Production of Seawater DMS and Related Compounds, measurements from the NOAA Ship Ronald Brown

Andrew Hind, Carlton Rauschenberg and Paty Matrai

Bigelow Laboratory for Ocean Sciences

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Questions:

is there sufficient marine DMS (dimethyl sulphide) production to sustain observed flux and is this enough to produce observed CCN (cloud condensation nuclei) and clouds?

what is the role light/UV (f clouds, POCs (pockets of open cells), and eddies, filaments on DMS production?)
Oceans supply globally:
98% of atmospheric DMS
94% MSA (methanesulfonic acid)
32% SO$_2$

18% non-sea-salt SO$_4^{2-}$ but in the S hemisphere this 43%

=>
Marine biology influences clouds, how do clouds influence biology? In which direction is the feedback?

(numbers from Gondwe et al., 2003)
DMS production is complex and difficult to predict...

From Simo, 2001
Uptake and retention of DMSP by bacteria

Particles (assimilation by bacteria)

Dissolved non volatile S, including $SO_4^{2-}$

Flux to atmosphere

$0-10\%$

Adapted from Kiene and Linn, 2000
Seawater measurements we made:

- Discrete DMS, DMSP
- Chlorophyll fluorescence
- DMS/DMSP production rates
- Nutrients ($\text{NO}_3^-$, $\text{PO}_4^{2-}$, $\text{SiO}_3^{2-}$)

+ Light spectra, 300-800 nm
Incubations

Examining the role of light/UV on surface seawater

Measuring changes in DMS/DMSPp/DMSPd/chlorophyll over 24 hrs

Typically 3 treatments, each in triplicate so 12 bottles

Each bottle

- 3 x for chlorophyll
- 2 x for DMS
- 2 x for DMSPp
- 2 x for DMSPd

=> 108 samples per incubation
Most surface SW DMS data from the Huebert lab at UH, thanks Barry, Ming and Rebecca
Surface chlorophyll vs. UH DMS
Initial DMS vs. net DMS production

Initial DMS (nM)

net DMS production rate (nM/day)
Solar dose vs. net DMS production

Thanks to Chris Fairall, Sergio Pezoa et al. for radiation data
Lots more to do

- Analysis of light and ocean mixed layer depth – relationship between DMS/DMS production and dose of light/UV?

- Test existing algorithms for SW [DMS] in this region (Vallina, Bell, *et al.*)

- What is the role of plankton species composition?

Or

![Ceratium hirundinella](image1)

*For further information, you can refer to the studies by Vallina, Bell, *et al.**