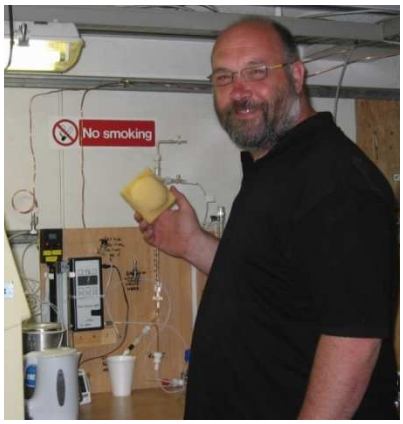
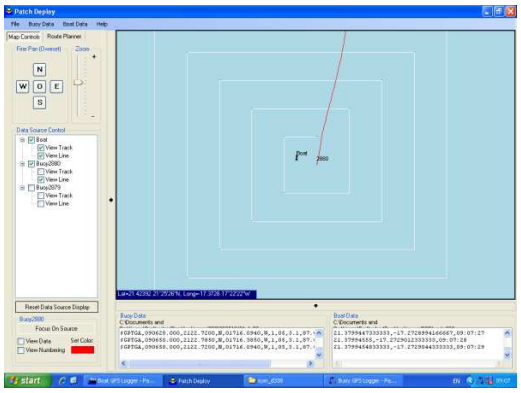
Wednesday 22 April 2009 JD 112



The ship remained close to the wire walker buoy throughout the night, travelling at a speed of about 1 knot. Dan Comben and the NMF-SS team have mended the liquid nitrogen generator, and so John Stephens was able to measure dimethyl sulphide (a compound produced by plankton and relevant to the atmospheric sulphur cycle) for the first time from the pre-dawn CTDs at 03:30 (see photo 1). After sampling the CTDs, John, Phil and Malcolm L. finished saturating the tank of seawater with sulphur hexafluoride and helium (see photo 2), and 3rd Officer Iain Macleod prepared to bring the ship alongside the buoy ready for the tracer release. At this point we realised that the GPS buoy had become detached from the buoyancy above the wire walker. Since without the GPS buoy we would have no way of finding the wire walker (and so the centre of the SF_6 patch), we knew that we would have to recover both the wire walker buoy and the GPS buoy, rejoin and redeploy them. Unfortunately, without the surface line of the GPS buoy, the wire walker buoy was very difficult to snag with a grapple hook. In attempting to retrieve the wire walker on board, the wire became caught under the boat on the rudder, the rope and drogue snapped and the wire walker was lost. Ian Slater (Chief Engineer) and his team then undertook a series of checks to test that both the rudder and the propeller were unharmed. We waited to be told whether all was OK, or whether we would need to be towed back to Tenerife. When given the all clear to engage the propellor, we successfully retrieved the GPS buoy at around 16:08.

Without the wire walker, we now needed to deploy another drifter as the central marker for the release of SF_6, at the predicted latitude and longitude where the original wire walker buoy would have been had it not been lost (in order for the samples collected alongside the buoy this morning to be relevant to those collected in the future SF_6 patch). Then, using software to continually predict the position of the ship relative to the moving central buoy, we deployed the SF_6 and helium as the ship followed an expanding spiral pattern (see photo 3). The deployment was completed at 23:30, seven hours later than planned, and we then deployed drifters at the corners of the 3 x 3km patch of SF_6, finishing at 02:00 on Thursday. These drifters are 'drogued' at a particular depth, that is, there is a 6m x 2m hooped circle of tarpaulin attached to the wire or rope which drags in the water, helping the drifter to move with the water currents rather than with the surface winds. When the final drifter was deployed, we went for a well deserved drink in the bar to commiserate the loss of the wire walker and celebrate the rest of the deployment. The time series experiment we're about to embark on, is only made possible by the hard work, commitment and professionalism of Riqui and the physics team –Tim, Bea and Thomas and Phil and the SF_6 / air-sea exchange team – Malcolm, John and Ian. After the disappointment of losing the wire walker less



than 24 hours ago, and the scare that 50m of wire had become wrapped around the ship's propeller, the successful completion of the deployment was a great relief.

Thursday 23 April 2009 JD 113

Only 1 hour after the SF_6 and drifter deployment, we were ready for the first pre-dawn casts within the SF_6 patch. Sea surface temperature was 17.1 ^{o}C, air temperature 16.9 ^{o}C, plankton chlorophyll fluorescence was 0.69, nitrate concentrations were 7.8 umol l^{-1} and the wind was a steady 20 knots NNE. The collection of this

first data in our time series experiment is a significant milestone. We applied to do this research in 2004/5 and were originally scheduled to undertake the cruise in 2006. However, due to various problems with RRS Discovery, the cruise was postponed from 2006 to 2008 and then again to 2009. So it has taken us almost 5 years to reach this point. To say 'well done' to Riqui, Tim, Bea, Thomas, Phil, John and Malcolm L., and 'thank you' to all the ship's officers, crew and technical staff who contributed to this achievement, we celebrated with wine at dinner. The daily timetable from now on will consist of surveying the extent and concentration of the SF_6 patch overnight, pre-dawn casts at 03:30, further CTD casts at 09:00 and 12:00, and when possible 20:00, plankton nets, atmospheric sampling, optical measurements at solar noon and 2 hourly profiles with a free-falling turbulence probe to assess the physical structure of the water column. All overside activities went well today, the net samples revealed an incredibly diverse community of diatoms in the phytoplankton, and the optical cast showed that the depth at which light reduced to 1% of surface irradiance was 35m. At the midday cast SST was 16.8 ^{o}C, salinity 36.18 and chlorophyll fluorescence 0.87. In order to map the SF_6 patch, Phil, Malcolm, John, Frankie and Ian work a shift each to monitor the SF_6 analytical system overnight (see photo 4). The concentrations of SF_6 are plotted on a 'bubble' plot, with the diameter of the bubble indicating the concentration of SF_6 (see figure). Combining information from the ship's track, the track of the 5 buoys we deployed yesterday and the concentration of the SF_6, we can guide the ship to an area with high concentrations of SF_6 and give the navigator an estimate of the distance and direction he should stay from the nearest buoy in order to remain in the SF_6 patch during the day when we have no surface SF_6 measurements (blue circle is 3 km diameter centred on the 'best estimate' of the patch centre at the yellow circle).