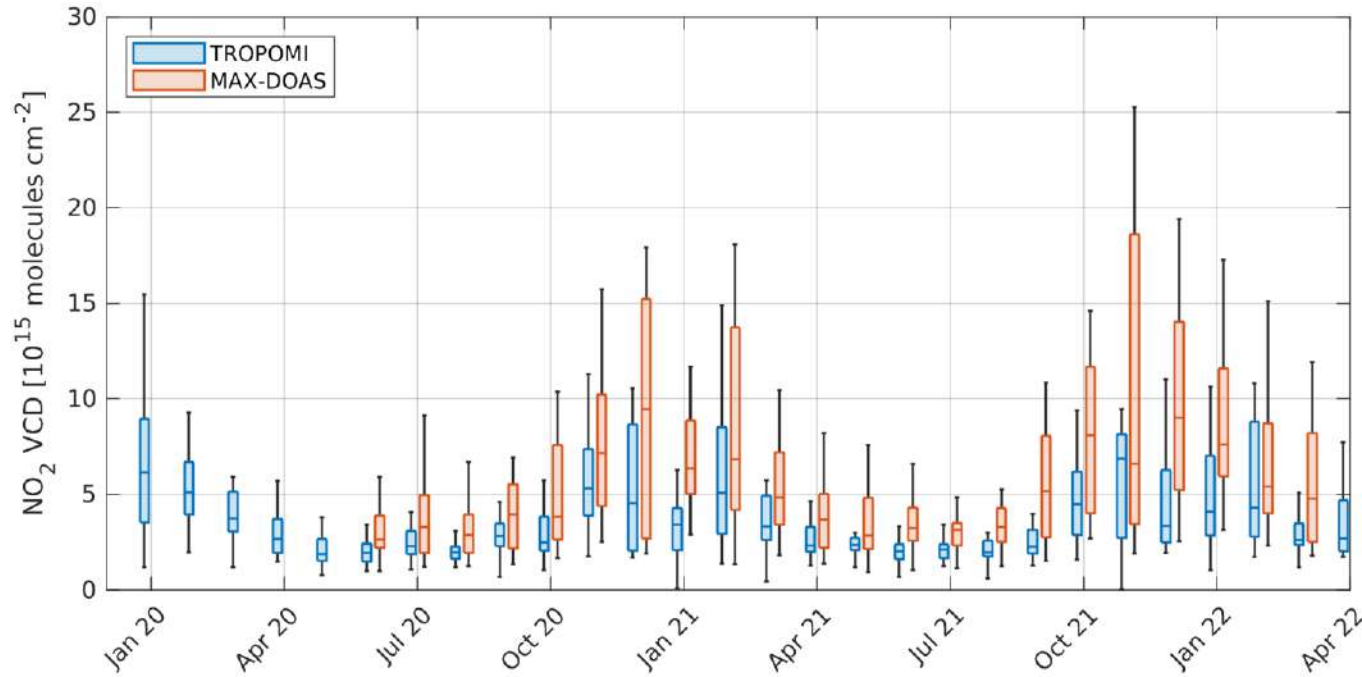
Using S5P in identifying local pollution levels | tropospheric NO₂



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Karagkiozidis, D., et al., Retrieval of tropospheric aerosol, NO₂, and HCHO vertical profiles from MAX-DOAS observations over Thessaloniki, Greece: intercomparison and validation of two inversion algorithms, *Atmos. Meas. Tech.*, 2022.

Poster by **Dimitris Karagkiozidis** | Validation of the TROPOMI/S5P NO₂ and HCHO columns using ground-based MAX-DOAS measurements over Thessaloniki, Greece

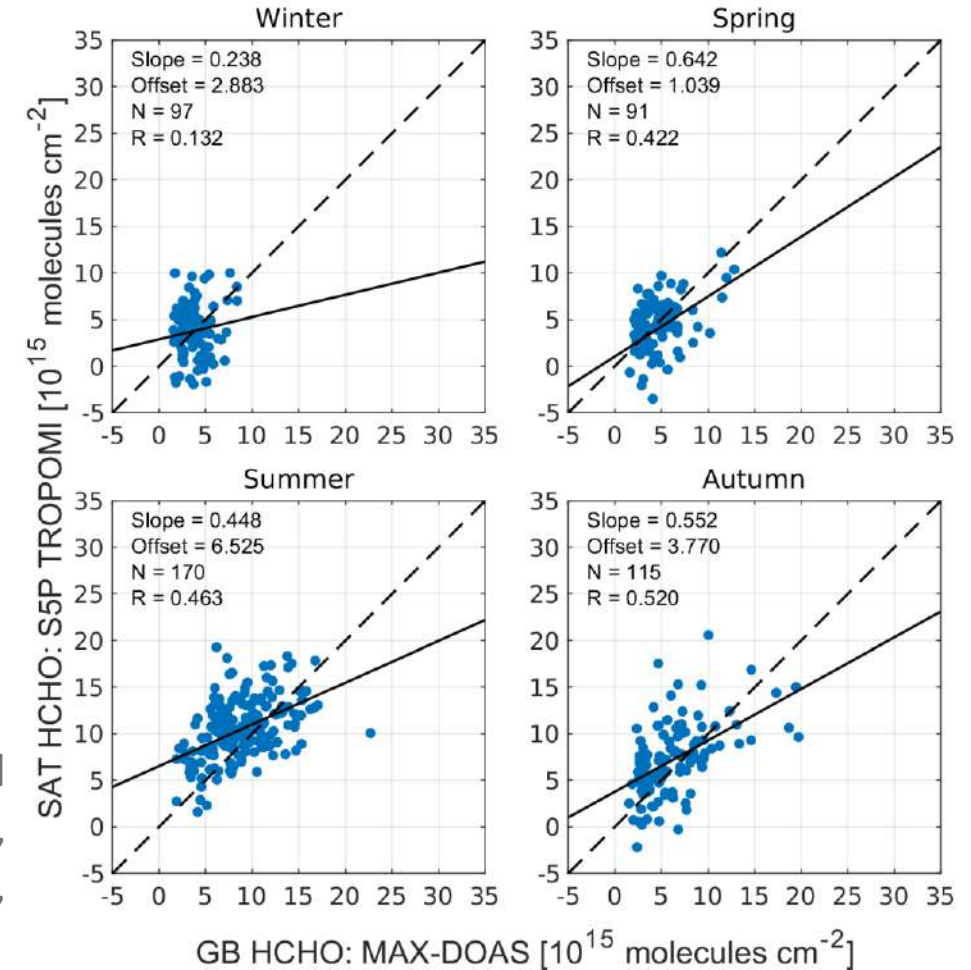
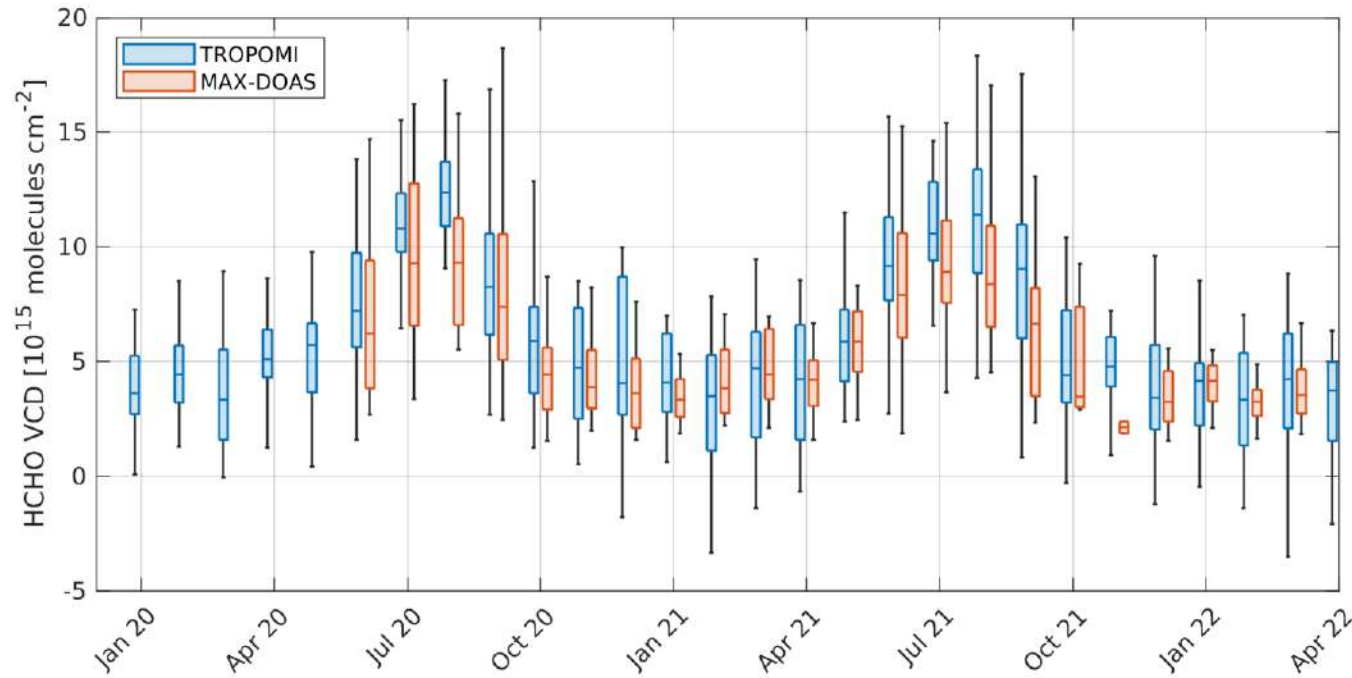
Using S5P in identifying regional pollution levels | HCHO



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Karagkiozidis, D., et al., Retrieval of tropospheric aerosol, NO₂, and HCHO vertical profiles from MAX-DOAS observations over Thessaloniki, Greece: intercomparison and validation of two inversion algorithms, *Atmos. Meas. Tech.*, 2022.

Poster by **Dimitris Karagkiozidis** | Validation of the TROPOMI/S5P NO₂ and HCHO columns using ground-based MAX-DOAS measurements over Thessaloniki, Greece

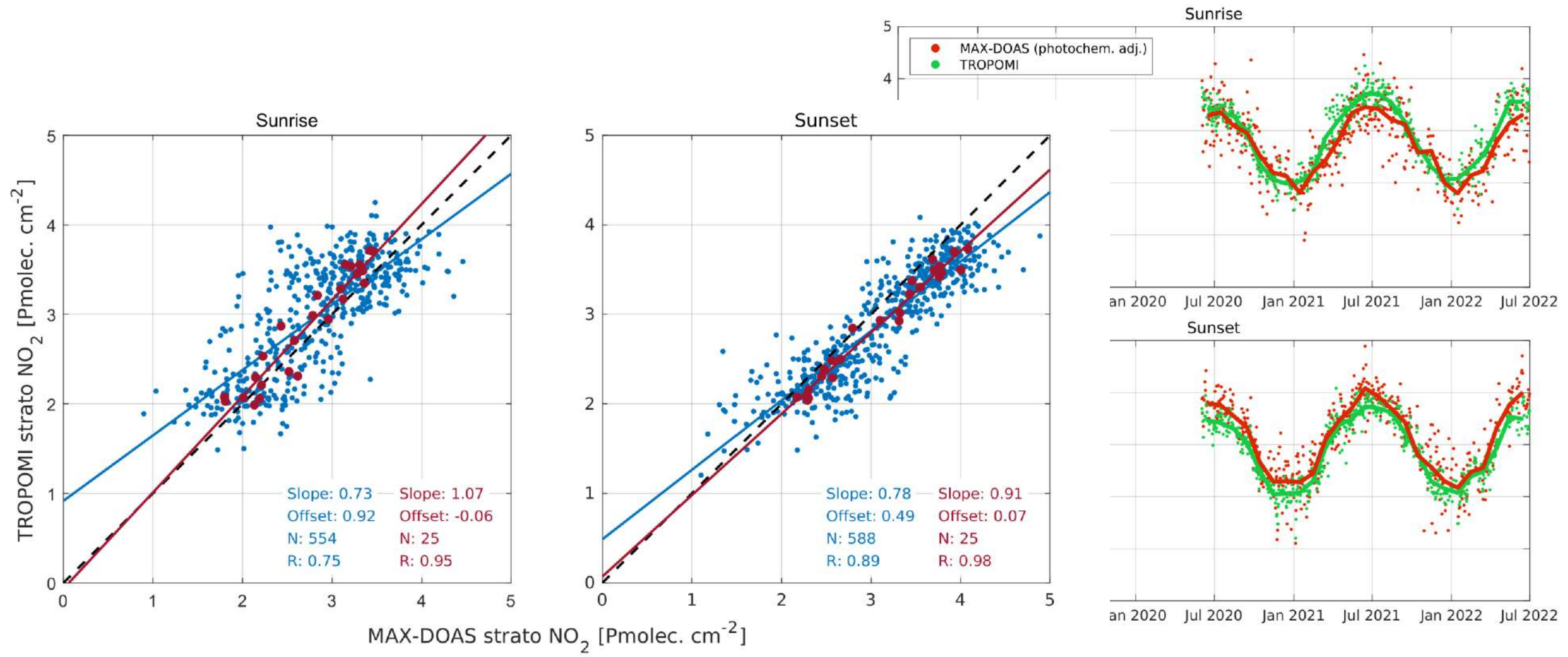
Using S5P to assess stratospheric NO₂ levels



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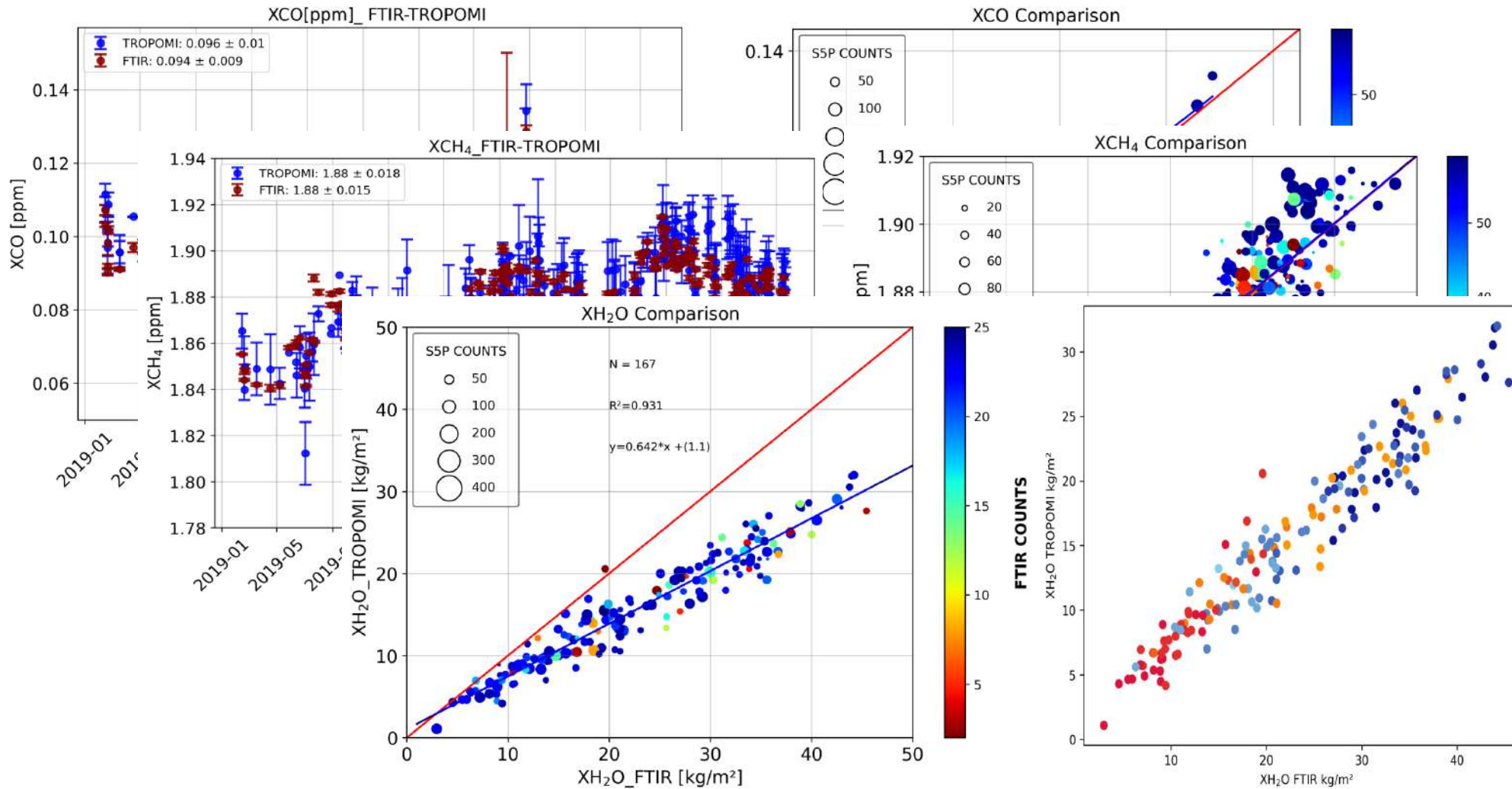
Using S5P in identifying GHG levels | xCH₄, xCO & xH₂O



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Mermigkas, M.,
et al., FTIR
Measurements of
Greenhouse
Gases over
Thessaloniki,
Greece in the
Framework of
COCCON and
Comparison with
S5P/TROPOMI
Observations,
Remote Sensing,
2021.

Poster by **Marios Mermigkas** | S5P/TROPOMI CH₄ and CO total column average mixing ratio validation over Thessaloniki, Greece using FTIR spectrophotometry

Using S5P to assess global total water content



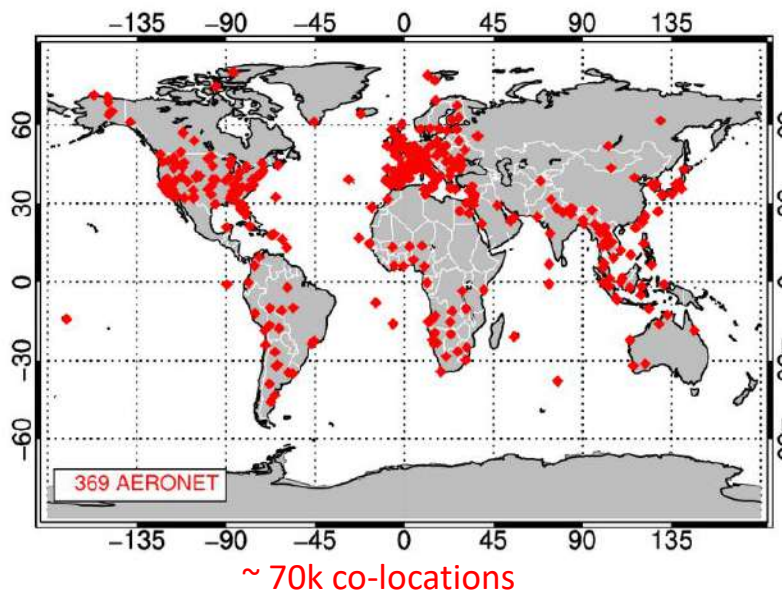
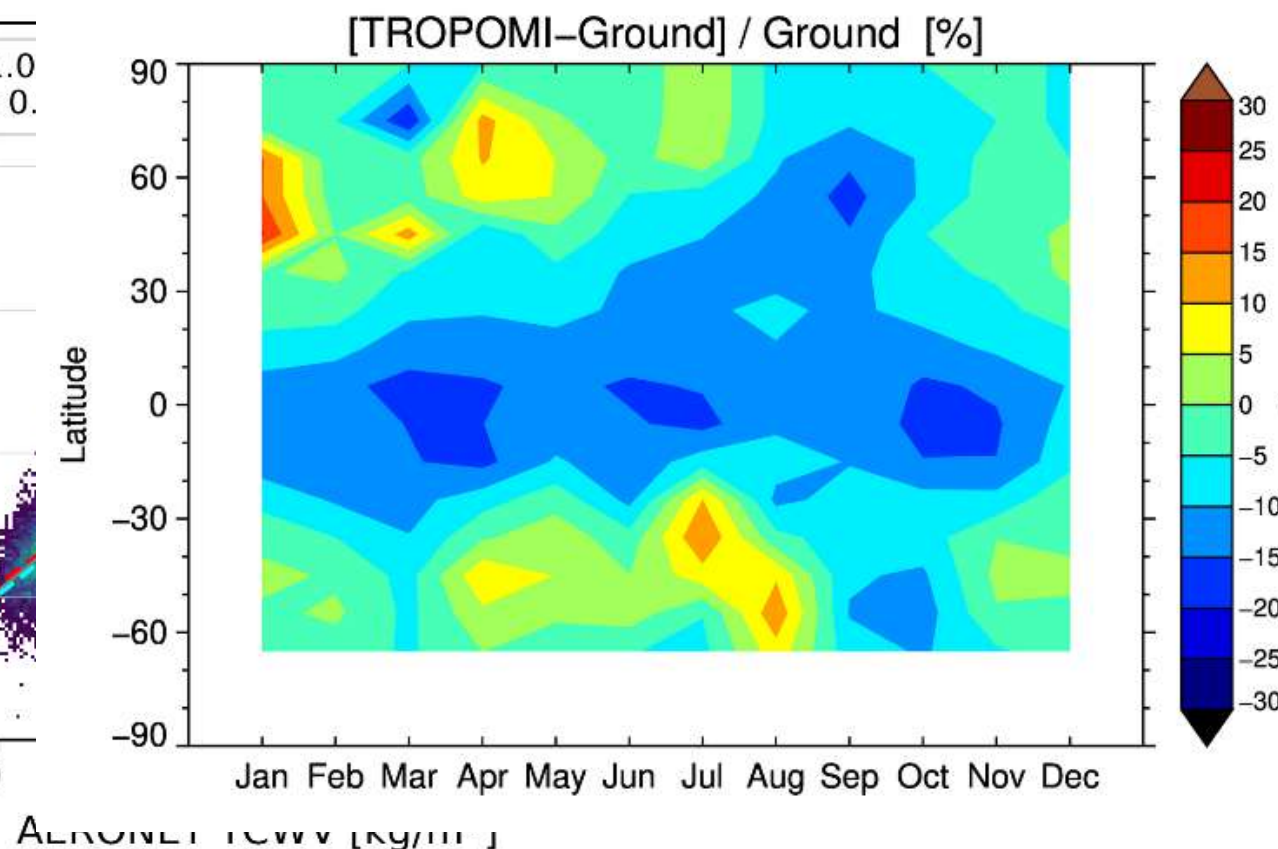
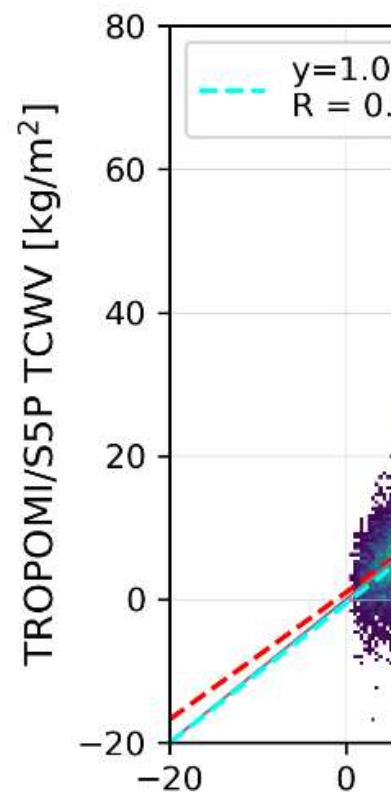
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Garane, K., et al., TROPOMI/S5P Total Column Water Vapor Validation against AERONET ground-based measurements, *Atmos. Meas. Tech. Discuss*, 2022.



Using S5P NO₂ to validate a CTM over Greece and update power plant NO_x emissions



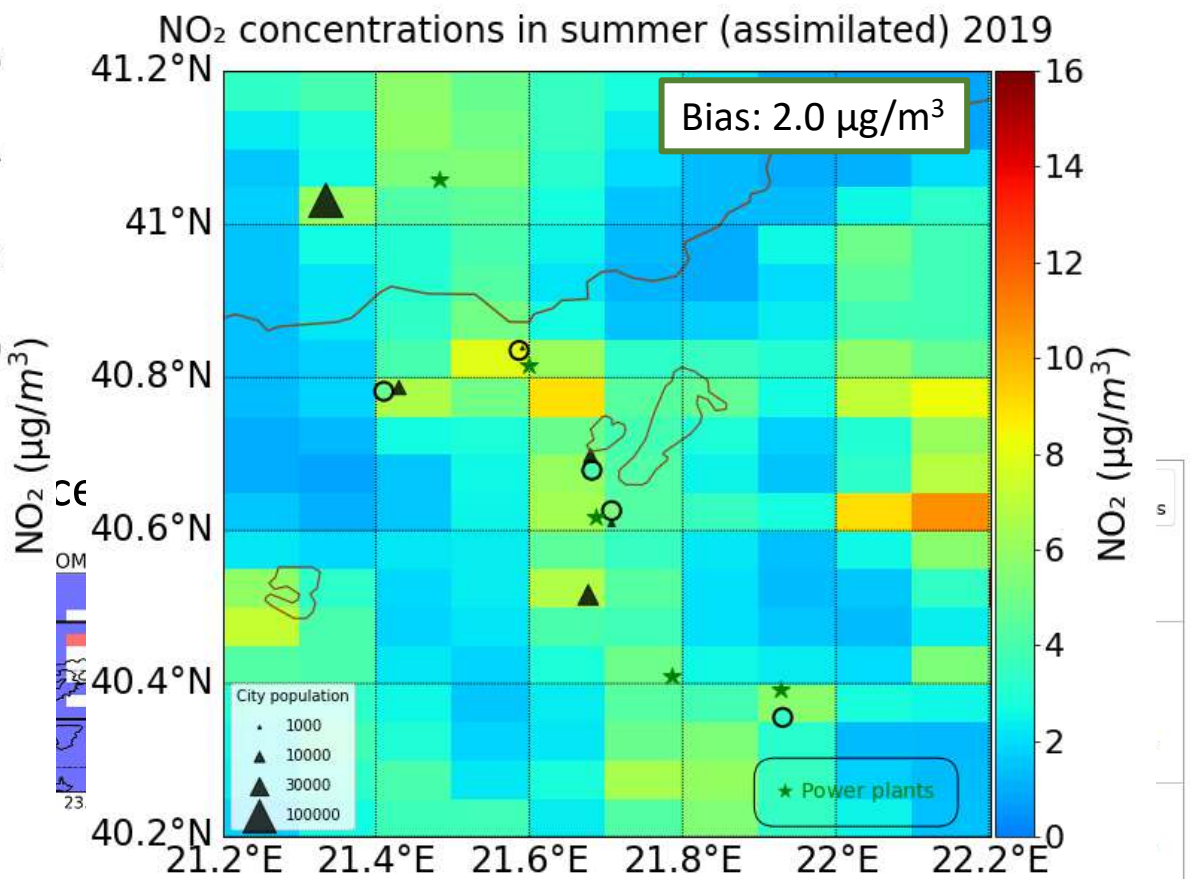
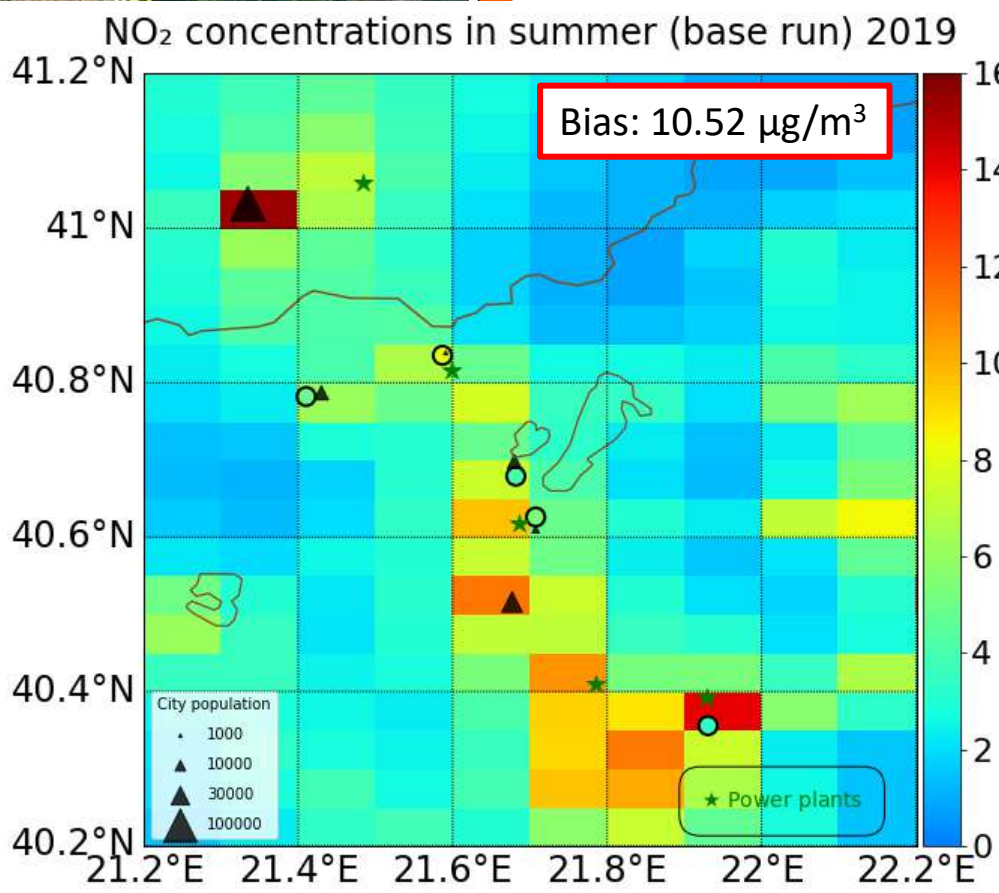
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Poster by **Ioanna Skoulidou** | Updated NO_x emissions during lignite phase-out era in Greece using S5P/TROPOMI



$r_{\text{spat}} =$

Skoulidou, I., et al., Evaluation of the CHOTOS-EUROPOS NO₂ simulation using ground-based measurements and S5P/TROPOMI observations over Greece, *Atmos. Chem. Phys.*, 2021

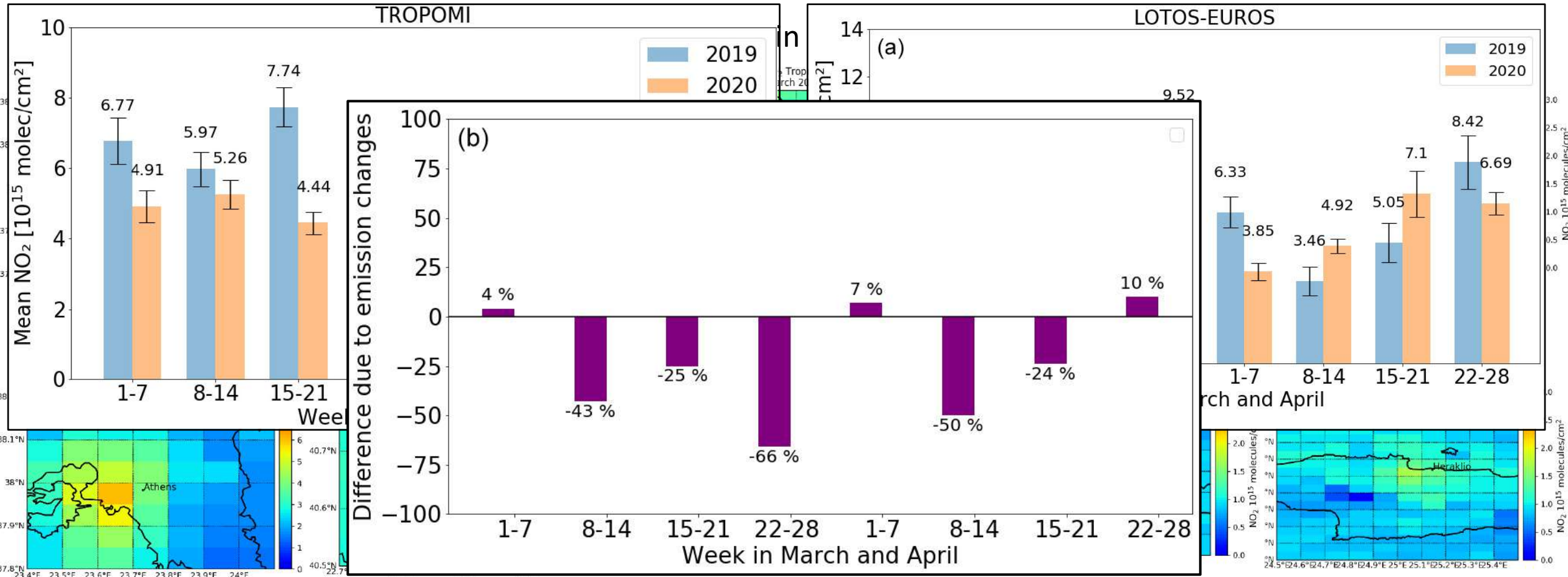
Using S5P NO₂ to assess the COVID lockdown in 2020 over Greece



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Koukouli, M.E., et al., Sudden changes in nitrogen dioxide emissions over Greece due to lockdown after the outbreak of COVID-19, *Atmos. Chem. Phys.*, 2021.

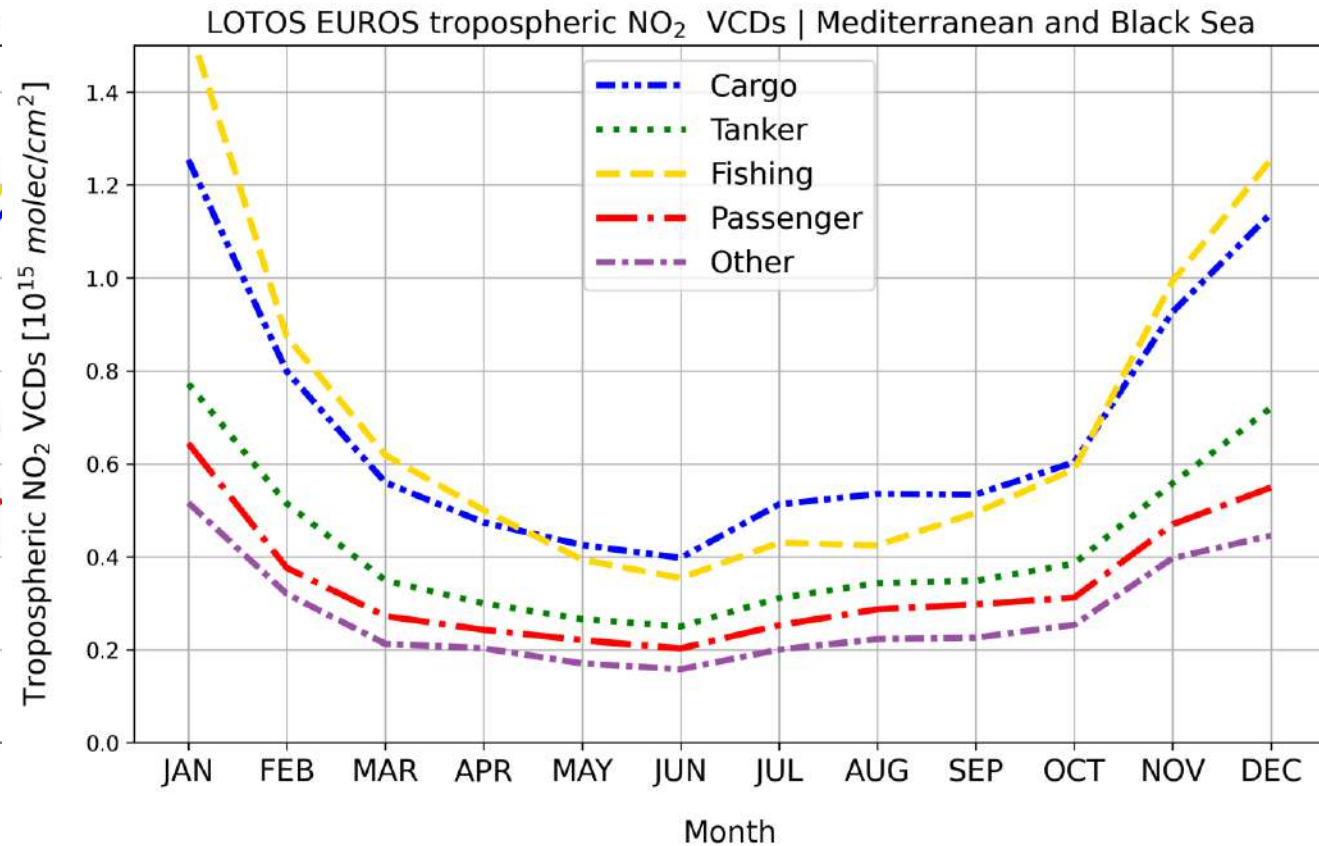
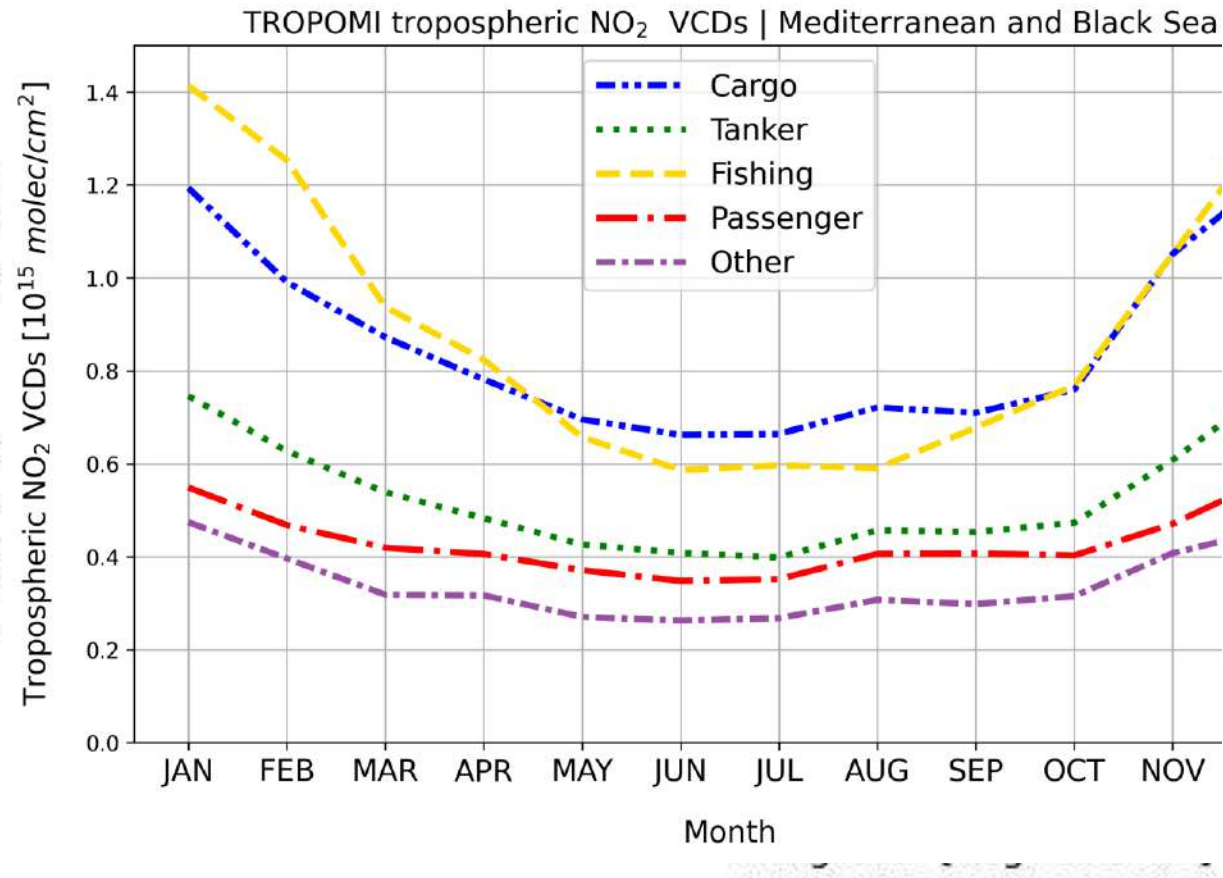
Using S5P NO₂ to relate NO_x emissions to shipping activities in the Mediterranean Sea



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Pseftogkas, A., et al., A New Separation Methodology for the Maritime Sector Emissions over the Mediterranean and Black Sea Regions, *Atmosphere*, 2021.

Using S5P NO₂ to infer NO₂ surface concentrations on a European Scale



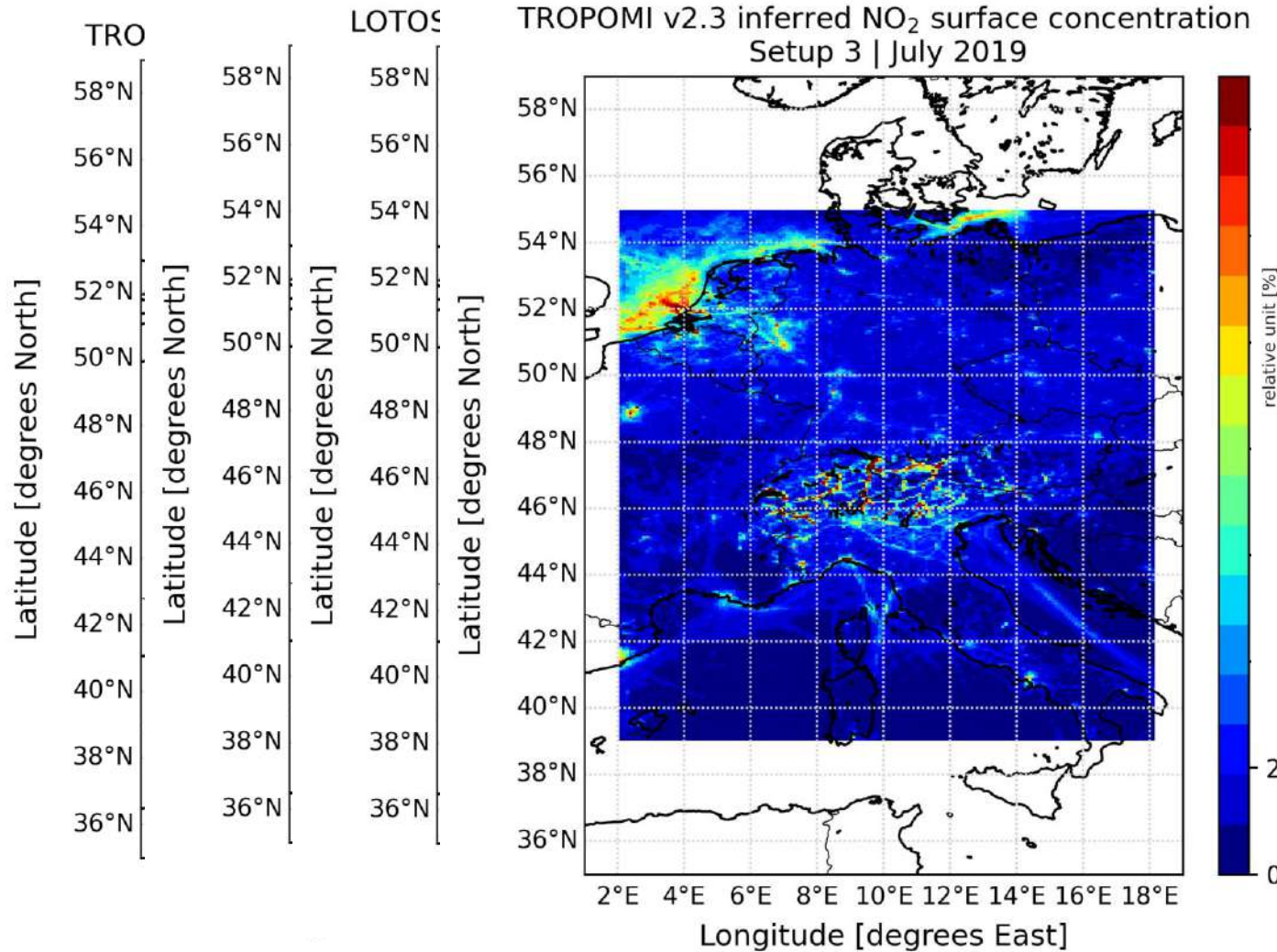
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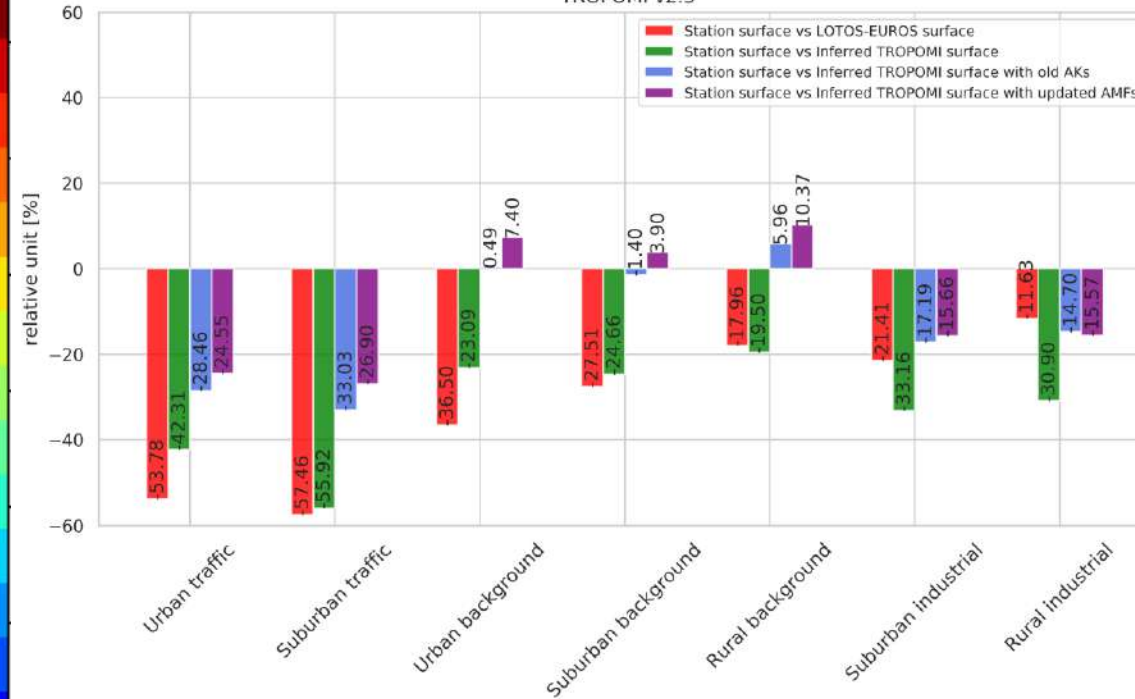


TROPOMI v2.3 inferred NO₂ surface concentration Setup 3 | July 2019



Relative Bias of datasets | June & July TROPOMI v2.3

Relative Bias of datasets | December & January TROPOMI v2.3



Pseftogkas A, et al., Comparison of S5P/TROPOMI Inferred NO₂ Surface Concentrations with In Situ Measurements over Central Europe, **Remote Sensing**, 2022.

Poster by **Andreas Pseftogkas** | Comparison of S5P/TROPOMI inferred NO₂ surface concentrations with in-situ measurements over Central Europe

Using S5P to monitor dust and smoke events in the Mediterranean



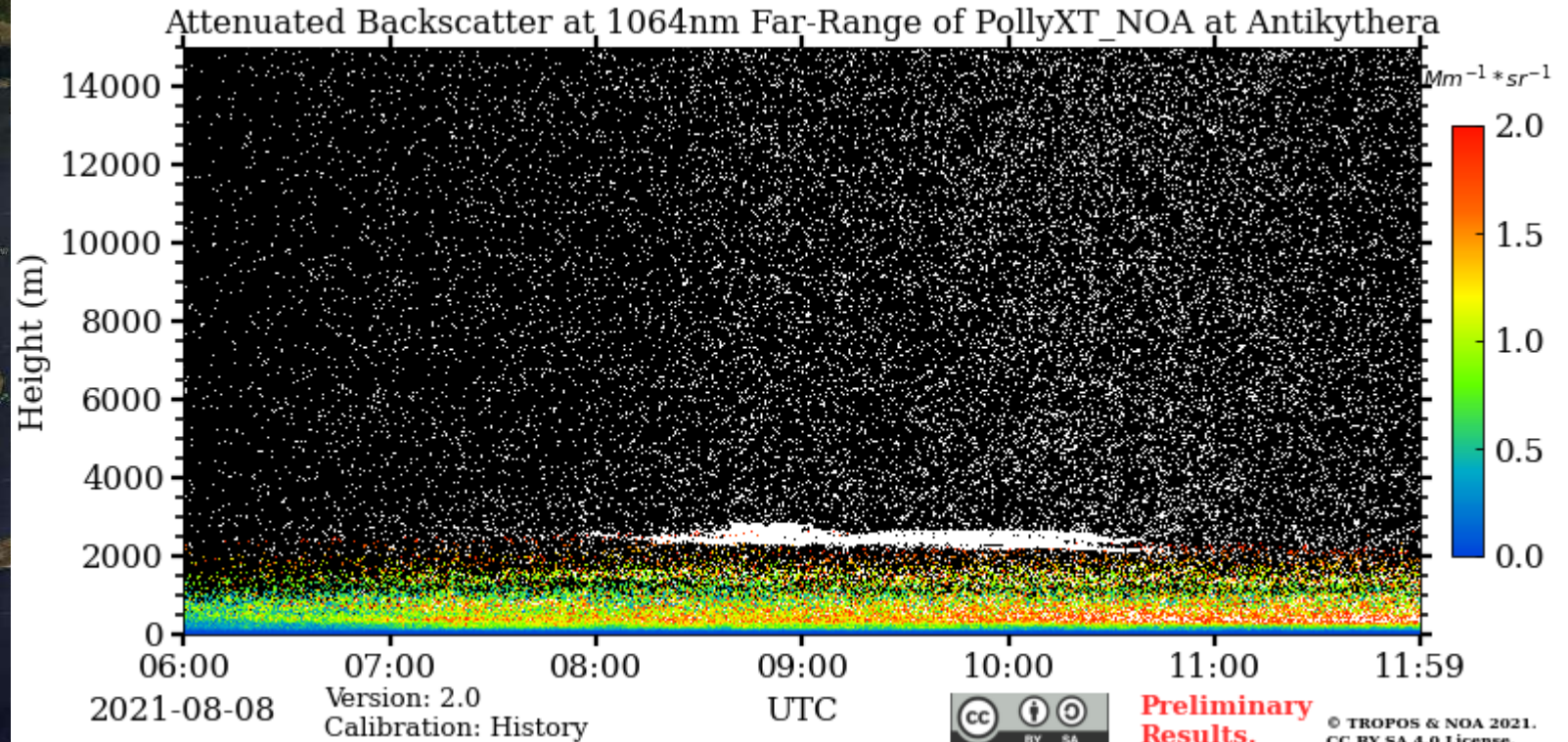
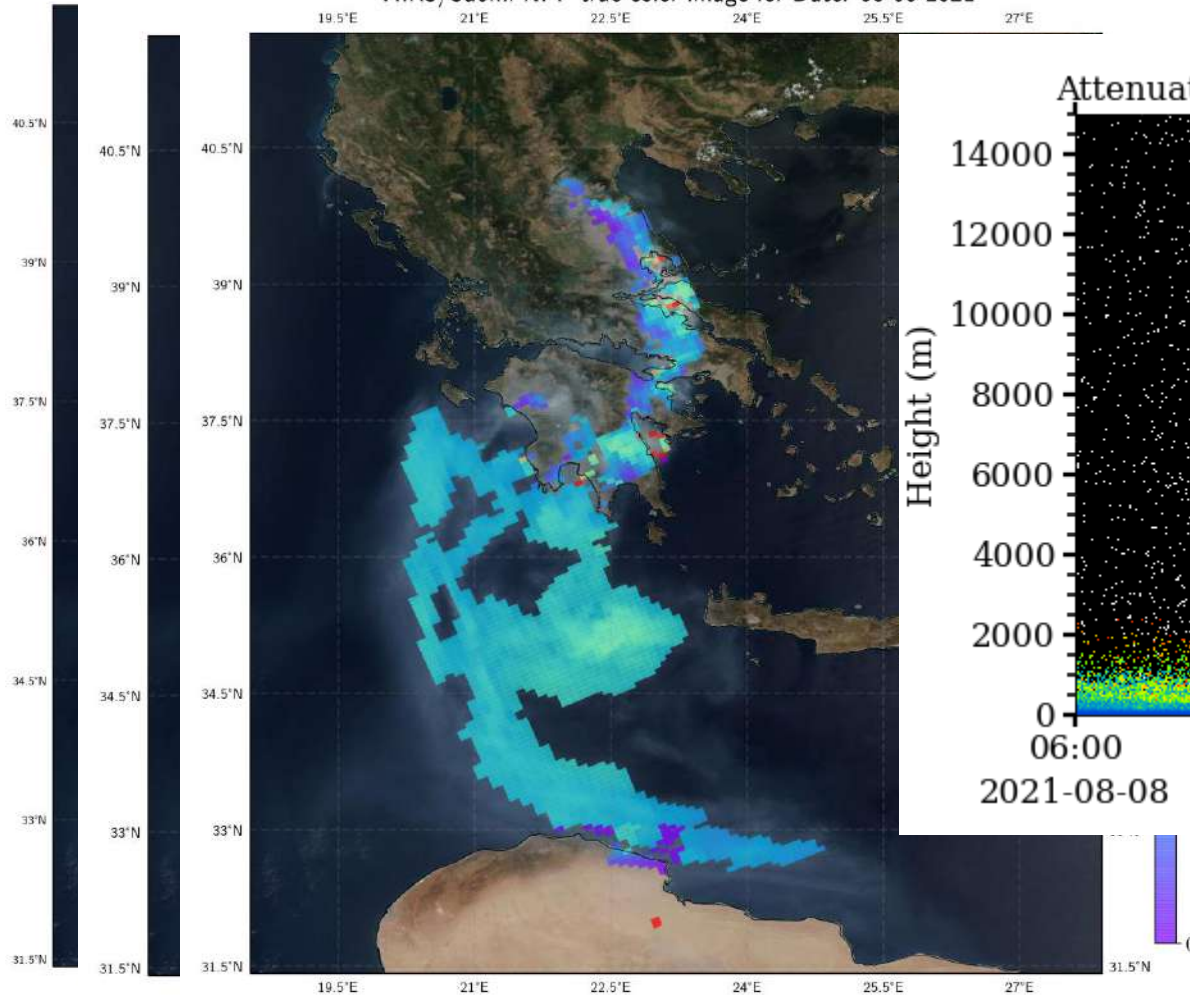
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TROPOMI Aerosol Layer Height (ALH) - Orbit number: 19792
VIIRS/Suomi NPP true color image for Date: 08-08-2021



Created: LAP AUTH, Michailidis K. / komichai@auth.gr

Poster by **Konstantinos Michailidis** | Observations of extreme dust and smoke aerosol plumes during 2018-2022 over the Eastern Mediterranean

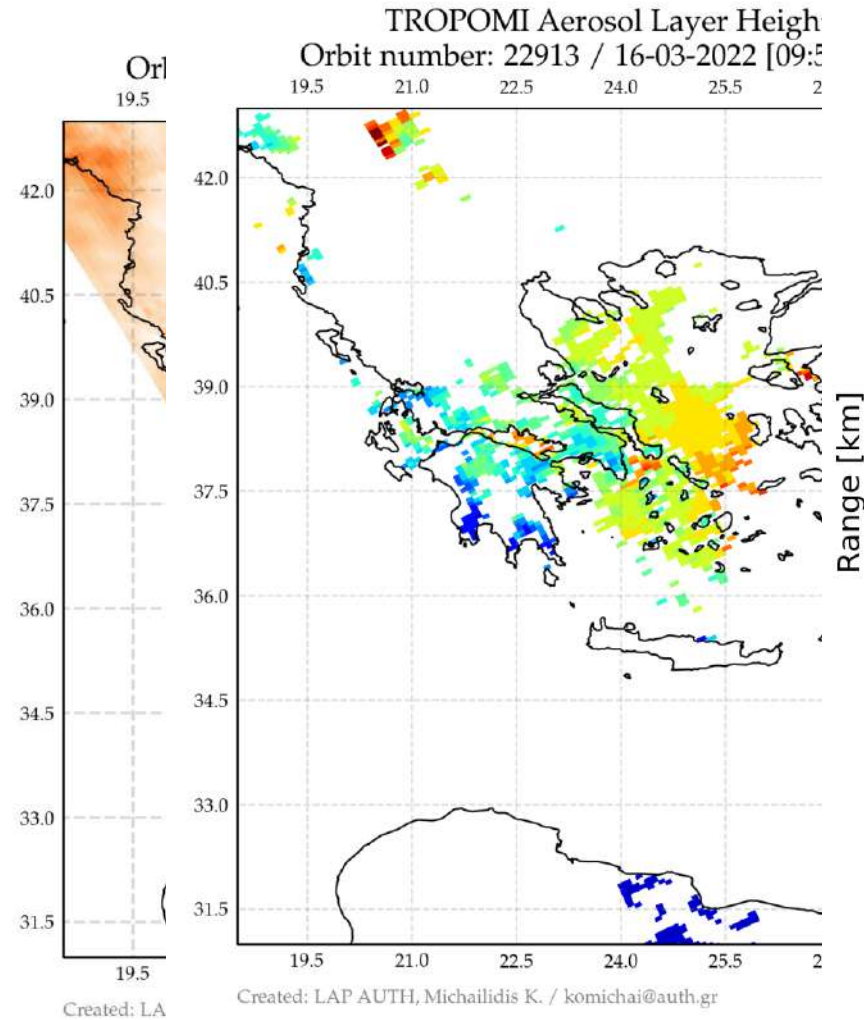
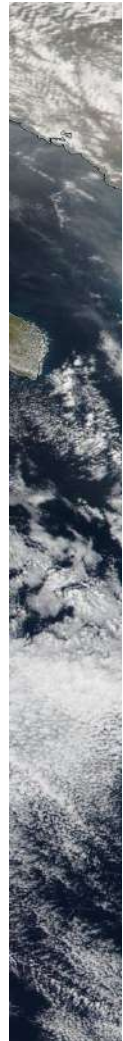
Using S5P to monitor dust and smoke events in the Mediterranean



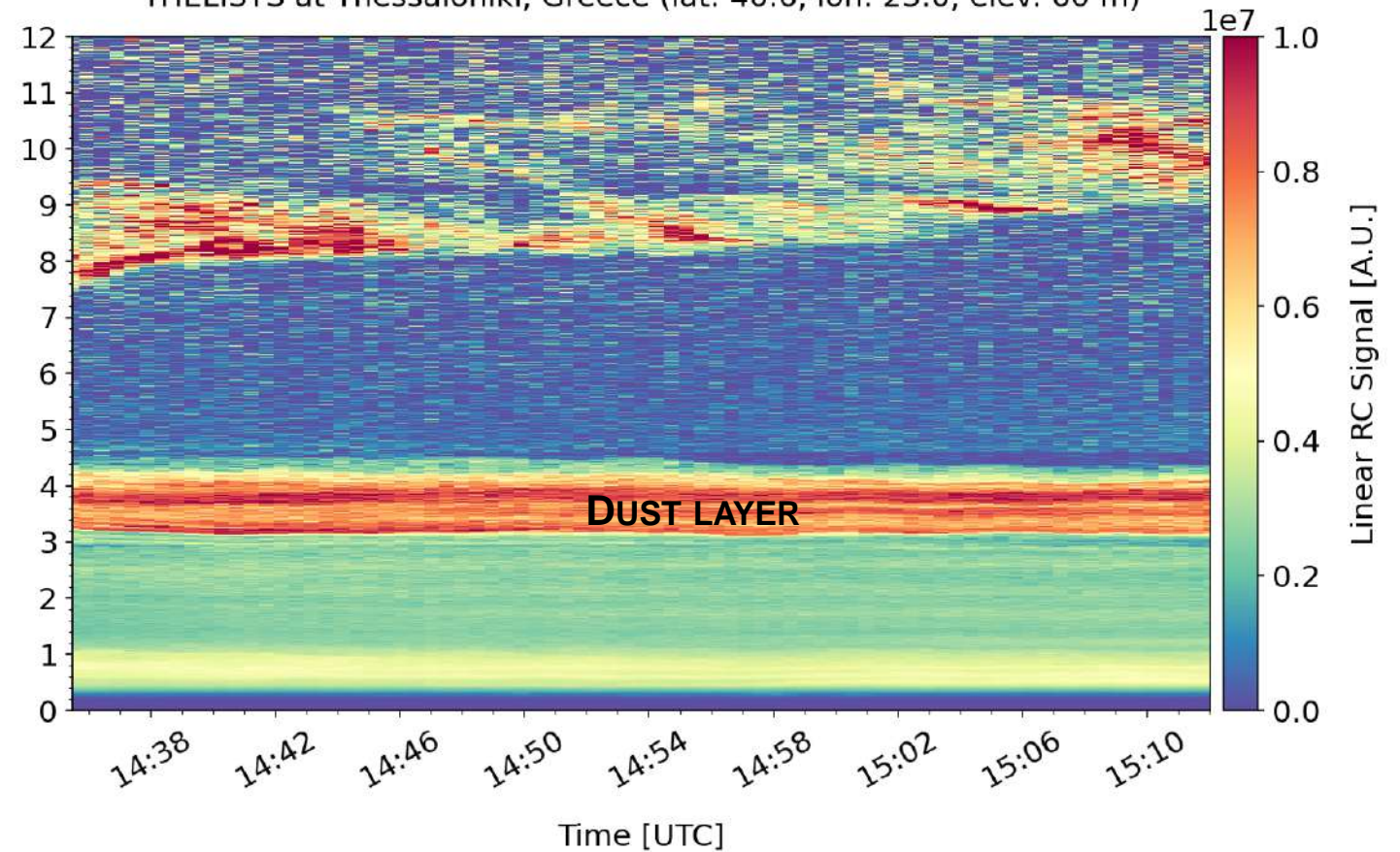
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Time-Height cross sections
On 2022/03/16 from 14:35 to 15:12 UTC, \nearrow 0.0° off-zenith
THELISYS at Thessaloniki, Greece (lat: 40.6, lon: 23.0, elev: 60 m)



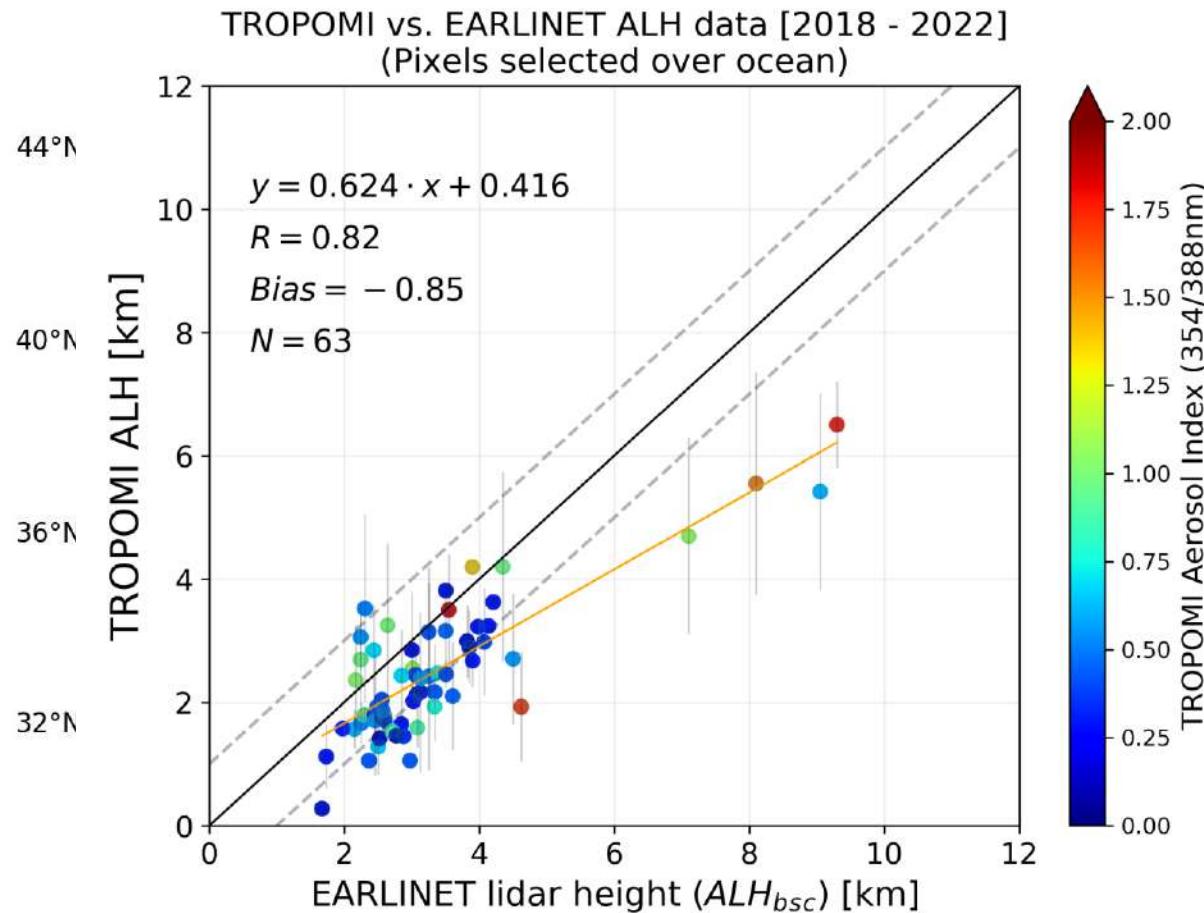
Using S5P to assess the aerosol layer height observations in the Mediterranean



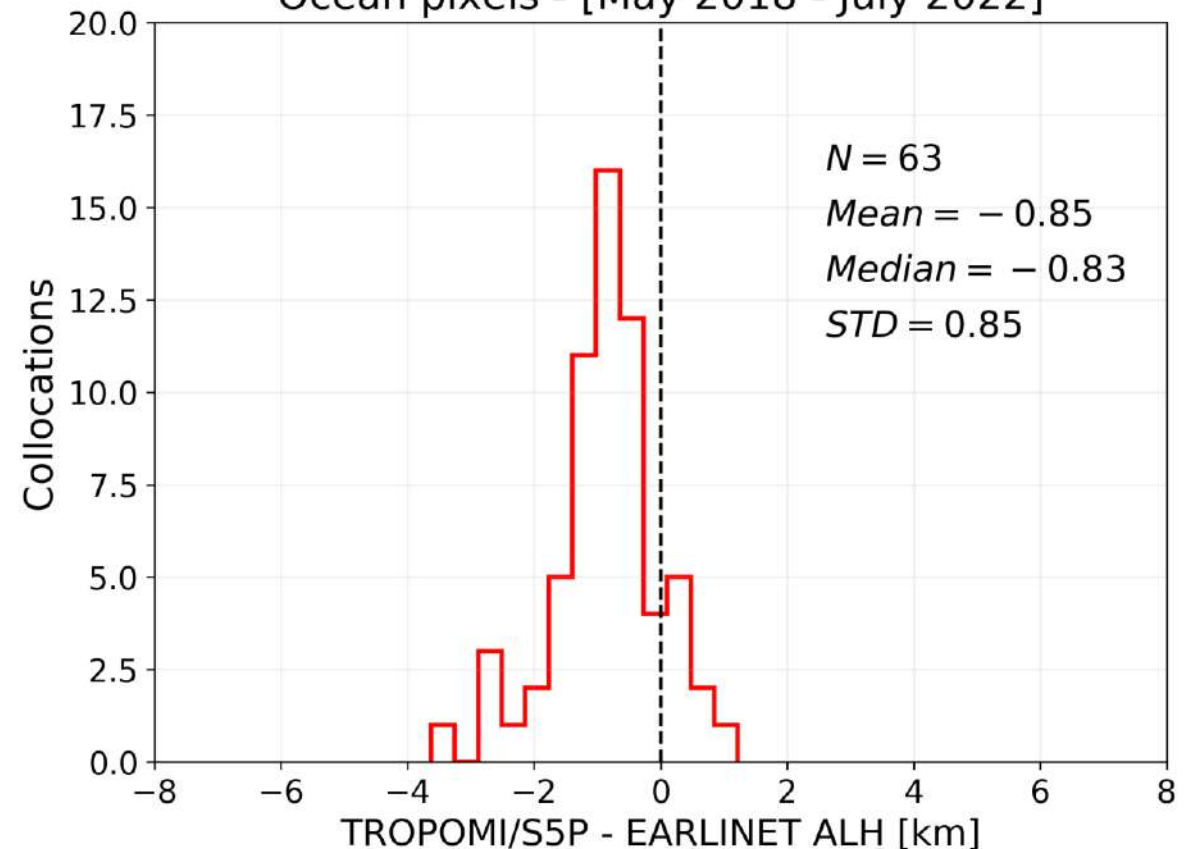
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TROPOMI/S5P vs EARLINET ALH
Ocean pixels - [May 2018 - July 2022]



Michailidis, K., et al., Validation of the TROPOMI/S5P Aerosol Layer Height using EARLINET lidars, *Atmos. Chem. Phys. Discuss.*, 2022.

Poster by **Konstantinos Michailidis** | Validation results of TROPOMI ALH product using EARLINET ground-based lidar observations during 2018 - 2022

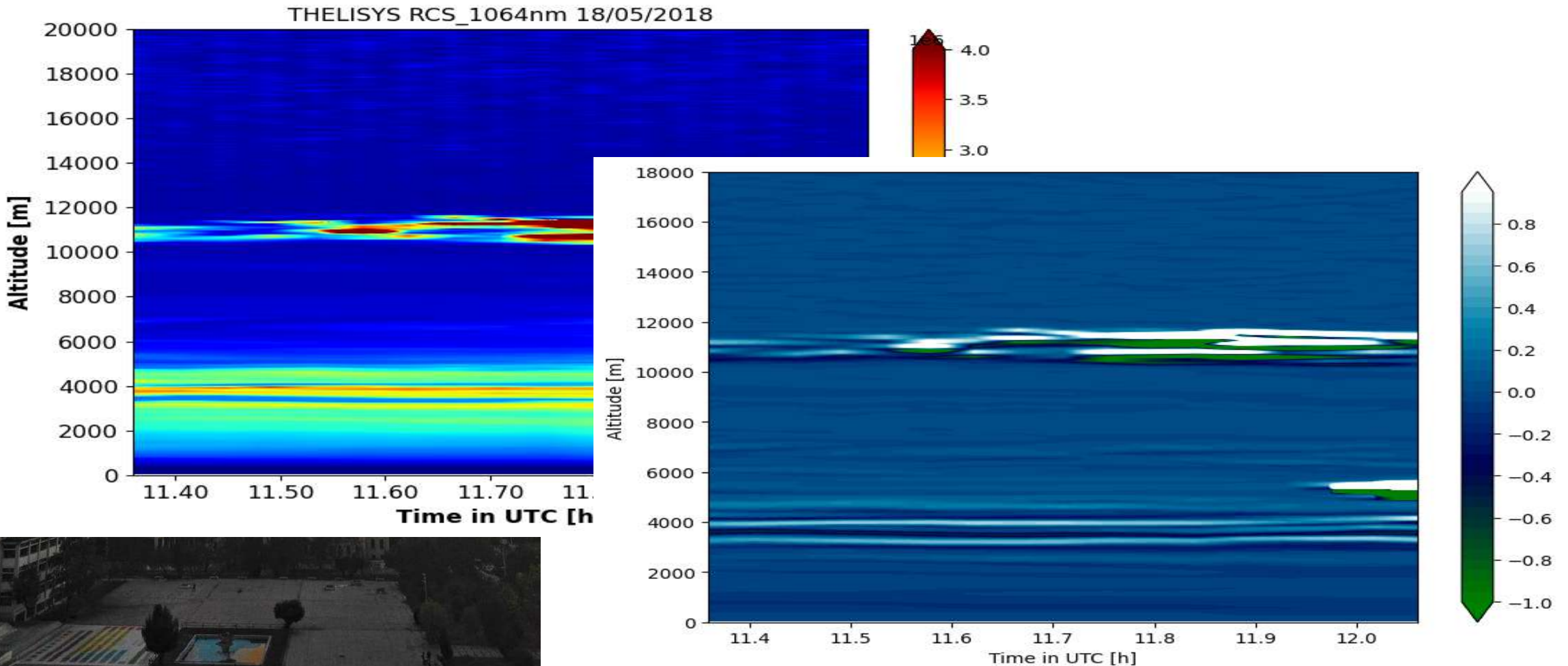
Using S5P to quantify cirrus clouds over the middle latitudes



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Voudouri, K. A., et al., Variability in cirrus cloud properties using a PollyXT Raman lidar over high and tropical latitudes, *Atmos. Chem. Phys.*, 2020.

It does not end here....



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... I invite you to check out the following posters in this conference!

- Comparison of global cloud fraction S5P/TROPOMI measurements from November 2017 to December 2021 with Synoptic observations | **Chrysovalantis Sarakis**
- Potential for TROPOMI/S5P Ozone Profile Validation against Brewer Umkehr observations | **MariLiza Koukouli**



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