

Meteor 55 1st Weekly Report (12.10.2002-20.10.2002)

Meteor Cruise 55 departed Willemstad, Curacao on Saturday October 13 at 18.15. Just a week prior to departure, the decision was made to shift the end-port for the cruise from Abidjan in the Ivory Coast to Doula, Cameroon. This was required due to continued civil unrest in the Ivory Coast. Arrangements for Doula were still being made as we left.

Most of the scientific staff arrived in Curacao two days prior to departure after a gruelling 20-hour journey. They were greeted by a few tanned, relaxed colleagues who had wisely travelled earlier. Late that evening Meteor was viewed sailing through the narrow entrance to Willemstad harbour. On October 12, we arrived at dockside to find that all our containers had been delivered and those to be carried on board were already stowed. There followed the usual frenzy of moving boxes, unpacking, and setting up.

The set-up of the laboratories for this cruise has been unusually complex. A large amount of sophisticated analytical equipment is deployed on board, including 7 gas chromatographs within the Universal and Geo Labs alone. Most of these systems are supplied with surface water that is pumped continuously from the Meteor's 'Moon Pool', as well as by centrally-distributed supplies of high-purity nitrogen, ultra-clean air and hydrogen from gas generators. Due to excellent organisation of the shipment and lab assignments by Hermann Bange, and superb cooperation from the crew, the set-up went extremely fast despite the complexity. This allowed us to meet the planned departure time which had been brought forward by 12 hours due to the long transit to Douala ahead.

Meteor 55 is the first German SOLAS (Surface Ocean Lower Atmosphere Study) expedition, and one of the very first SOLAS expeditions worldwide. SOLAS is a brand-new, international global-change research program that is focussed on atmosphere-ocean exchanges. Internationally, only the Canadians have been quicker than Germany to get SOLAS into the water (and air). Briefly put, SOLAS aims to investigate the role of the atmosphere for surface ocean chemistry and biology, and the role of surface ocean biology and chemistry in controlling atmospheric chemistry and climate. For Meteor 55 we have assembled a team of ocean chemists, biologists and atmospheric chemists to work together on a range of issues related to atmosphere-ocean chemical interactions. It is hard within the context of this first report to do justice to the breadth of programs that we are conducting on this cruise. I will leave a detailed discussion of individual scientific programs and their findings to later weekly reports. In this report I would rather convey an impression of the themes underlying the cruise and the general atmosphere that is developing on board.

On the ocean side, the cruise includes a full biological program looking at biomass, productivity and nitrogen fixation along the cruise track. The ocean chemists are measuring a range of dissolved gases ranging from oxygen and CO₂ through the long-lived radiatively-active trace gases N₂O and CH₄, to a wide range of shorter-lived, naturally produced trace gases including halocarbon compounds, dimethyl sulphide, and the alkyl nitrates. The atmospheric chemists are measuring a range of trace oxygenated organic compounds such as acetone, methanol and acetonitrile not only in the atmosphere but also, almost for the first time, in the ocean. Intercalibrations between the ocean and atmosphere measurements, and between the different groups, are being conducted on board. Joint experiments and sampling programs are being undertaken. I have been particularly pleased to see intense communication between 'atmosphere people' and 'ocean people' at mealtimes and coffee breaks. The atmospheric chemists are looking down microscopes and marvelling at plankton diversity. The oceanographers are being exposed to continuous measurements of ozone, methanol and BrO and learning about the structure of the atmosphere.

An important theme for the cruise concerns the role of the atmosphere in supplying key nutrients required for phytoplankton growth. An atmospheric chemistry program examining dry and wet deposition of iron and nitrogen species is therefore closely tied to an ambitious program of biological experimentation. In the experiments, nitrogen, phosphate, iron and even Sahara dust, are being added to water samples collected from along the cruise track in order to study the growth response of phytoplankton to these different nutrient additions.

Based on what I have seen so far, I am sure that the atmosphere and ocean groups will develop long-term collaborations and joint projects based on results and ideas that arise from this cruise. If this happens, then one of the overall aims of the Meteor 55 cruise will have been fulfilled.

Some specific details:

Sampling: We are doing 2 stations per day: a morning station with 2 CTD casts, a trace-metal hydrocast and net tows and an afternoon CTD cast. We made our first station on October 16 about 240 miles due east of Trinidad and Tobago. A very large portion of our measurements however are made on air and pumped surface seawater during steaming.

A notable feature of the cruise so far has been the support we have received from the Deutsche Wetterdienst (DWD). The scientific staff have been provided with meteorological satellite images, analyses of ITCZ position, and all-important rainfall forecasts for our dry and wet deposition measurement program. A coordinated and expanded program of radiosonde launches has been worked out. Cooperation with the DWD will be important for future SOLAS research, and this is a small but promising first step.

At present all our analytical and sampling systems are operational. Experiments are also underway. Here are a few early highlights: our first clear evidence for deposition of dust was measured on 15-16 October with visible red streaks seen on the filters after a 40 hour collection. Dust continued to show up on the filters for a few days until apparently interrupted by a northward excursion of the Intertropical Convergence Zone. High frequency continuous measurements of atmospheric methanol are also showing interesting structure associated with our position relative to the ITCZ. A new dissolved oxygen sensor that we are field testing along the cruise track has shown excellent stability and extremely high resolution. A diurnal signal in surface water oxygen saturation of a couple of percent is clearly discernible in the data.

Based on daily Seawifs images of ocean colour, we altered course to intersect a large region of very high surface chlorophyll that was clearly visible from space at about 10°N, 52°W. The feature reflected Amazon-derived material that had been swept more than 400 miles offshore. Sampling of this plume revealed coastal assemblages of plankton but also, surprisingly for us, many tufts of nitrogen-fixing *Trichodesmium* were seen. Surface salinity and pCO₂ dropped rapidly to <29 and <290 ppm respectively. Later we sailed through a major surface slick of blooming *Trichodesmium*. These were growing well above a chlorophyll maximum that was composed of diatoms. This was clearly what Seawifs had detected and without the Seawifs imagery we would have missed this completely. Several experiments were initiated with water collected from within this feature. The remainder of the cruise track may well continue along 10°N instead of 11°N as originally planned. We are receiving several other observational and model products on board, including maps of integrated dust deposition. These products are being examined to guide our cruise track with respect to regions of dust deposition.

In summary, it has been an exciting and busy week full of both expected and unexpected findings that bode well for the remainder of the cruise. Equipment became operational rapidly which means that we are

all having fun measuring, experimenting and enjoying our work. The cruise has a very international flavour, and we have scientists on board with origins in 7 nations. Many have not sailed with Meteor before. All the scientific staff are impressed by the capabilities of the crew and officers of Meteor. Not only the professionalism but also the cooperation and friendliness of the crew have been exemplary. The crew of Meteor are a national, even international, treasure.

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