Meteor 55: 5th Weekly Report (11.11.2002-17.11.2002)

The beginning of the 5th week saw us complete our final CTD at station 51 west of Liberia. This was the 110th CTD cast of the cruise. This completed a short series of stations that we had made while steaming south-eastwards from 11°N, 20°W at the beginning of our transit to Douala. This short section allowed us some time to do a couple more deep CTD casts in order to resolve the deep N_2O profiles.

At Station 51 water was collected to initiate a second 'mega-experiment' in which most groups on board once again participated. In these experiments, 48 hour incubation experiments are conducted on-deck using 12-liter bottles. In the first experiment, the incubation bottles had been deliberately manipulated in various ways in order to stimulate either phytoplankton or bacterial growth. The treatments in the 2nd experiment were more limited, involving the addition of 'all' nutrients or the addition of dissolved organic carbon (to stimulate bacterial growth), and there were replicate treatments. The 12-liter bottles were maintained on deck under near-surface light conditions and sampled for a wide variety of parameters after 24 and 48 hours. A preliminary look at the data from the experiments suggests no obvious trends for the volatile halocarbons and N_2O over the course of the incubations. Experiments of this nature are likely to be a focus for future SOLAS research however, because a causal and mechanistic understanding of oceanic trace gas production is required. Through conducting these experiments on board towards the end of the cruise, and discussing the experimental design and results together, we have started developing ideas how such experiments should be conducted.

After station 51 our work reverted to underway sampling and air analyses. The transit from the last station to Douala was approximately 1400 nautical miles! The halocarbon and alkyl nitrate groups took the opportunity of this long transit to intercompare standards. Other groups spent time working up their data and, of course, writing their sections of the cruise report. An important late evening activity was working on the Meteor guest book. (The Chief Scientist kept a deliberately hands-off policy on this and expects, as a result, to find some embarrassing pictures in the final product). We held a science results discussion at which the various groups highlighted their initial findings, and outlined their short-term plans for working up samples and analyzing results. In the course of this discussion, additional useful collaborative analyses between groups were identified. It is clear that all groups that were on board have collected excellent data sets and that there are many exciting and new findings to write about. Given the risk associated with taking so many complex analytical systems to sea, several for the first time, it was gratifying to see that all groups had a highly successful cruise.

Some highlights that appeared:

- The west-east transit showed strong gradients in dissolved and particulate iron in the water column. A unique aspect of this cruise is our ability to relate these water-column measurements to dust characteristics measured simultaneously along the transit as well as to models of dust deposition provided by the atmospheric chemistry groups.

- We collected sufficient data for alkyl nitrates and halocarbons to identify very clear patterns in the vertical profiles. Many gases show profiles characterized with a maximum near, but not necessarily at, the chlorophyll maximum. Detailed analysis of these profiles together with biomass and biological rate measurements is already providing insight into likely production pathways. In the

case of CH_3I, on-board experiments have revealed, for the first time, the factors that control its production.

- In the case of N_2O, the along-transit gradients of sub-surface dissolved oxygen are mirrored in N2O concentrations. Detailed analysis of these gradients and of the steep N2O gradients that exist through the thermocline should provide useful information on N2O formation rates and fluxes.

- The nutrient bioassay experiments conducted throughout the cruise have provided insight into the nutrients that limit primary production along the transect. These experiments were also used to experimentally investigate the influence of limitation by different nutrients on nitrogen fixation. Initial results show a major limiting role for inorganic nitrogen throughout the cruise, with a secondary role for iron and/or dust in certain parts of the section. Findings concerning the influence of nutrient and dust additions on nitrogen fixation await analysis of samples in the laboratory.

The transit allowed us to have boxes packed and ready upon arrival in Douala. However container packing had to be done in Douala. Our planned arrival at the pilot station at 08.00 on the 17th was delayed until 16.00 due to lack of berths in the harbour. Finally we docked at about 18.00 and completed formalities fairly smoothly. At the time of writing we are still waiting to pack the remaining containers that are being delivered this morning (the 18th). Given that the science party are scheduled to depart this evening for home at 2300, its going to be a very busy and tiring day.

Synopsis: the Meteor 55 cruise was the first German SOLAS (Surface Ocean Lower Atmosphere Study) cruise and one of the very first SOLAS cruises worldwide. I think that we were very successful in bringing marine chemists, atmospheric chemists and biologists together to work together on common themes. The enthusiasm for this interdisciplinary work was shared by all on board, and, by the end of the cruise all could see the benefits. The days of atmospheric chemists measuring oceanic trace gas distributions in the absence of related oceanographic or biological information are, hopefully, over. Similarly, a host of new scientific questions involving the atmosphere have been identified by the marine scientists, and their understanding of and interest in the dynamics of the atmosphere has been increased greatly. The marine chemists have also been exposed to state-of-the-art atmospheric trace gas measurement systems.

All of this, as with all Meteor cruises, was only possible because of the excellent performance of the ship and her officers and crew. The science support has been exceptional throughout. The experience and creativity of the officers and crew is what stands out: they are flexible, and able to quickly and accurately analyze special needs and situations that develop. This is as true of the seamen on deck as it is of the technical staff and officers. Things run smoothly and well. Problems get solved. People are helpful and genuinely concerned that the science gets done efficiently, excellently and safely. All of the scientists on board Meteor 55 are grateful for the support they received and we wish the officers and crew all the very best for the future. We sincerely hope that the excellence that characterizes Meteor at the present time can be maintained into the future.

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