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The unexpected impact of ocean acidification on the production of dimethyl sulfide and other important climate relevant organic gases

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Nearly 60 hydrocarbons, halocarbons, alkyl nitrates and organic sulfur trace gases were quantified from sea water and air samples taken from the nine mesocosms over the 24 day PeECE III experiment. Three replicate mesocosms of three scenarios representing the present day CO_2 atmospheric concentrations (equilibrated to 375 ppmv of atmospheric CO_2), future CO_2 concentrations anticipated by the end of this century (when considering the IPCC's business as usual scenario, 750 ppmv of CO_2), and a triple present day CO_2 case (1150 ppmv CO_2) were sampled each day. Peak dimethyl sulfide (DMS) concentrations corresponded with the bloom in *Emiliania huxleyi*. The peak in DMS came later in the double and triple CO_2 mesocosms and the time integrated average amount of DMS was 20 and 15 percent higher in the double and triple CO_2 "Worlds", respectively. Results of DMS measurements made by other researchers showed similar results. Chloroiodomethane had its peak concentration much later than the maximum in chlorophyll corresponding to the decline of the phytoplankton bloom. (At this time DMS experienced a secondary maximum.) When integrating the CH_2ClI concentration with respect to time, we estimate that production of CH_2ClI is about 40 percent higher in the 2xCO_2 and about 100 percent higher in the 3xCO_2 mesocosms.

Marine production of DMS critically impacts the radiative properties of the Earth because it is a major source of cloud condensation nuclei in the clean marine environment. A significant perturbation to its production and subsequent sea-to-air flux

will alter the Earth's albedo. Marine production of CH_2ClI is a major source of atmospheric iodine (I). Once released to the atmosphere, it participates in catalytic ozone (O_3) destruction. The concentration of O_3 is pivotal to the oxidative capacity of the atmosphere because it is a primary hydroxyl (HO) precursor. Significant future CH_2ClI emissions would result in lower O_3 mixing ratios and ultimately lead to longer lifetimes of some greenhouse gases such as methane. Results and climatic implications of other gases will also be presented. Perturbations of these gases, by the few marine microorganisms studied during PeECE III, suggests the potential impact on other marine climate relevant gases as a result of projected ocean acidification.