

# Identifying different source contributions of formaldehyde using long-term MAX-DOAS measurements of atmospheric trace gases

MAX PLANCK INSTITUTE  
FOR CHEMISTRY

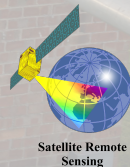


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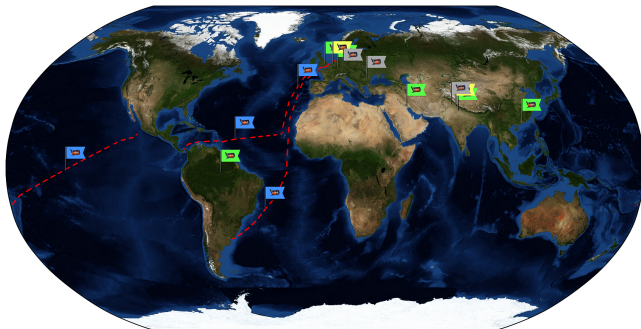
26 May 2022 | 15:24–15:31 | AS3.22 | EGU22-4750



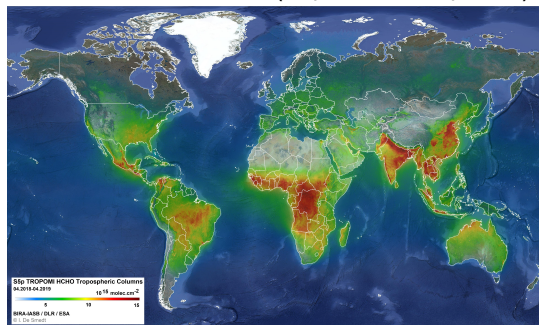
Abstract



Satellite Remote  
Sensing

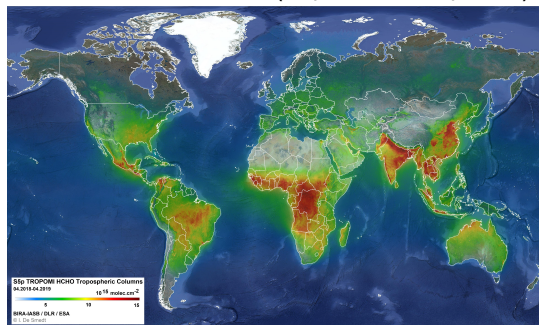


TROPOMI HCHO VCD (04/2018 to 04/2019)

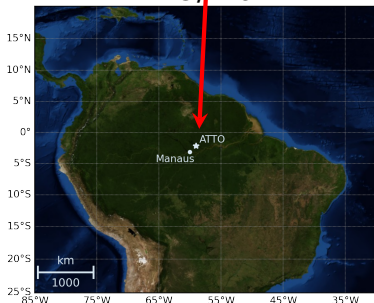


- ▶ Long-term MAX-DOAS measurements at different places around the globe
- ▶ Focus on tropospheric formaldehyde (HCHO)
- ▶ Identification of different pollution levels, source contributions and chemical regimes
- ▶ Here: focus on two stations
- ▶ Based on correlations of dSCDs of different trace species (at 3°)

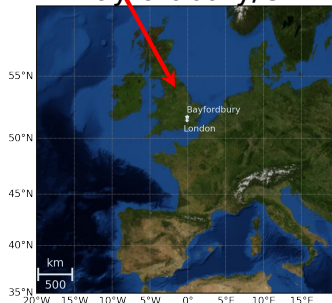
TROPOMI HCHO VCD (04/2018 to 04/2019)



ATTO/Brazil



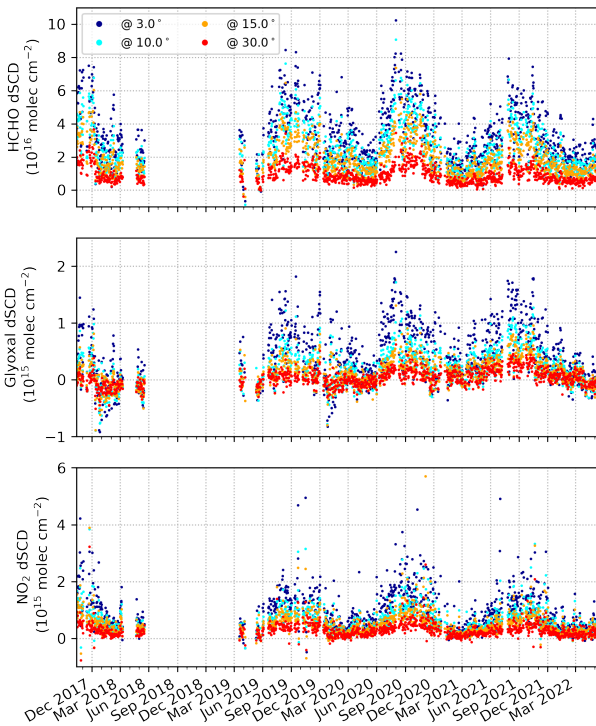
Bayfordbury/UK



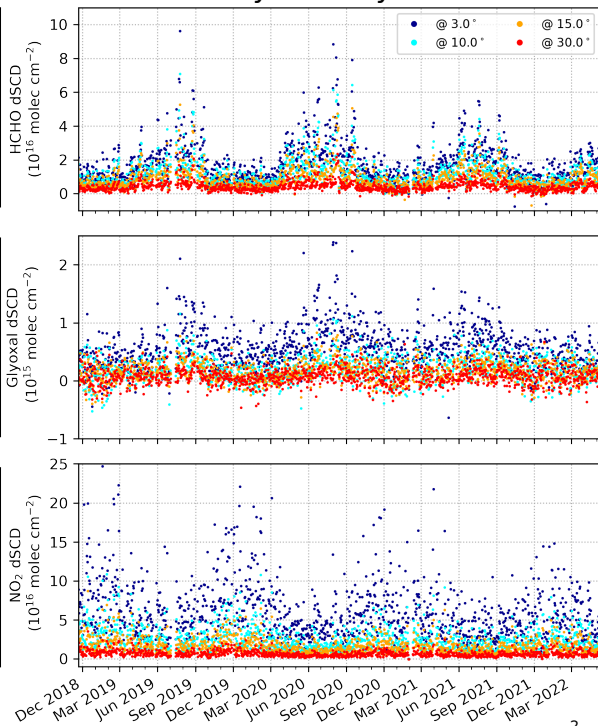
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# Overview: HCHO, glyoxal and NO<sub>2</sub> time series

## ATTO/Brazil

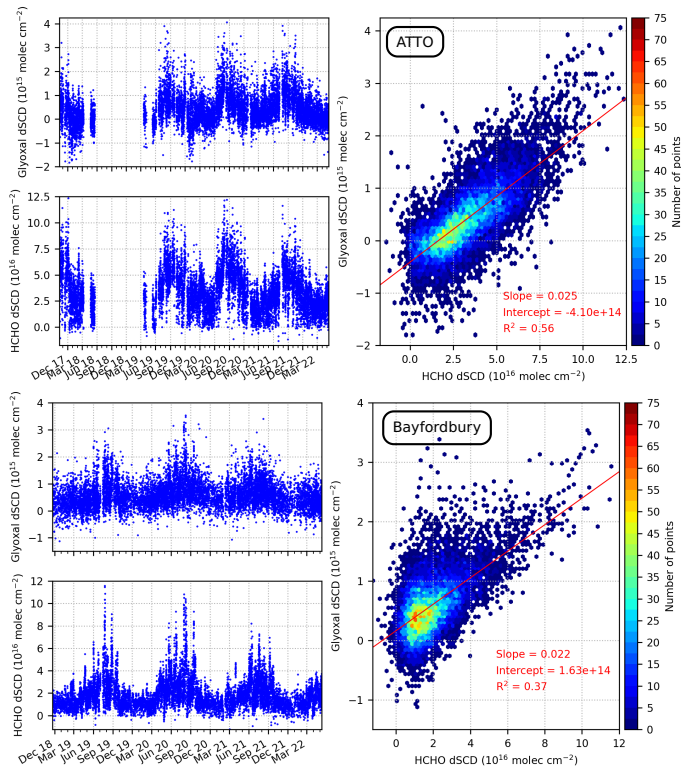


## Bayfordbury/UK





# Trace gas correlations: Glyoxal vs. HCHO



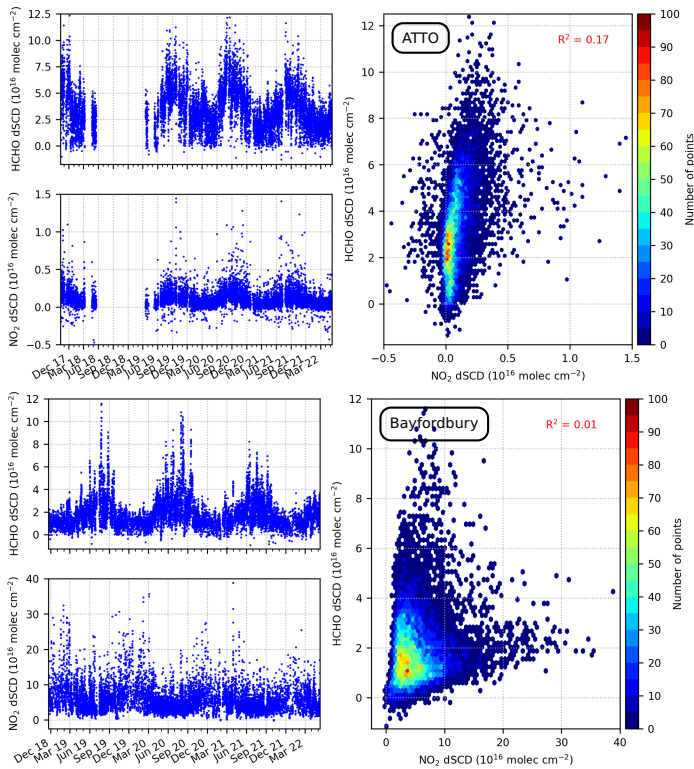
## ▶ ATTO:

- ▶ Simultaneous enhancements (mainly September → dry season)
- ▶ Good correlation for low elevations
- ▶ Profile shapes might differ (decreasing slope with increasing elevation)

## ▶ Bayfordbury:

- ▶ Simultaneous enhancements (mainly June/July → summer)
  - ▶ Still reasonable correlation
  - ▶ More complex patterns, slope decreases faster with elevation
- ▶ dSCDs indicate similar glyoxal to HCHO ratios for ATTO and Bayfordbury

# Trace gas correlations: HCHO vs. NO<sub>2</sub>



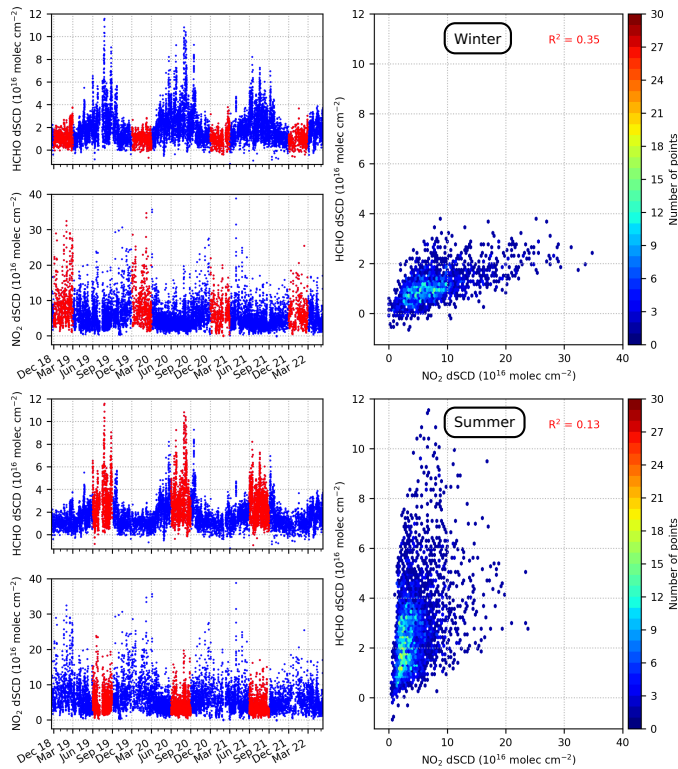
## ▶ ATTO:

- ▶ Simultaneous enhancements (mainly September → dry season)
- ▶ Highest NO<sub>2</sub> columns only associated with moderate HCHO abundances

## ▶ Bayfordbury:

- ▶ Two branches: moderate and high HCHO values → winter and summer (next slide)
- ▶ Similar for other elevations
- ▶ For both stations: Glyoxal vs. NO<sub>2</sub> shows overall similar behaviour

# Trace gas correlations: HCHO vs. NO<sub>2</sub>



## Only Bayfordbury

### ► Winter:

- Moderate HCHO under high NO<sub>2</sub> conditions → direct emissions of HCHO dominate

### ► Summer:

- High HCHO also under low NO<sub>2</sub> → secondary formation from precursors (anthropogenic/biogenic) dominate
- Also in summer episodes of moderate HCHO under high NO<sub>2</sub>

- Glyoxal vs. NO<sub>2</sub> shows overall similar behaviour

## ▶ ATTO:

- ▶ Good correlation of HCHO to glyoxal suggests similar sources → biogenic
- ▶ No clear correlation of HCHO to NO<sub>2</sub>

## ▶ Bayfordbury:

- ▶ Winter → HCHO abundance is determined by (direct) anthropogenic emissions (strong correlation to NO<sub>2</sub>)
- ▶ Summer → Secondary formation from both anthropogenic and biogenic precursors can lead to rather high columns (at 3°) up to daily means of several 10<sup>16</sup> molec cm<sup>-2</sup> (comparable to ATTO)

## ▶ Outlook:

- ▶ More sophisticated investigations based on VCDs, surface values and profiles
- ▶ More detailed analyses of the ratio glyoxal to HCHO (complex behaviour)
- ▶ Inclusion of meteorological data
- ▶ More stations



Thanks for your attention and interest!

In case of questions, comments and suggestions please contact:

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*Abstract*