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CAMAERA

WP7

Updating Biogenic VOC - activities and current status

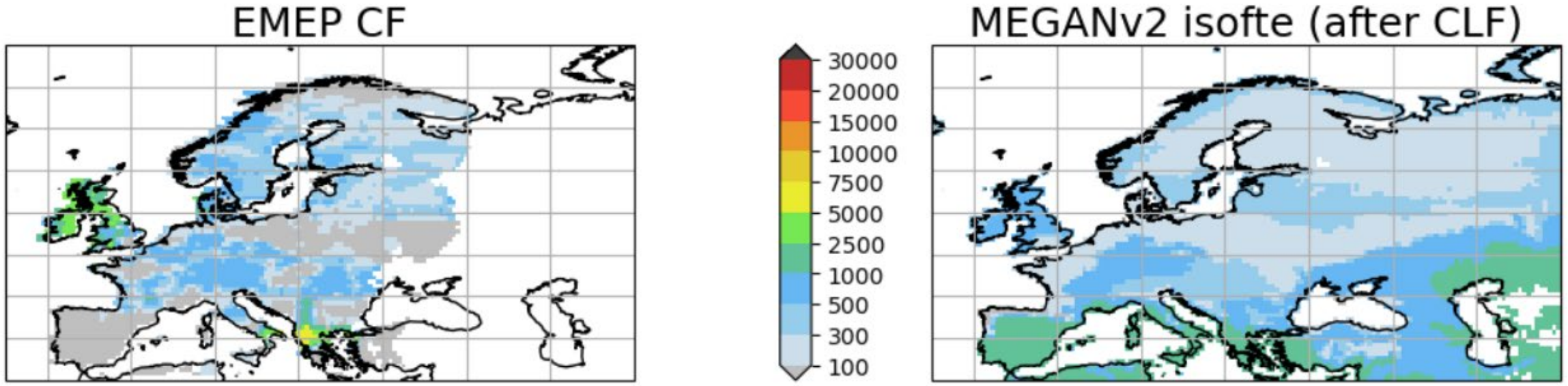
David Simpson (Met Norway) & Vincent Huijnen (KNMI)

CAMAERA meeting 04-05.6.2025

WP7 Land-cover and BVOC update

Starting Status:

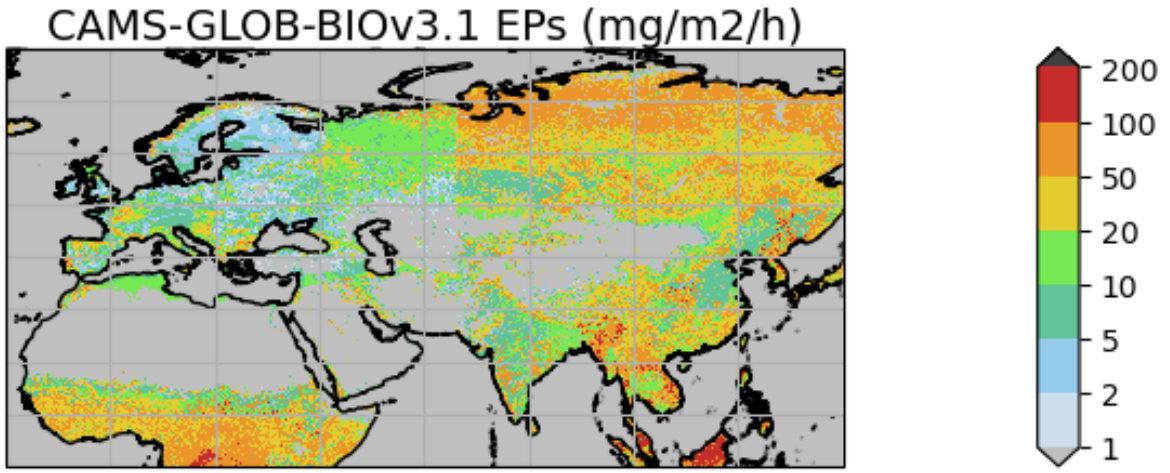
- Emission Potentials very different between EMEP and MEGAN, e.g. isoprene from coniferous needleleaf



WP7 Land-cover and BVOC update

Starting Status:

- IFS BVOC from CAMS-GLOB-BIO
  - with MEGAN2-like algorithms
  - European isoprene emission factors from EMEP (> 130 tree species!)
  - RoW from MEGAN2
- Issue 1: discontinuous between EMEP domain and rest of globe
- Issue 2: discrepancy with preliminary satellite estimates

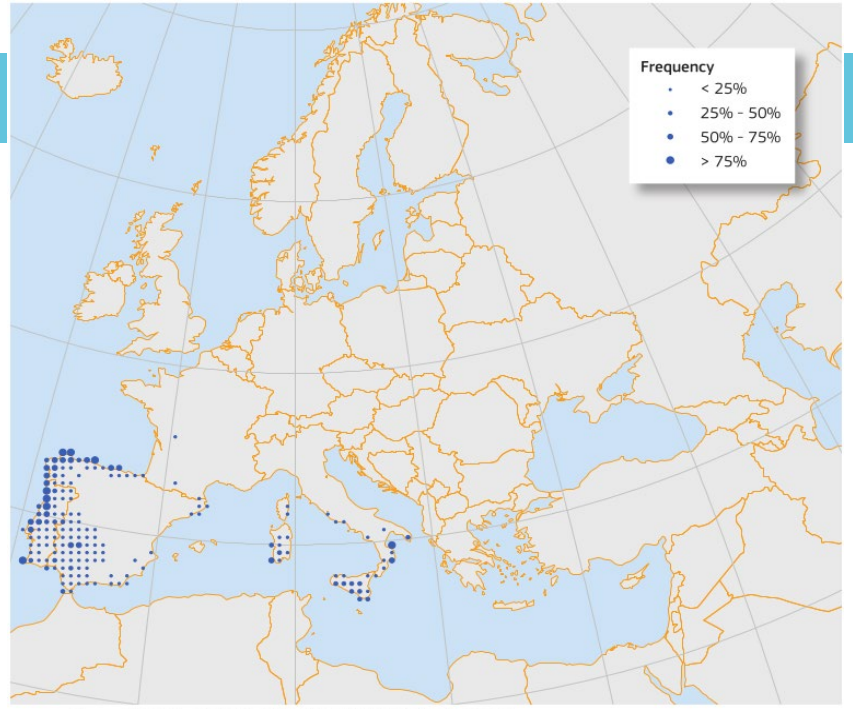


Aims:

- Updated land-cover basis for BVOC (and soil NO emissions)
- Improve emissions factors and algorithms to better match surface and satellite data

BVOC Land Cover issues

- EMEP/European EPs based upon data for > 130 tree species, assigned to 4 forest PFTs.
- EMEP also uses PFT-specific LAI
- MEGAN/IFS etc use ca. 10-15 PFTs
- According to ESA (and CLM-MEGAN and ECOCLIMMAP-SG), no evergreen broadleaf in Europe. Misses eucalyptus, Holm Oak, etc. ….. important for BVOC!
- Need to sub-divide e.g. ESA “unmanaged grasslands” into tundra, savannah, moorland, and maybe shrubs (?)
- Definitions vary :-(
  - e.g. ESA shrubs > 3m. These are trees in FAO definitions!



Map 1: Plot distribution for *Eucalyptus* spp.

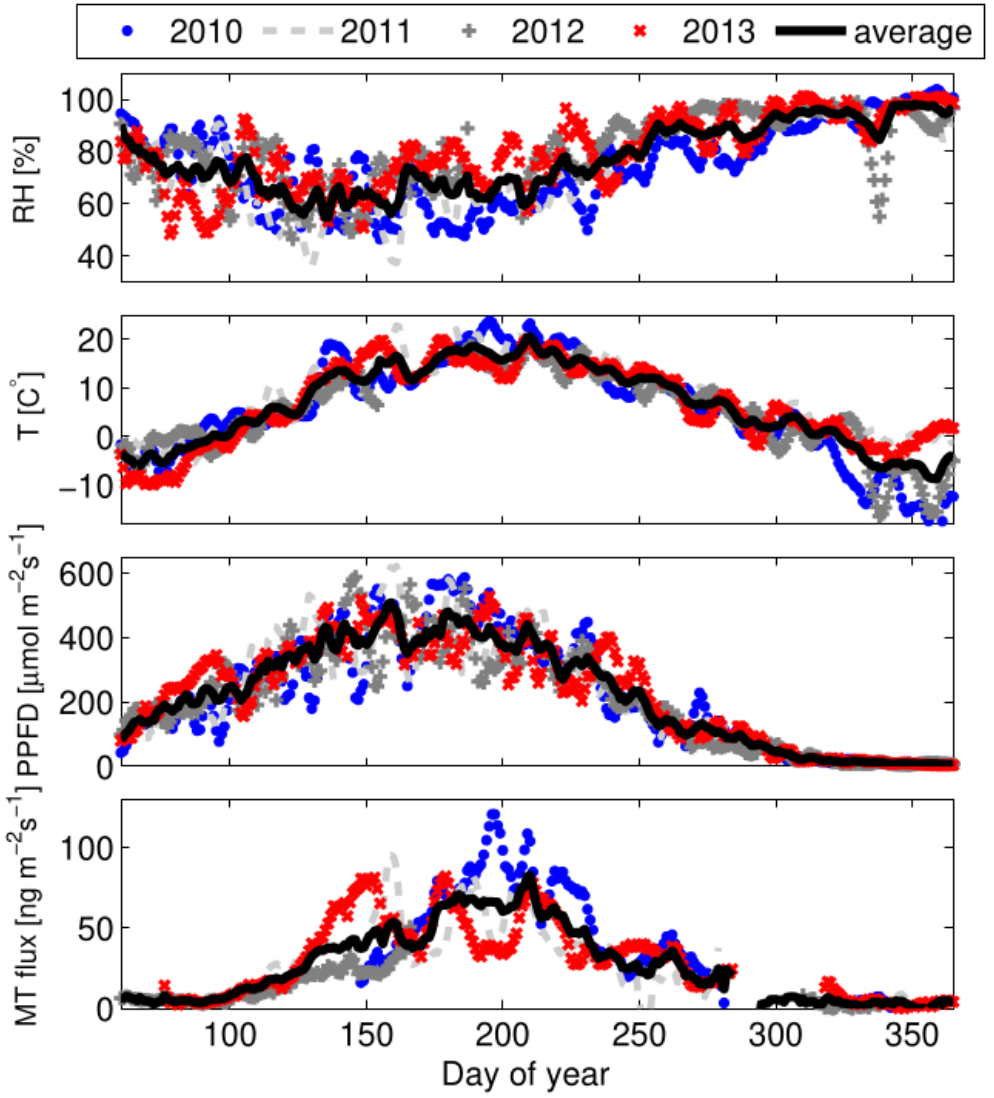
Eucalyptus - from Cerasoli ea, European Atlas of Forest Trees, 2016

SEE THURSDAY TALK

WP7 Emission potential updates

Much new data for some key species and ecosystems, e.g. Norway spruce, Scots pine, oaks, and wetlands

- Of course, difficult to interpret ;-)
- Many complexities related to seasonality
- Still, revising EPs for EMEP usage.
- Prelim: isoprene emissions might decrease in some ecosystems (boreal forests), but sesquiterpenes will likely increase.



Rantala e.a. 2015: long-term data from Hyytiälä

WP7 Emission potential updates

- Decisions, decisions - what to do about sesquiterpenes…..

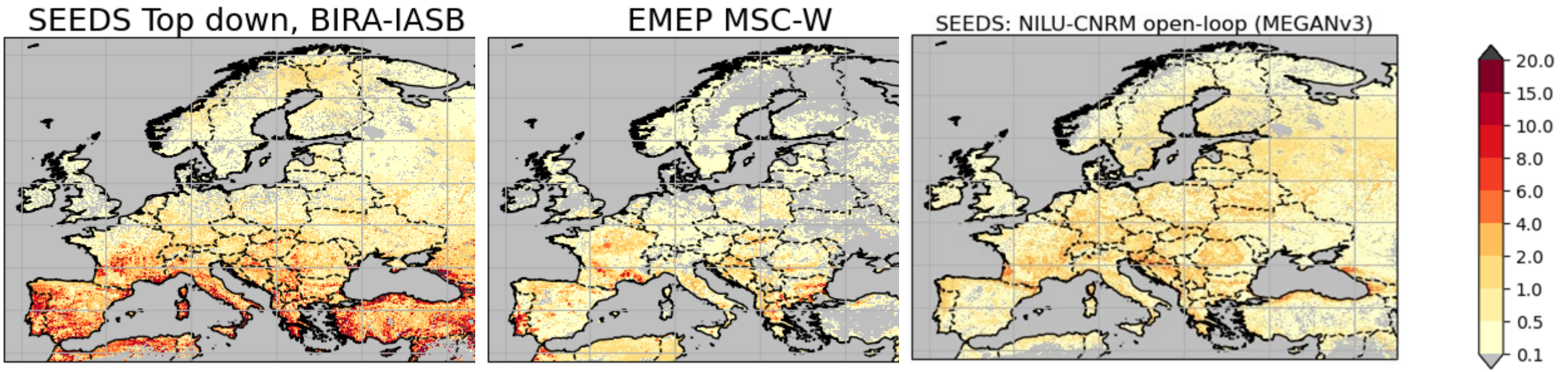
Species	EP-Iso $\mu g\, g^{-1} h^{-1}$	EP-MT $\mu g\, g^{-1} h^{-1}$	EP SQT/MT (%)
Norway spruce (*Picea abies*)			
EMEP	1	1.5	10%
van Meeningen 2017	0.94	1.5	20%
Finland, Hakola 2023	?	0.3	800-1200%
Finland, MEGANv2.1 from Hakola	4	1.9	16%

(& MEGANv3 seems to use SQT/MT ~100% for Norway spruce)

WP7 Comparison with satellite and other data

Isoprene emissions: preliminary comparison with satellite?

g/m^2

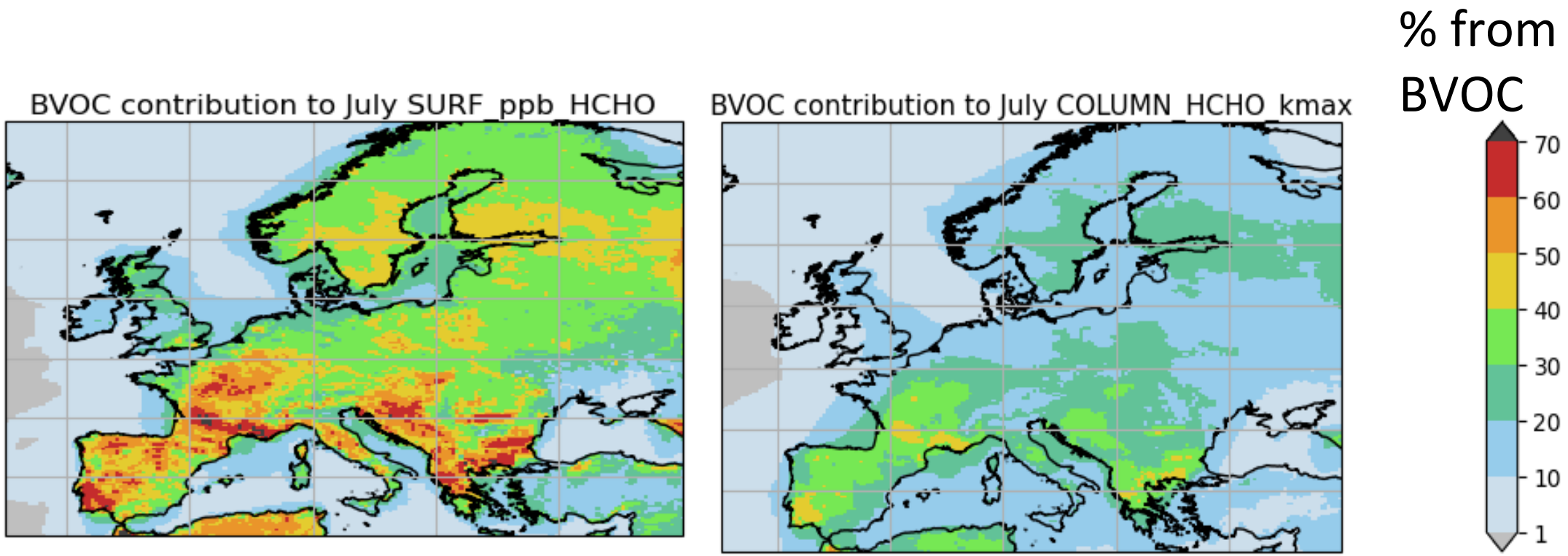


Suggests EMEP and MEGANv3 emissions too low, but:

- Inversion depends on a-priori model (here MAGRITTE)
- Issues with measured HCHO (cf FTIR data)
- Issues with link between HCHO & Isoprene
- Convergence would require substantial changes in emission factors - are these plausible?

WP7 Met Activities, BVOC

Can we use HCHO to get BVOC emissions? EMEP results for July 2019:



Implies that satellite retrieval of isoprene emissions via HCHO cannot ignore AVOC.

WP7 NEW LAND-COVER SYSTEM (via python scripts, prelim)

Flexible hierarchy:

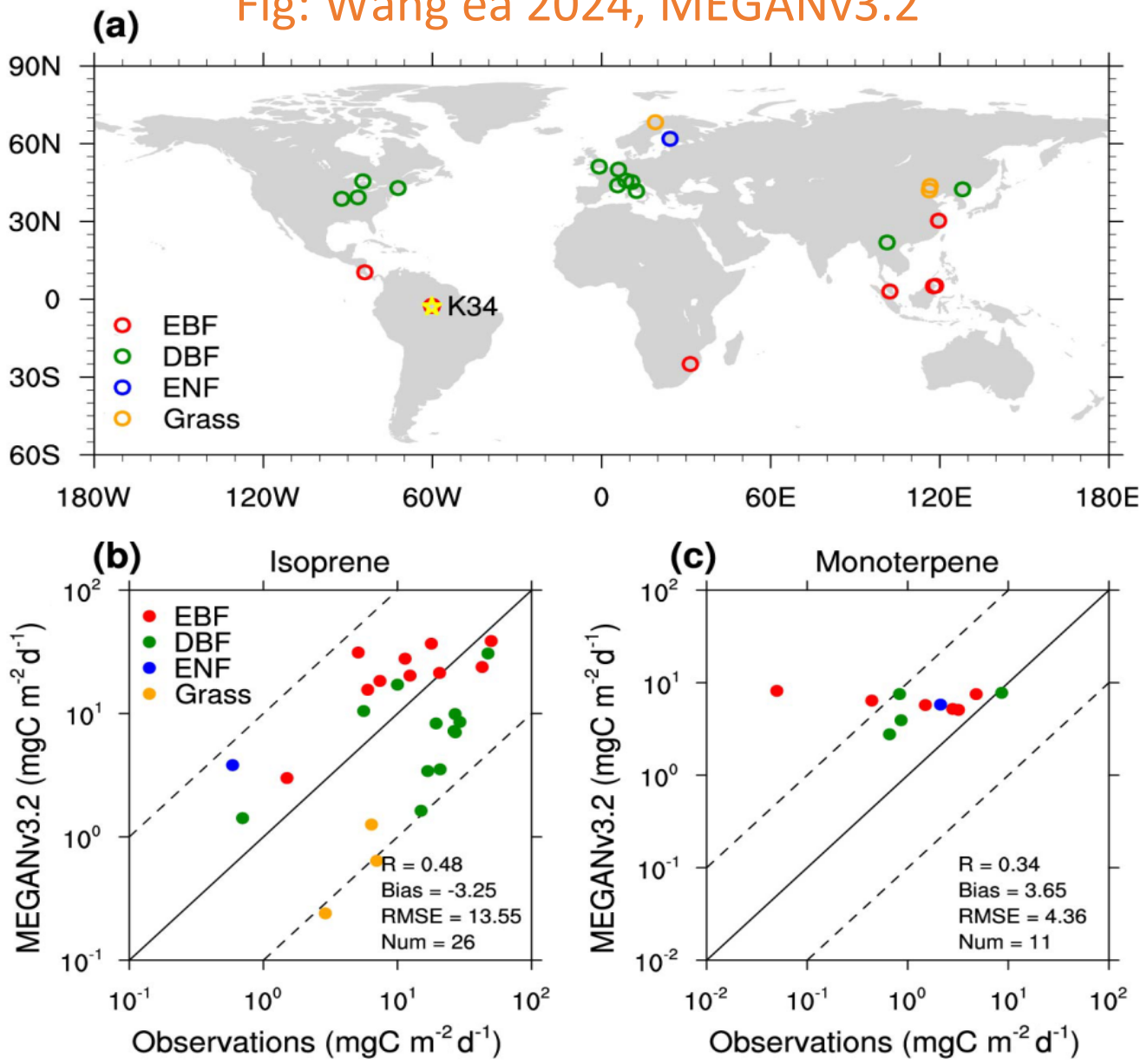
- Top = **ESA** or **ECOCLIMMAP-SG** or **MEGAN**
- + Koeppen or Olson => Steppe, boreal, desert etc
- + EMEP/SEI or CORINE
  => Tundra, Med. Scrub, moorland
  => Med. broadleaves
- Allows uniform system from km-level to global
- Allows EMEP-level detail where available
- Avoids cross-walk tables

WP8 MET Norway activities, BVOC

The next phase:

- Further comparisons with CrIS, Tropomi
- Towards MEGAN3?
- More focus on algorithms, seasonality
- And SQT

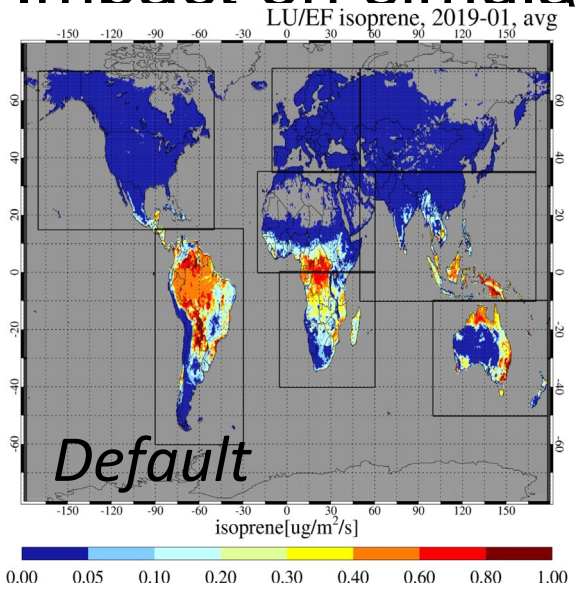
Fig: Wang ea 2024, MEGANv3.2

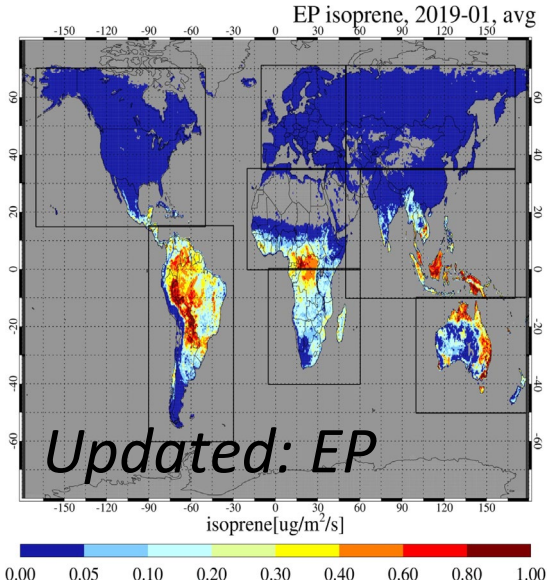


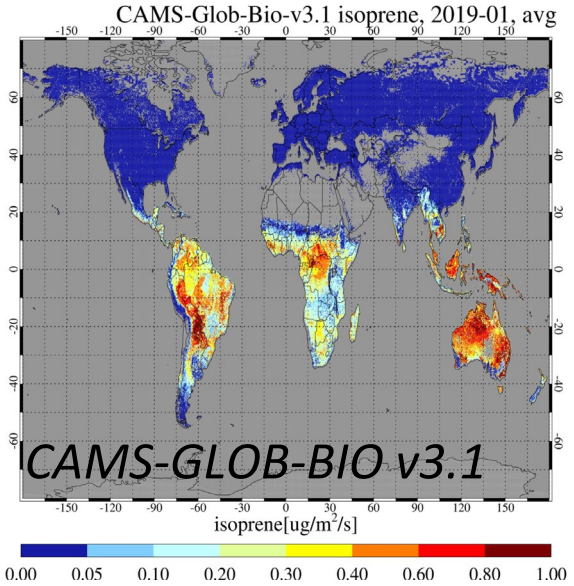
Updates to IFS-COMPO

- MEGAN-style online parameterization of BVOC in IFS-COMPO; large uncertainties remain.
- Test the update of using a gridded Emission Potential dataset.

- Impact on simulated emissions:





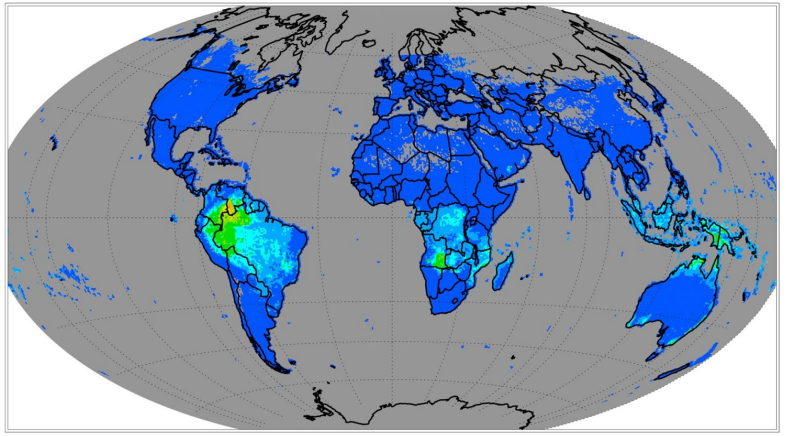


- *Exploit satellite retrievals to validate such changes.*

IFS-COMPO against CrIS, January 2019

Impact of using LU/EF (middle) vs Emission Potential (right)

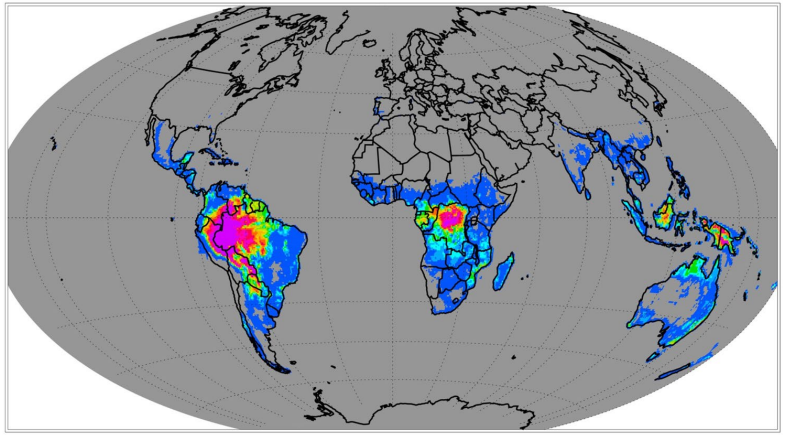
CrIS mean C_5H_8, Jan — SNPP (Wells et al. 2022)



C_5H_8 column density [10^{15} molec/cm^2]

0.0 2.5 5.0 7.5 10. 12. 15. 17. 20. 22. 25. 27.

IFS–COMPO mean C_5H_8, Jan — LU/EF



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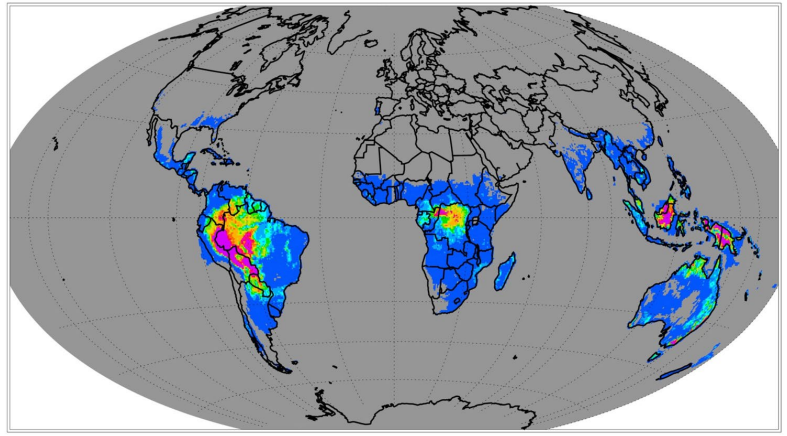
IFS–COMPO mean C_5H_8, Jan — EP



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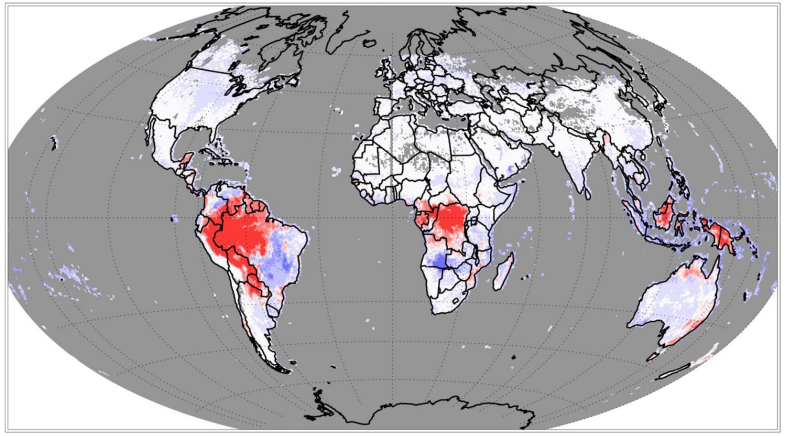
bias C_5H_8: LU/EF – CrIS for Jan



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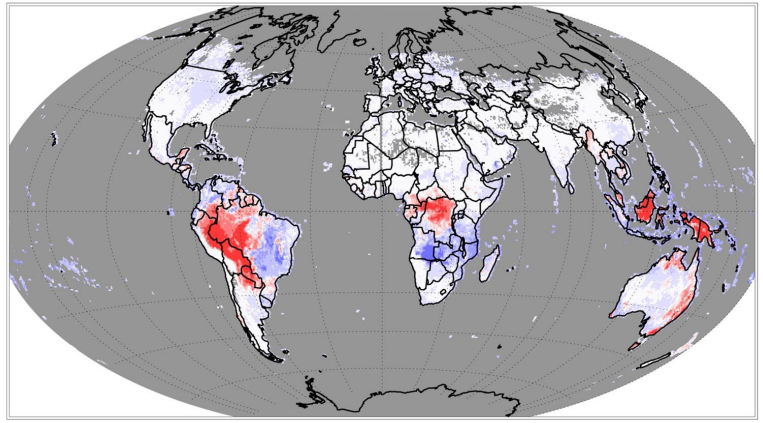

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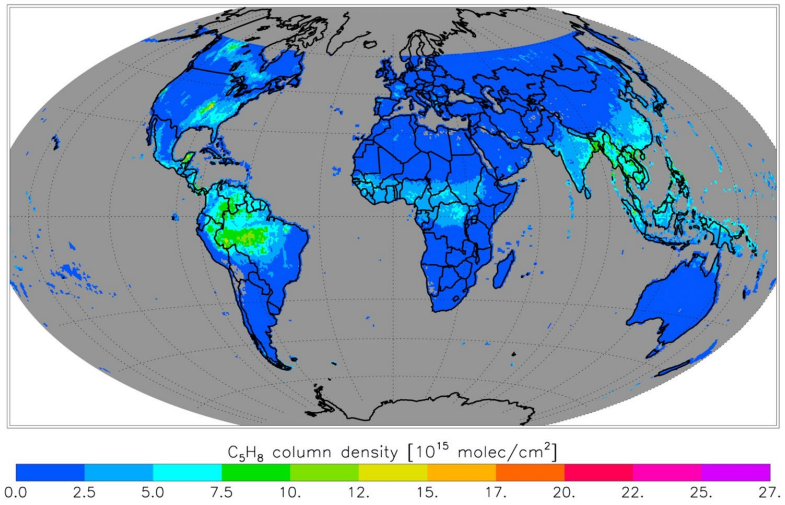

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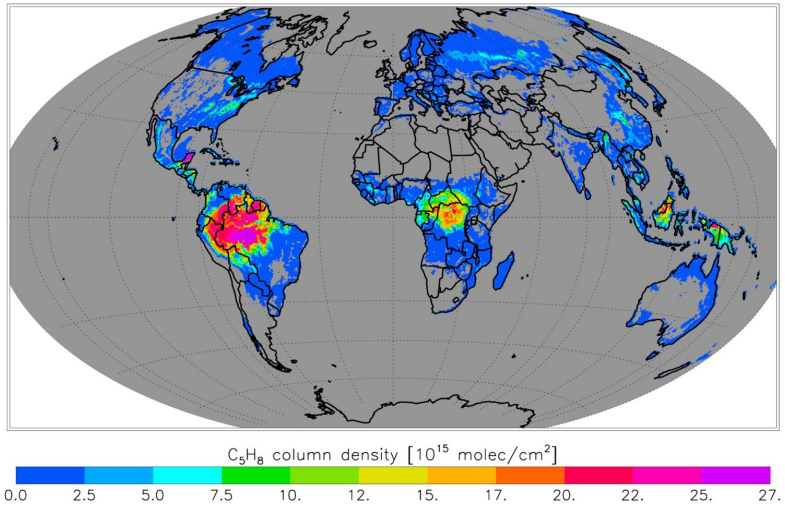

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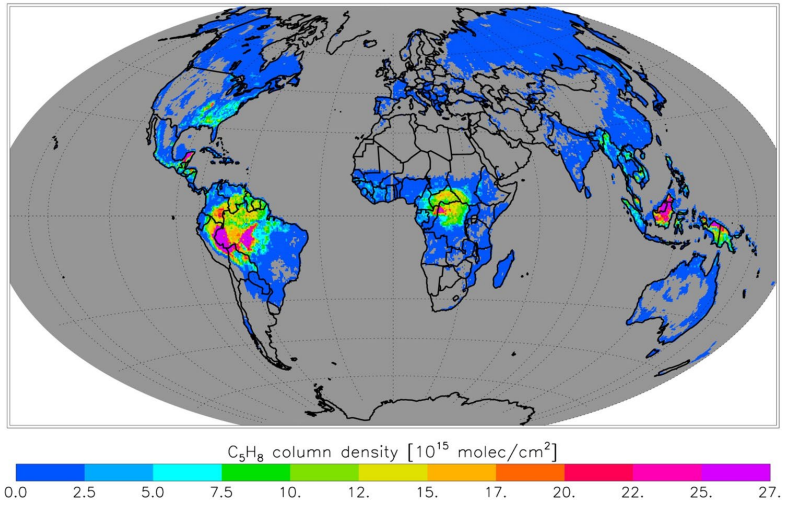

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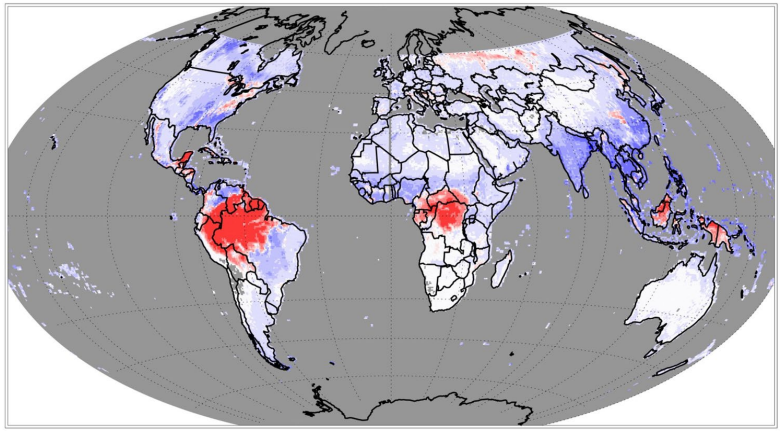

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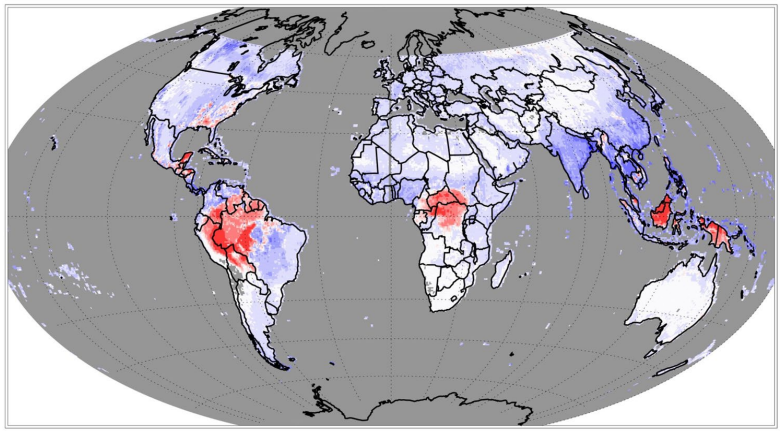

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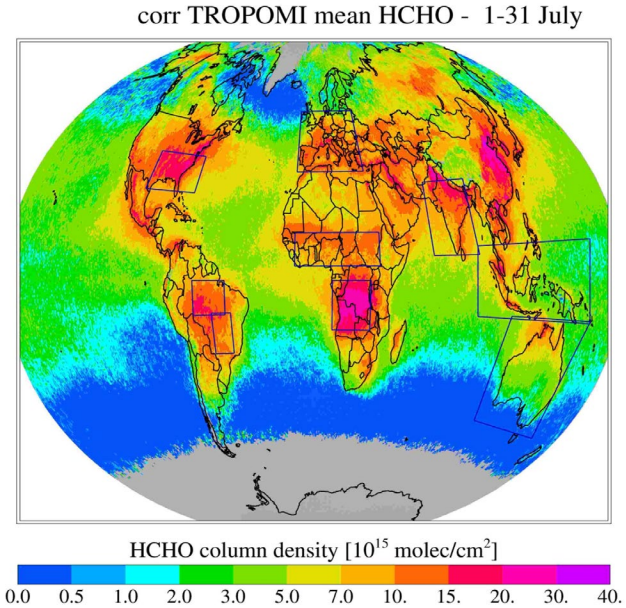
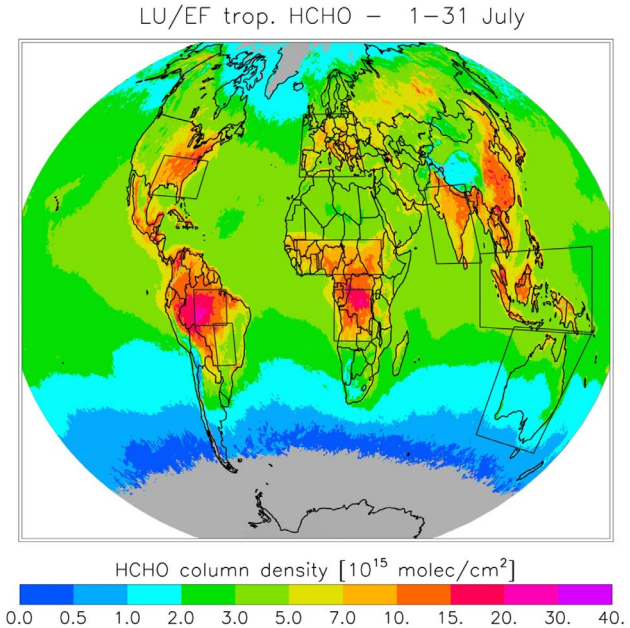
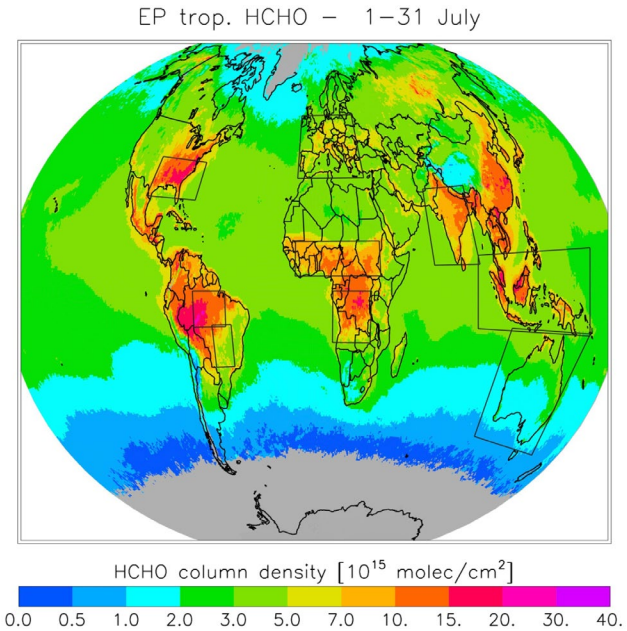
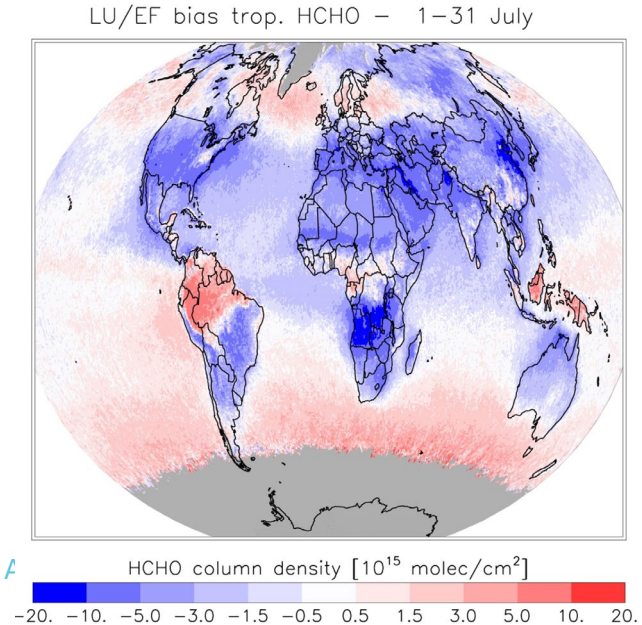
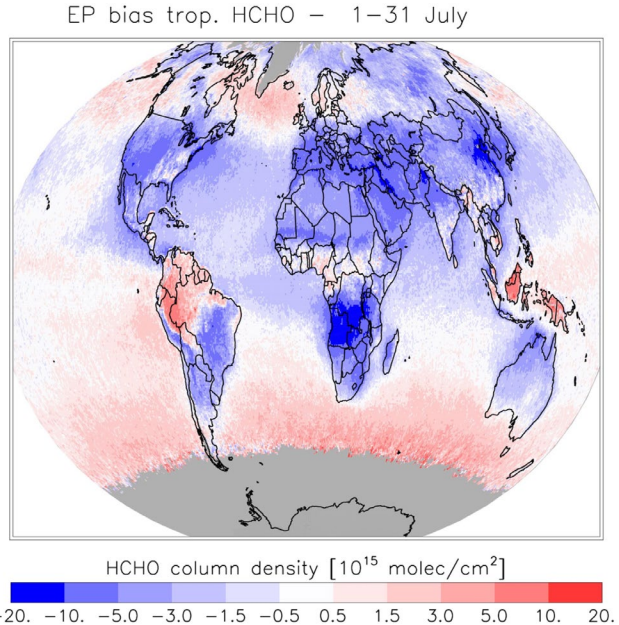
Evaluation of CH2O columns





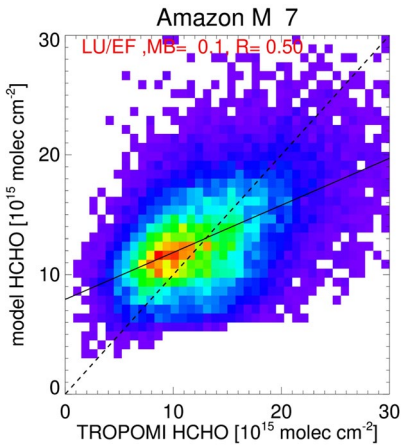


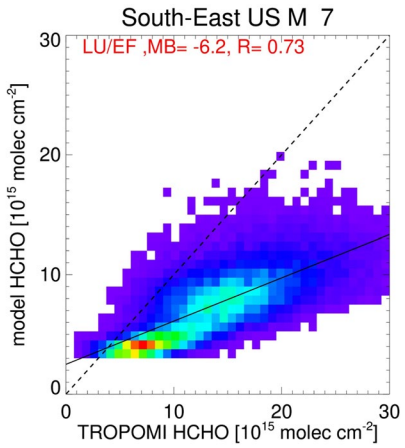


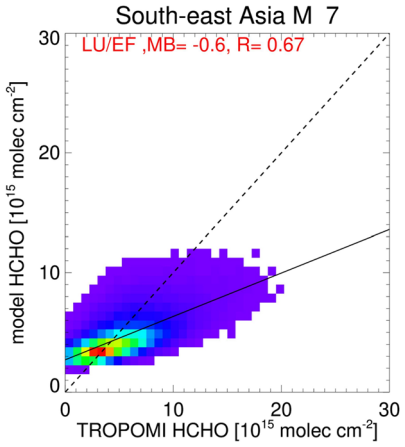


Statistical evaluation

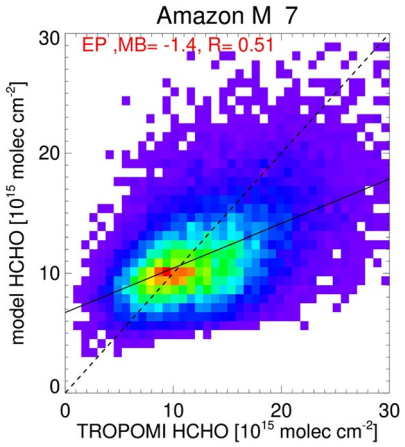
Use of LU/EF

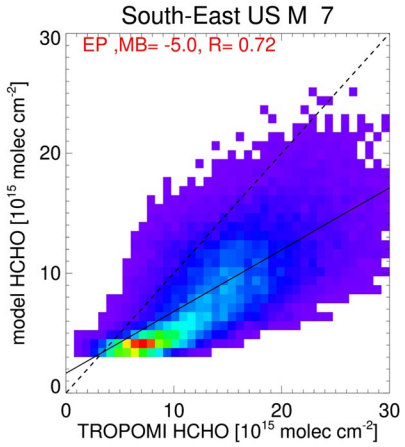


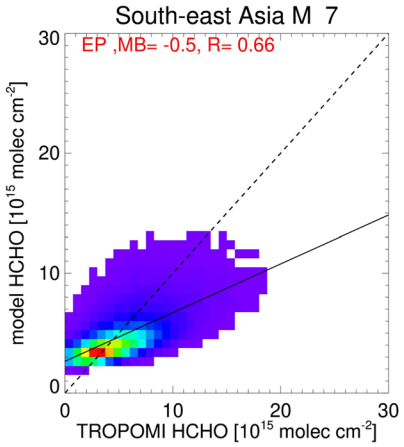




Use of EP







Summary:

- Use of emission potential closes gap between IFS-COMPO and CAMS-GLOB-BIO emission estimates,
- but this does not resolve biases seen when evaluating the model against CrIS (C5H8) and TROPOMI (CH2O)
- Future: better exploit C5H8 direct CrIS observations to optimize the emission potential?