Perspectives on BVOC emission estimates from CAMS

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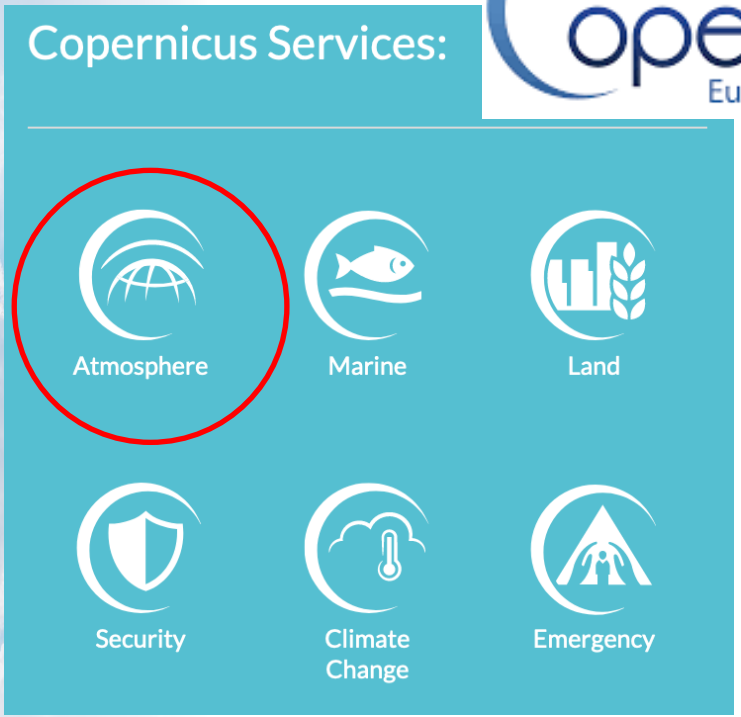
Overview of CAMS



Copernicus Europe's eyes on Earth

Atmosphere Monitoring Service

The Copernicus Atmosphere Monitoring Service (CAMS) provides consistent and quality-controlled information related to air pollution and health, solar energy, greenhouse gases and climate forcing, everywhere in the world.

IMPLEMENTED BY ECMWF

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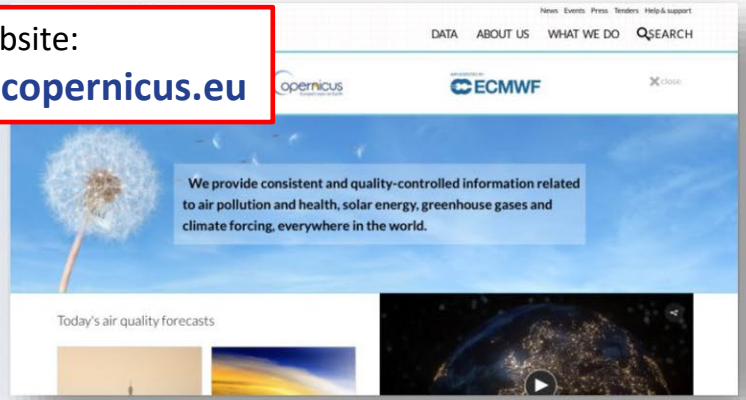
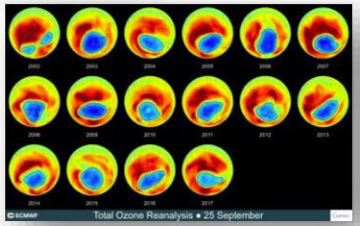
CAMS data fully public and free-of-charge

Website:
atmosphere.copernicus.eu



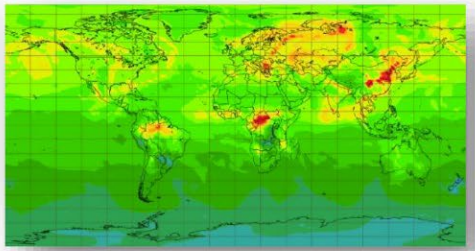
European Air Quality and products in support of policy users

Ozone layer

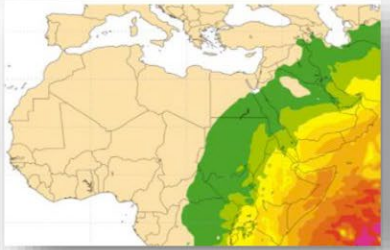


Climate forcings

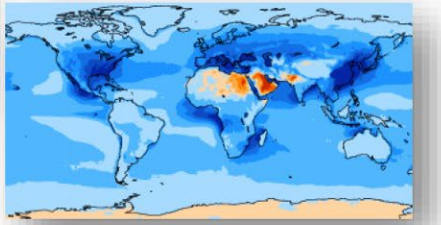
Bottom-up emissions and surface fluxes of greenhouse gases



Global analyses, forecasts and reanalyses (2003-...)



Solar radiation and UV index



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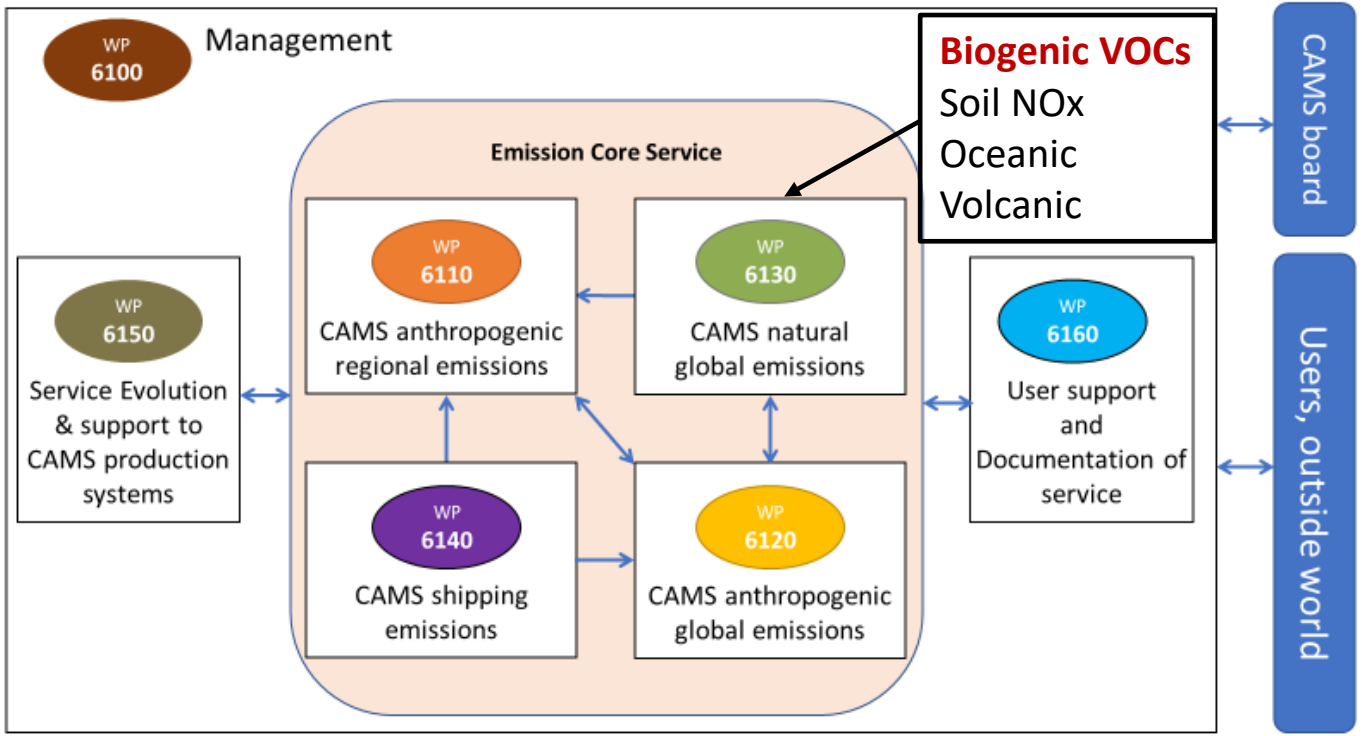
CAMS2_61: Global and Regional emissions



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Global dataset of BVOCs: CAMS-GLOB-BIO

CAMS-GLOB-BIO dataset

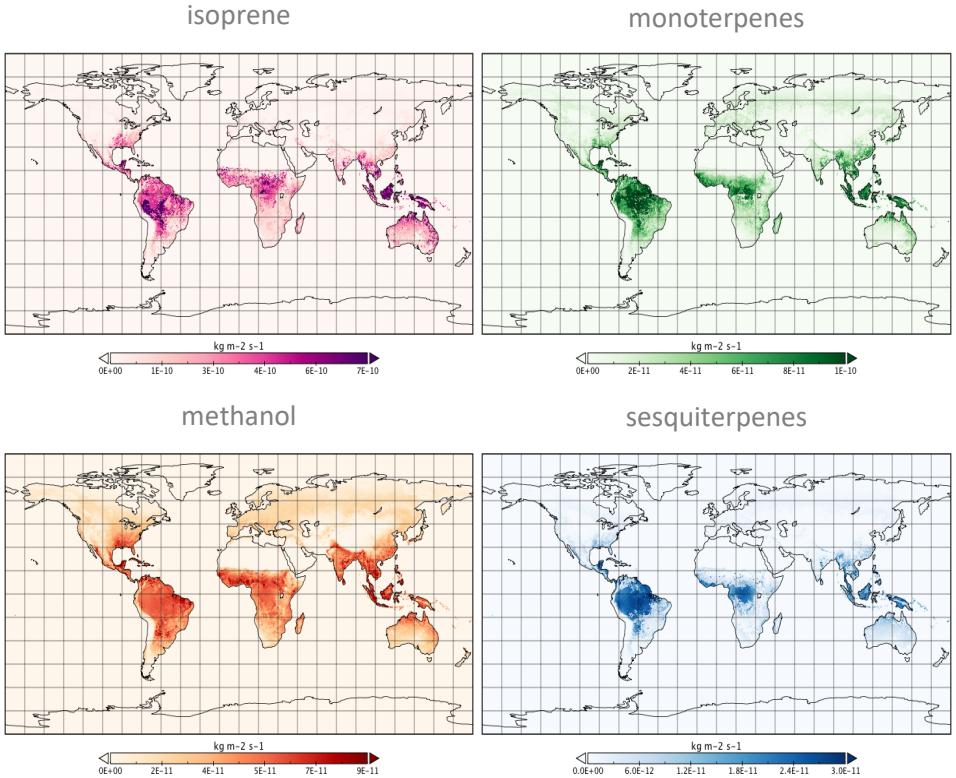
- 'bottom-up' global emission dataset of biogenic VOCs from vegetation
- Simulated by the Model of Emissions of Gases and Aerosols from Nature (MEGANv2.1) *(Guenther et al., 2012)*
- Driven by ECMWF meteorological reanalyzes
- Vegetation seasonality provided with the MODIS5 Leaf Area Index
- Data available as monthly means and monthly averaged daily profiles

Sindelarova et al., ESSD (2022)

https://doi.org/10.5194/essd-14-251-2022

Spatial distribution of BVOC emissions

CAMS-GLOB-BIOv3.1 (mean 2000-2019)



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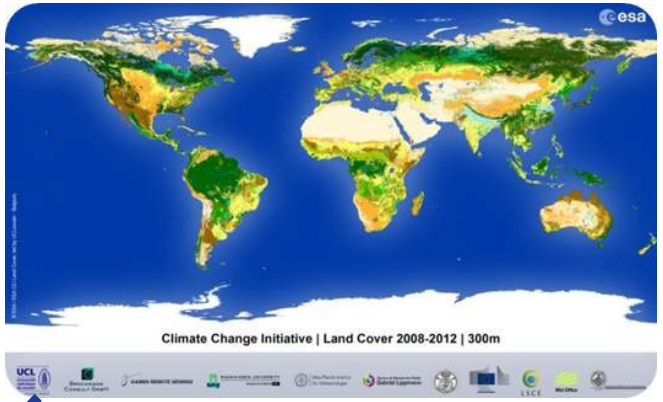
CAMS-GLOB-BIO datasets

CAMS-GLOB-BIOv3.1

- driven with ERA5 meteorology
- covers 2000-2022 period
- with 0.25° x 0.25° hor. spatial resolution
- static land cover from CLM4
- update of isoprene emission factors in Europe based on detailed land cover and species-specific data provided by the EMEP model

ESA-CCI land cover

esa-landcover-cci.org



CAMS-GLOB-BIOv3.0

- based on ERA5
- covers 2000-2019 with 0.25° x 0.25° res.
- considers land cover change defined by annual land cover data from **ESA-CCI**

CAMS-GLOB-BIOv1.2

- driven with ERA-Interim
- covers 2000–July 2019
- resolution 0.5° x 0.5°

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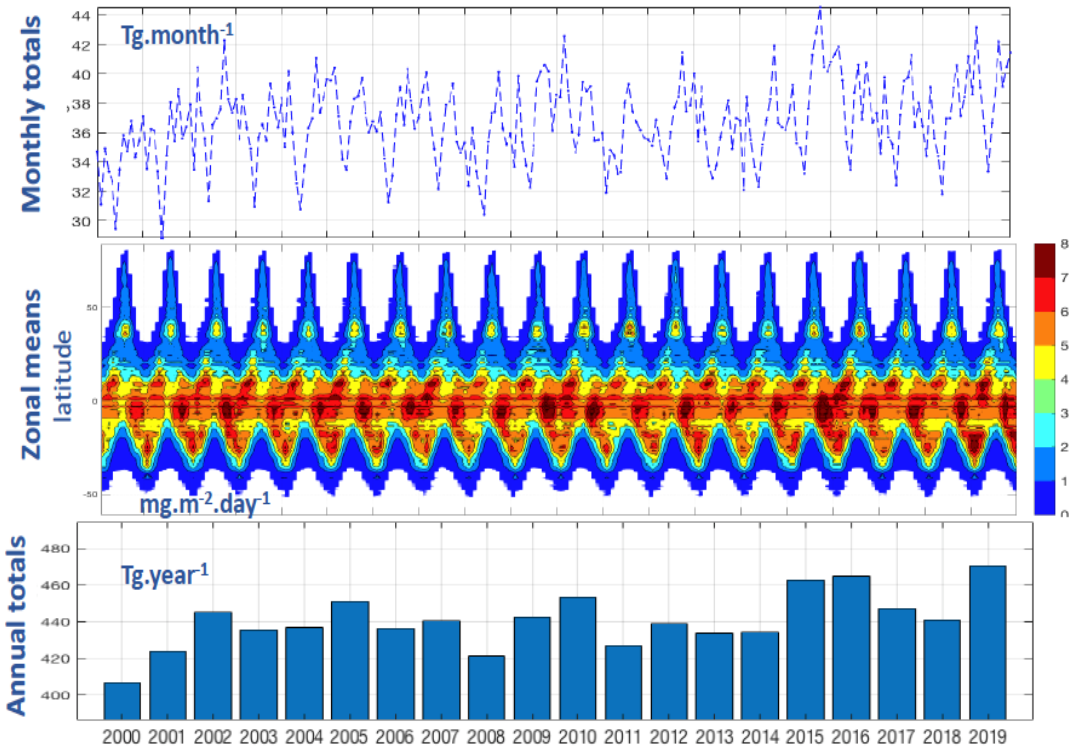
CAMS-GLOB-BIO datasets

List of modeled species

isoprene
〈-pinene
®-pinene
other monoterpenes
sesquiterpenes
CO
ethane
propane
butane and higher alkanes
ethene
propene
butene and higher alkenes
methanol
ethanol
formaldehyde
acetaldehyde
other aldehydes
acetone
other ketones
formic acid
acetic acid
toluene

Isoprene global time series 2000-2019

CAMS-GLOB-BIOv3.1



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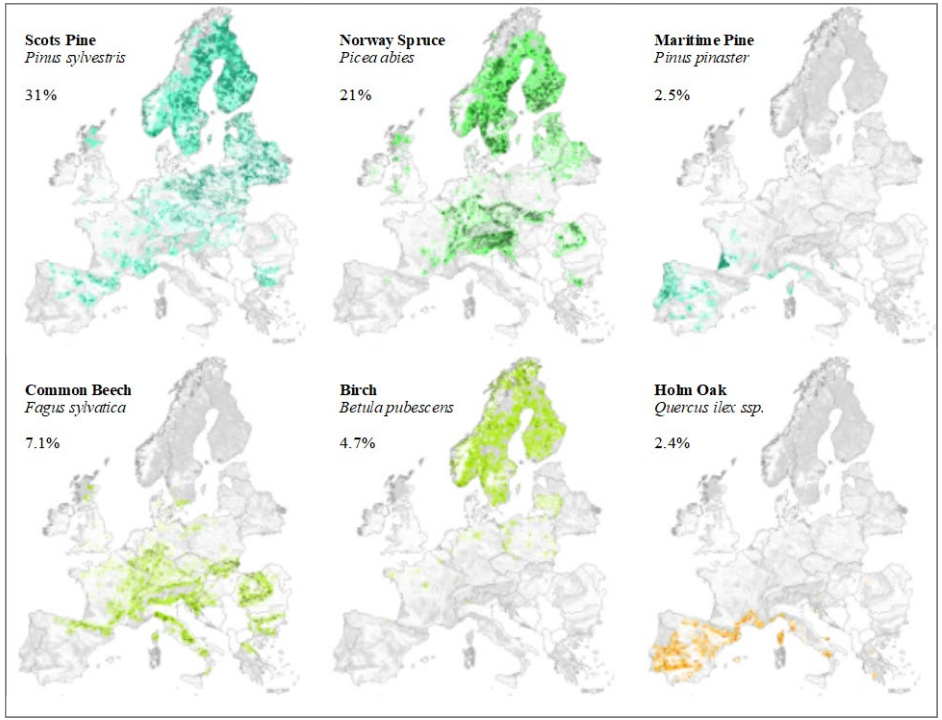
Isoprene EF update in Europe

In bottom-up BVOC emissions crucial parameter is **Emission Factor** assigned to a vegetation type

Find balance between accuracy and level of detail in land cover description

→ **Update of MEGAN isoprene EP map in Europe** using information collected for the EMEP model

- Corine Land cover
- Location of single tree species
- Database of EFs



Köble and Seufert (2001)

Collaboration with Dave Simpson (Met Norway)

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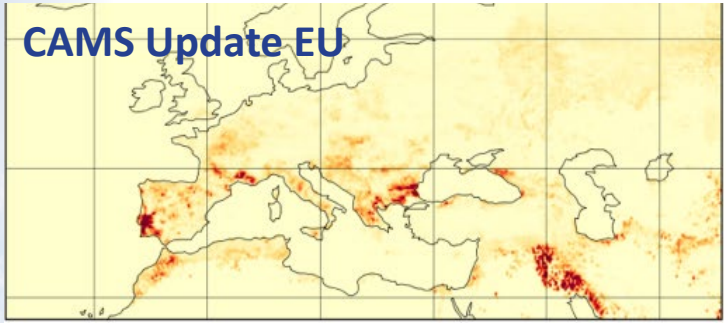
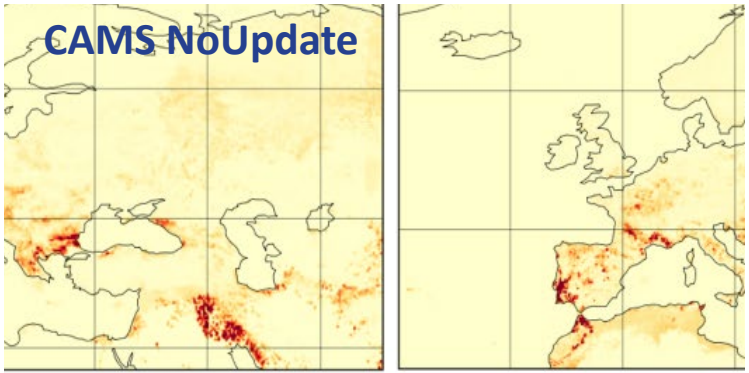
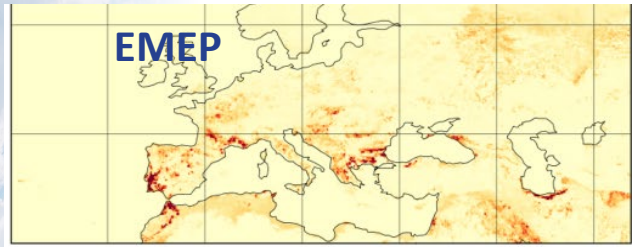
Isoprene annual mean (2016) calculated with updated EPs in Europe

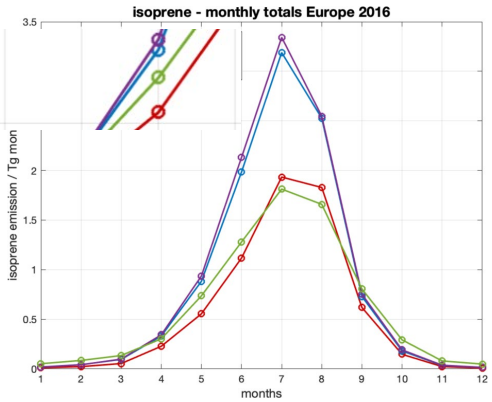






→ ~ 35% isoprene reduction

CAMS NoUpdate = 10 Tg/year
CAMS UpdateEU = 6.6 Tg/year
EMEP = 7.3 Tg/year



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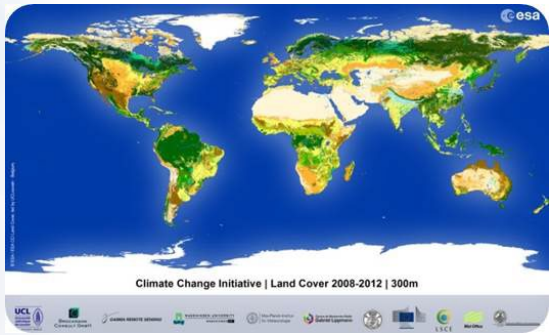
Effect of changing land cover

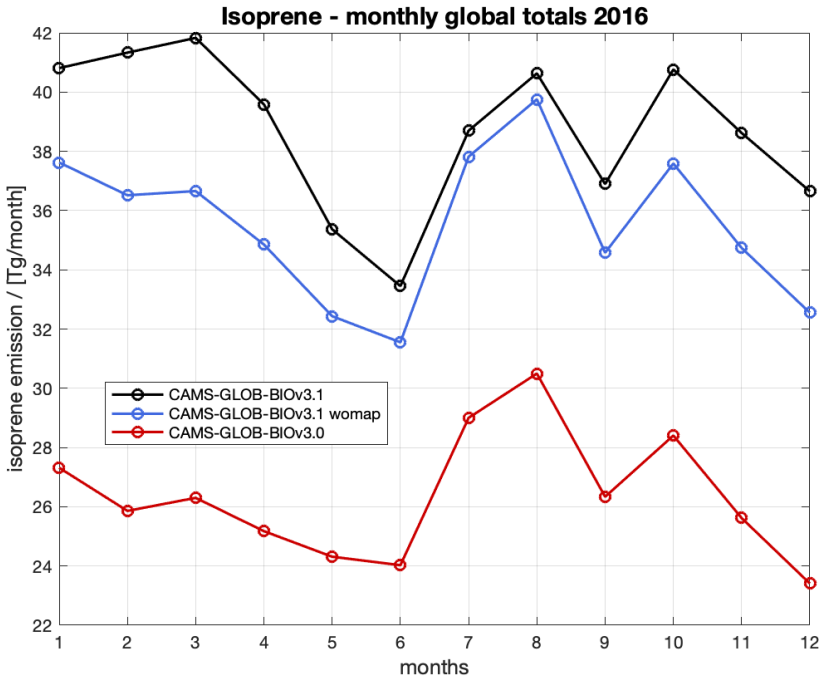
- In order to simulate effect of land cover change on emissions the static CLM4 land cover maps were replaced by annually changing ESA-CCI land cover maps

→ Emission reduction
→ Change in trends



esa-landcover-cci.org

→ **CAMS-GLOB-BIOv3.0 dataset**



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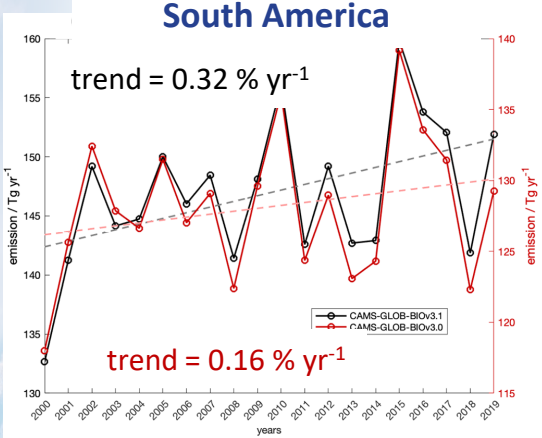
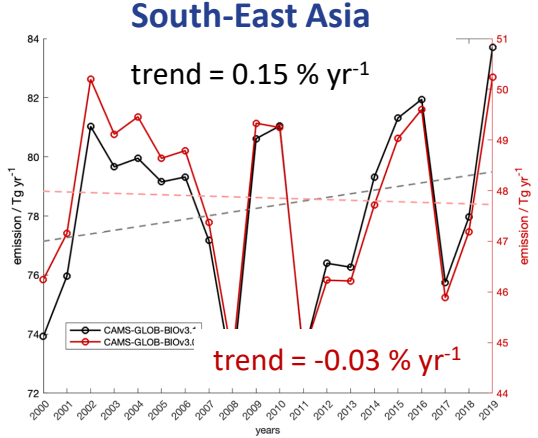
Effect of changing land cover

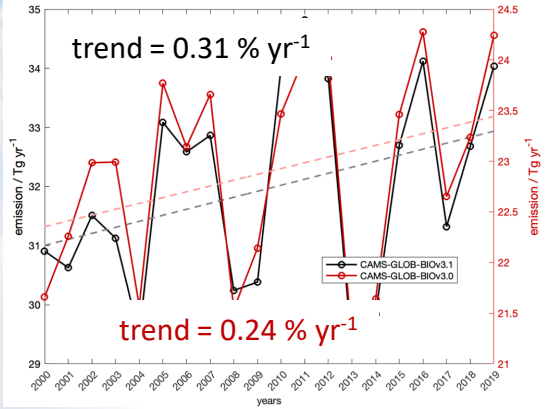
South America



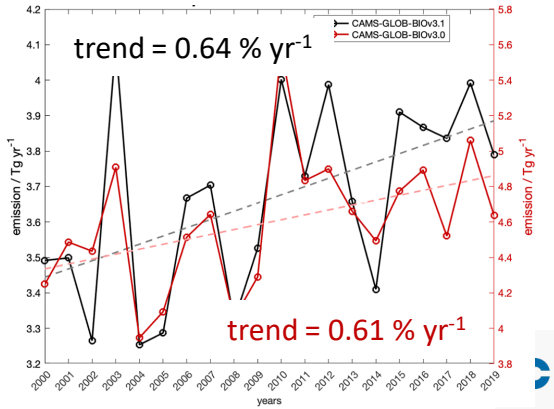
South-East Asia



North America



Europe



Isoprene emission trends due to changing land cover

annual totals
2000-2019

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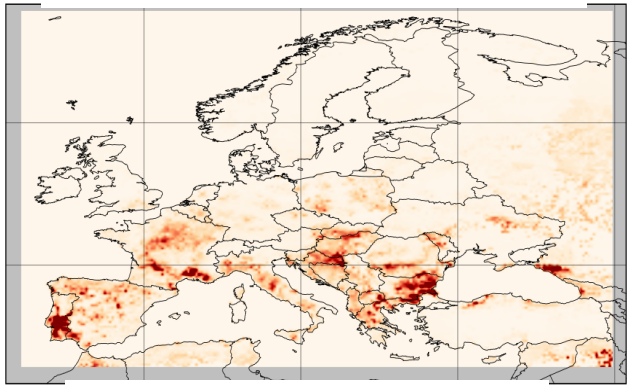
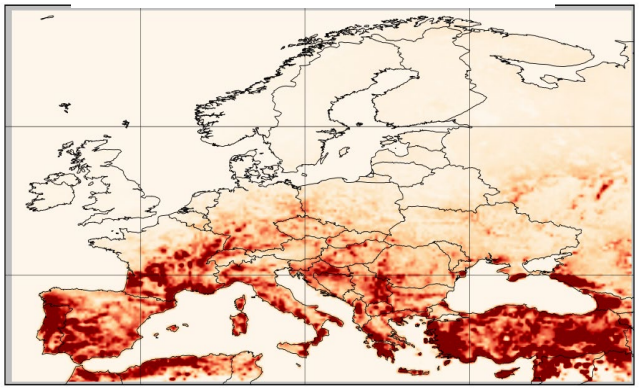
Comparison with SEEDS TD data

Isoprene monthly mean emissions

CAMS-GLOB-BIOv3.1 – Aug 2018

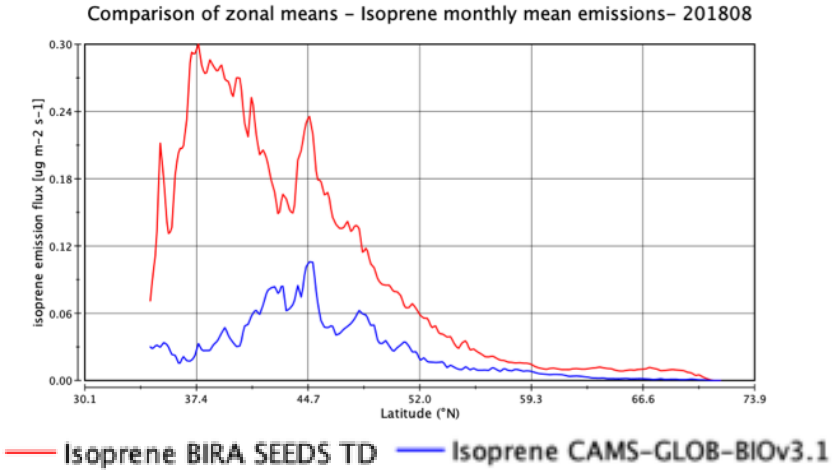


SEEDS TD – Aug 2018



- SEEDS TD dataset provides valuable source of information for comparison and improvement of CAMS-GLOB-BIO dataset

SEEDS
Sentinel EO-based Emission and Deposition Service



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Perspectives for CAMS and CAMEO

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- ✓ Comparisons with the top-down SEEDS isoprene emissions
  → improvements of the CAMS emissions especially in the southern Europe

- ✓ Collaboration with the BIRA group (Glenn-Michael Oomen, Jenny Stavrakou) within the CAMEO project
  → estimating uncertainties of isoprene emissions and constaining emissions with HCHO observations

CAMEO

https://www.cameo-project.eu/

- ✓ Collaboration with Paul Hamer (NILU) on comparison of the SEEDS and CAMS bottom-up isoprene estimates
  → inspiration on improvements in soil moisture stress parameterization and hourly temporal resolution

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