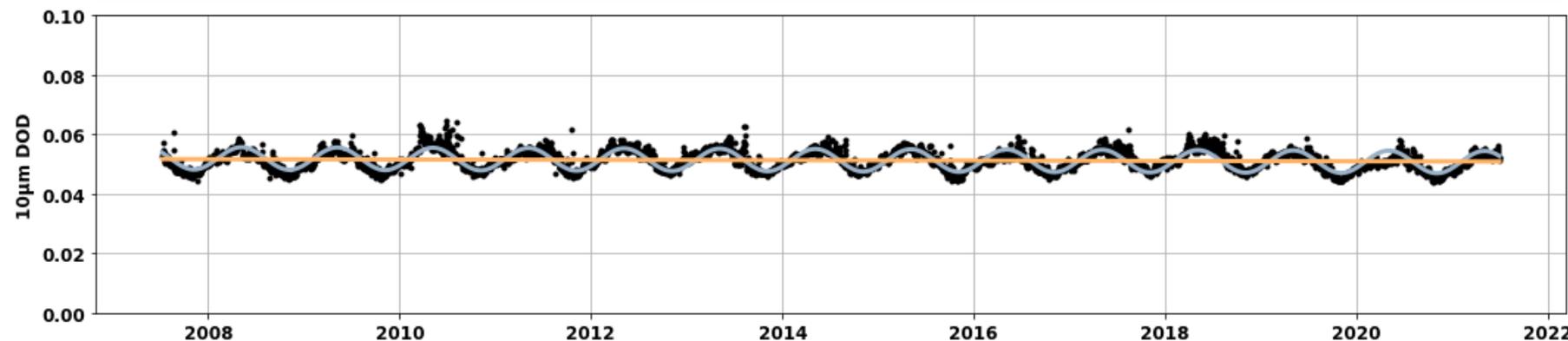


* Credits: NASA Worldview



Dust trends
from IASI

Mineral dust trends
from 14 years of consistent 3D IASI MAPIR v5.1 data
 Sophie Vandebussche, Martine De Mazière



ROYAL BELGIAN INSTITUTE FOR
SPACE AERONOMY

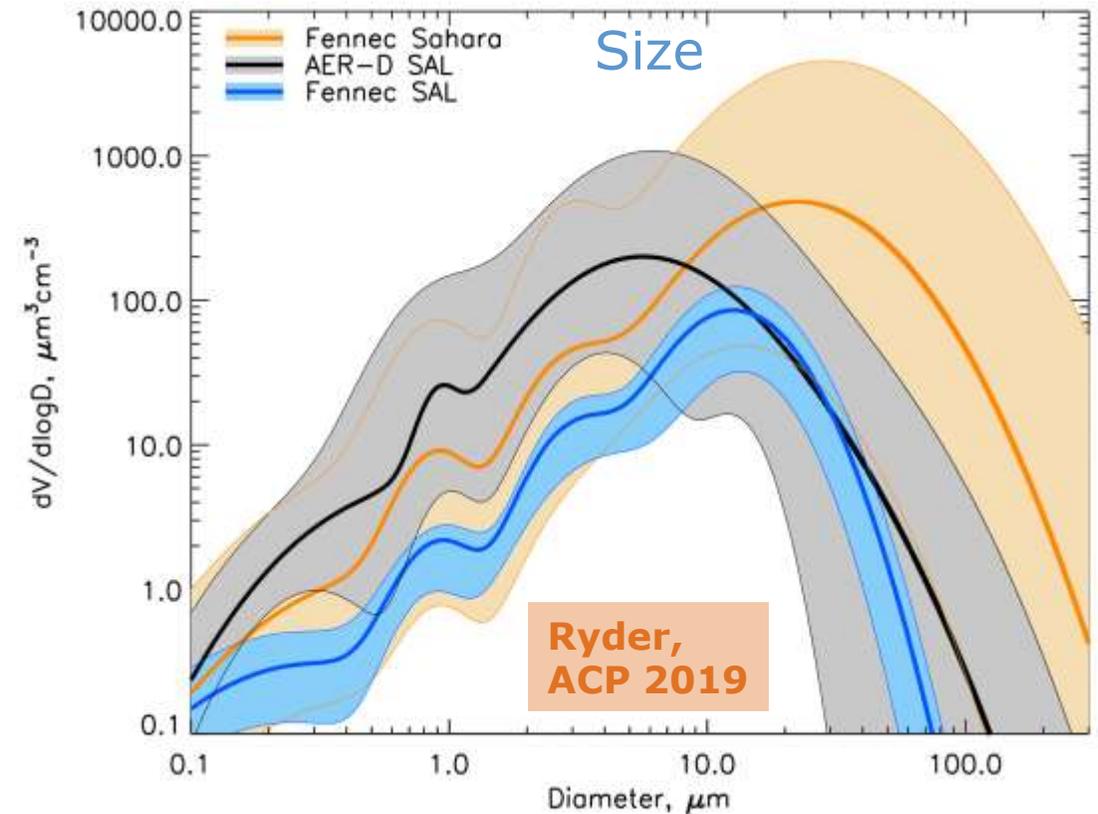
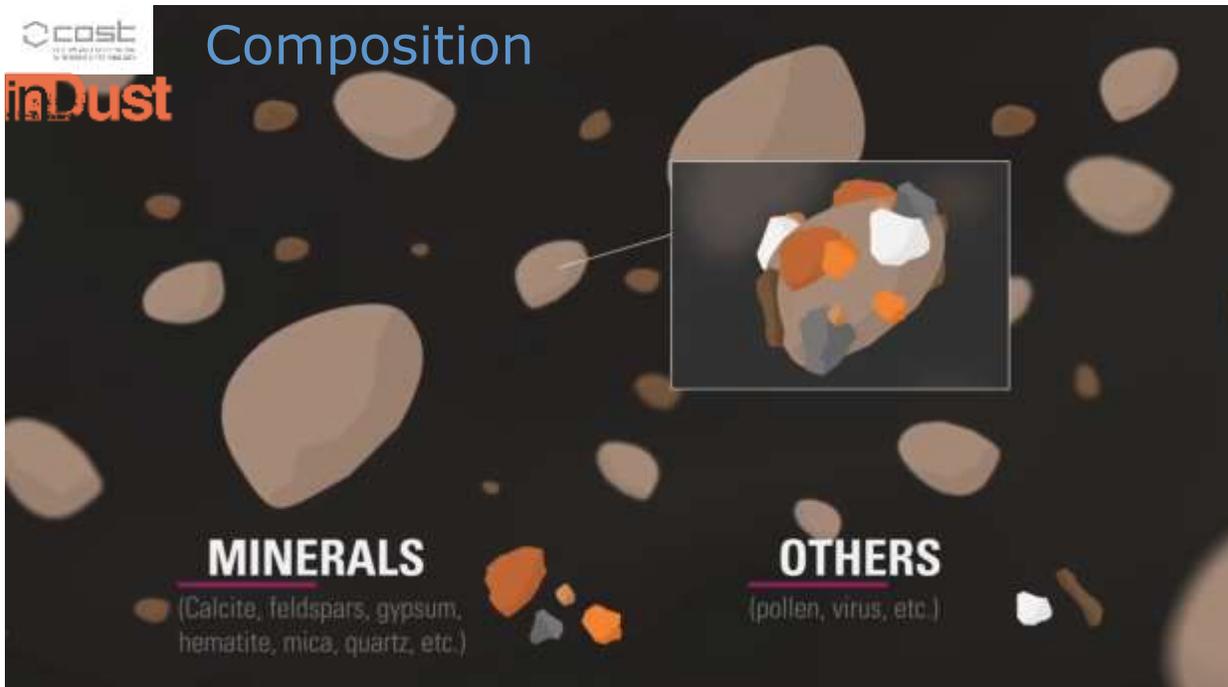




Mineral dust aerosols



Small mineral (sand) particles uplifted by strong winds from dry / bare areas

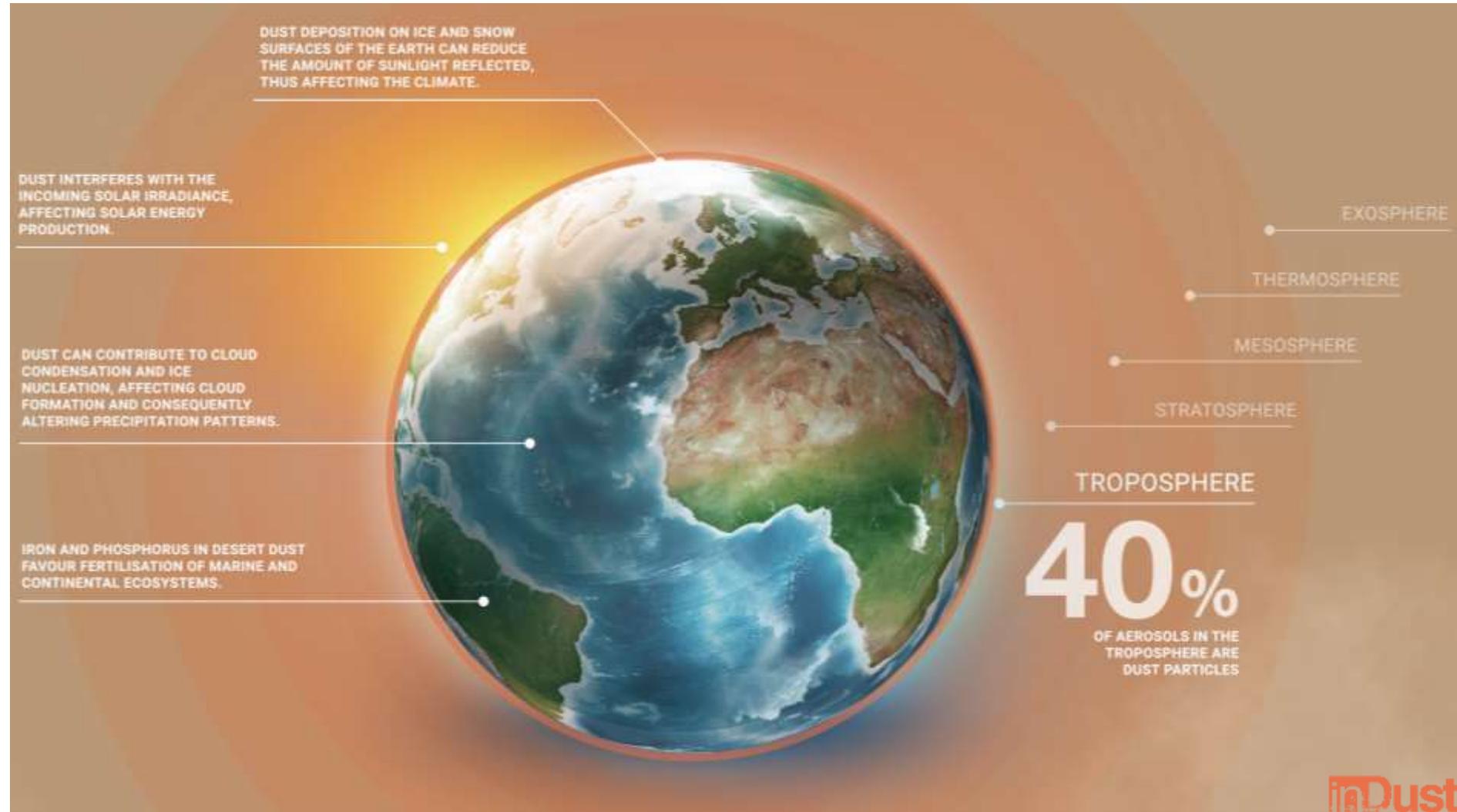




Why do we care?

- Radiative effects
 - Surface
 - T profile
 - Circulation
- Impact on clouds
 - Rain
 - Radiative prop.
- Glacier's albedo
- Damage to plants

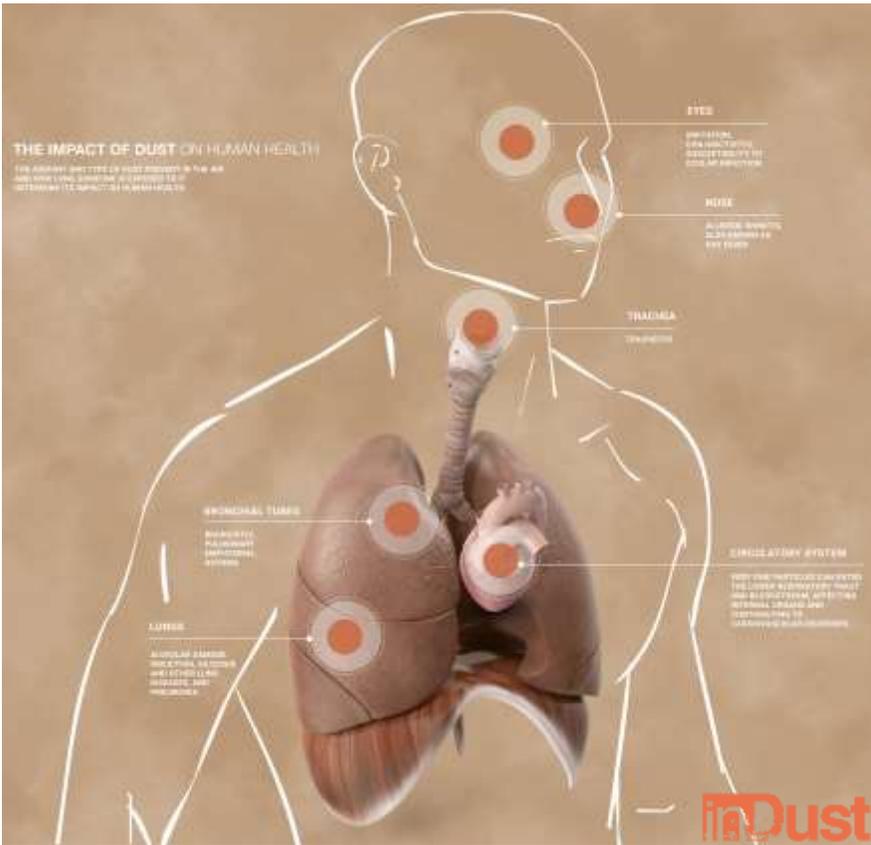
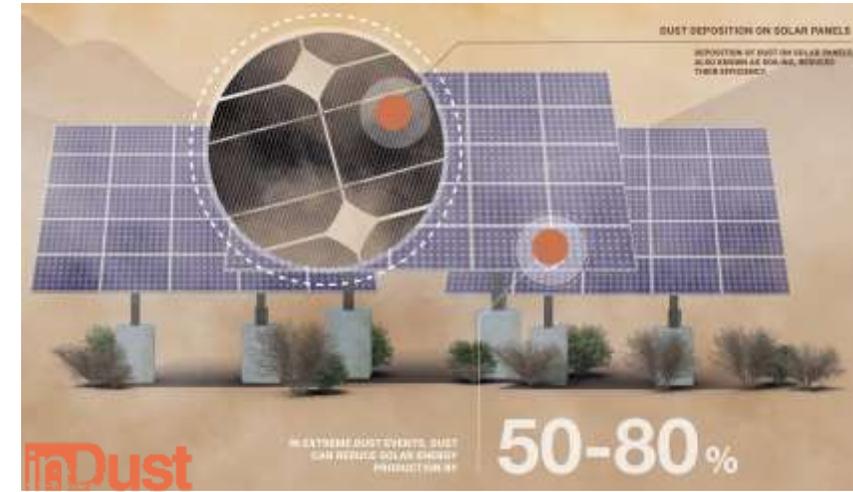
- Fertilisation (Fe + P)





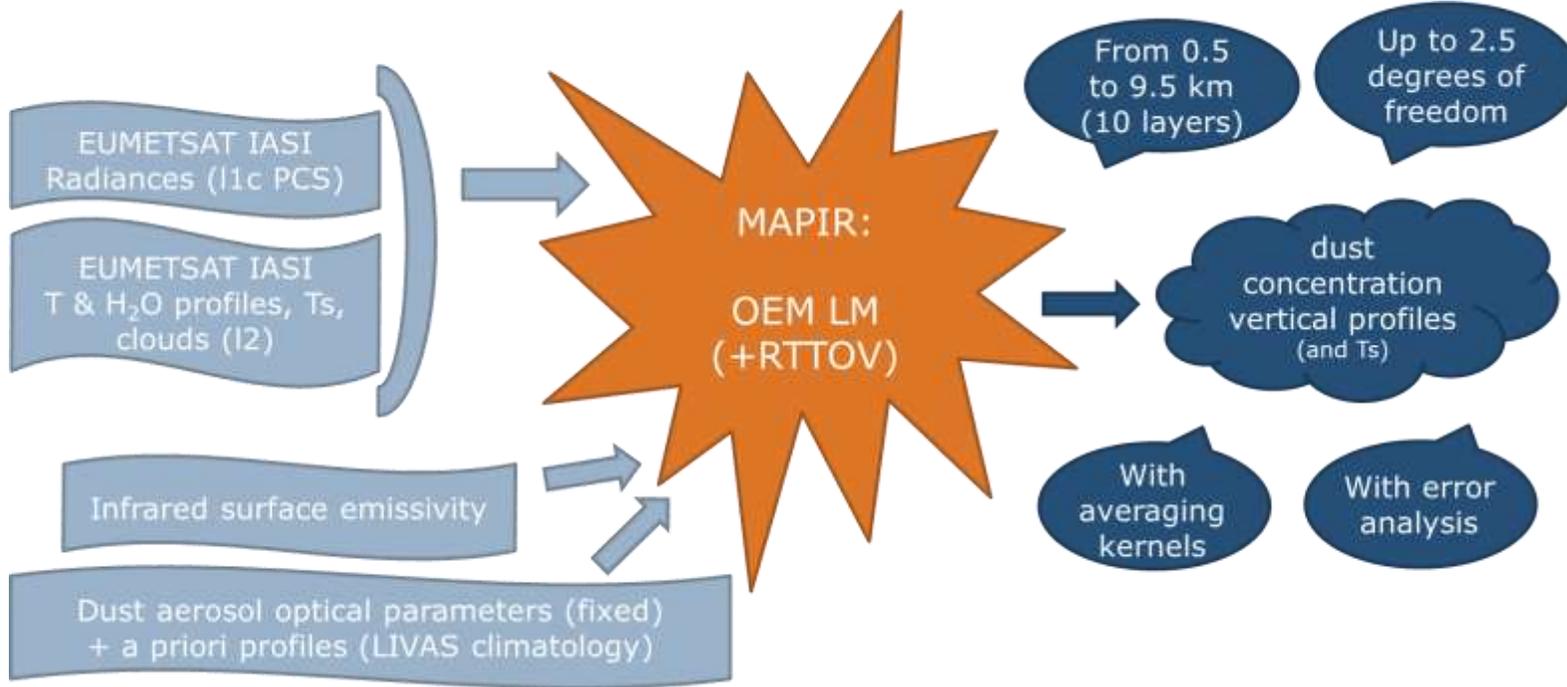
Why do we care?

- Health issues
- Aviation
- Ground transport
- Infrastructure
- Remote sensing
- Solar energy
- Agriculture



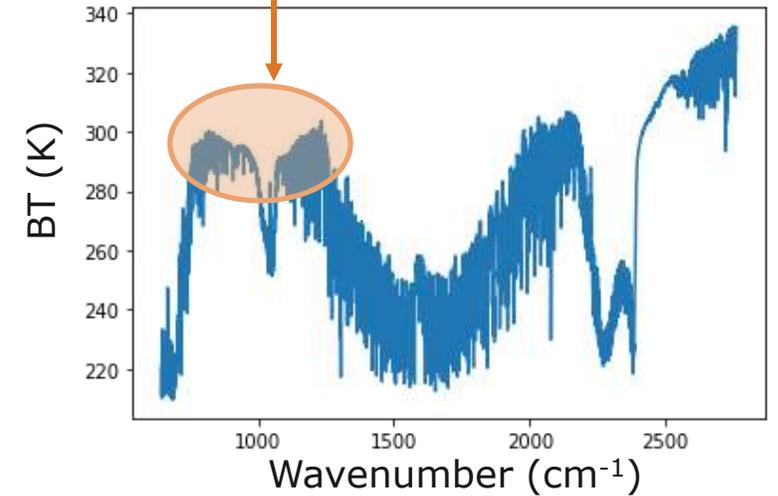
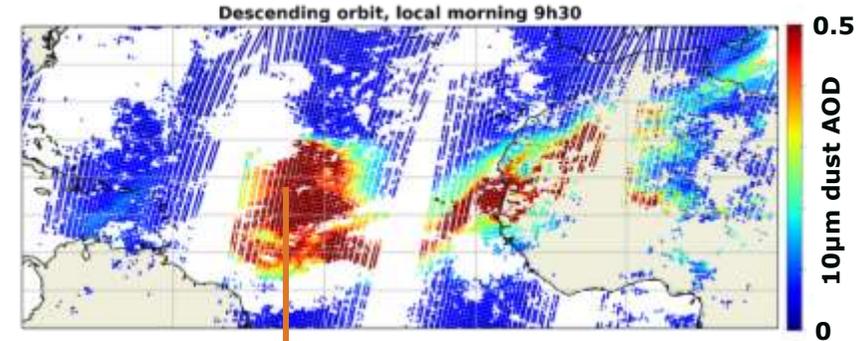


Mineral dust observations with IASI



Poster
24

Godzilla dust storm, (20) June 2020

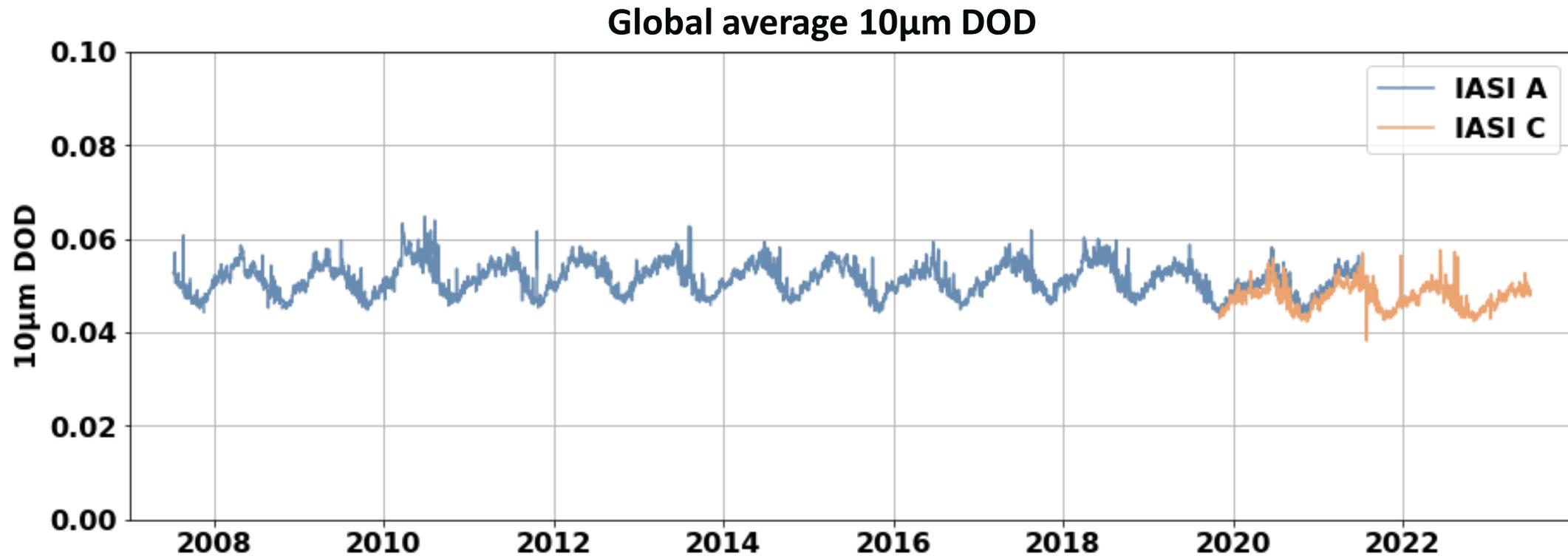




Long-term data

IASI-A: 07/2007-06/2021 → 14 years
"RPRO" I1c PCS FDR v1 & I2 CDR v1.1

IASI-C: 11/2019-10/2023 → +2 or 3 years
"OFL" (orbits) I1c PCS & I2 PWLR3

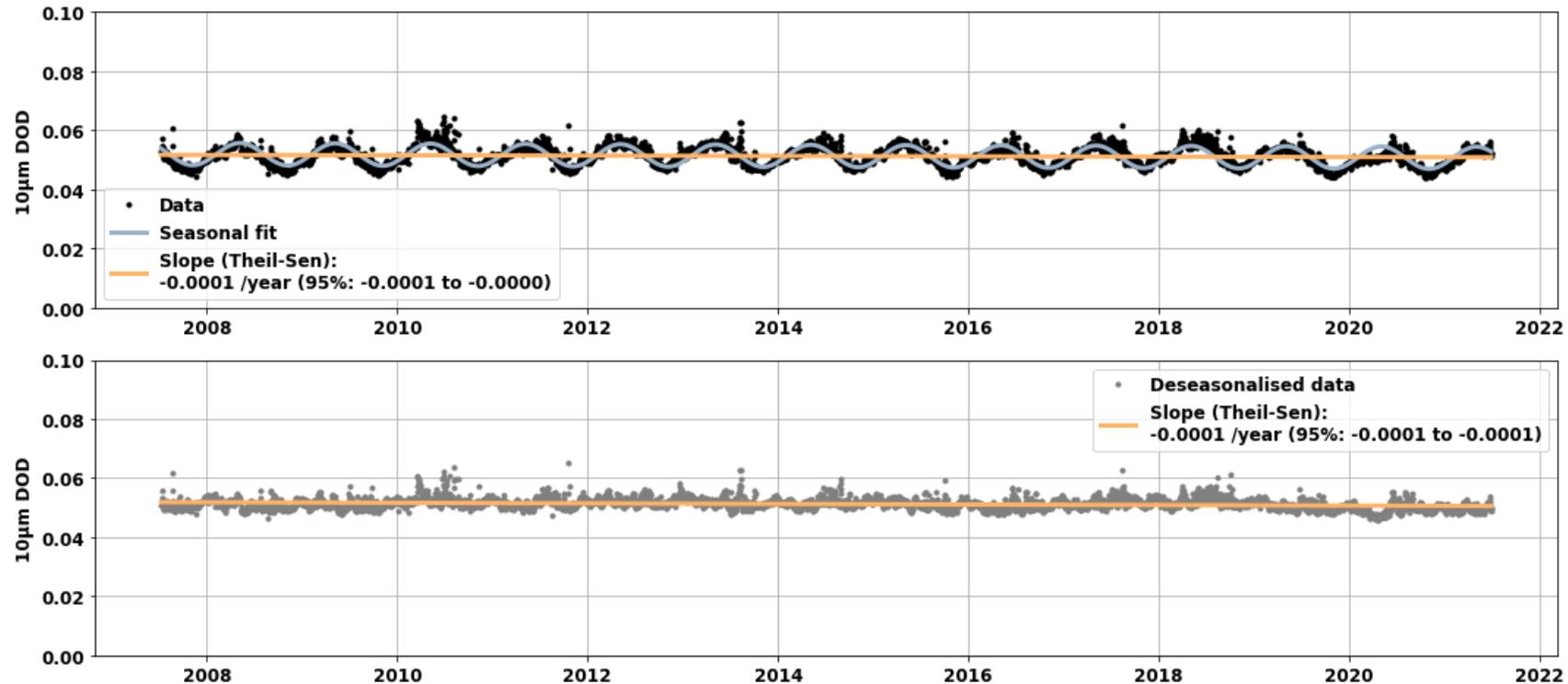




Trends analysis: method

- Daily IASI DOD10 μ m (all day, or separately morning and evening)
- Robust non-parametric estimator: Theil-Sen slope
- Seasonal sinus cycle removed

Global average





Trends analysis: maps

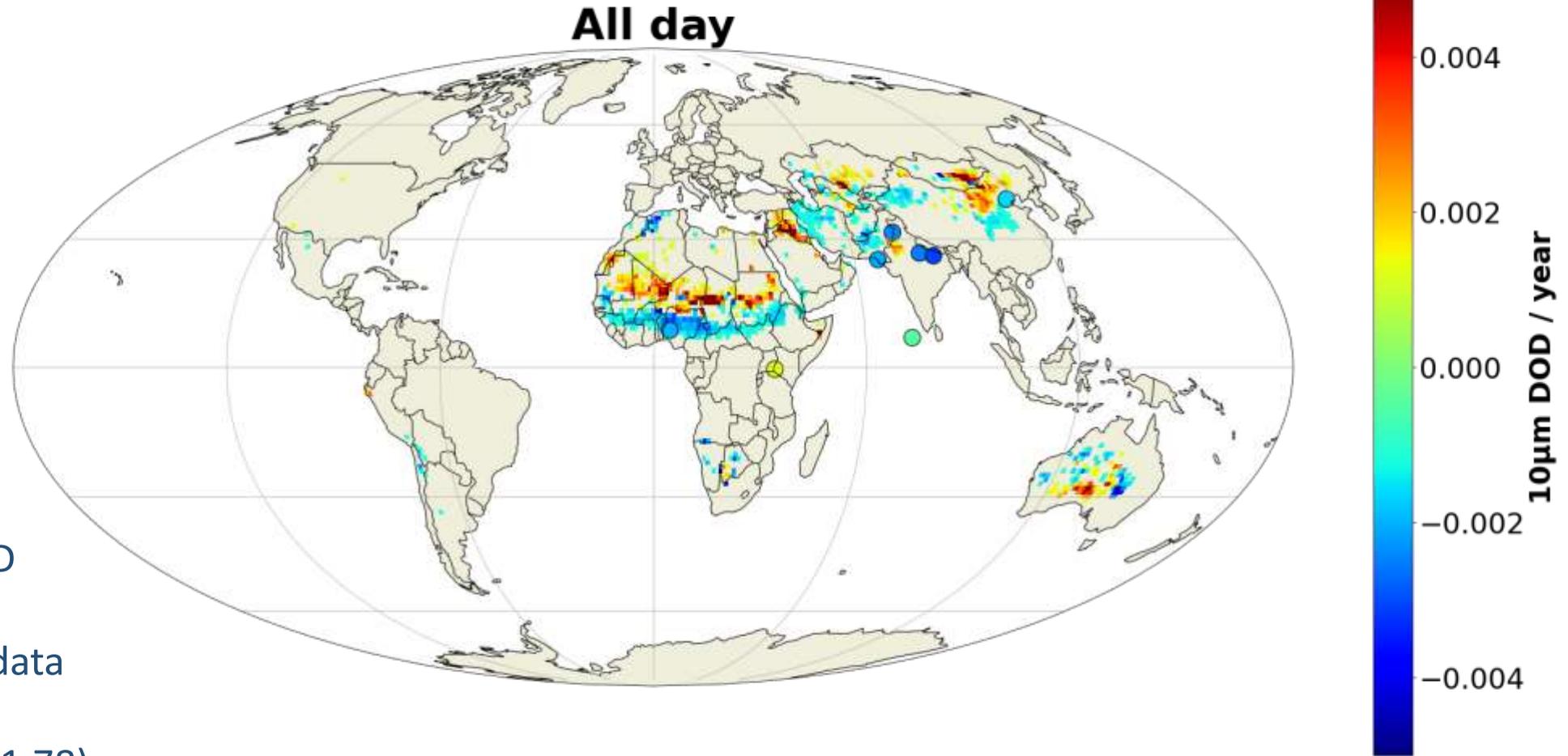
Only grid cells where

- median AOD > 0.05
- 0 is not in the 95% confidence interval
- $|\text{trend}| > 0.001/\text{year}$



Circles: AERONET trends

- SDA coarse mode AOD
- Same time range
- Max 3 years without data
- Same method
- Converted to $10\mu\text{m}$ (/1.78)





Trends analysis: maps

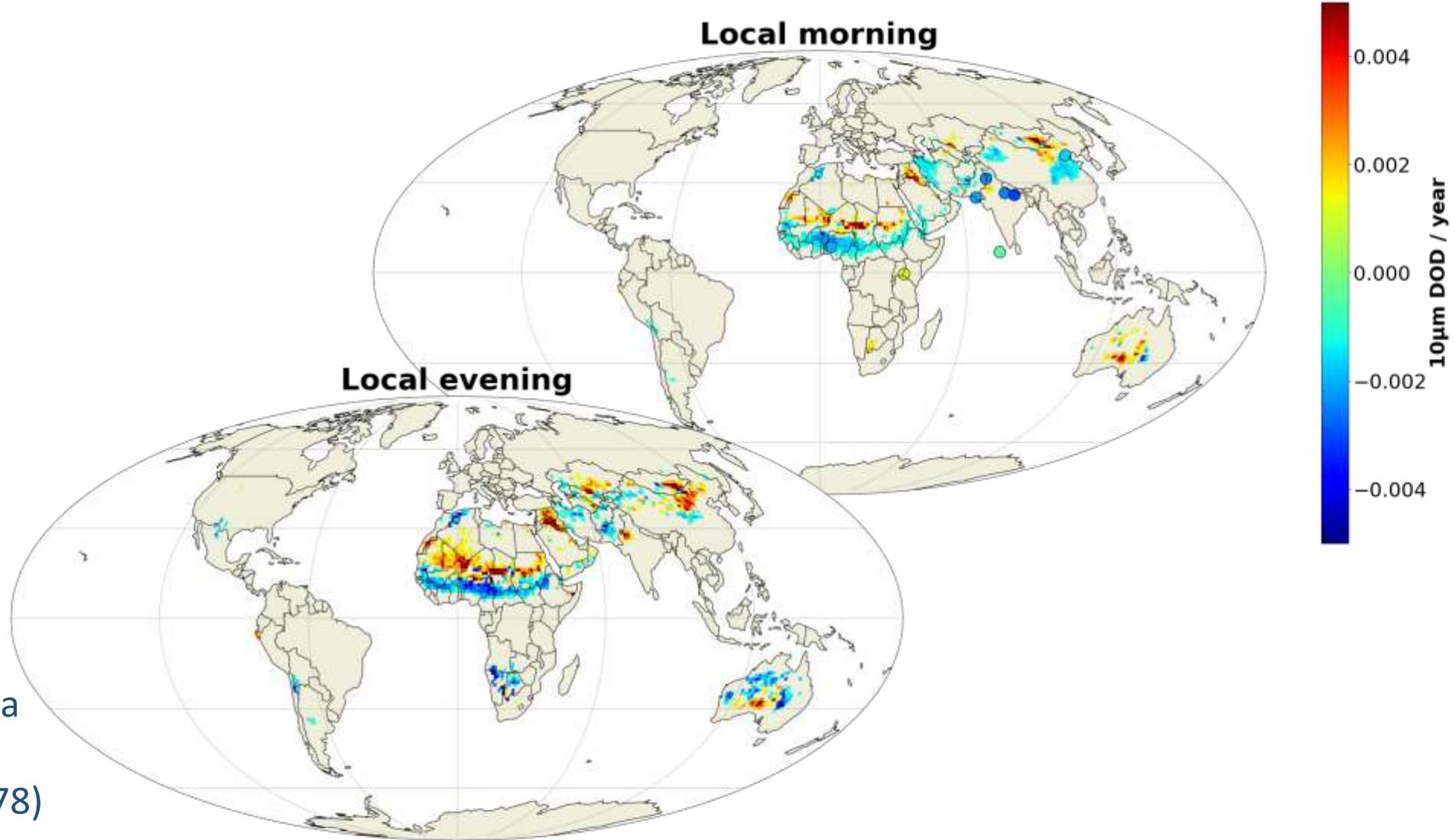
Only grid cells where

- median AOD > 0.05
- 0 is not in the 95% confidence interval
- $|\text{trend}| > 0.001/\text{year}$



Circles: AERONET trends

- SDA coarse mode AOD
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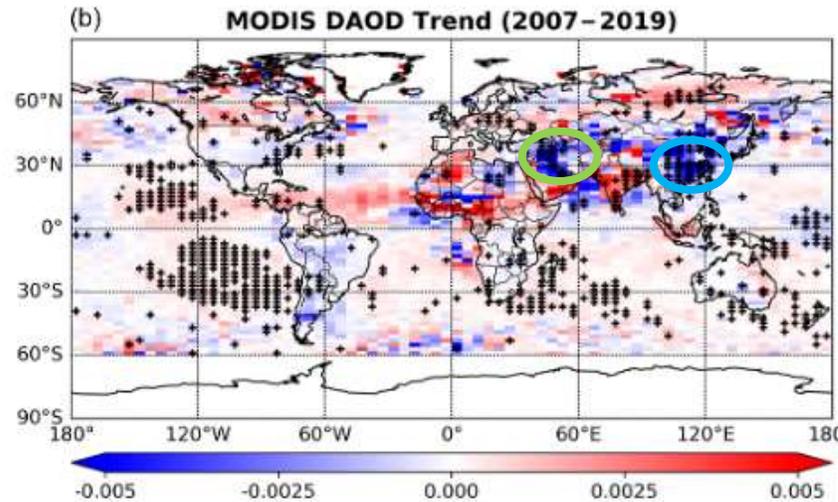
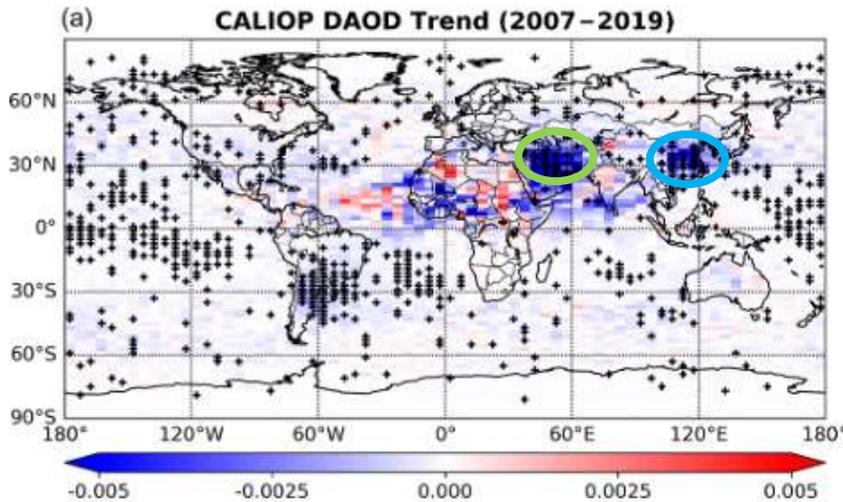
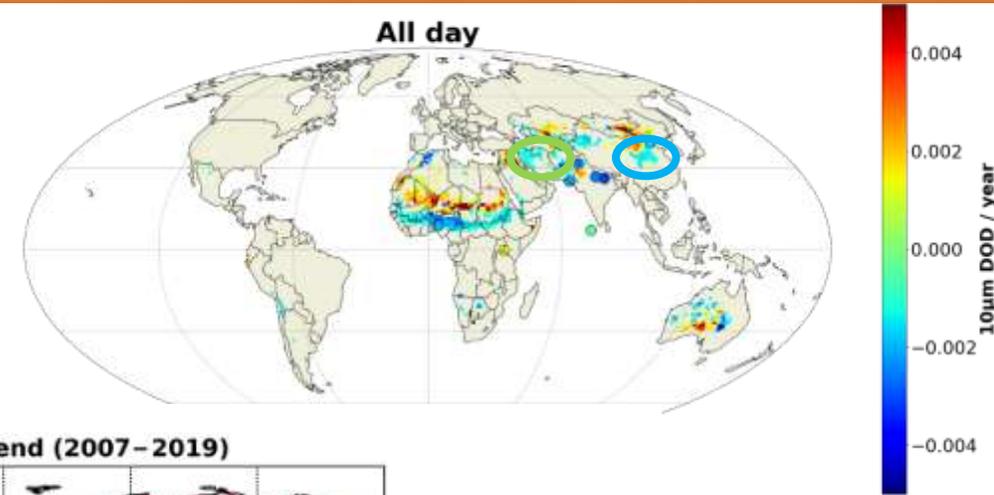




Trends analysis: maps, comparisons

CALIOP, MODIS, IASI: significant trends not in the same area...
Common: **W Iran** and **E China** have a significant decreasing trend

Song et al. ACP 2021



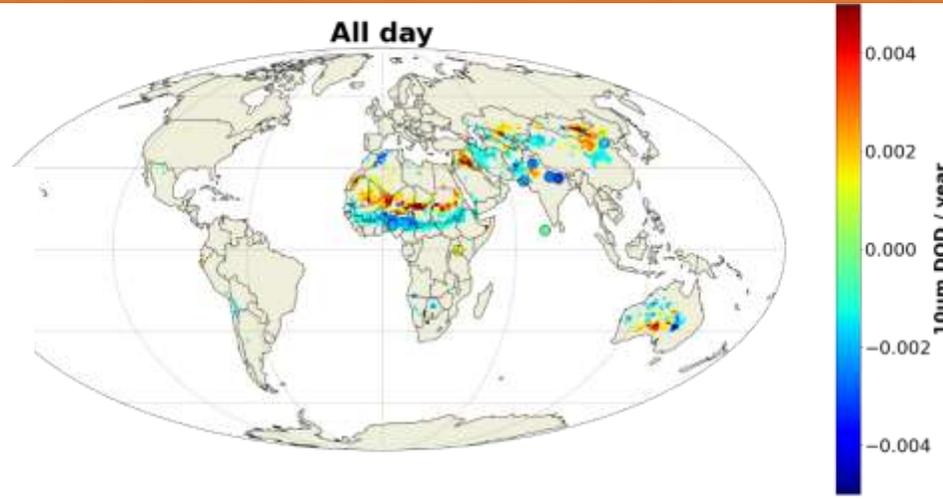
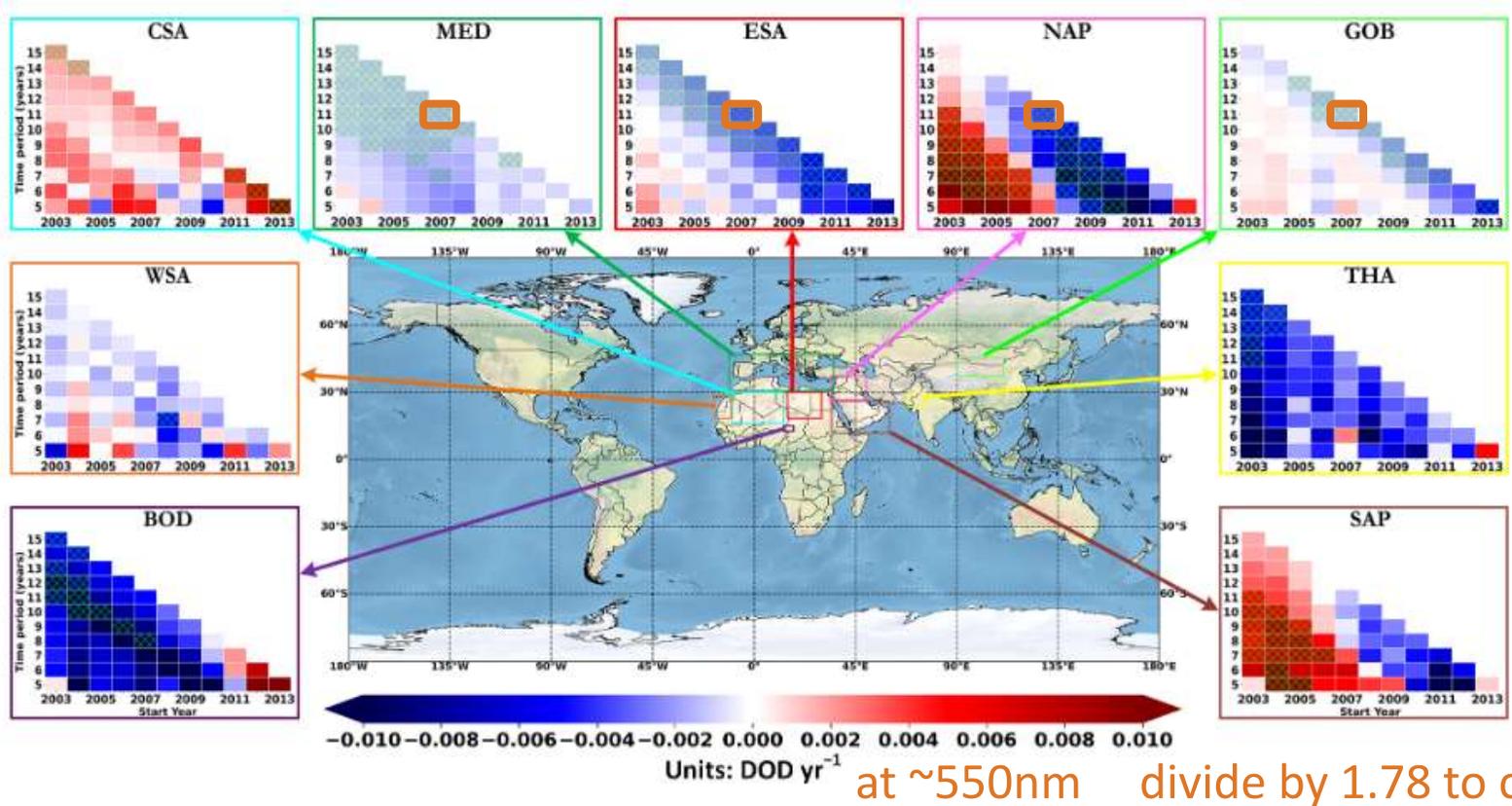
at ~550nm
divide by 1.78
convert to 10µm

Figure 14. Global map of DAOD trend based on CALIOP (a) and MODIS (b) dust climatology data over 2007–2019 period. Red and blue represents increasing and decreasing trend, respectively. The “+” symbol denotes trends with p value < 0.05 , which are considered as statistically meaningful trends.



Trends analysis: maps, comparisons

Logothetis et al. ACP 2021



MIDAS data (MODIS + Merra-2)
2007-2017, when significant
Not in the same area as IASI...

Figure 9. Regional DOD trends at different time intervals, with at least a 5-year time series. The acronym full names are documented in Table 3. The YY' axis shows the number of trends included in the analysis, while XX' is the starting year. The hatched pixels represent regions with significant trends ($|\omega/\sigma_\omega| > 2.0$).



Outline

- Method: daily data, simple seasonal cycle removal, Theil-Sen slope
- Larger trends for night-time
- Increase for Sahel, Iraq, SE of Aral (Kazakhstan/Uzbekistan), Thar (India/Pakistan), Gobi (Montgolia, N China), Great Victoria and Simpson (Australia)
- Decrease for S of Sahel, NW Algeria, Iran, Registan (Afghanistan/Pakistan), Taklamakan (W China), E China, Australia (other than those above)
- Agreeing well with AERONET trends for the same period (only 2 sites !!)



Future

- Analyse the IASI-C vs IASI-A “bias”
- Dig in the day vs night differences
- Compare with other data sets for same time range
including / especially the other IASI dust products (ULB, LMD)
- Find explaining factors for the trends (winds, humidity, vegetation, ...)
- Trends in number of events (at sources or transported), ...
- Improve trend significance test using Mann Kendall tests



THANK YOU!
MORE INFO?

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iasi.aeronomie.be