

Exploring the use of various atmospheric OH fields using MCF

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Wageningen, 21.10.2024



- Goal: Inverse modeling of biomass burning CO (and CH₄) emissions
- requires reasonable OH to get loss right
- Problem: state-of-the-art OH climatology is over 20 years old
- Updated fields have been proposed, so far none clearly 'better'
- Here: use MCF to assess quality of fields

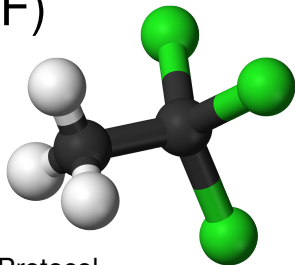
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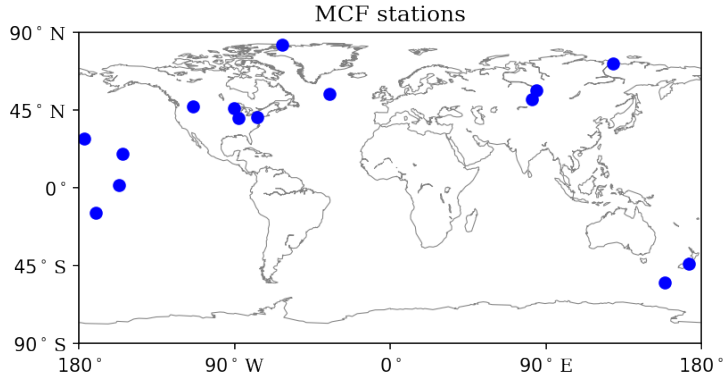
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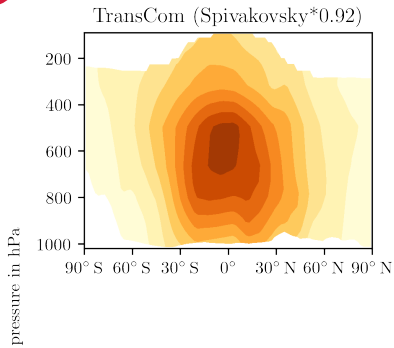
Methyl Chloroform (MCF)



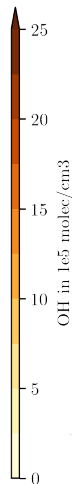
- 1,1,1-Trichloroethane, CH_3CCl_3
- Ozone depleting solvent, regulated under Montreal Protocol
- atmospheric load declines since 1996
- Loss processes: mostly reaction with OH, also ocean uptake and photolysis
- rate of decline informs on OH available in atmosphere

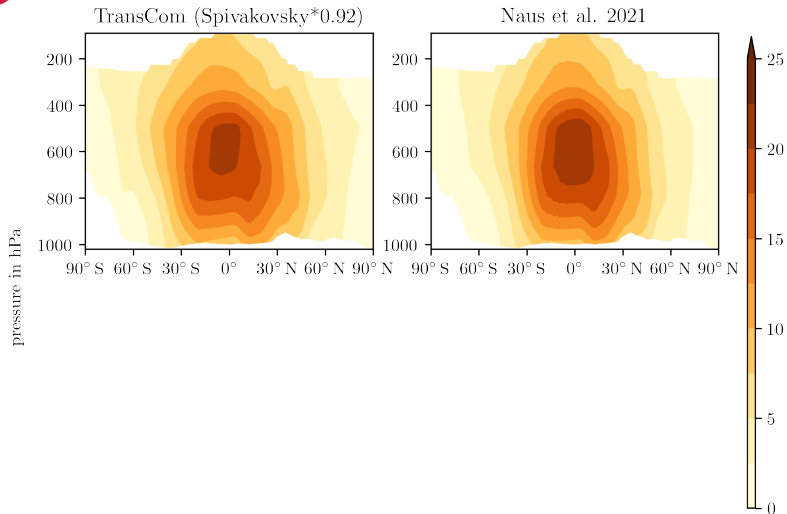


- Sparse global network of NOAA/GMD surface flask measurements
- Long timeseries, some over 3 decades, weekly to monthly resolution

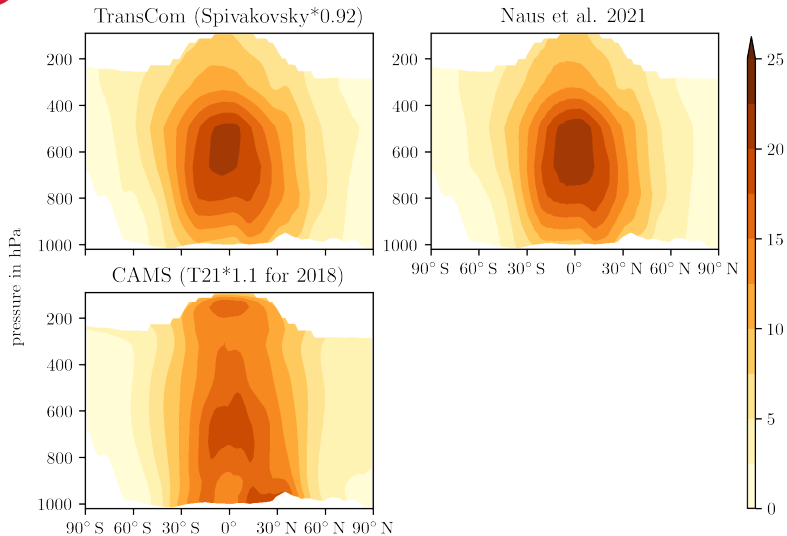


- TransCom: climatology; tropo: Spivakovsky et al. 2000, strato: Brühl
- Naus: optimized TransCom
- CAMS: IFS based simulated OH
- TM5: simulated OH (Myriokefalitakis et al. 2020)
- Naus puts TransCom closer to models

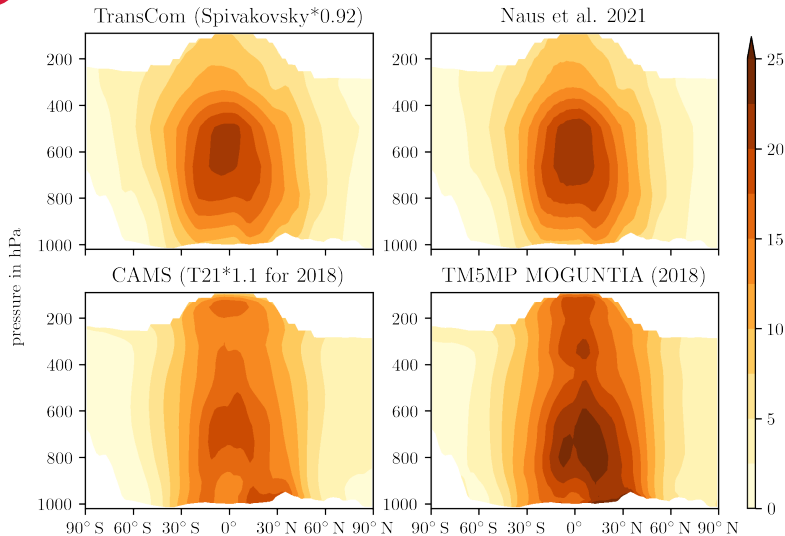




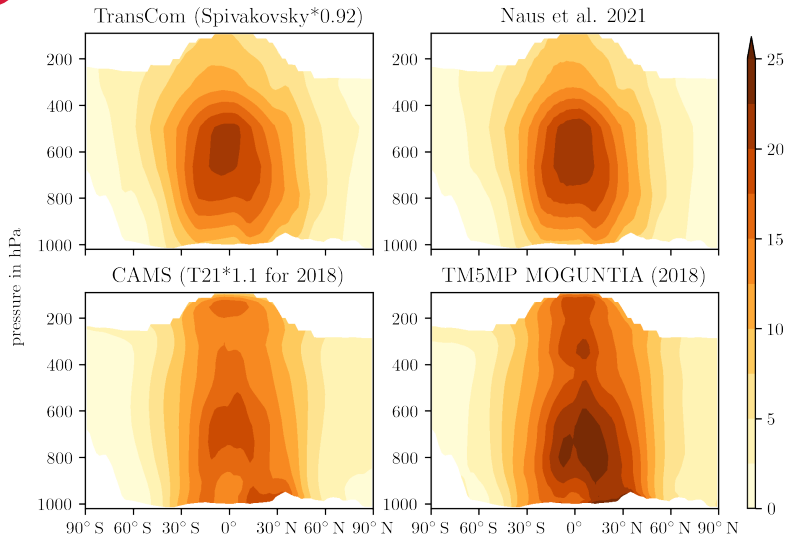
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- MCF-only branch of TM5-MP-4dvar (TMVar) model
- 21 year (1998-2018) forward simulations of global MCF at $6^\circ \times 4^\circ$
- 5 different OH fields
 - $2 \times$ TransCom OH
 - Combining Spivakovsky and Brühl within the model as in TM5-4dvar
 - Prior field from Naus et al 2021, already pre-combined
 - Naus, TM5, CAMS
- Same residual emissions, ocean sink, and photolysis rates as in Naus et al. 2021

Bug alert! When reading OH concentrations other than CAMS to calculate loss rates (for MCF, CH₄, ..) in TMVar, loss might be heavily overestimated. Bug fix coming soon to a repository near you, but keep it in mind when using old versions/branches.

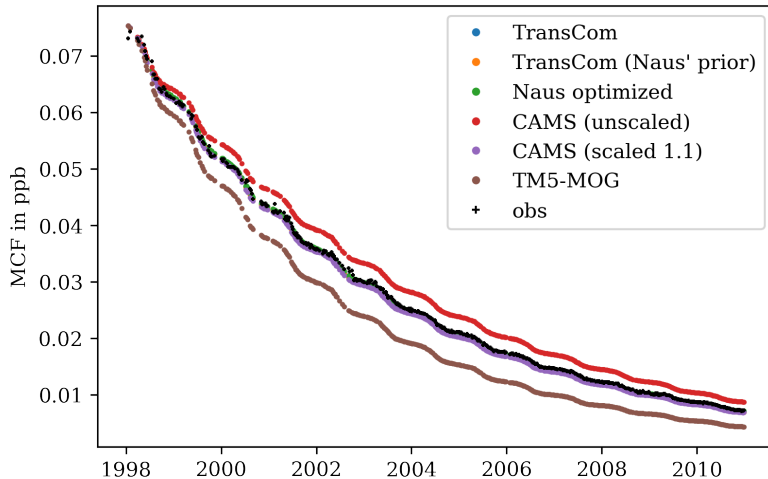
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(Very) preliminary results



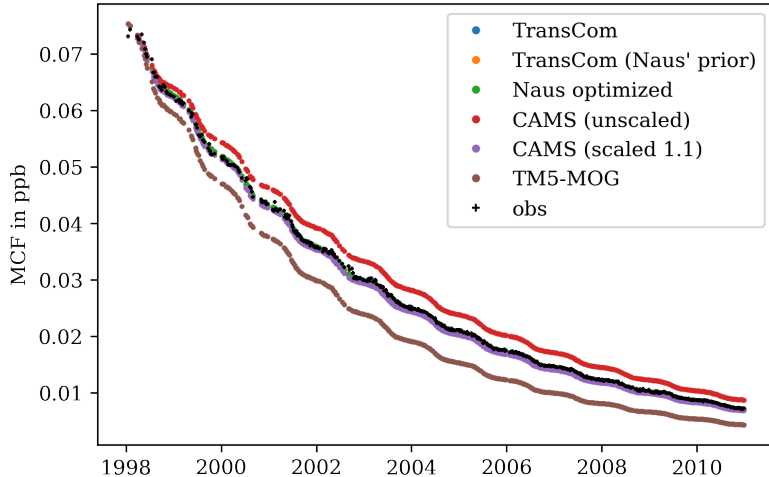
Alert, Nunavut, Canada (ALT) 82.45° N, -62.51° E



- Other stations very similar
- Reproduced Naus' results
- Arjo advises scaling CAMS by 1.1
- TM5-MOG OH far too large

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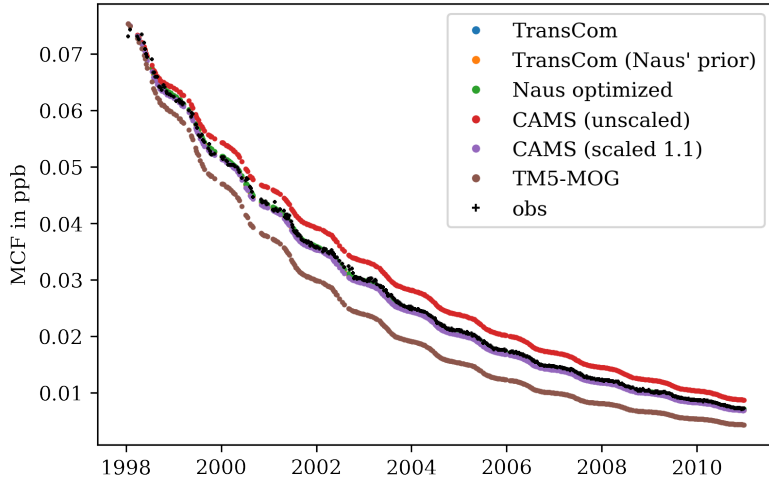
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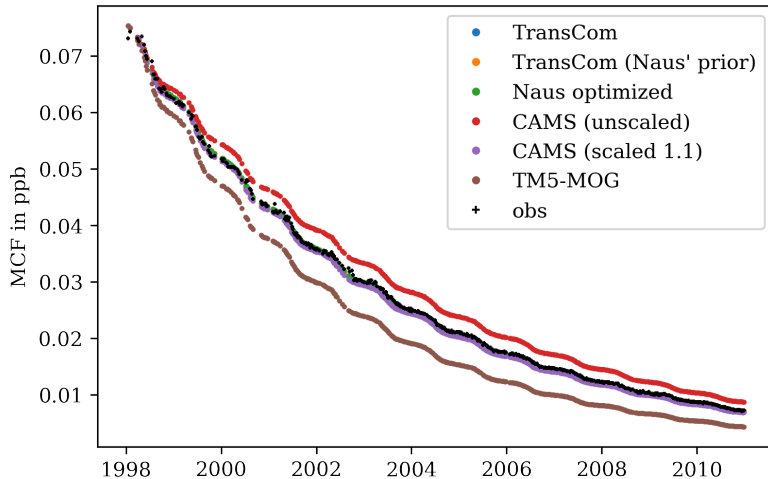
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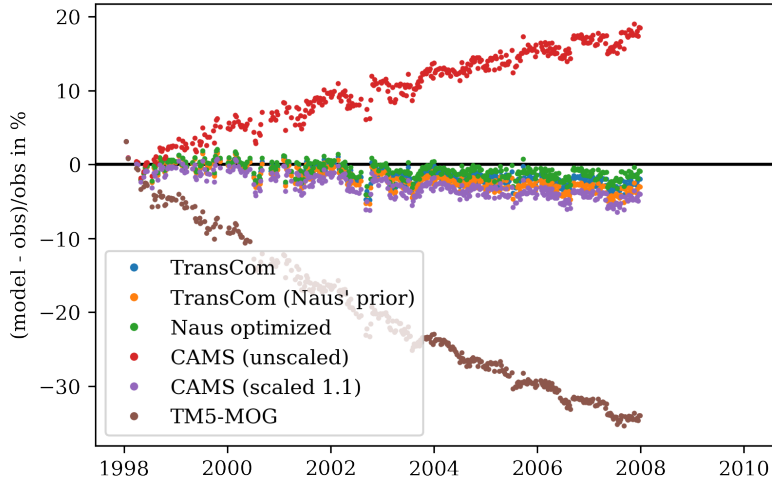
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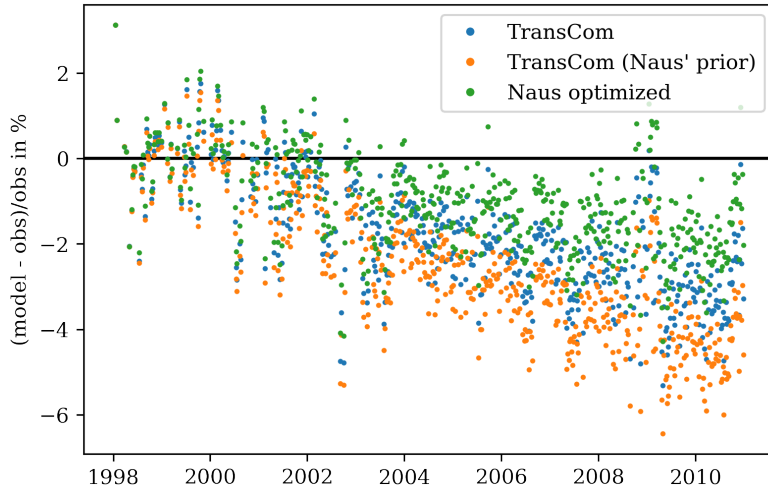


Global RMS

TransCom:	2.2%
Naus' prior:	2.8%
Naus opti:	1.6%
CAMS:	15.4%
CAMS*1.1:	3.4%
TM5:	27.6%

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Merging within TMVar results in lower mismatch compared to Naus' pre-combined prior

- Not related to meteo
- Same resolution
- Same scaling factors
- Vertical averaging?

- MCF branch of TMVar is working on aether
- Results as expected, old (scaled) Spivakovsky climatology still agrees very well with MCF measurements and better than models
- Naus' study pushes TransCom zonal distribution closer to other fields. Good middle ground for now?
- Bug in TMVar OH reading routine found!

Thank you for your attention. Questions?

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