Source characterization of reactive carbon in a mixed forest ecosystem (Vielsalm, BE)

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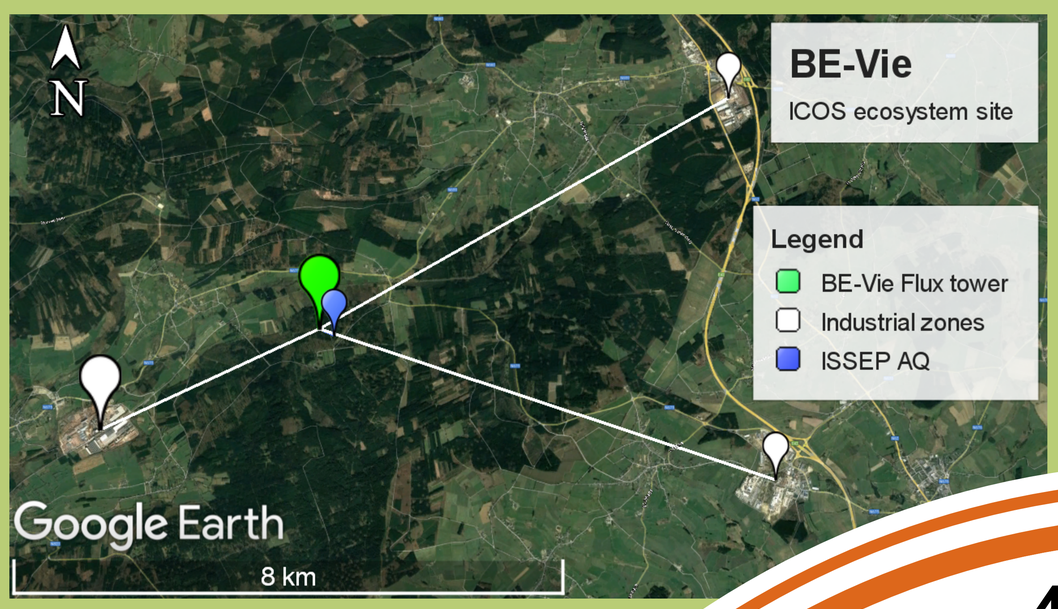
1. Measurement site



Mixed forest ecosystem in the Integrated Carbon Observation system (ICOS) network located in the Belgian Ardennes.

Data presented here from the **2022 growth season** (May-October).

2. Objectives

i) Source Identification

What are the chemical signatures present in our dataset?
Can we **attribute** these signatures to specific sources/processes?

ii) Source localization

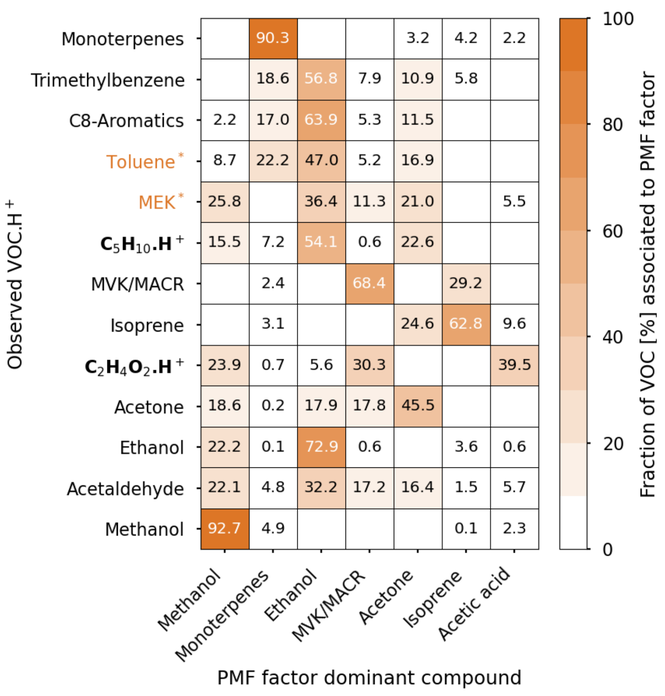
Can we identify **where** these chemical signatures originate from?

iii) Chemical reactivity

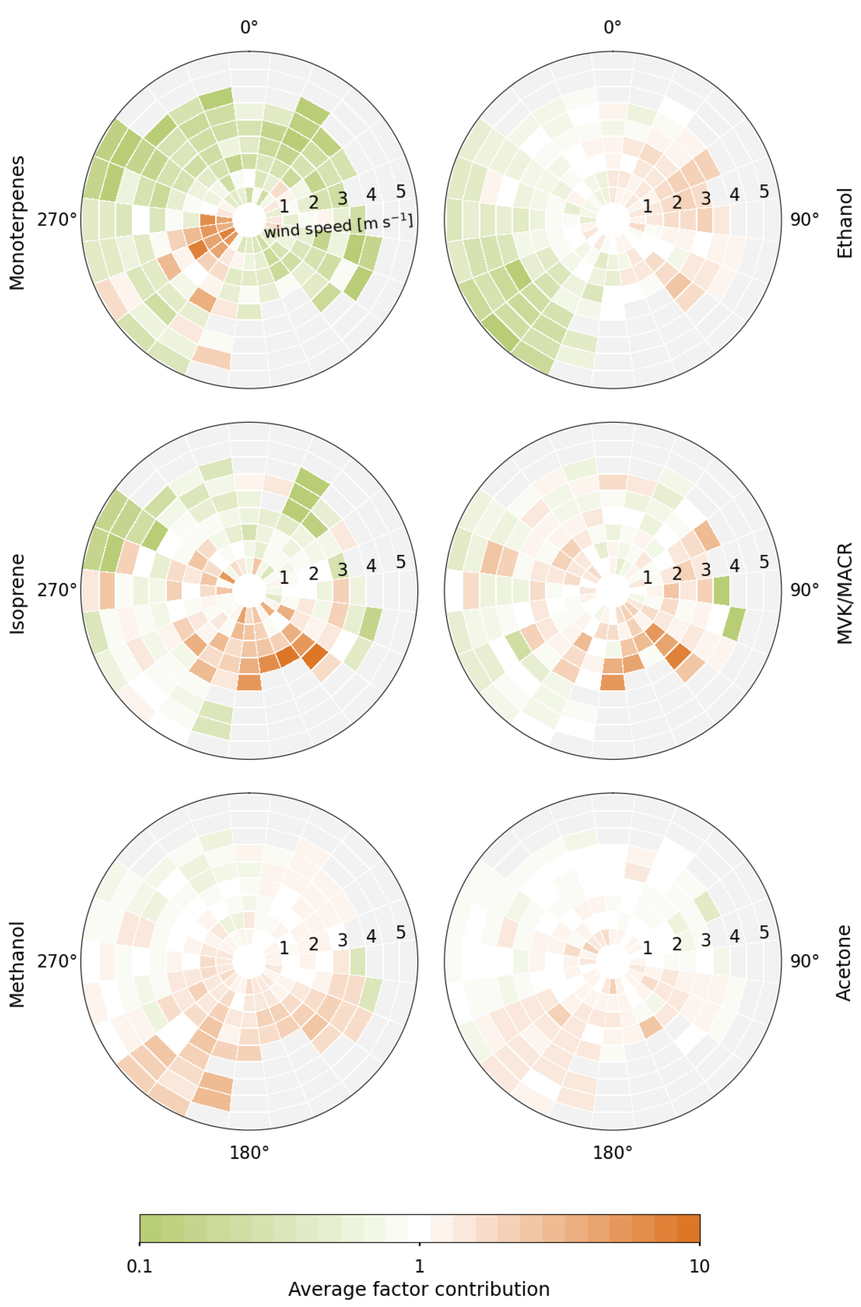
How do the different chemical signatures affect **OH-reactivity**?

4. Results

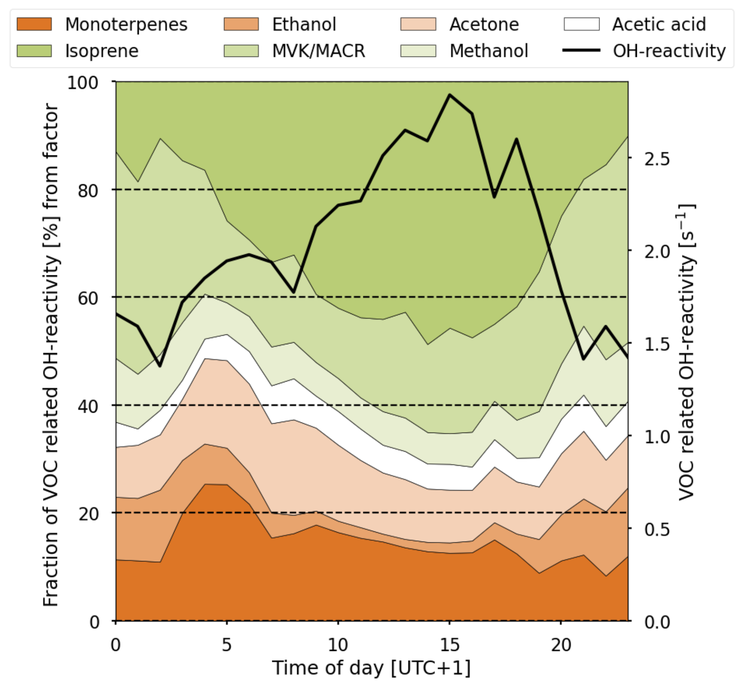
i) Factor profiles



ii) Factor contribution pollution roses



iii) Median reactivity distribution



VOC related OH-reactivity calculations constrained to data from July 2022

3. Methodology

i) Positive Matrix Factorization

Factor contribution
Temporal variation of sources

Number of factors

Factor profile
Chemical signatures

Measurement
at time *i*, of compound *j*

Residual

$$x_{ij} = \sum_{k=1}^{p} g_{ik} f_{kj} + e_{ij}$$

ii) VOC related OH-Reactivity calculation

VOC related OH-Reactivity
of source k at time i

Reaction rate constant
between compound j and OH

$$R_{i,k} = \sum_{j} k_{OH-VOC_j} g_{i,k} f_{k,j}$$

5. Conclusions

OH-Reactivity:
mean ± std (max) s^{-1}

Monoterpenes factor
Origin: Mainly sawmill, southwest of site
OH-reactivity: 0.6 ± 1.2 (22.8) s^{-1}

Ethanol factor
Origin: Industry, sites to the East
OH-reactivity: 0.1 ± 0.1 (0.4) s^{-1}

Isoprene factor
Origin: Biogenic, highest contributions from the South-East
OH-reactivity: 1.0 ± 1.2 (11.1) s^{-1}

MVK/MACR factor
Origin: Isoprene oxidation
OH-reactivity: 0.5 ± 0.4 (1.7) s^{-1}

Methanol factor
Origin: Unknown, broad southern source
OH-reactivity: 0.2 ± 0.1 (0.6) s^{-1}

Acetone factor
Origin: Unknown, broad southern source
OH-reactivity: 0.3 ± 0.1 (1.1) s^{-1}

Acetic acid factor
Origin: Unknown, uniform pollution rose (not shown)
OH-reactivity: 0.1 ± 0.1 (0.7) s^{-1}

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Financial support was provided by the Belgian Federal Science Policy Office through the ACTRIS-BE (FSIRI/00/AC1), and BERTRAC (Prf-2021-034_BERTRAC#2) projects. The Public Service of Wallonia provided support through ICOS-Wallonia (project n° 1217769).