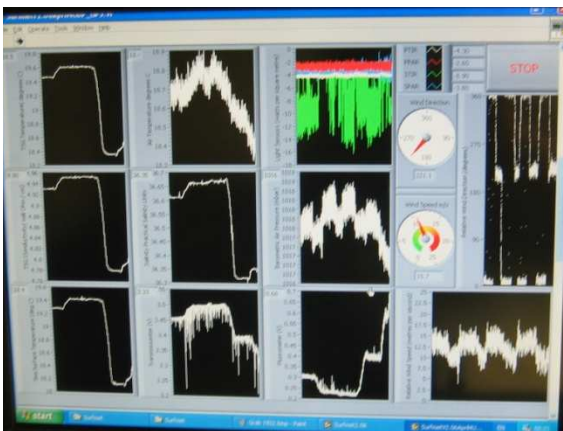


Monday 20 April 2009 JD 110

One of the most important sampling times of the day for us is the early morning CTD casts. This is the only time of the day when we can collect water, siphon it carefully into replicate bottles and 'incubate' it on the back deck during daylight hours. The incubators are cooled to the temperature at which the sample was collected and covered in blue plastic screens which simulate the light intensity and colour range of the water that was collected. The samples are incubated for 24 hours and we put the bottles in the incubators before dawn so that the plankton samples which were collected from depths where light is very low (those below about 35m here) do not get 'light shocked' (see photo 1). We measure the activity of the plankton by determining at the end of the incubation, how much carbon they have taken up (Claire), how much oxygen they produce or consume (Pablo and Vas), how much amino acids they take up (Polly), how much nitrogen they consume or produce (Darren), and how much phytoplankton is eaten by zooplankton and how much is lysed by viruses (Susan). This 'pre-dawn' series of casts start at about 03:00, so you can imagine the potential chaos caused by 15 sleepy scientists wanting to collect water from various combinations of 24 depths in the dark. We also measure dissolved gases in the water – such as oxygen, nitrous oxide, methane, dimethyl sulphide and the two gases we will be deploying – helium and sulphur hexafluoride. These gases have different solubility properties in seawater and so it is important to sample the CTD bottles in a particular order so that those gases which are furthest from equilibrium in the air are sampled first. This means that the first person sampling from each CTD bottle has the pressure of knowing everyone else is waiting for them to finish. Of course, everyone would like to be first so that they can get their samples analysed quickly, so there is usually a bit of jostling and overtaking. Then just to add extra spice to the mayhem, on every cast 1 or 2 of the CTD bottles don't close properly and so the careful plan we had made beforehand and copied on to a white board quickly has to be re-arranged with minimum huff taking.



This morning we aimed to sample water with a relatively high plankton concentration. Therefore we needed



to monitor the underway measurements of fluorescence (related to the amount of phytoplankton present) and stop the ship when the fluorescence reaches a maximum. This is easier said than done, as someone has to watch the data stream (see photo 2) and guess whether the next measurement will be higher or lower. We are in an area where the plankton concentration is very patchy and so unless you react quickly, by the time the ship has slowed down, it can drift out of the high plankton patch. This is what happened this morning, and so to try to return to an area with a high plankton concentration I asked the bridge to turn the

ship around (such power I have !). 2nd Officer Mike Hood (see photo 3) performed a classic Williamson turn (that which is used to return to exactly the same place should someone go overboard) to get us back in a moderately high plankton region.

During the day the weather worsened from Force 7 to gusting Force 9. We continued the large scale survey measuring water currents, temperature and salinity, but were restricted to one line of travel to avoid putting the ship broadside to the weather. We headed inshore to an area of high plankton concentration as seen in the satellite ocean colour images, and planned how to deploy the buoys and SF₆ scheduled for Wednesday. However, as the weather remained force 7-9 and the forecast predicted the same for the next 4 days, it was possible that we would soon be hove to with all over-side activities cancelled. The area in which we wanted to deploy the SF₆ and drifters was also very close to a number of pinnacles rising from the seabed at 60m or so to 11m, and marked on the chart as 'position doubtful'. This region has undergone few previous bathymetric surveys – and so understandably we were 'proceeding with caution'. The ship travelled up and down the line of least pitch and roll during the night, at one stage being close enough to land to use mobile phones.



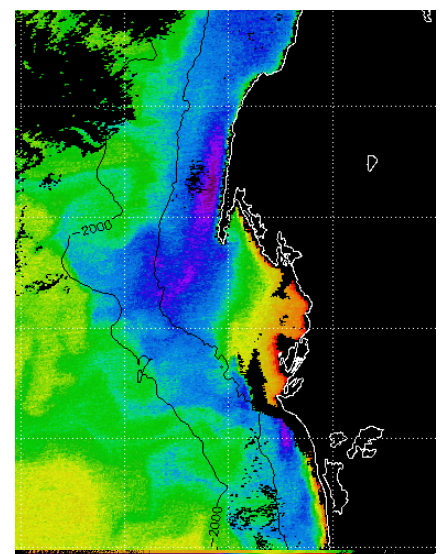
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03:00 came around all too quickly, and with the wind and swell dropping overnight, we were able to deploy the two pre-dawn CTDs to collect water samples, before a short ADCP survey to the north and east of the area



of high plankton concentration. The data from the ADCP survey and the tracking of the 4 'throw away' drifters we deployed on Friday suggested that this would be a good place to deploy the SF₆ with a view to following a single water mass as it moved south and west for the next 10-12 days. Riqui and Tim (see photo 4) spent the rest of the day deploying and recovering the drifters, adjusting the buoyancy on the 'wire walkers' (instruments which move up and down a wire suspended beneath the drifter collecting vertical profiles of temperature and water movement), and testing the

deployment of the turbulence probe (which measures fine scale water movement). Around lunchtime we received a satellite image of sea surface temperature which showed that yesterday's storm had caused cold nutrient rich water to rise to the surface lowering the surface water temperature (see purple colouration on satellite image – our area of high plankton concentration is the black splodge to the west of this). This upwelling of deep water is exactly the process that we are here to study, so the timing of the storm couldn't have been better (though the people who were very ill probably don't think so) – it had produced the start of a new filament which hopefully we can measure throughout its journey from the coast to offshore. At the end of the day, we deployed the drifter plus wire walker which would become the central marker of our SF₆ Lagrangian study (=sampling the same water mass as it moves, as opposed to an Eulerian study which samples the same geographic position irrespective of the water mass flowing past). The ship kept close to this buoy



overnight so that we would be ready to sample alongside it at 03:00 on Wednesday before releasing the sulphur hexafluoride and helium gas patch.