OVOCs
Oxygenated volatile organic compounds

OCEANS 2025 WP 2.1 (ii)

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Jo Dixon (biological turnover), Rachael Beale (seawater) &
Roisin Walsh Univ of Bristol (atmopshere)

Alcohols: Methanol, Ethanol, Propanol
Aldehydes: Formaldehyde, ethanal (acetaldehyde), propanal
Ketones: Propanone (acetone)

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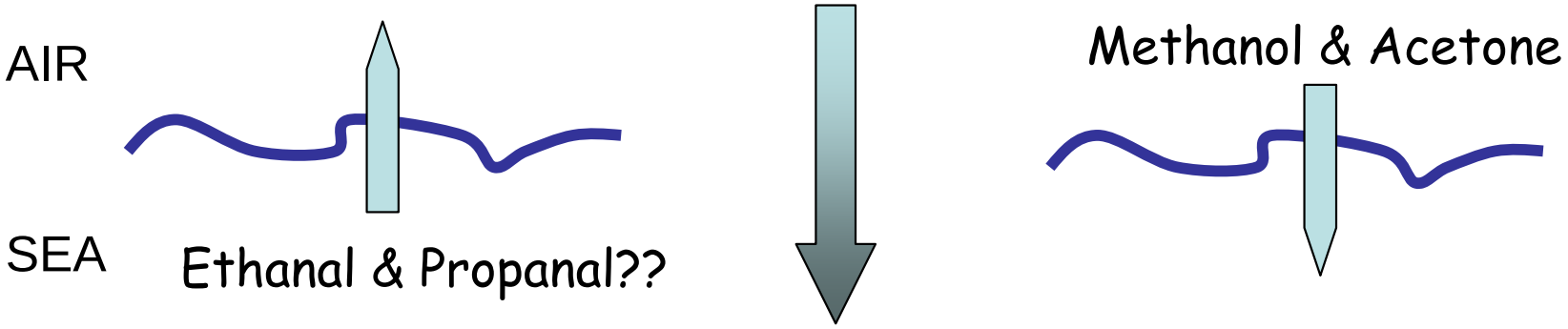
Why are these compounds important?

They have an important role in the oxidant photochemistry of the troposphere

- sequester nitrogen oxides
- act as a source of HOx radicals in the troposphere
- contribute to organic carbon in aerosol (via cloud interactions & polymerization)

OVOCs are known to have large terrestrial sources but attempts to reconcile atmospheric observations with known sources have suggested that oceanic sources may be quite significant.



The role of the oceans in the global budgets of OVOCs remains largely unexplored & there is little reliable data (Singh et al., 2003)

Hypothesis: A combination of the air to sea flux of methanol together with in situ production from photochemical degradation of CDOM sustains methylotrophic organisms throughout the surface ocean

How?.....

1) Measure selected OVOC concentrations in seawater (using GC-FID & PTR-MS techniques) – Phil & Rachael

- Depth profiles
- Spatial changes
- Temporal changes (diurnal)

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2) Measure concurrent selected OVOC concentrations in air (using GC-MS techniques) - Roisin

Atmospheric VOCs present in our standard

- Alcohols:
  - Methanol
  - Ethanol
  - 1-Propanol
  - 1-Butanol
  - MBO
- Aromatics:
  - Benzene
- Alkanes:
  - Butane
- Aldehydes:
  - Acetaldehyde
  - Propanal
  - Butanal
  - Hexanal
  - Acrolein
  - Methacrolein
- Ketones:
  - Acetone
  - MVK
  - MEK

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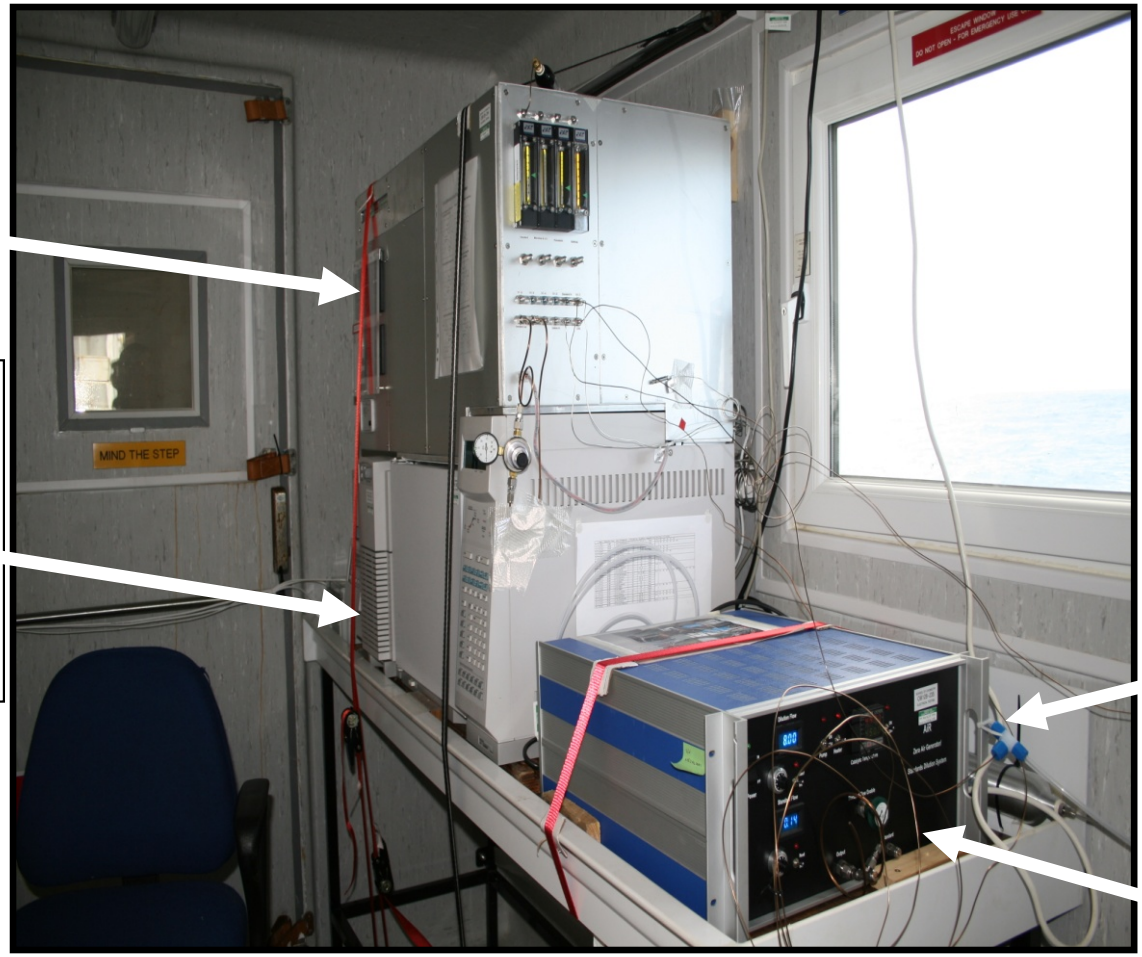
OVOC MADS - GCMS

Modified Adsorption/ Desorption System

Gas Chromatograph coupled to a Mass Spectrometer

Computer



Standard Gas Cylinder

Helium Gas Cylinder

Air Sampling Inlet

Zero-Air Generator

Courtesy of R Walsh

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3) Investigate photochemical production of selected OVOC compounds in surface seawater (using incubation in quartz vessels & GC-FID & PTR-MS analysis) – Phil & Rachael & Jo

4) Quantify total methanol respiration and particulate (cellular/size factionation) uptake (turnover rates etc..) using C14 label incorporation) – Jo (& Rachael – diels)

- Depth profiles
- Spatial changes
- Temporal changes (diel cycles) samples from FISH??
- Light versus dark incubations
- Changes along a production gradient

5) Possibly…Take some samples for DNA analysis for presence of methlyotrophic bacteria (Jo) …tbc…..

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Experiments

Daily;
Main CTD – concentration data & bacterial uptake of methanol

Plus

Photochemical incubation expts
Frequency of expts – not sure at this point…….

Sampling & water requirements

From Main CTD (assuming ~1 hr analysis time per sample for OVOCs) – max 1 litre for each depth & 6- 8 depths - Rach??
& up to 2L for 6 depths (Jo) concentrating in euphotic zone

Ideal concurrent measurements

Bacterial production (Mike???) & numbers

CDOM (for photochemical expts)

Chlorophyll, PP

Atmospheric oVOC requirements

- Would be best if the instrument was set up in a container rather than in the main lab – reduce risk of contamination from solvent use, instrument works best when kept at approx 20 °C
- Need access to the mast (main/fore) to attach the air inlet line
- Need access to a helium cylinder
- Because of the contamination from the incinerator, would like to be informed of times when we will be travelling with the wind for extended periods of time, as opposed to head to wind – ideally container situated on foredeck..!

Courtesy of R Walsh

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