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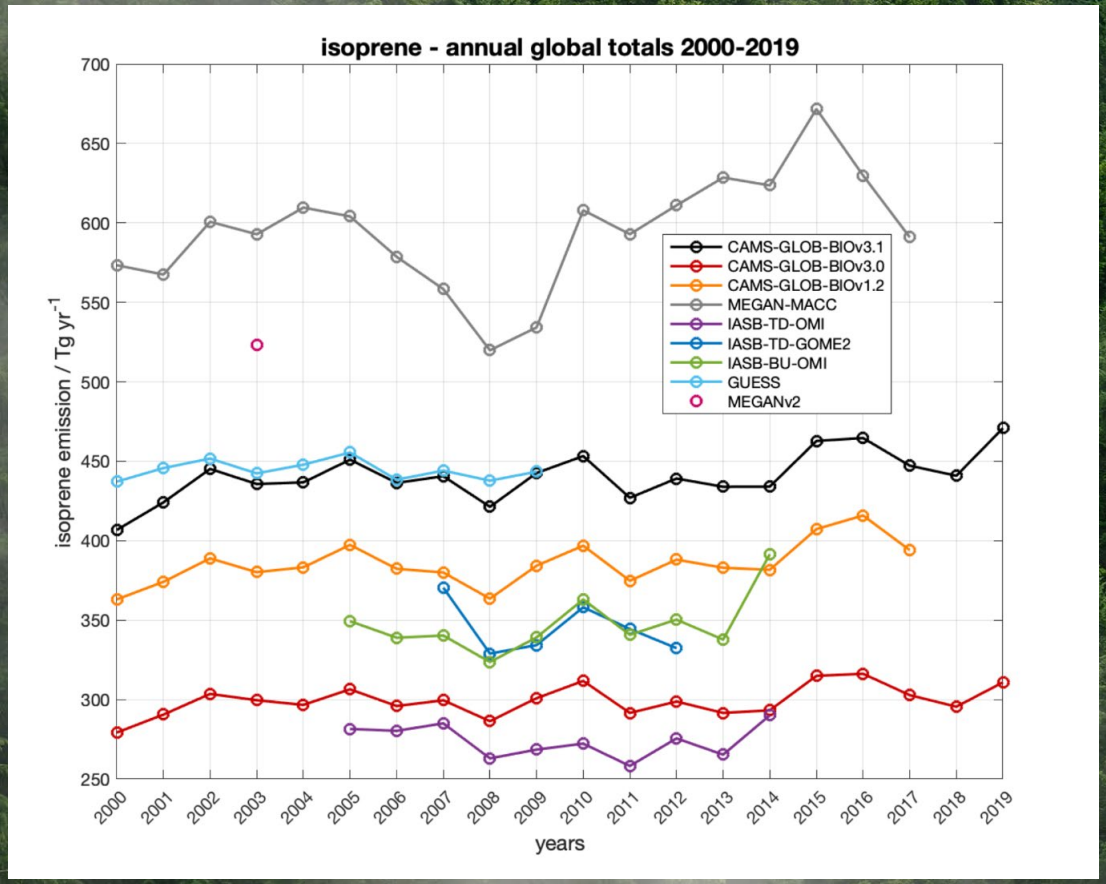
SEEDS VOCs
and links to ozone

SEEDS
Sentinel EO-based Emission
and Deposition Service

BIRA-IASB

tropo.aeronomie.be
Tropospheric Chemistry Modeling Unit

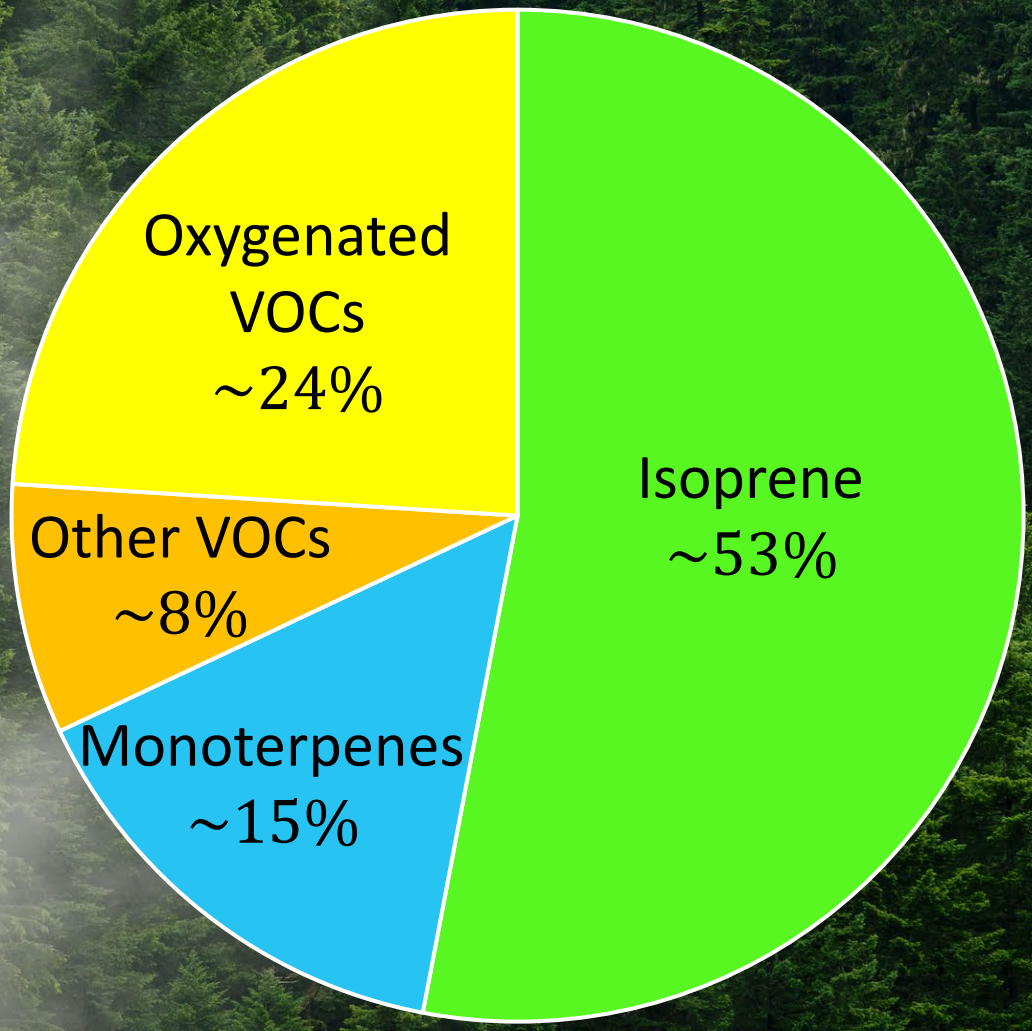


Sinderlarova et al. (2022)

Natural emissions by vegetation are currently poorly constrained

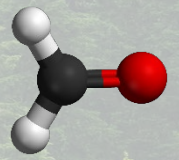
They are a large source of uncertainty in air quality and climate models

Global annual volatile organic compound (VOC) emissions

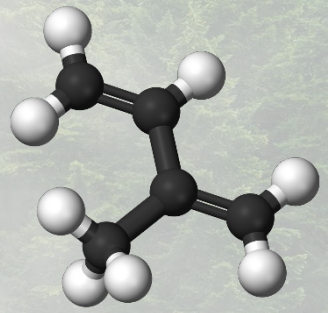


Sentinel-5P
TROPOMI instrument

Formaldehyde



Isoprene



Other VOCs

NOx

Air quality

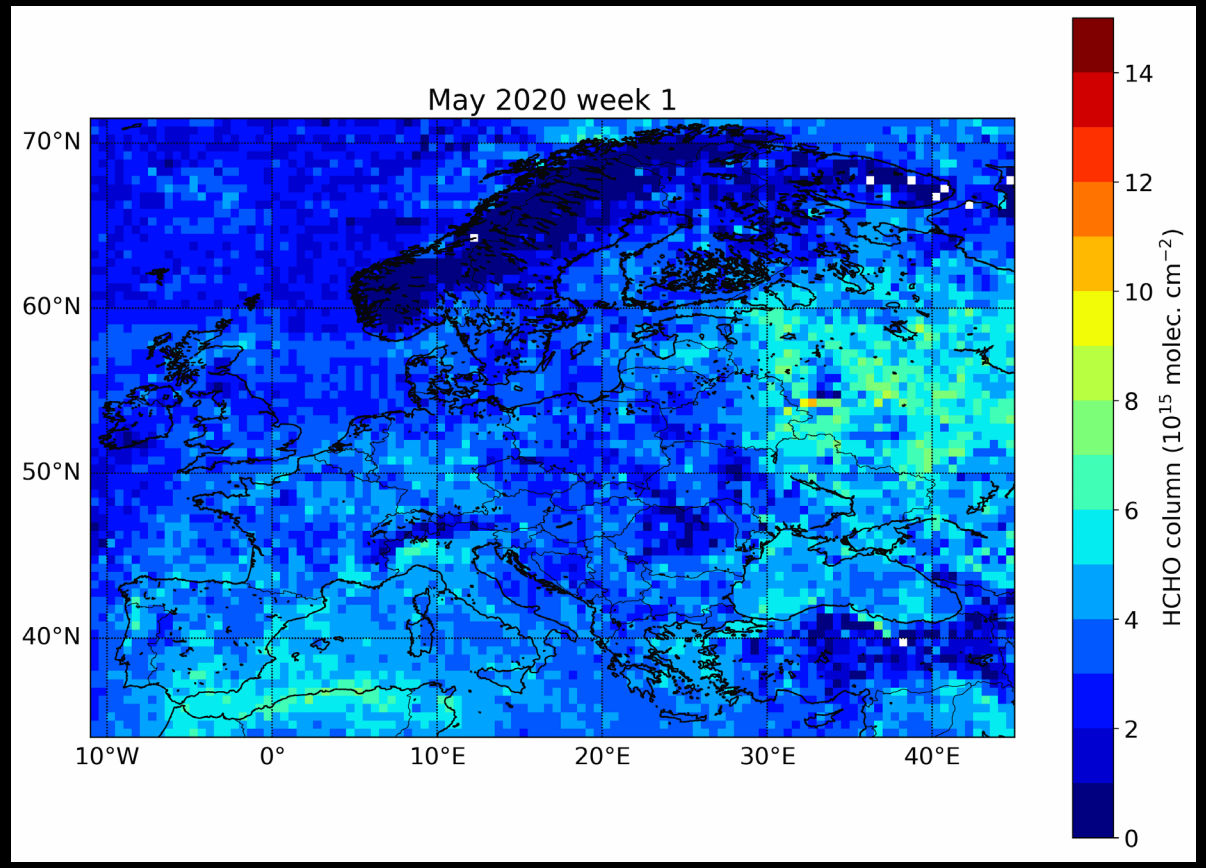
Ozone

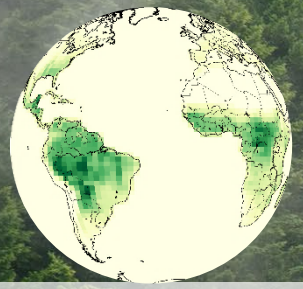
Aerosols

We employ an inverse modelling strategy:

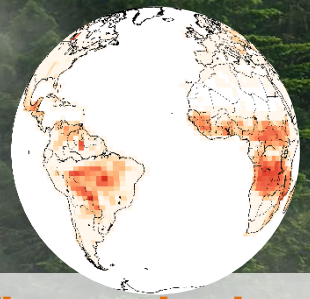
Start from observed formaldehyde data by TROPOMI and infer the biogenic emissions

TROPOMI formaldehyde (HCHO) vertical columns

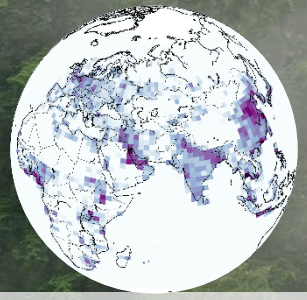




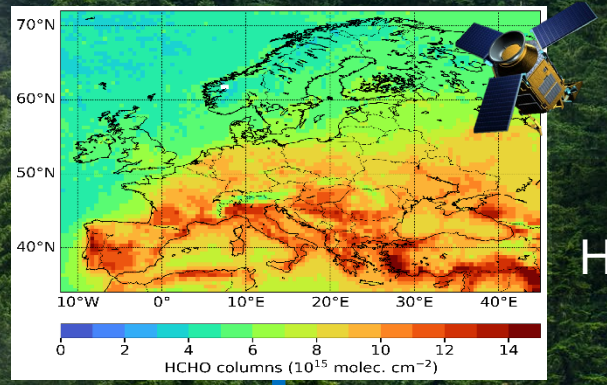
biogenic emissions



fire emissions



anthropogenic emissions



TROPOMI HCHO columns

Inversion constrained by weekly-averages

MAGRITTE chemistry-transport model and its adjoint

Iterative minimization algorithm

Top-down biogenic isoprene fluxes

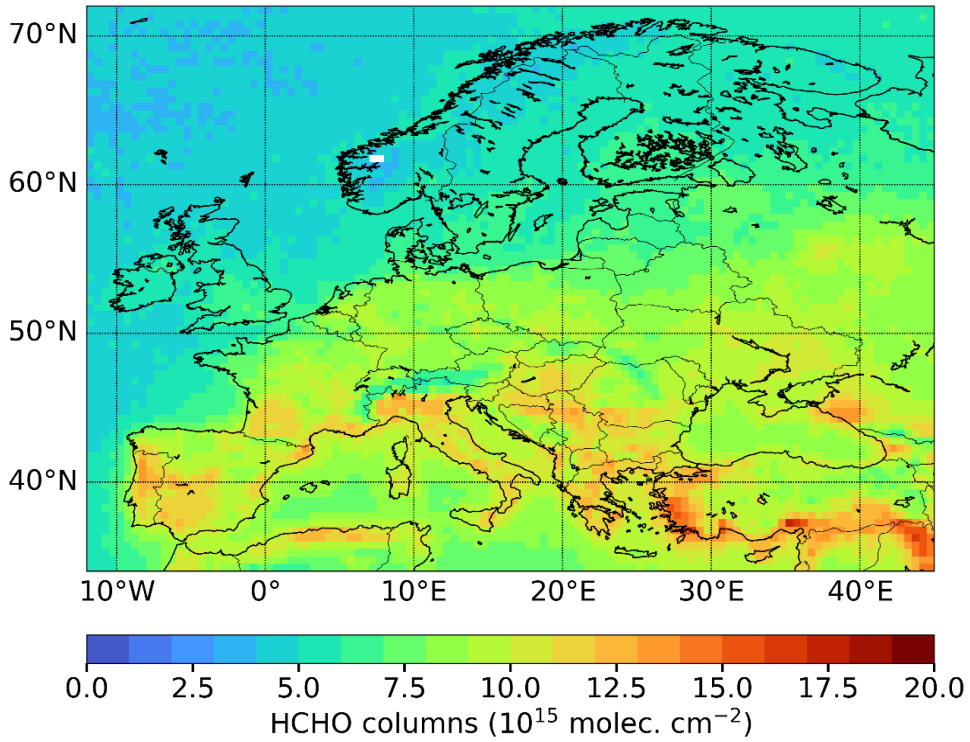
Top-down biomass burning fluxes

Top-down anthropogenic fluxes

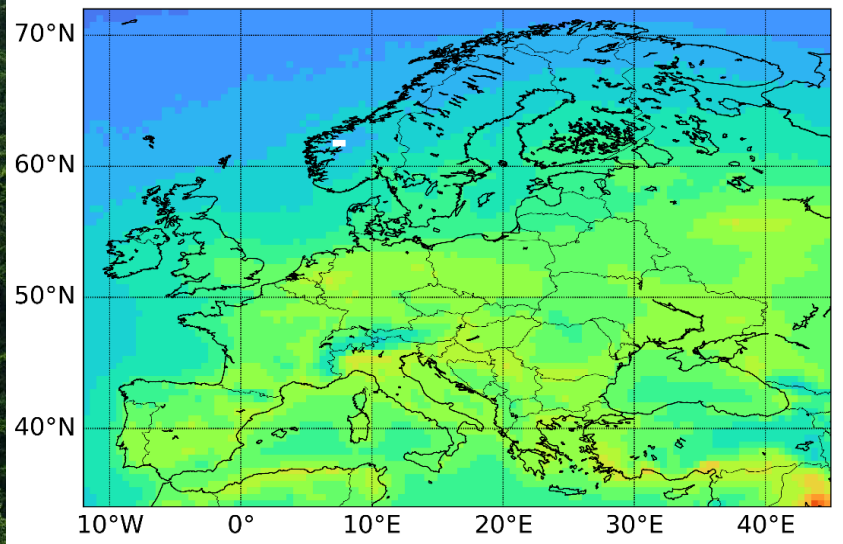
- ❑ MEGAN-MOHYCAN a priori biogenic emissions
- ❑ State-of-the-art BVOC oxidation included in the model

Formaldehyde columns in summer over Europe

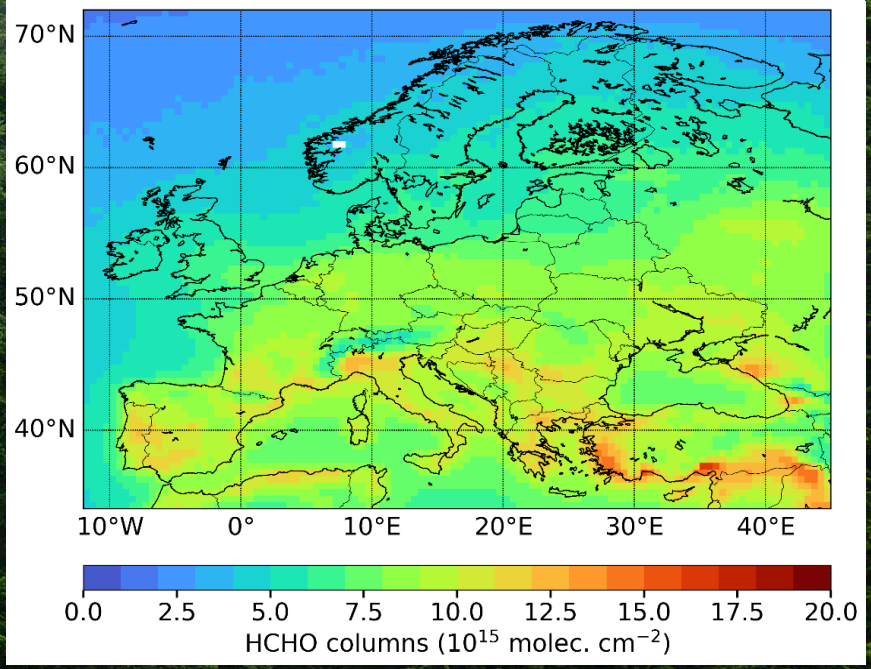
TROPOMI (observed)



MAGRITTE model (a priori)

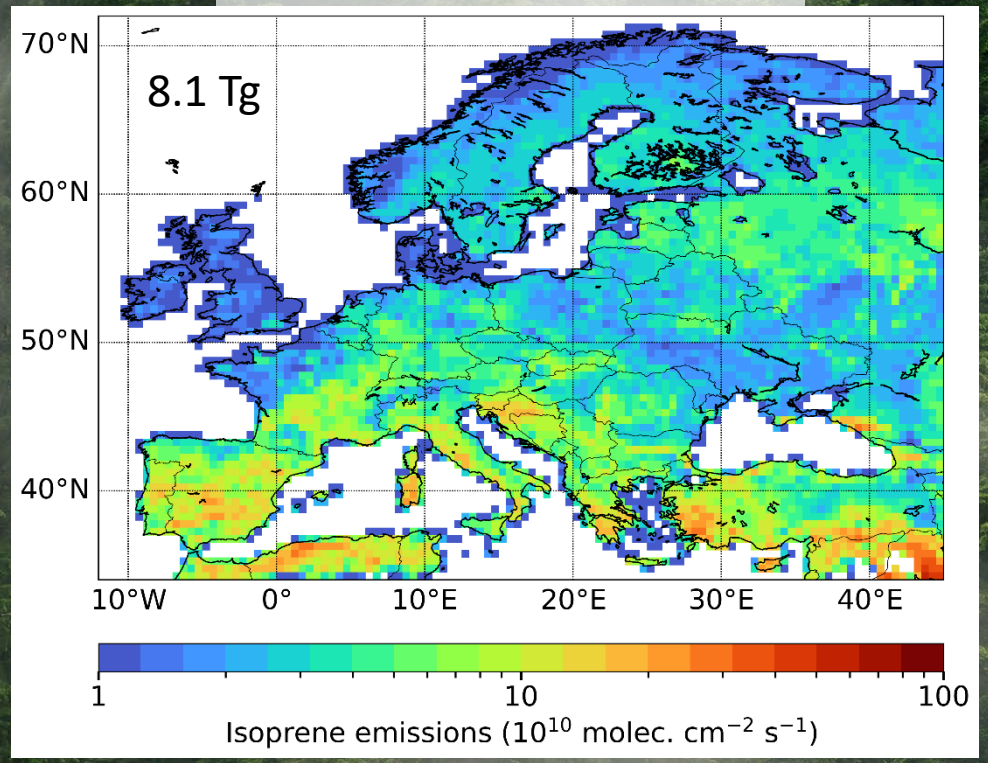


MAGRITTE model (optimized)



Isoprene emissions

A priori emissions



Optimized (top-down) emissions

18.5 Tg

Inversion at:

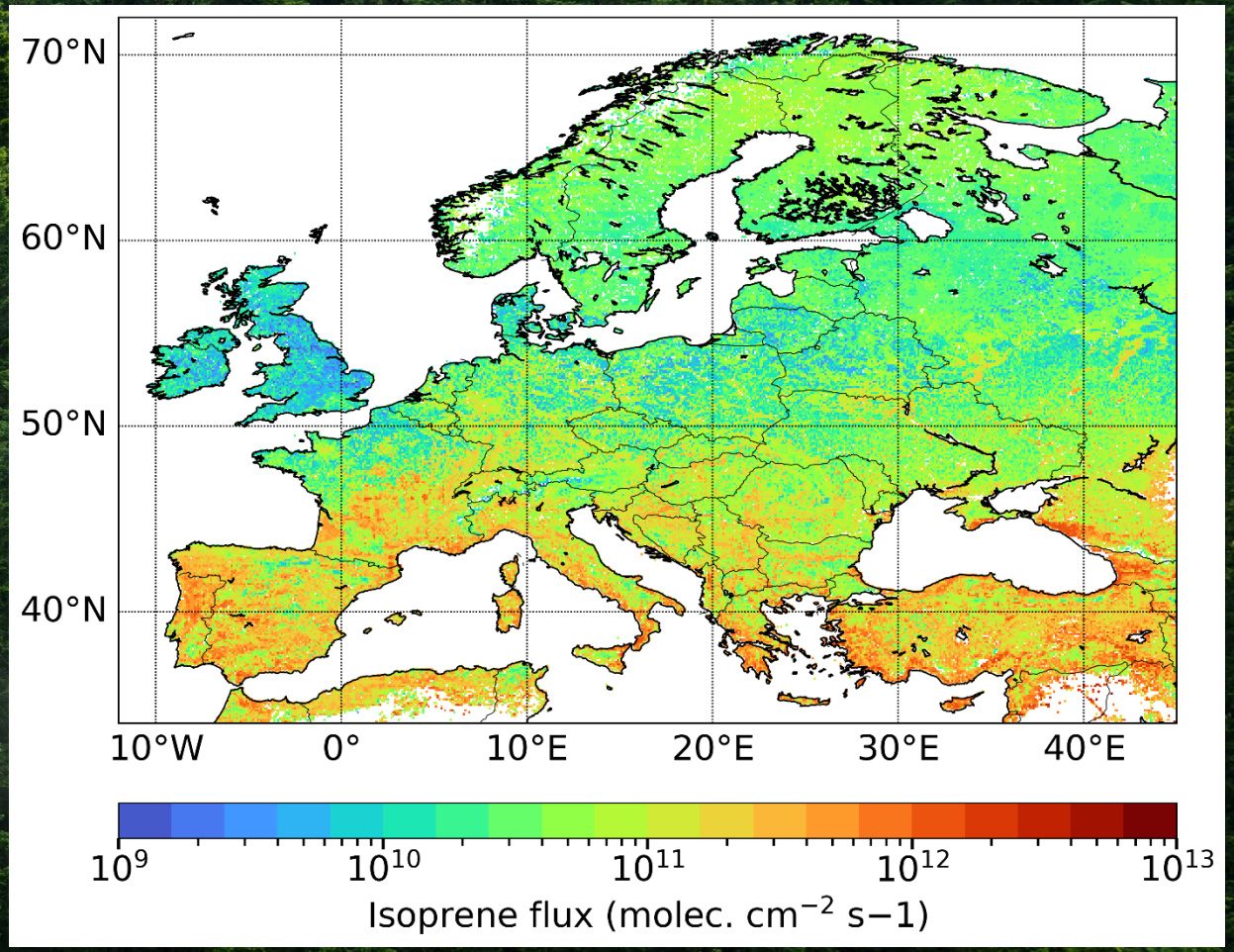
- $0.5° \times 0.5°$ spatial resolution
- Weekly temporal resolution

Downscaled using MEGAN-SURFEX3

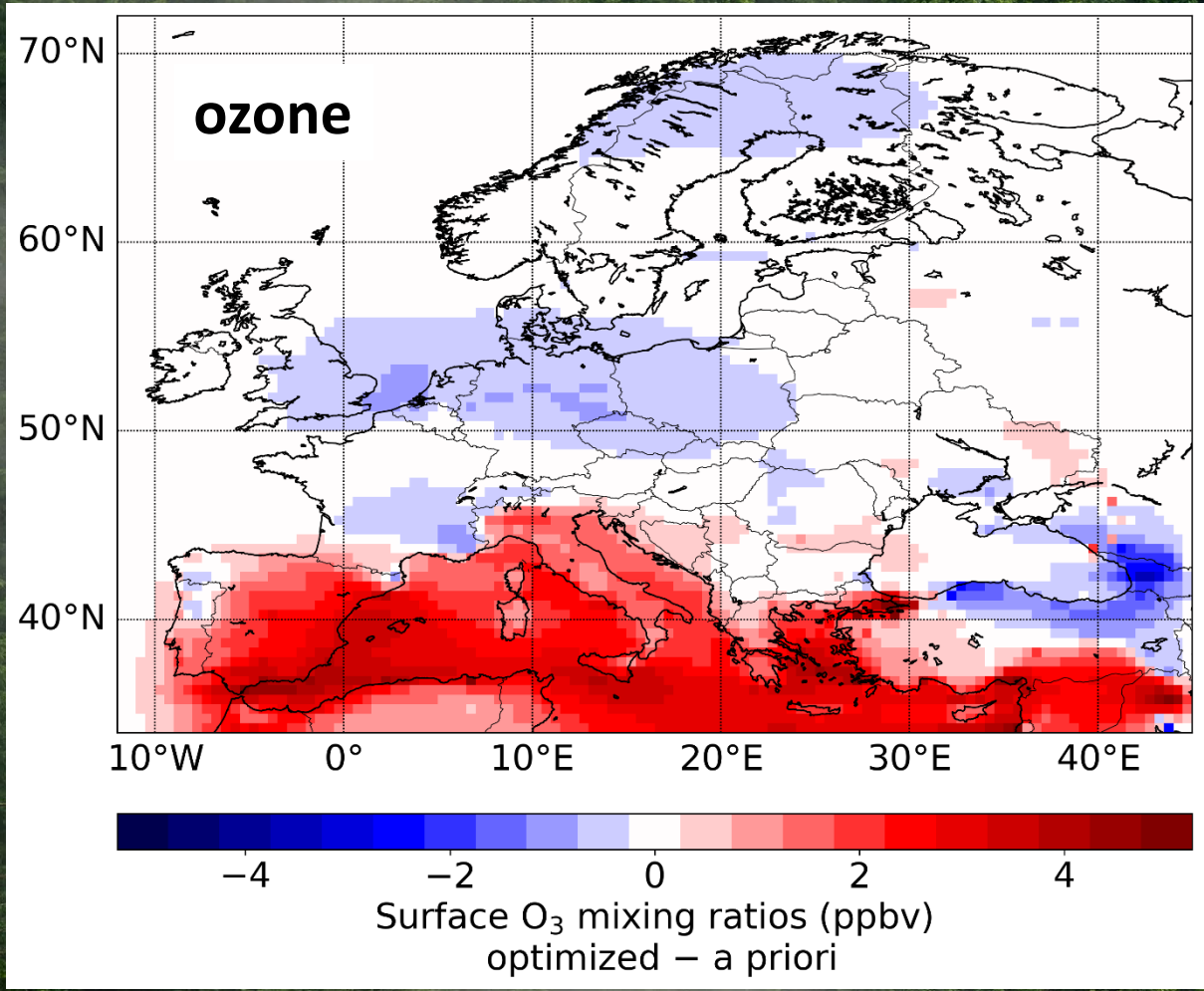
Public dataset provided at:

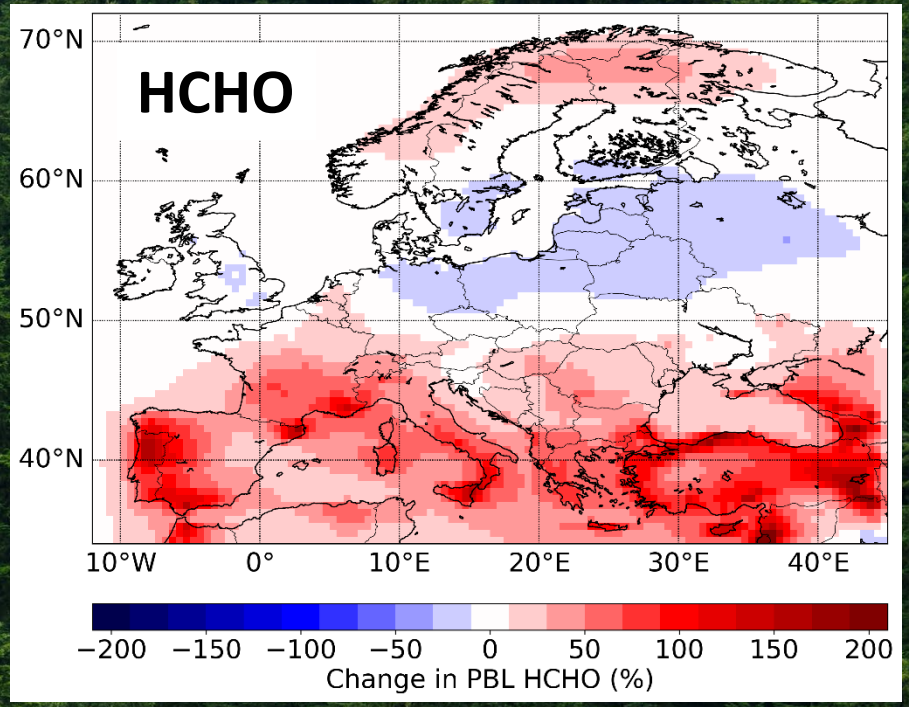
- $0.1° \times 0.1°$ spatial resolution
- Daily temporal resolution

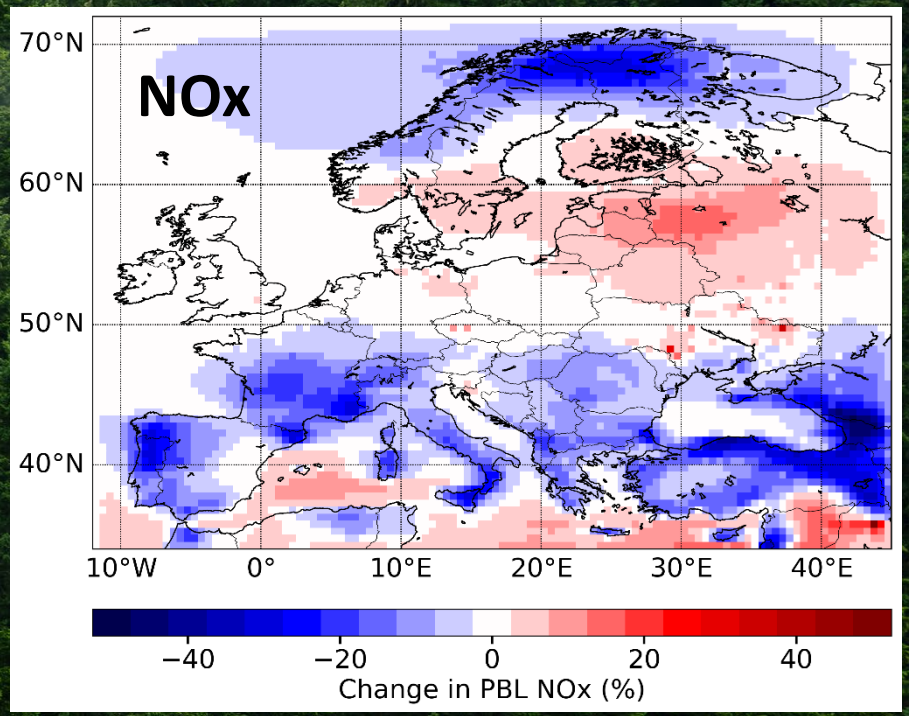
→ https://www.seedsproject.eu/



Modeled ozone concentrations near the surface in July 2019

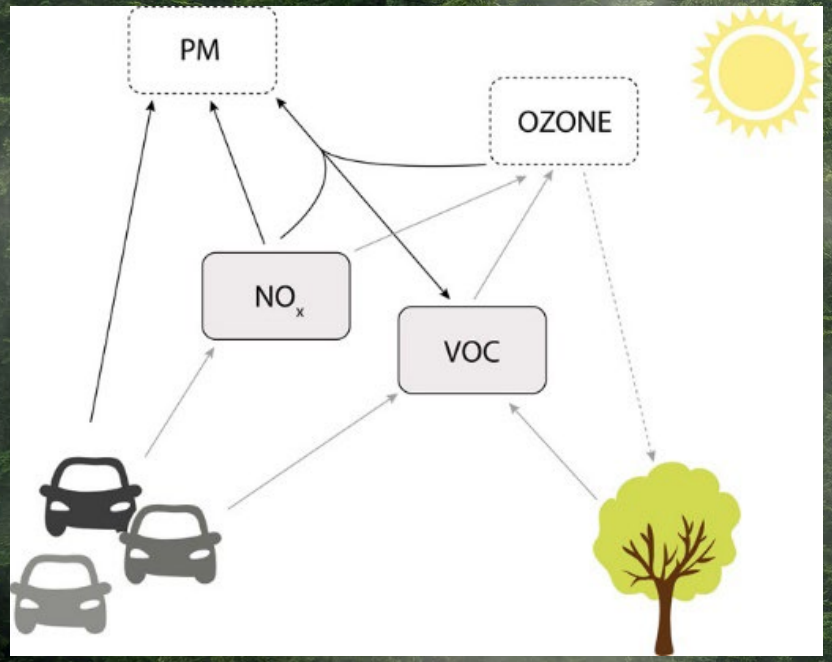


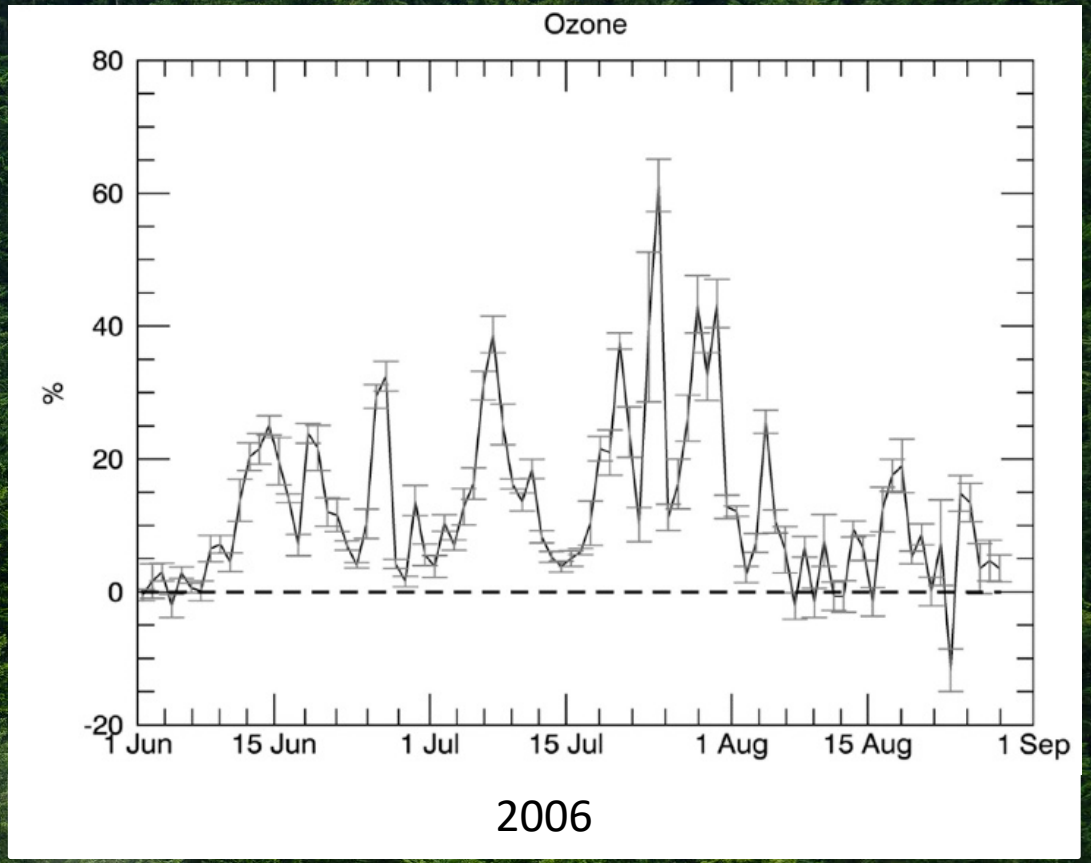




Effect of VOC emissions on air quality during a heatwave in Berlin

Hot weather results in high isoprene emissions from trees



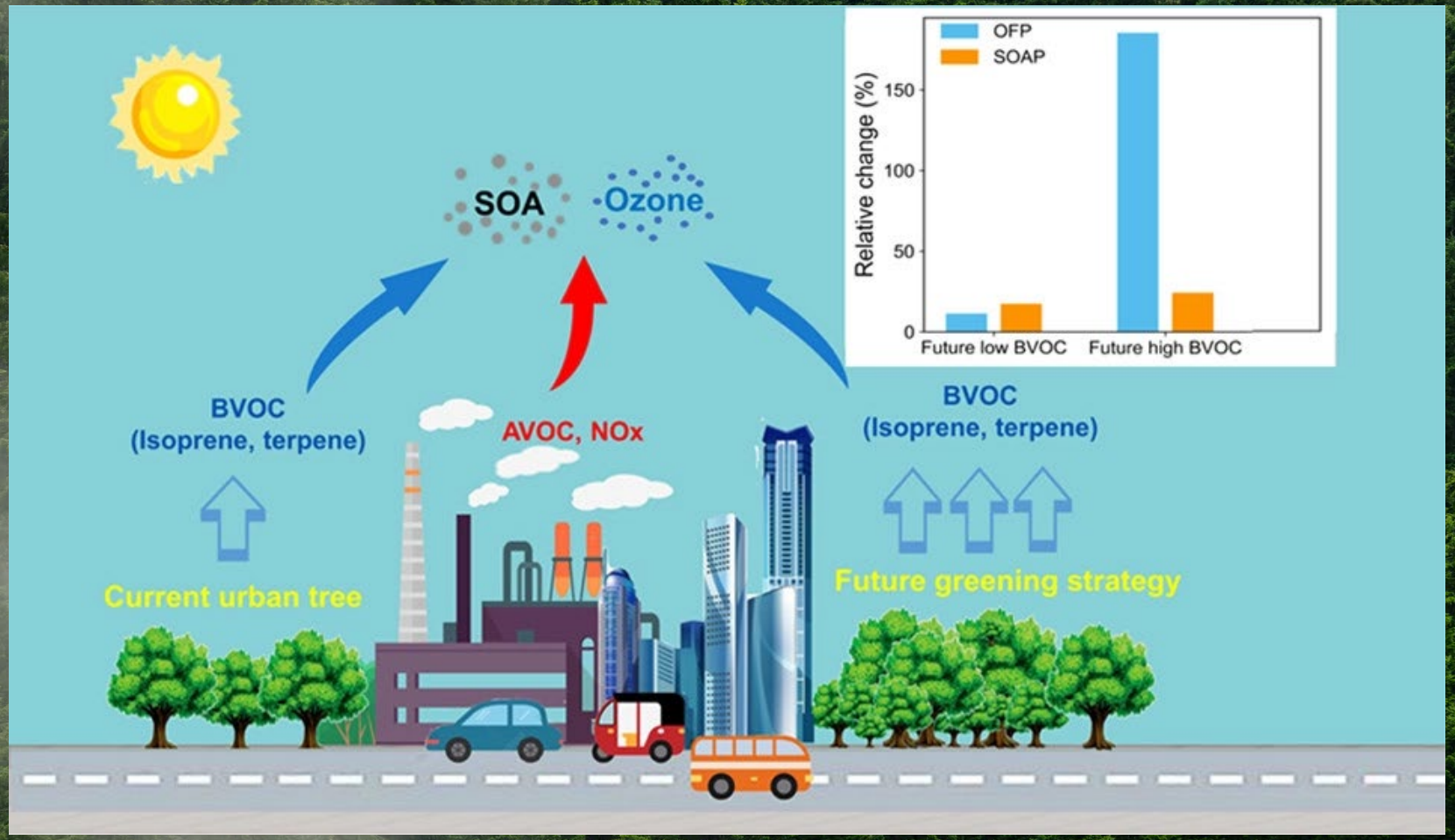


2006

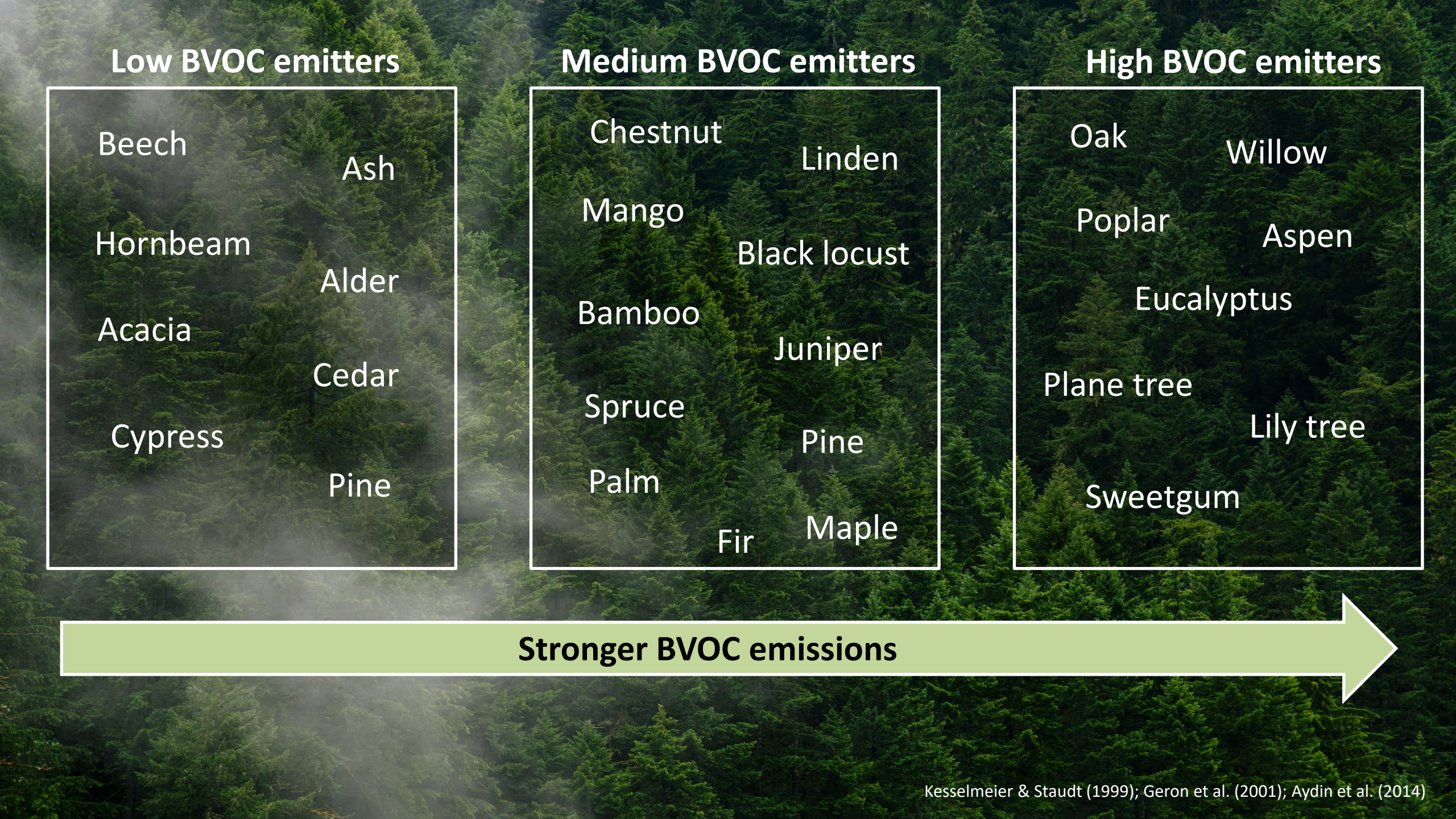
The simulated contribution of VOC emissions from vegetation can reach 60% during hot summer days in urban environments

Churkina et al. (2017)

Increases in BVOCs due to urban greening trends are compensating the reduction of anthropogenic VOC emissions



Gu et al. (2021)



Kesselmeier & Staudt (1999); Geron et al. (2001); Aydin et al. (2014)

Overview

SEEDS provides up-to-date top-down biogenic emissions based on TROPOMI HCHO data

- Covering 2018—2020
  → 2021—2022 on the way
- Dataset provided at $0.1° \times 0.1°$ spatial resolution and daily temporal resolution

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