

## Meteor 60-5: Weekly Report #1

Meteor 60 Leg 5 departed Fort-de-France (Martinique) at 1330 (local) on March 9. Some of the 26-strong scientific staff had already enjoyed a short holiday in Martinique, while others arrived two days prior to departure. We all spent a pleasant Sunday together on the beach at our hotel: swimming, wind-surfing (well, almost), and diving. On Monday morning the planned bus transfer to Meteor was cancelled due to the roads to our part of Martinique having been completely blocked by a strike or demonstration. This reminded us that Martinique is part of Europe despite the relaxed Caribbean atmosphere. After some momentary confusion, which was not helped by the Chief Scientist's incomplete mastery of French, we obtained alternative transport in the form of ferryboats. We finally reached Meteor, two hours late, to find our containers already on board and ready to be unloaded. Unpacking and laboratory set up continued right up until the time of departure, but we were then able to relax a little and enjoy the view as we sailed along the western coast of Martinique.

The main theme of Meteor 60-5 is to resample a set of hydrographic stations that were occupied in 1981 during the US-led Transient Tracers in the Ocean program (TTO). We have therefore given Meteor 60-5 the nickname: 'TTO Revisited'. The TTO expedition was itself, partly a reoccupation of the famous GEOSECS expedition of the early 1970's. Both GEOSECS and TTO were concerned with the penetration into the ocean of tracers derived from nuclear fallout: particularly tritium ( $^3\text{H}$ ) and radiocarbon ( $^{14}\text{C}$ ). The atmospheric weapons testing of the early 1960's had initiated a global-scale tracer-labeling experiment that was monitored by worldwide expeditions such as GEOSECS and TTO. These expeditions and the tracers measured, returned major new insights, as well as some new questions, concerning the circulation of the deep ocean.

By the time of TTO however, concern was already shifting away from the decaying problem of man-made radioactivity towards the growing problem of man-made  $\text{CO}_2$ . Hence the TTO cruises included extensive measurements not only of fallout tracers but also of oceanic  $\text{CO}_2$ .

Twenty-three years on from TTO, there has still been no carbon equivalent of the Nuclear Test Ban Treaty, and the result is that the  $\text{CO}_2$  problem continues to grow. Human beings continue to release more and more  $\text{CO}_2$  into the atmosphere, with 30-40% of the amount released 'disappearing' into the ocean. The consequence of the ocean uptake is that ocean  $\text{CO}_2$  levels are rising. The major goal of the Meteor 60-5 cruise is to collect data to document and quantify this increase of oceanic  $\text{CO}_2$  over time. Comparison of our data with the high-quality data collected 23 years ago during TTO, should give us an unprecedented view into the magnitude of this change and its geographical distribution. This information in turn can be used to check and improve the models that try to predict how much  $\text{CO}_2$  the ocean will take up in the future.

During Meteor 60-5, we will travel along the long path trod by the RV Knorr, 23 years ago. The result is an strange looking cruise track that zigs and zags across the mid-latitude Atlantic in order to reoccupy as many TTO stations as possible. The Meteor 60-5 cruise, combined with a northern North Atlantic cruise of Meteor and two related US-led cruises last year, will provide an almost complete 'snapshot' of the North Atlantic for the period 2003-2004. This can be compared directly with how the Atlantic looked in 1981. In addition to the expected  $\text{CO}_2$  increase, we are looking for changes in temperature, salinity, oxygen, nutrients and tracers such as the Freons using the high-quality TTO data as a baseline.

At the time of writing this report, all planned measurement programs are underway and a routine has developed. Almost every measurement group has experienced one or two initial problems so that we have kept the Meteor's excellent electronics department very busy, but now everything is functional with the exception of an in-situ fluorometer.

We have already sampled 6 of the old TTO stations. Overall the data quality looks very good, with our nutrient and oxygen data falling exactly on top of the older data. We can already see evidence for a significant increase of CO<sub>2</sub> in the top 700-800m of the water column. Last night we sampled at TTO station 22 (25° 47'N; 66°W) and then made a right turn, so that we are now heading northeast towards a cluster of TTO stations located 750 nautical miles south of Newfoundland. As we travel slowly north, we keep a close eye on the weather charts. So far it's been warm and calm, and the immediate forecast also looks good, however storms will undoubtedly play an increasingly important role for our cruise in the coming weeks.

In addition to the TTO reoccupation, we have several other science programs on board, including an extensive biological program of observations and experiments. In the next weekly report, I will introduce the various groups and their scientific activities.

Douglas Wallace  
Chief Scientist, Meteor 60-5