

I07N Cruise Report – Week 3 (May 7 - May 13)

This week was relatively rich for events. It started as usual with routine operations at stations. An Argo float and a mini wave buoy were deployed on the first day of the week. The weather was good as in previous weeks, and all operations were going smoothly. On the second day we entered the Mauritius EEZ, and by the end of the day we reached the location of a PMEL mooring, communication with which was lost 5 years ago. We were asked to attempt to find the mooring and, if the buoy is present, to recover the mooring or at least to make pictures of the buoy if we are off the schedule. We arrived at the mooring location in the dark, however, the weather was favorable, and the visibility was good enough. Being well equipped with the ship's radar, night vision device, and a searchlight we started the search. Our plan was to locate the buoy, proceed to the next station (#42), and then return to the mooring and recover it next day in the morning. However, the buoy was not present. After hovering around for about an hour, the transducer was lowered at the last reported position of the mooring and disable command was sent. Unfortunately, the mooring is lost.

Although we did not have to spend much time for the recovery and proceeded to the next station right away, our anxiety was growing because we still did not have the Marine Scientific Research (MSR) clearance from the Seychelles. And by the time we reached the boundary between the Mauritius and Seychelles Exclusive Economic Zones (EEZs), the clearance was not issued. Whatever the bureaucratic reasons were involved, we were just stranded. Apparently, up to this moment the cruise was going too smooth, so something had to happen. And it happened. The situation was complicated by the fact that our Mauritius clearance was expiring at midnight on the day we arrived at the boundary. Therefore, there was not much we could do inside the Mauritius EEZ. We did a full-depth CTD cast just 3 nm off the Seychelles EEZ boundary, which became our new station 44. Then we did a net tow at around 10 pm. But at midnight all science operations were ceased, and all underway systems were turned off. We decided to wait for the clearance at station 44 and not to proceed to the next station. This would allow us to have continuous in space underway data once the clearance is issued. On the next day by noon, we still did not have clearance, so we started to prepare for the worst. We sent a request to the person who issued clearance for Mauritius asking him for an extension, which would let us return to a turning point at station 40 and head northeastward around the Seychelles EEZ. We had identified possible locations for 10 new stations inside the Mauritius EEZ. Fortunately, the Seychelles clearance came at around 2 pm, and we immediately rushed to the next I07N station.

The delay with clearance costed us one full day at sea, but at least we did not have to change the route. As a result, we had to cancel 5 stations to return on schedule. We decided to cancel stations 48, 50, 58, located over relatively flat bottom topography, and stations 52 and 54, located over the slopes of sea mountains. Cancelling the stations increased the spacing between the stations along the corresponding segments from 17 to 34 nm. But we still retained the short spacing between the stations over the Amirante Trench. A map of stations near the Amirante Trench, including those canceled, is displayed in fig. 1. We are still a little behind the schedule as the sea state does not permit seaming faster than 10 knots. Postponing the last station on leg 1 to leg 2 is not a desirable option, however, because it would take about half a

day from the leg 2 schedule just for steaming given the large area of the Seychelles bank we will have to cross. But we will do that if necessary as there'll be no more cancellations on the leg 1.

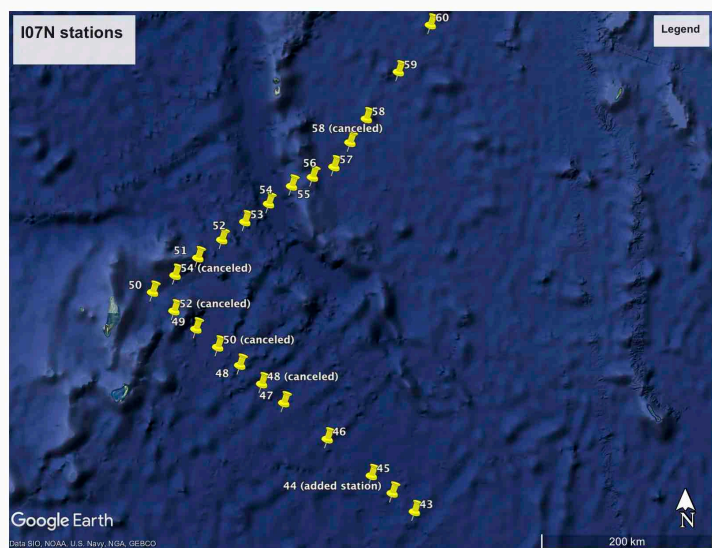


Figure 1. A map with stations near the Amirante Trench. Stations 48, 50, 52, 54, and 58 were canceled.

As we are completing the first leg of the cruise, some interesting scientific findings are starting to emerge. Below are the profiles of temperature, salinity, and oxygen from station 1 at 30°S to station 57 at about 8°S (fig. 1). We have passed a warm pool bounded by the eastward South Indian Countercurrent in the south and the westward South Equatorial Current in the north. We have observed the saltier subtropical water that subducts under the warm and less saline near-surface water. This subtropical water was still seen at our last CTD cast. The Antarctic Intermediate Water (AAIW) is not observed beyond station 38 (~14°S). The increased oxygen concentrations near the bottom associated with the Antarctic Bottom Water (AABW) are observed everywhere along the first leg of the cruise. What we find particularly interesting with regard to AABW is the observed concentrations of CFC in comparison to those observed in 1995 (see fig. 2). As you can see, in 2018 we have observed substantially higher concentrations of CFC in the AABW layer, which means that new AABW was formed over the last 23 years and advected all the way to the tropical latitudes of the Indian Ocean.

We are just one day away from our port stop in Victoria. Besides the issues with clearances and the necessity to cancel 5 stations on the first leg, everything else has been going well. The instruments are working great, no problems with the forward winch. The next report will cover only 3 days at sea during the fourth week as the other 4 days we will spend on shore.

Denis Volkov (Chief Scientist, CIMAS/NOAA-AOML)
Viviane Menezes (Co-Chief Scientist, WHOI)

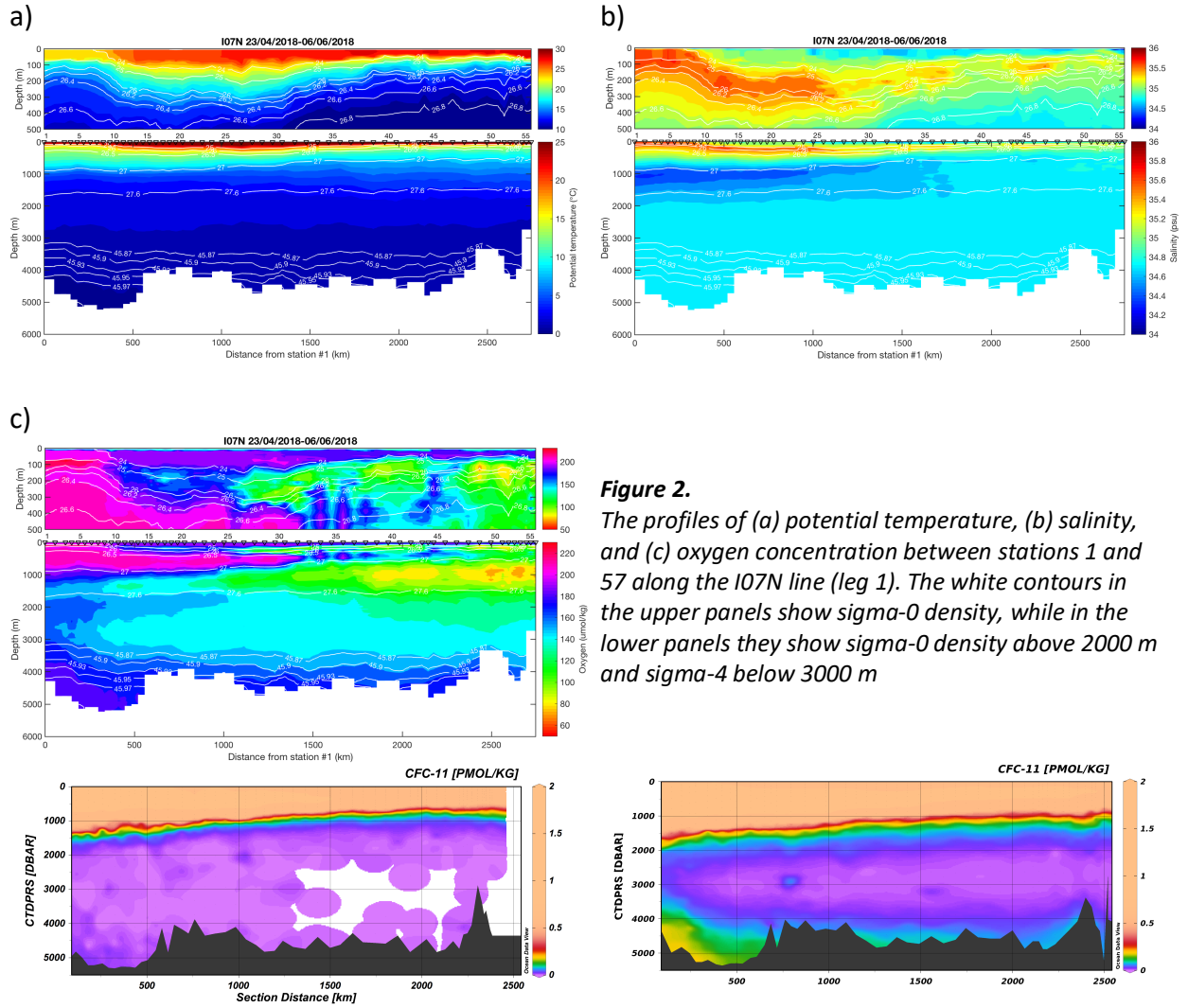


Figure 2. CFC concentrations along the I07N line (left panel) in 1995 and (right panel) in 2018.