28.09.2026:
Master Seminar II: Presentation

Photochemical reduction of Iodate through Iron-containing Complexes in Secondary Organic Aerosol from Monoterpene Oxidation

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Literature cited in this presentation and the information contained therein is drawn from my Master's Thesis proposal entitled "Photochemical reduction of iodate through iron-containing complexes in secondary organic aerosol from monoterpene oxidation", handed in on 21.12.2025, for the course *701-1211-01 Master Seminar: Atmosphere and Climate*. This proposal is declared here to be an official reference, but it is not stated within the reference section. No information has been copied in verbatim, and all information is paraphrased if it has been used.

Motivation

Relevance — why should be care about Iodine?

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2. It could form particles when reacting with oxygen that could grow into cloud-condensation nuclei (*1*) (direct- and indirect radiative forcing);

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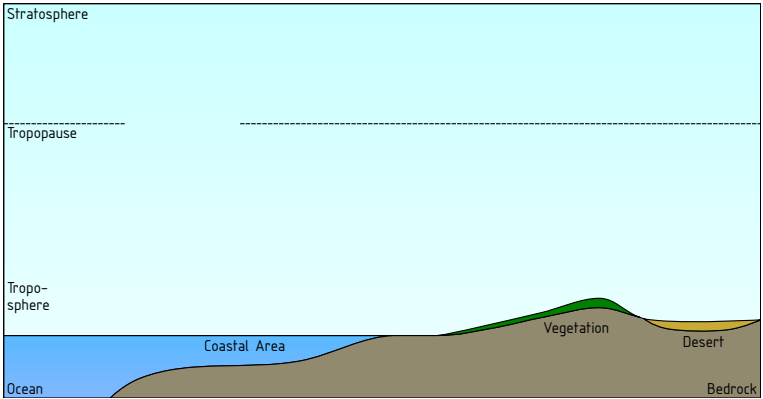
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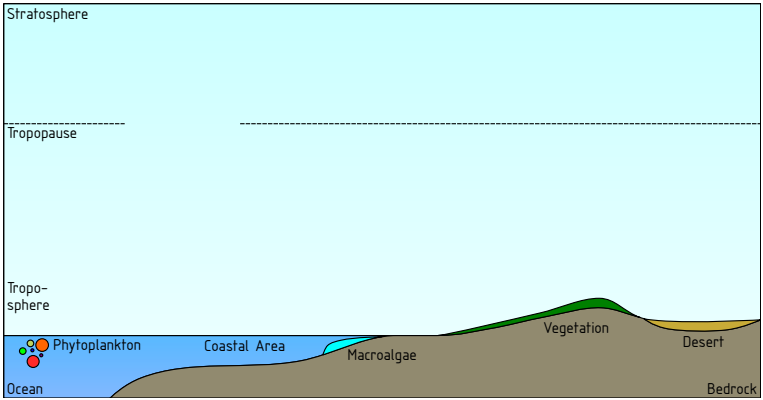
Monoterpenes and Iodine in the Atmosphere



Relevant literature: (*4–8*)

Motivation

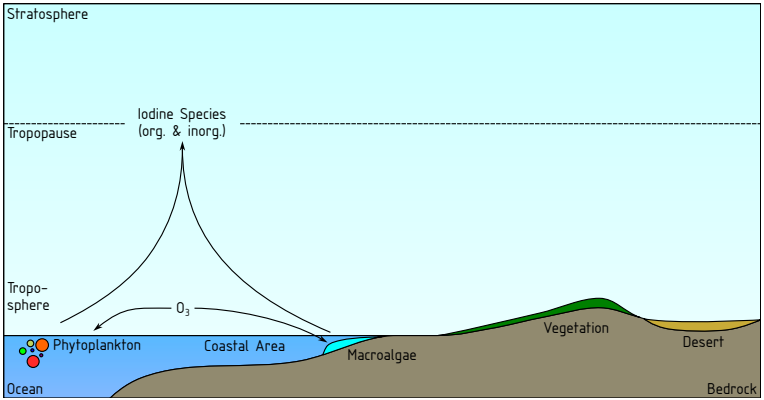
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Relevant literature: (*2*, *8*–*12*)

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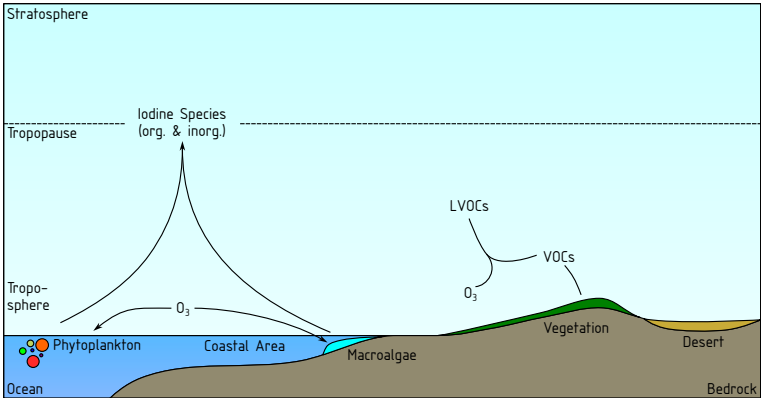


Atmospheric mixing ratios:
$\chi_{I_2} \approx 93$ pptv (*2*),
$\chi_{IO^\bullet} \approx 3 \ldots 20$ pptv (*2*),
$\chi_{HOI} \approx 1$ pptv (*13*),
$\chi_{I^\bullet} \approx 0.1 \ldots 22$ pptv (*2*, *13*).

Relevant literature: (*2*, *10*, *13–18*)

Motivation

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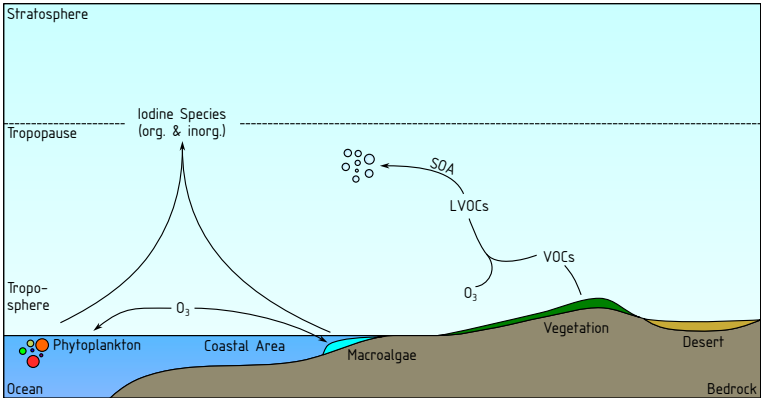
- VOC: Volatile Organic Compound.
- LVOC: low-volatility organic compound

Relevant literature: (*19–24*)

*Monoterpenes are second-most important biogenic VOC source after isoprenes (*107.5 TgC yr^{-1} *vs.* 465 TgC yr^{-1}*) (23, 24)*

Motivation

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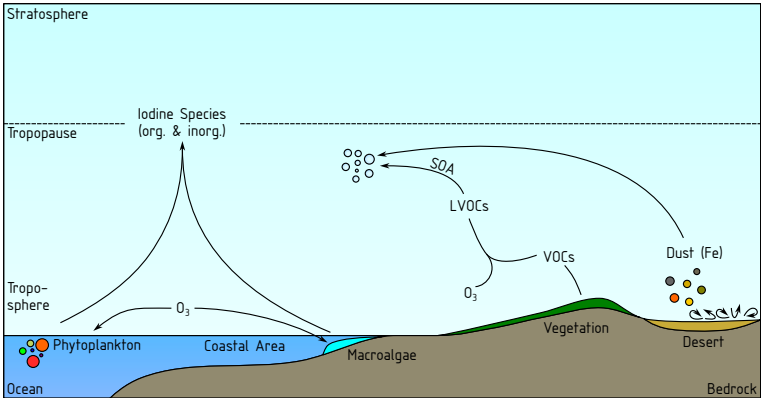
- SOA: secondary organic aerosol

Relevant literature: (*21*, *25–28*)

Oxidation products of monoterpenes (and isoprenes) may be common in SOA as they have (very) low volatility (21).

Motivation

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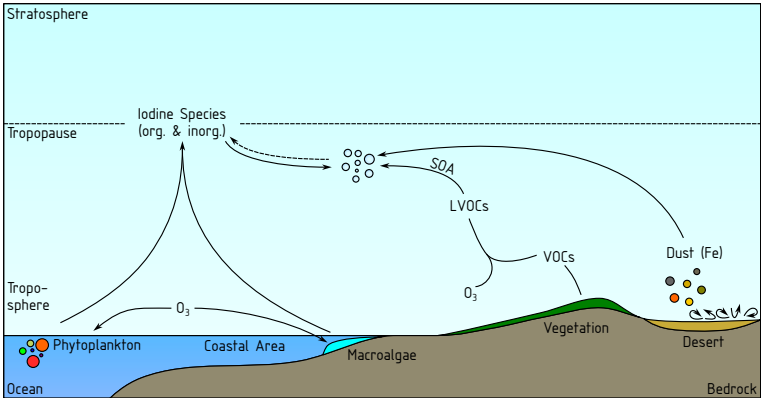


Relevant literature: (*29*)

Iron is most abundant transition mineral in dust. It may catalyse dust particle photochemistry (29)

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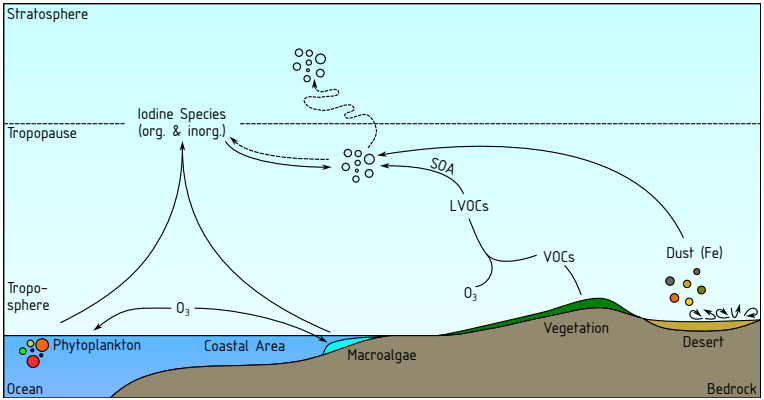
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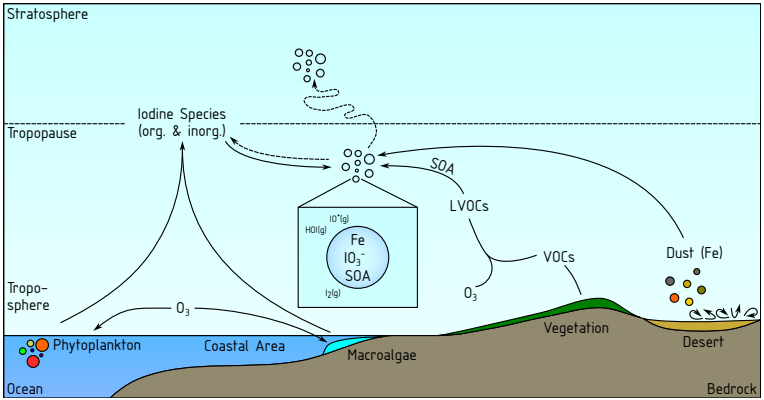
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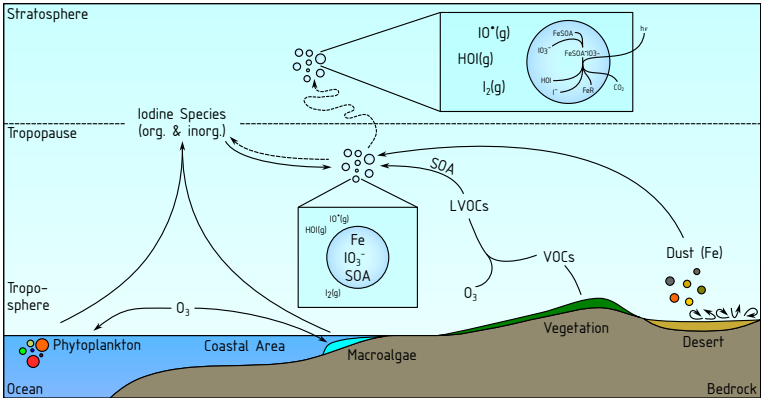


Relevant literature: (*3*)

Recent tropospheric obeservations: more iodide (I^-) in aerosol than iodate (IO_3^-) (3). Thermodynamics?

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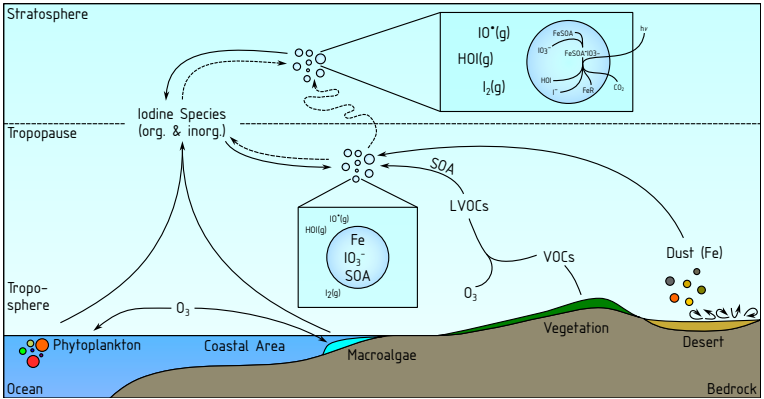


Relevant literature: (*32*)

*Free troposphere dust layers (*1.5…7 km*):* $10 \times \mathrm{IO^{\bullet}}$ *than atmospheric background (32).*

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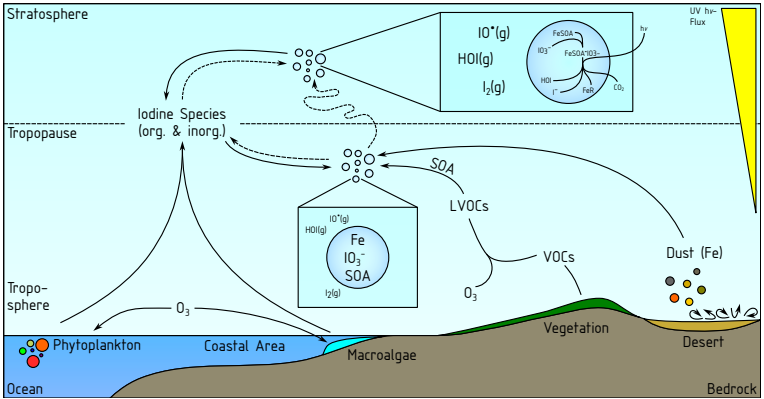


Relevant literature: (*30*)

Without recycling scheme, sustained concentrations of $IO^{\bullet}$ *in upper tropopshere / lower stratosphere cannot be explained (30).*

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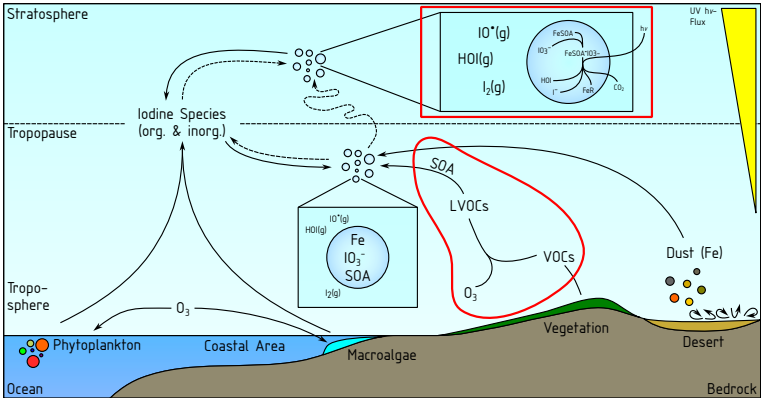
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Presence of gas-phase iodine monoxide radical (IO•) requires recycling mechanism. But how...? Some ideas are here (33)

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3. The acutual atmospheric process will be represented with a coated wall flow tube reactor (CWFTR) (see next slides). The product species will be monitored used a BTOF-CIMS.

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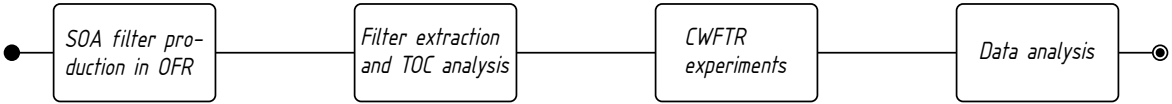
System = Fe + IO_3^- + SOA-extract

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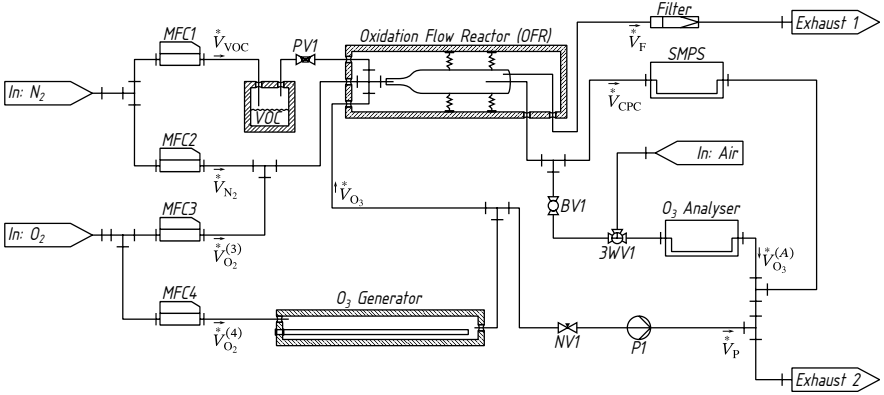
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Laboratory Representation

SOA generation — Oxidation Flow Reactor



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SOA generation — Oxidation Flow Reactor — Important Aspects

- Scanning mobility particle sizer (SMPS) allows to *estimate* particle density of generated SOA

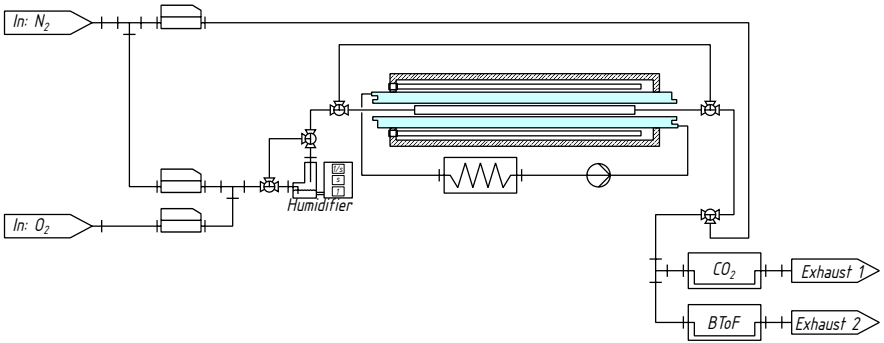
Laboratory Representation

SOA generation — Oxidation Flow Reactor — Important Aspects

- Scanning mobility particle sizer (SMPS) allows to *estimate* particle density of generated SOA
- To know it, we measure total organic carbon (TOC) using a TOC analyser

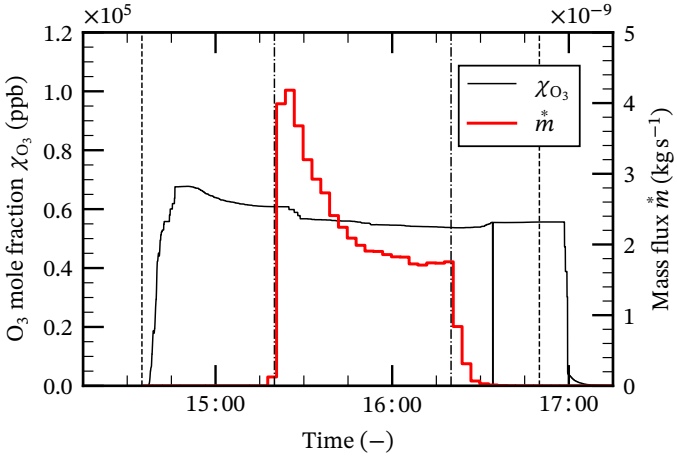
Laboratory Representation

Fe-SOA Complex Reaction with UV — Coated Wall Flow Tube Reactor



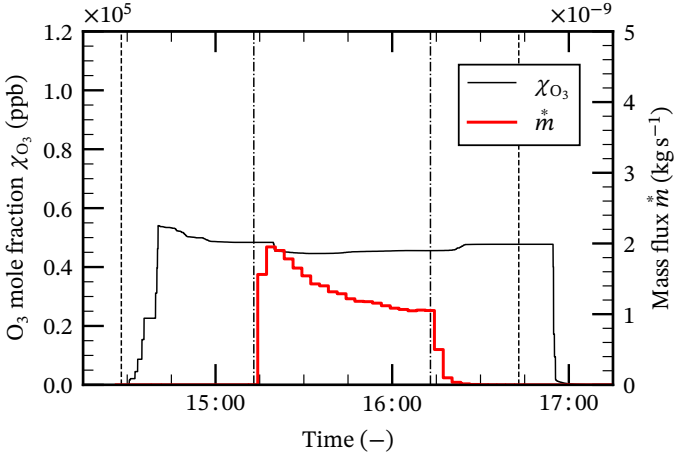
Amount of SOA on filter

SMPS estimates: α-pinene



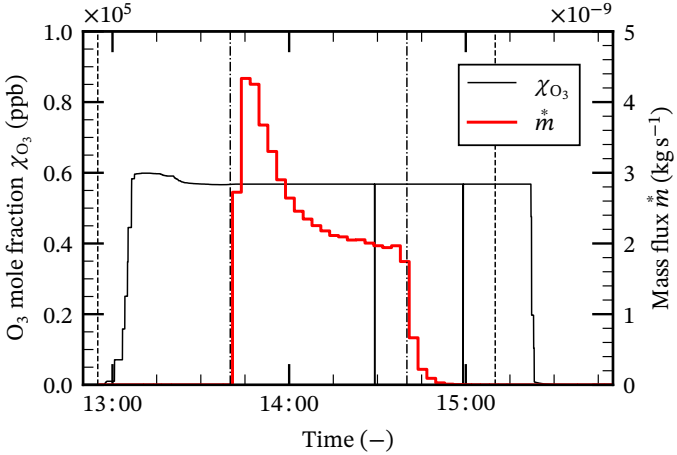
Amount of SOA on filter

SMPS estimates: Limonene



Amount of SOA on filter

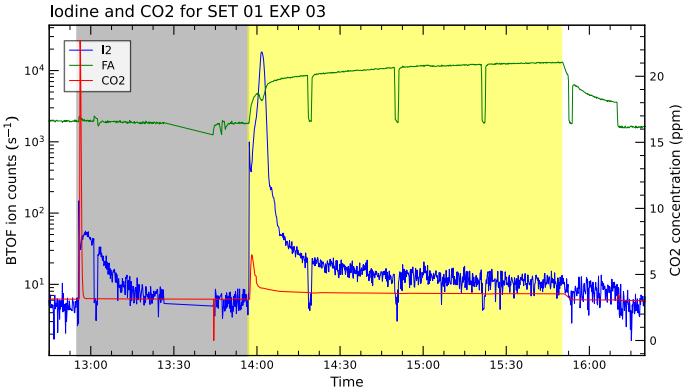
SMPS estimates: β-pinene



First CWFTR Results

Baseline

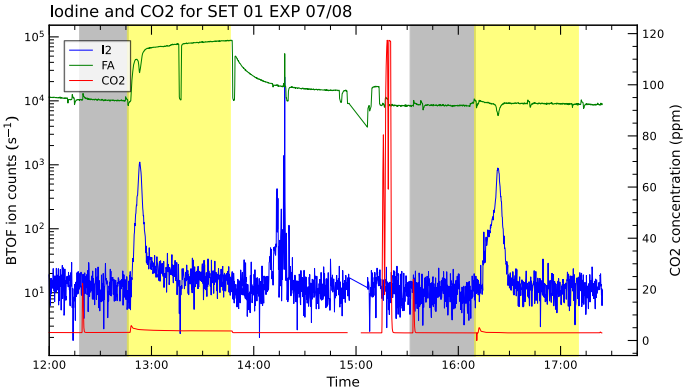
FeCit/CA/NaIO3 @ **11/1100/1** @ N2/O2 **1.3/0.346** lpm



First CWFTR Results

Fe(III) species

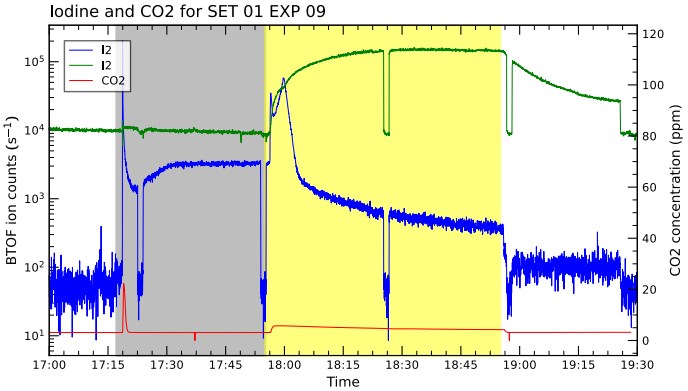
Fe2(SO4)3/Ca/NaIO3 @ 4/824/1 @ N2/O2 (**1.3** / **1.6**) / (**0.3** / **0**) lpm



First CWFTR Results

Fe(II) species

FeSO4/CA/NaIO3 @ 7/761/1 @ N2/O2 1.3 / 0.346 lpm



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Some final words on the process

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- I have one more experimental campaign, then I am done with lab!
- I have learned a *lot* about data handling, lab work, precision,…

References I

Much of the literature listed hereafter was taken over from the Master's Thesis proposal, without double-checking it again.

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