

Evaluation of Field-Collected Drifter and In Situ Fluorescence Data Measuring Subsurface Dye Plume Advection/Dispersion and Comparisons to High-Frequency Radar-Observation System Data for Dispersed Oil Transport Modeling

APPENDIX F – OCEANOGRAPHIC DATA

**A Final Report Submitted to
The Coastal Response Research Center**

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Appendix F. Oceanographic Data

Appendix F contains oceanographic data from conductivity – temperature – depth (CTD) casts measuring salinity, water temperature and water density versus depth. CTD casts were taken before the dye release and outside of the plume area in order to characterize the structure of the water column, the pycnocline depth, and the surface mixed layer depth. In the November 2005 and March 2006 experiments, the CTD apparatus was also used to measure fluorescence *in situ*. Thus, the fluorescence data are included here for those dates. However, in the June 2006 and November 2006 experiments, all fluorescence data were collected with the high resolution profiling fluorometer. Thus, only a few CTD casts were made in those latter experiments. The fluorescence data for the June 2006 and November 2006 experiments are in Appendix G. CTD and fluorescence data for the 9 August 2006 experiment are included here in Section F.8.

F.1 Results of November 8, 2005 Experiment

Figures F.1-1 and F.1-2 show the locations of the CTD casts for the 8 November 2005 experiment. The location of the dye release site and direction of drift during the release are shown in Figure F.1-1. Note that the longitude scale in Figure F.1-2 is greatly exaggerated, whereas the longitude and latitude scales in Figure F.1-1 are of equal degrees.

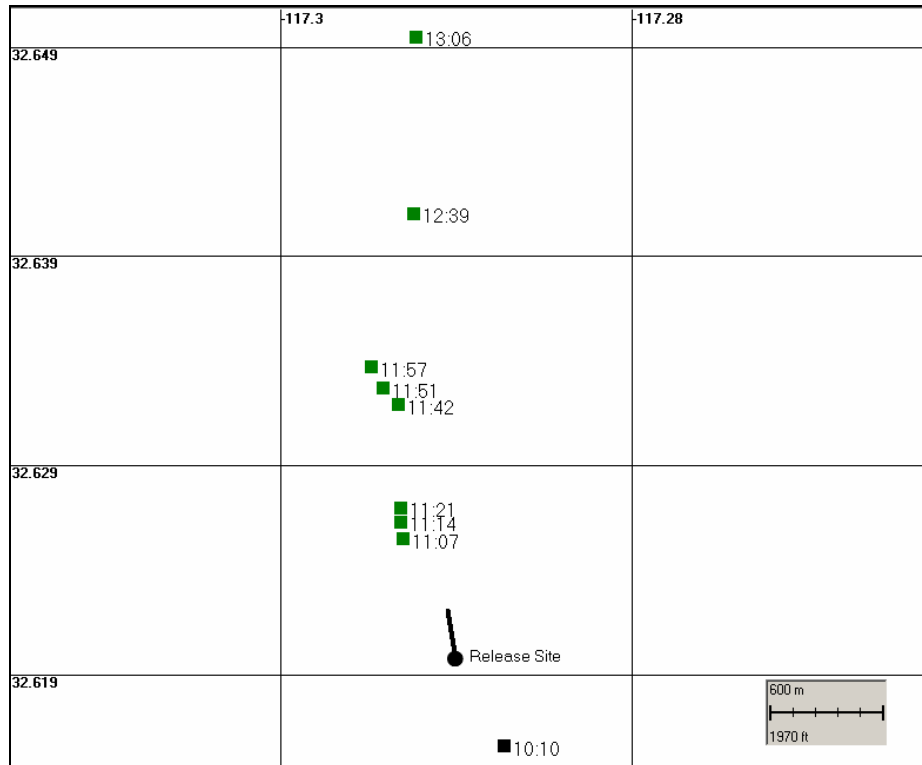


Figure F.1-1. Vertical CTD cast locations and times (local; black = before, green = after dye release) made aboard the SIO whaler on 8 November 2005.

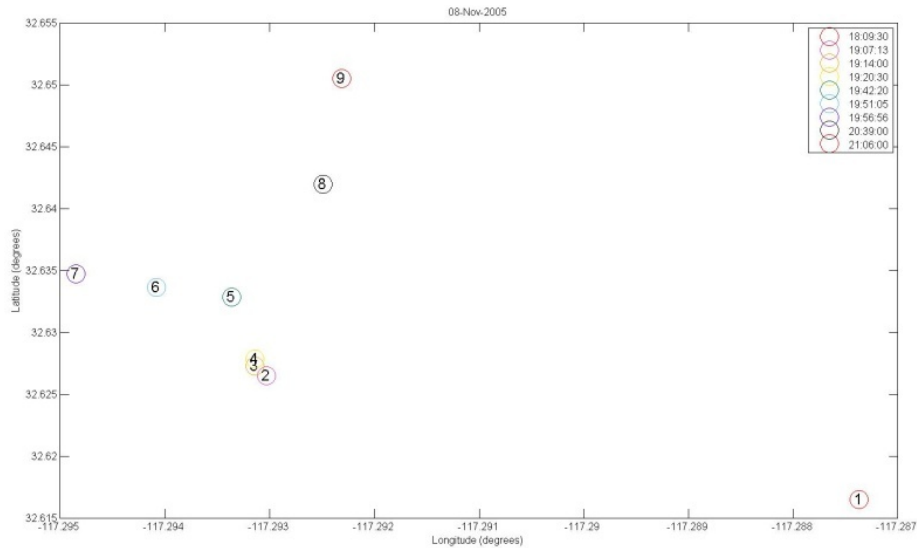


Figure F.1-2. Location of CTD casts 1-9 for 8 November 2005. Legend indicates time of CTD cast in UTC. Exact coordinates for Casts 10 and 11 were not recorded and not shown.

Figures F.1-3 to F.1-13 plot data recorded by the 11 CTD casts taken during the 8 November 2005 OSPR experiment. For each cast, four figures are displayed which show the oceanographic characteristics of the water column. Top left panel: temperature; top right panel: salinity; bottom left panel: density; bottom right panel: dye concentration. Date and time of each cast is listed at the top of each set of figures in coordinated universal time. Cast number is shown in the top right hand corner of the top right panel.

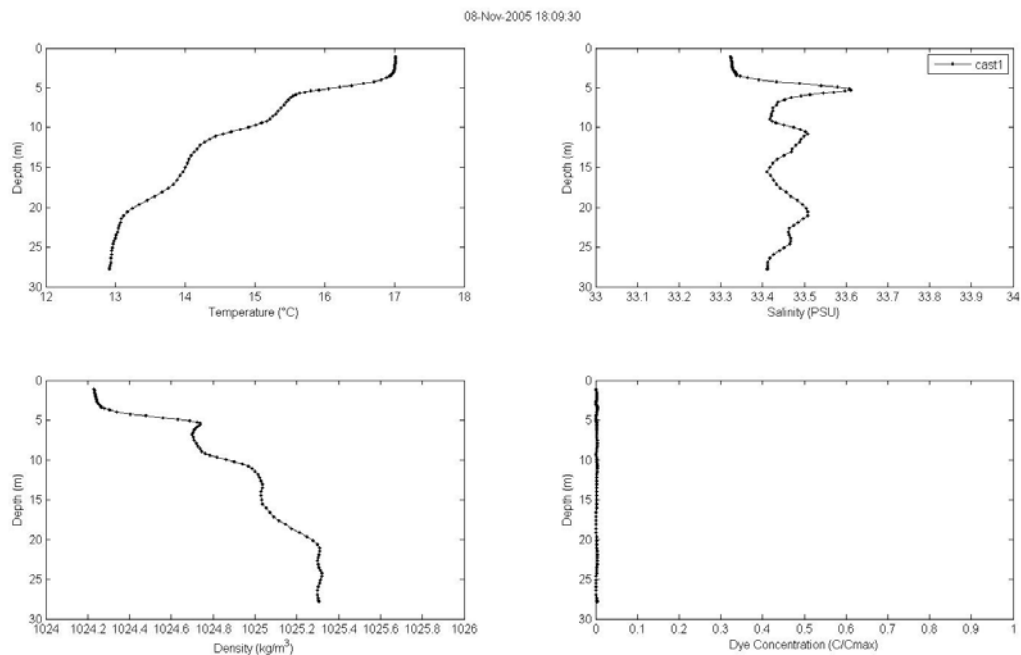


Figure F.1-3. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 1 on 8 November 2005.

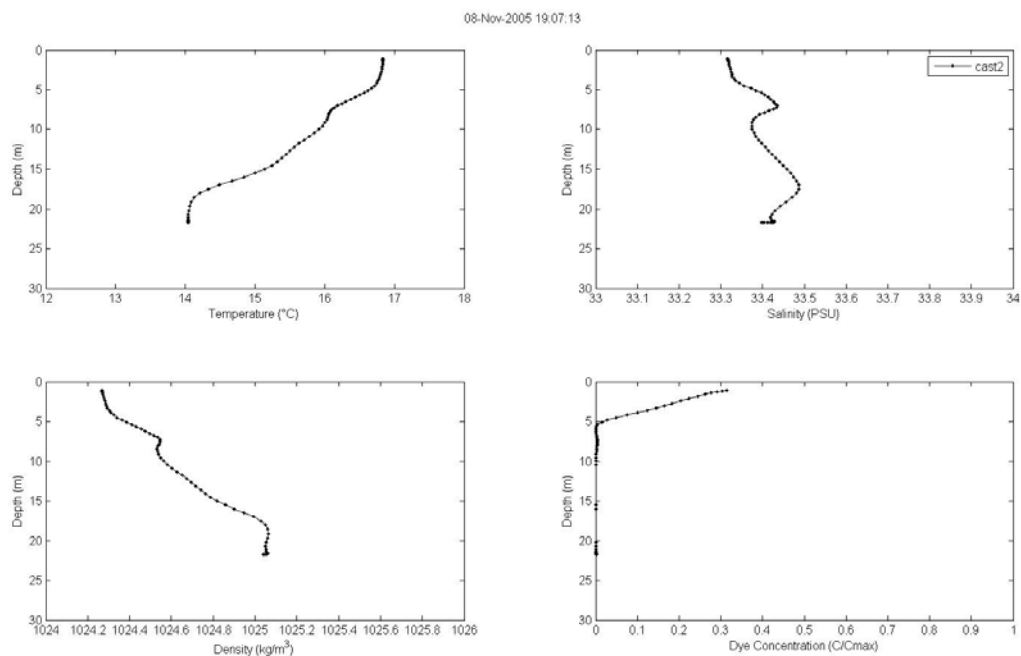


Figure F.1-4. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 2 on 8 November 2005.

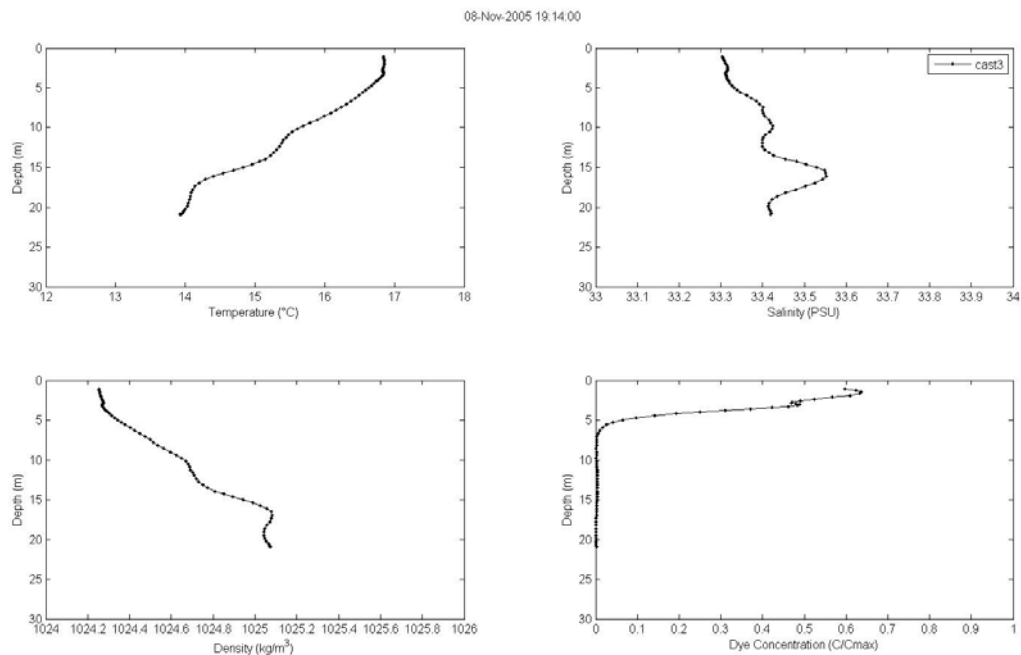


Figure F.1-5. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 3 on 8 November 2005.

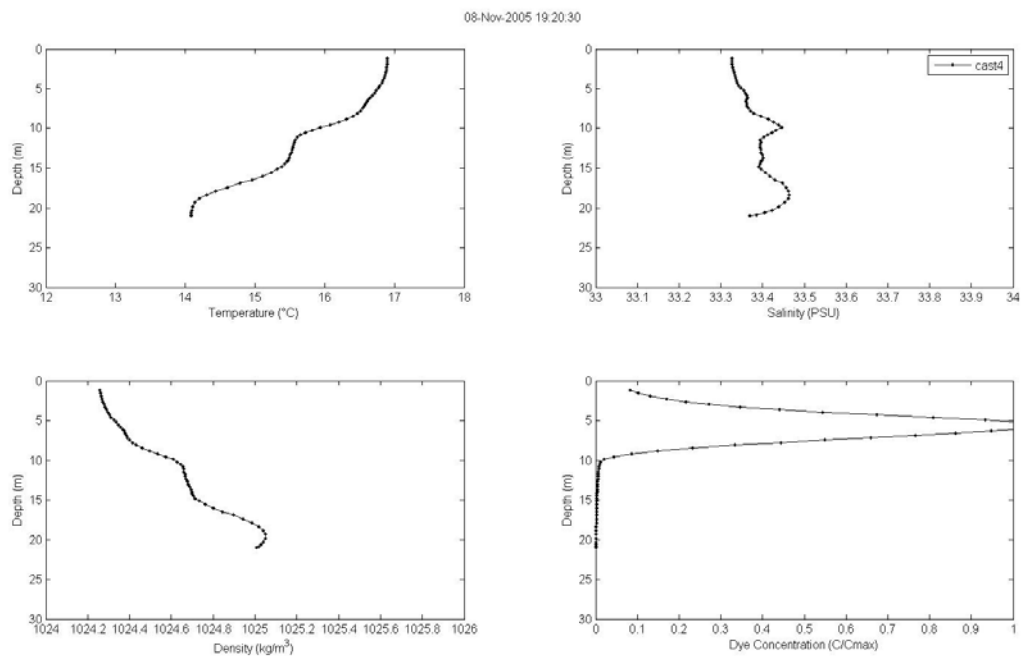


Figure F.1-6. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 4 on 8 November 2005.

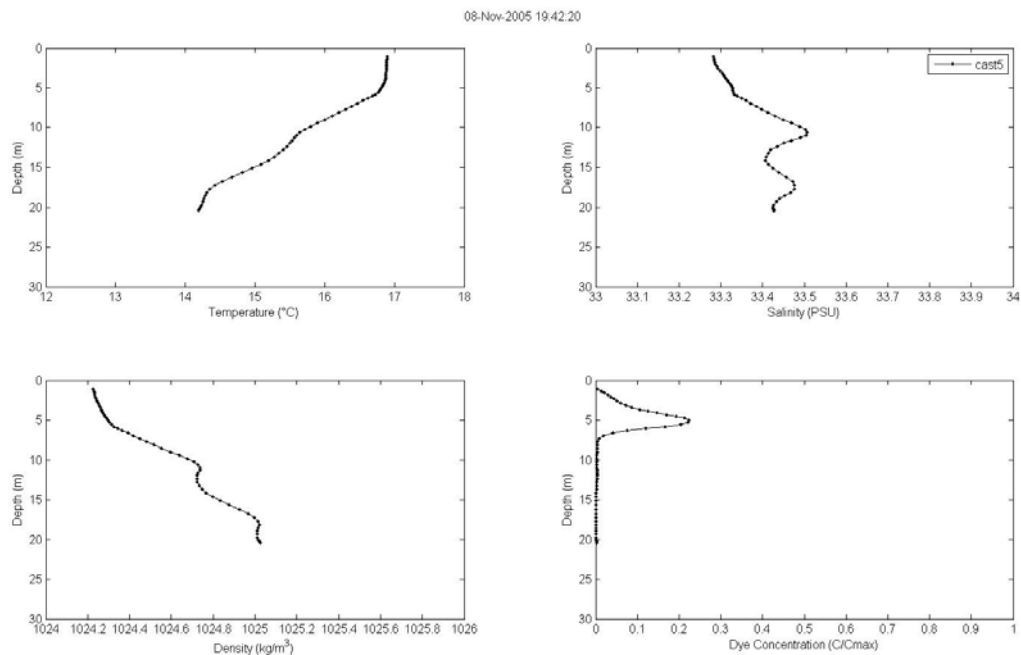


Figure F.1-7. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 5 on 8 November 2005.

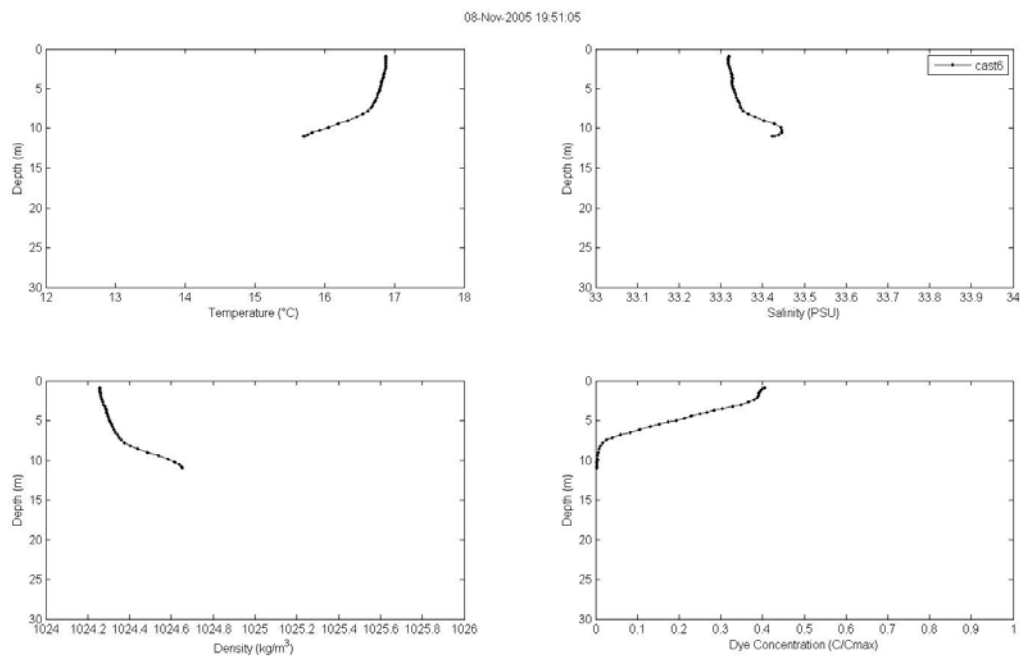


Figure F.1-8. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 6 on 8 November 2005.

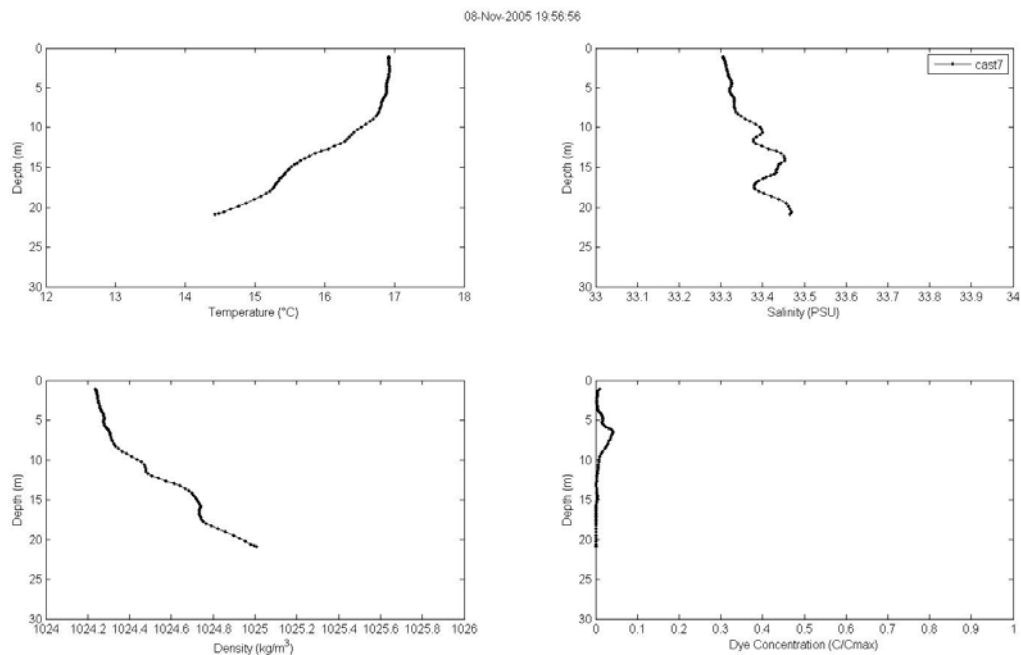


Figure F.1-9. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 7 on 8 November 2005.

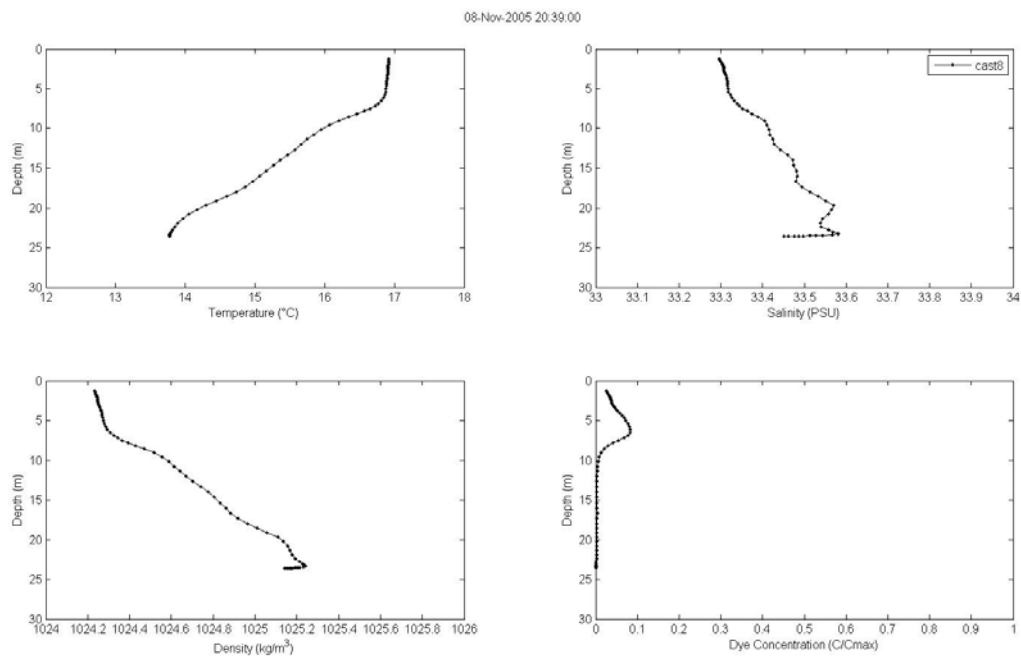


Figure F.1-10. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 8 on 8 November 2005.

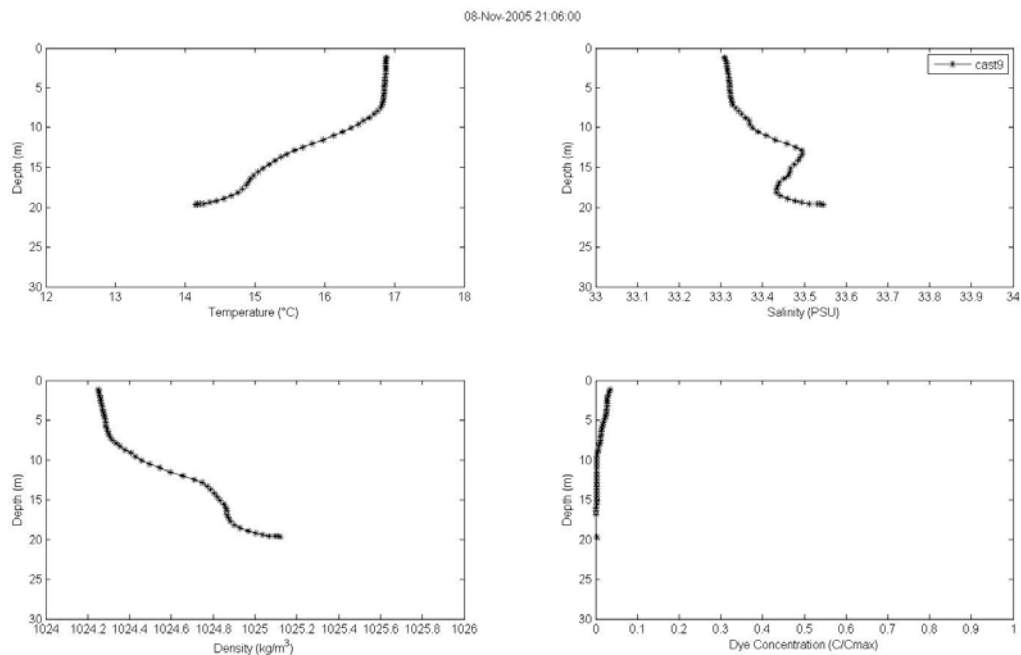


Figure F.1-11. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 9 on 8 November 2005.

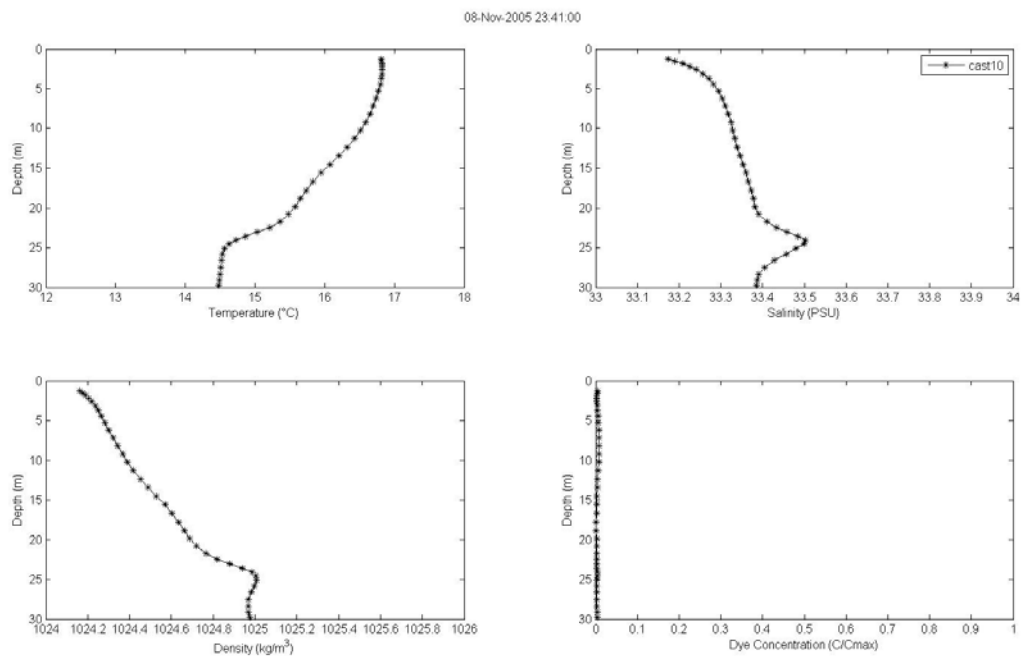


Figure F.1-12. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 10 on 8 November 2005.

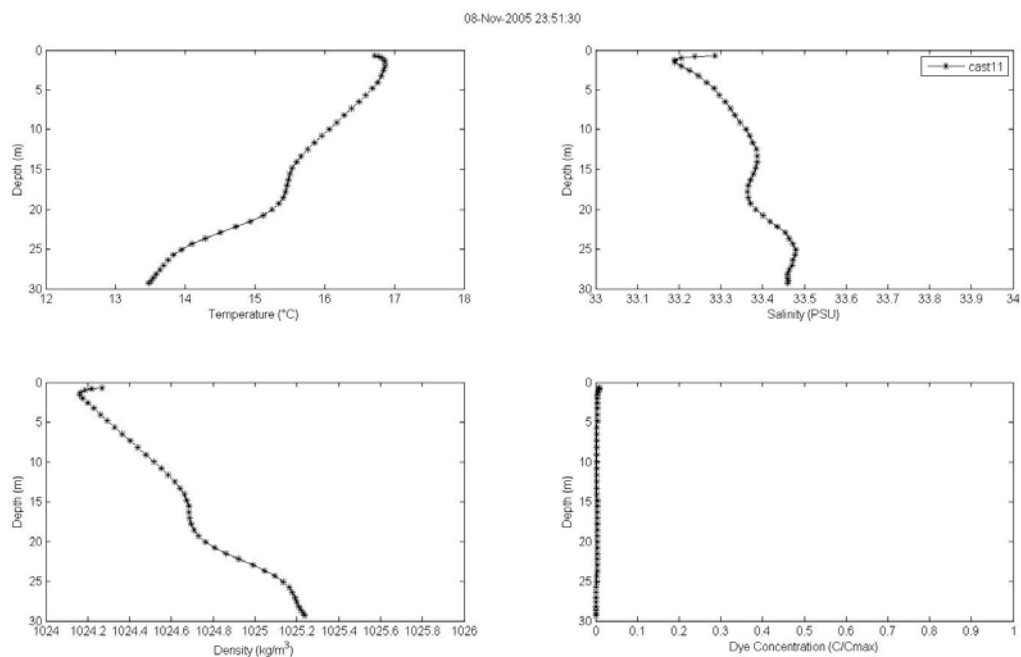


Figure F.1-13. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 11 on 8 November 2005.

F.2 Results of March 21, 2006 Experiment

Figures F.2-1 and F.2-2 show the locations of the CTD casts for the 21 March 2006 experiment. The location of the dye release site and direction of drift during the release are shown in Figure F.2-1. Note that the longitude scale in Figure F.2-2 is exaggerated, whereas the longitude and latitude scales in Figure F.2-1 are of equal degrees.

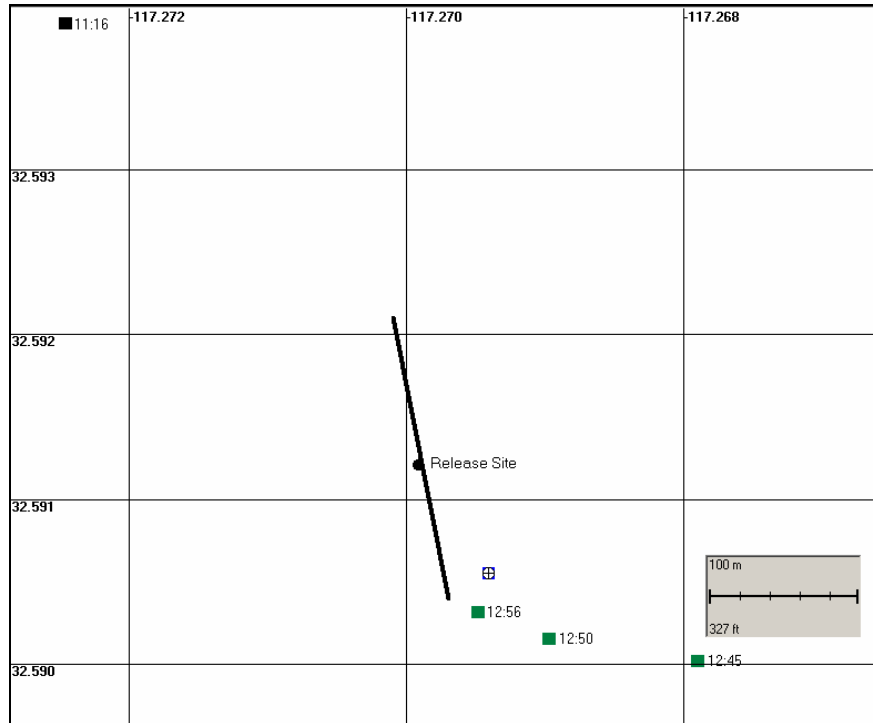


Figure 2.2-1 Vertical CTD cast locations and times (local; black = before, green = after dye release) made aboard the USCG *Munson* on 21 March 2006.

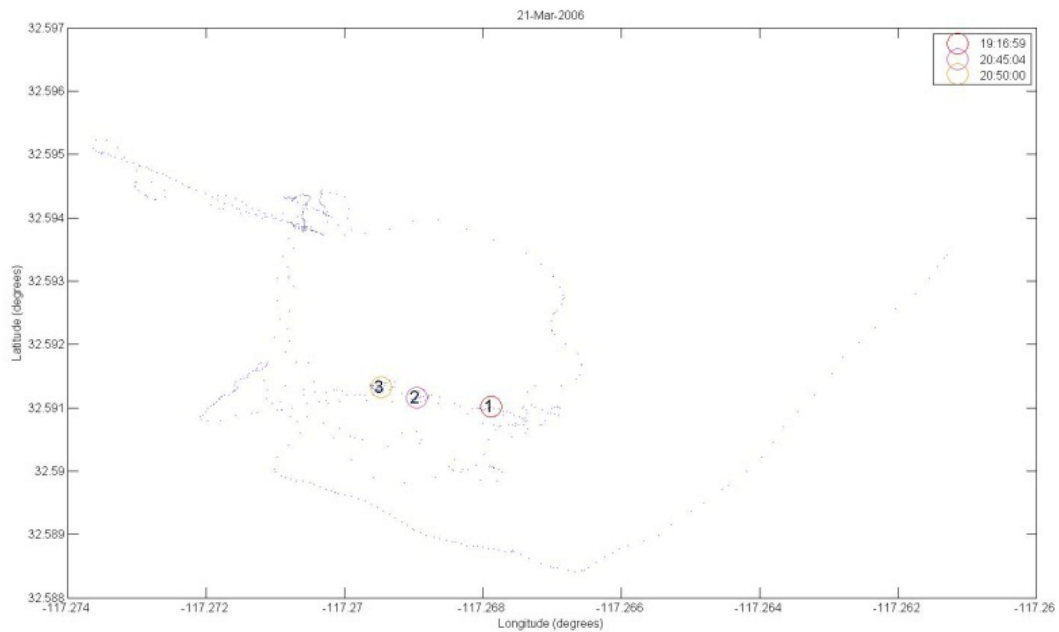


Figure F.2-2. Location of CTD casts 1-3 for 21 March 2006. Legend indicates time of CTD cast in UTC. Blue dots represent sampling boat track during survey.

Figures F.2-3 to F.2-6 plot data recorded by the 4 CTD casts taken during 21 March 2006 OSPR experiment. Because of technical difficulties and sea state, sampling was terminated shortly after the dye was released. For each cast four figures are displayed which show the oceanographic characteristics of the water column. Top left panel: temperature; top right panel: salinity; bottom left panel: density; bottom right panel: dye concentration. Date and time of each cast is listed at the top of each set of figures in UTC. Cast number is shown in the top right hand corner of the top right panel.

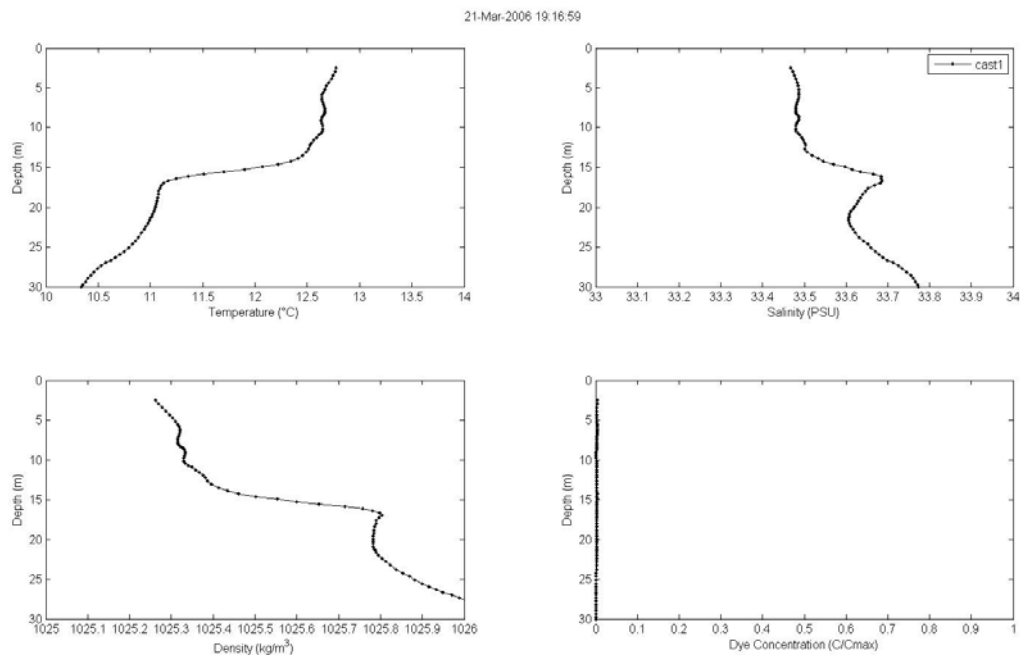


Figure F.1-3. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 1 on 21 March 2005.

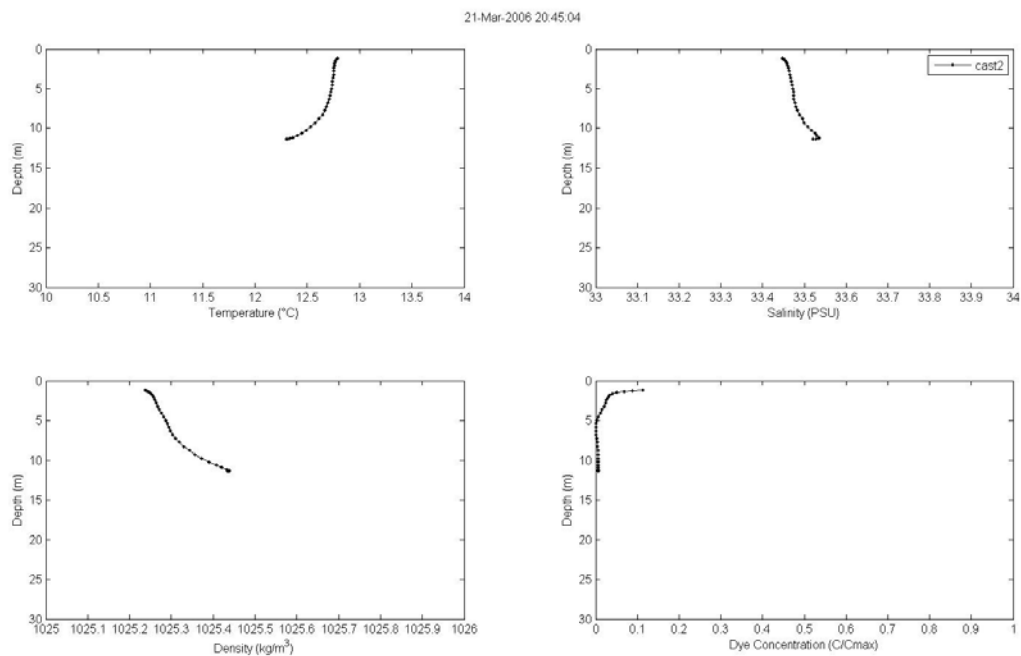


Figure F.1-4. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 2 on 21 March 2005.

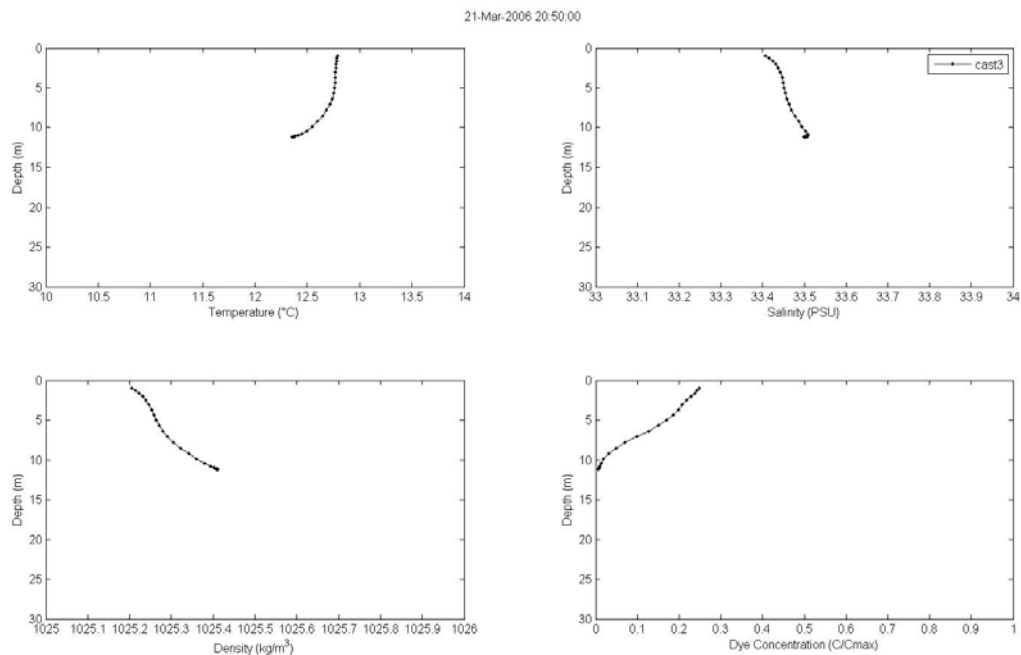


Figure F.1-5. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 3 on 21 March 2005.

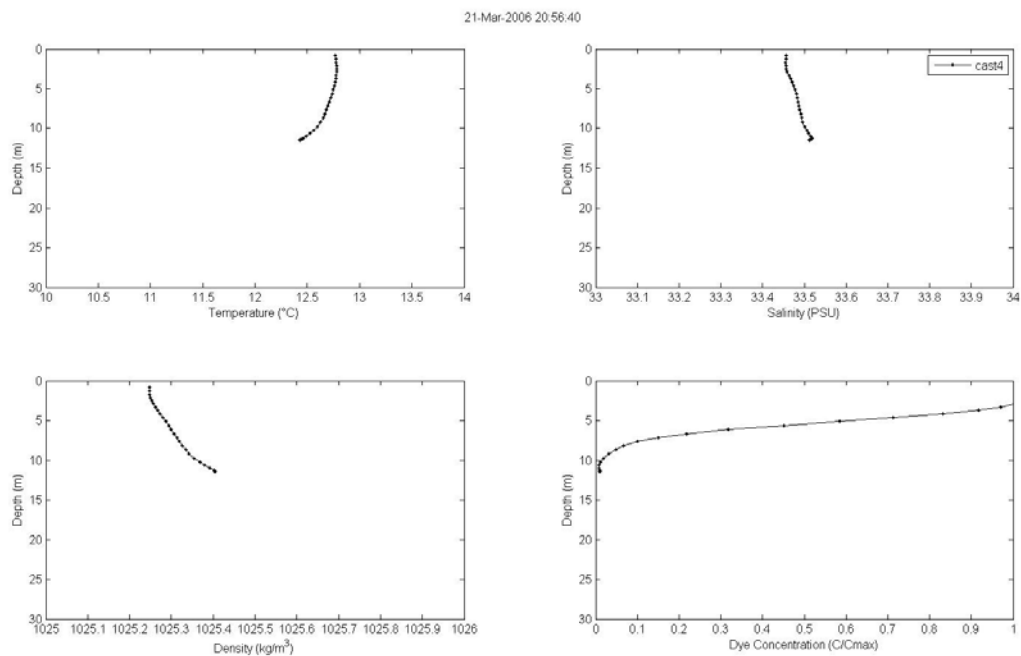


Figure F.1-6. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 4 on 21 March 2005.

F.3 Results of March 22, 2006 Experiment

Figures F.3-1 and F.3-2 show the locations of the CTD casts for the 22 March 2006 experiment. The location of the dye release site and direction of drift during the release are shown in Figure F.3-1. Note that the latitude scale in Figure F.3-2 is exaggerated, whereas the longitude and latitude scales in Figure F.3-1 are of equal degrees.

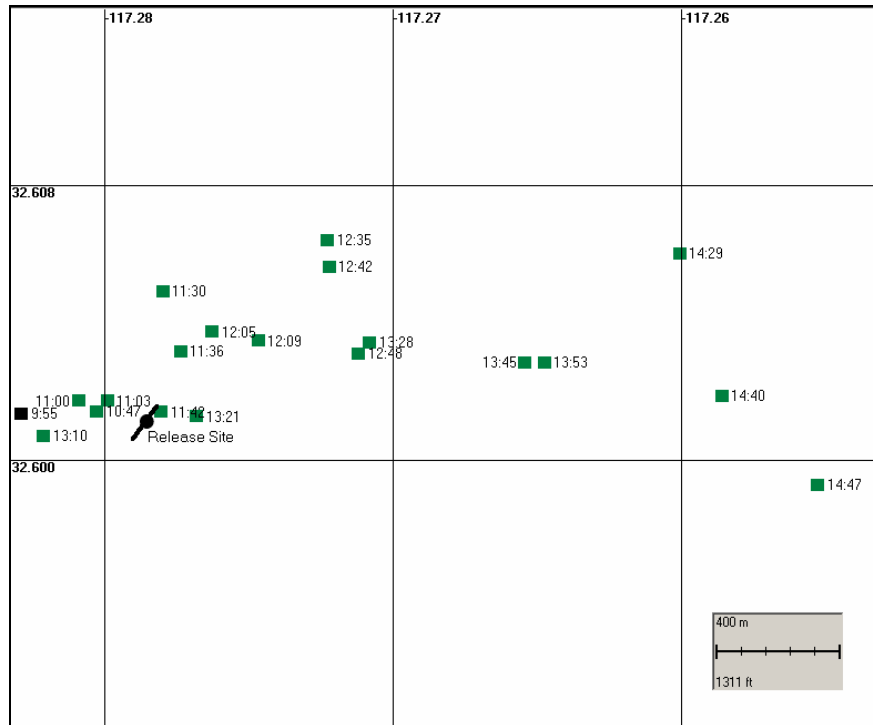


Figure F.3-1. Vertical CTD cast locations and times (local; black = before, green = after dye release) made aboard the USCG *Munson* on 22 March 2006.

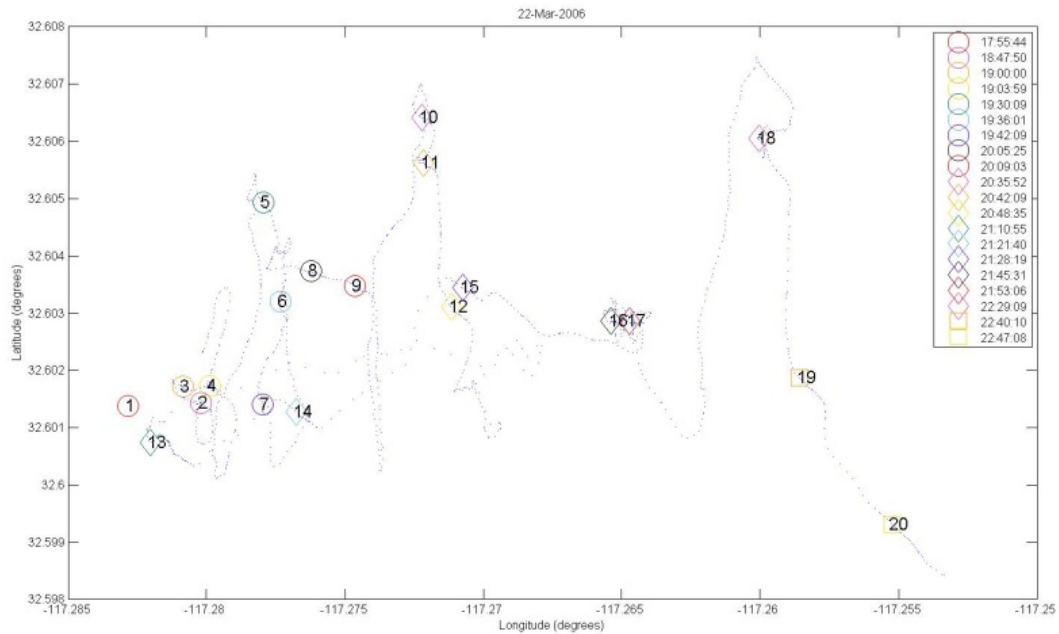


Figure F.3-2. Location of CTD casts 1-20 for 22 March 2006. Legend indicates time of CTD cast in UTC. Blue dots represent sampling boat track during survey.

Figures F.3-3 to F.3-22 plot data recorded by the 20 CTD casts taken during the 22 March 2006 OSPR experiment. For each cast four figures are displayed which show the oceanographic characteristics of the water column. Top left panel: temperature; top right panel: salinity; bottom left panel: density; bottom right panel: dye concentration. Date and time of each cast is listed at the top of each set of figures in coordinated universal time. Cast number is shown in the top right hand corner of the top right panel. Note- Casts 13-15 were taken outside of visible dye patch at original dye release location.

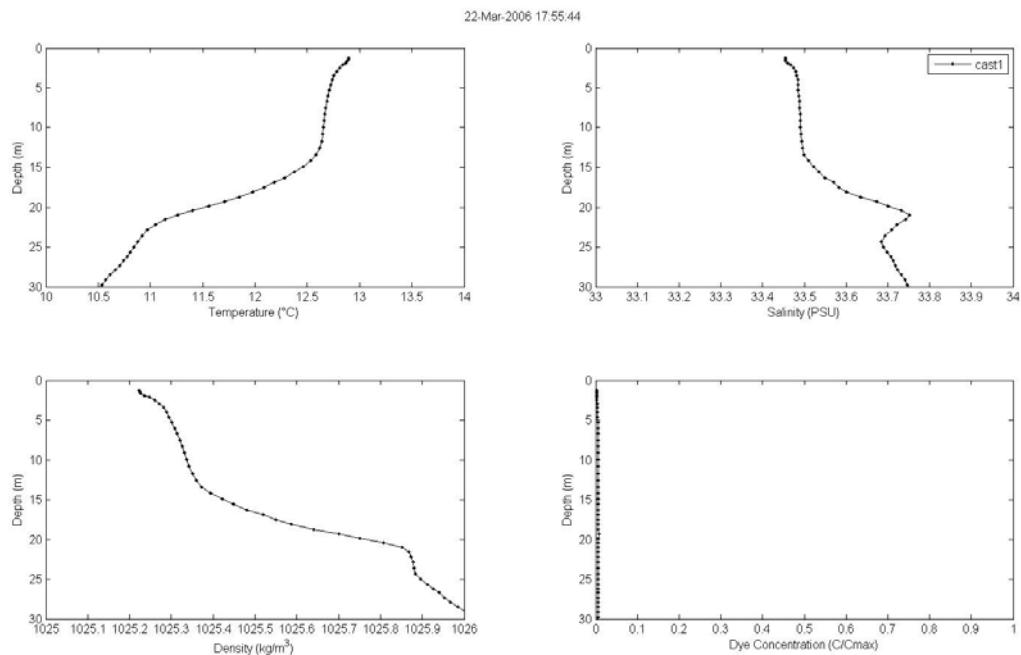


Figure F.3-3. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 1 on 22 March 2006.

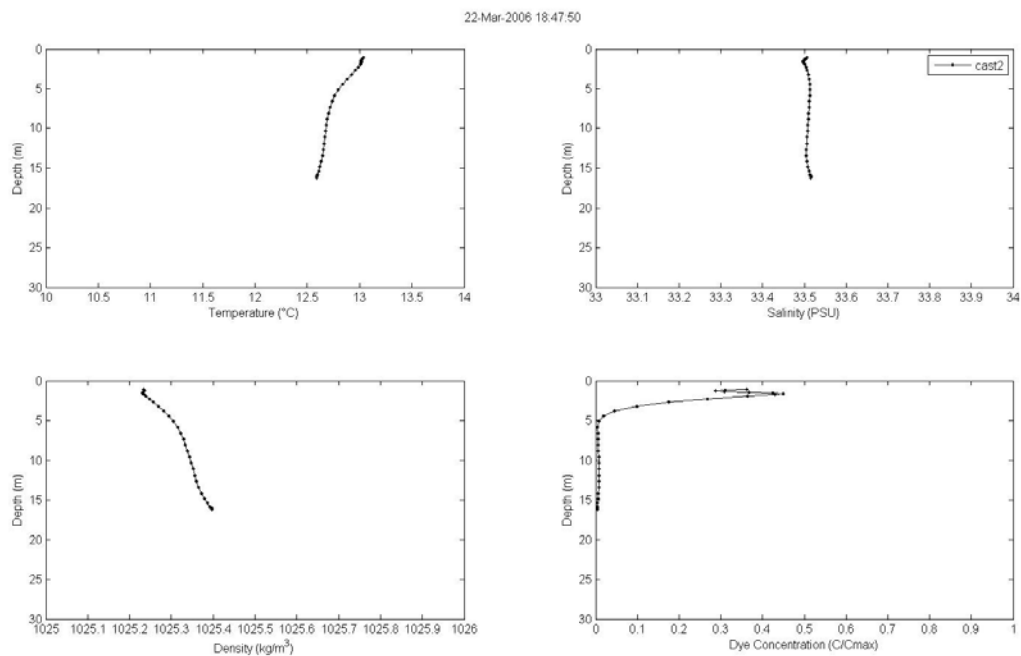


Figure F.3-4. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 2 on 22 March 2006.

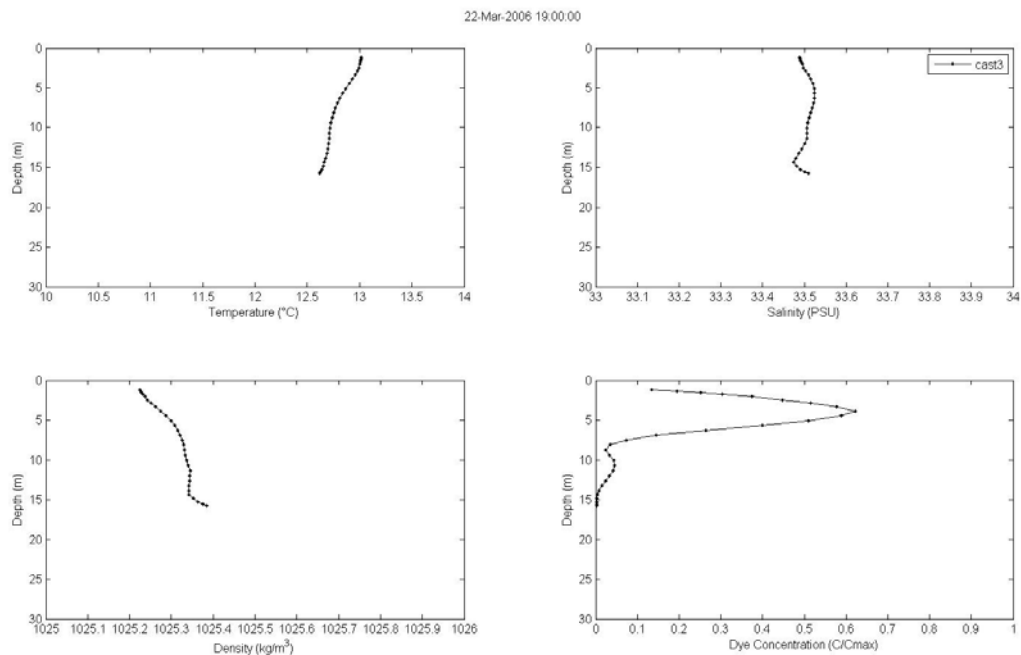


Figure F.3-5. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 3 on 22 March 2006.

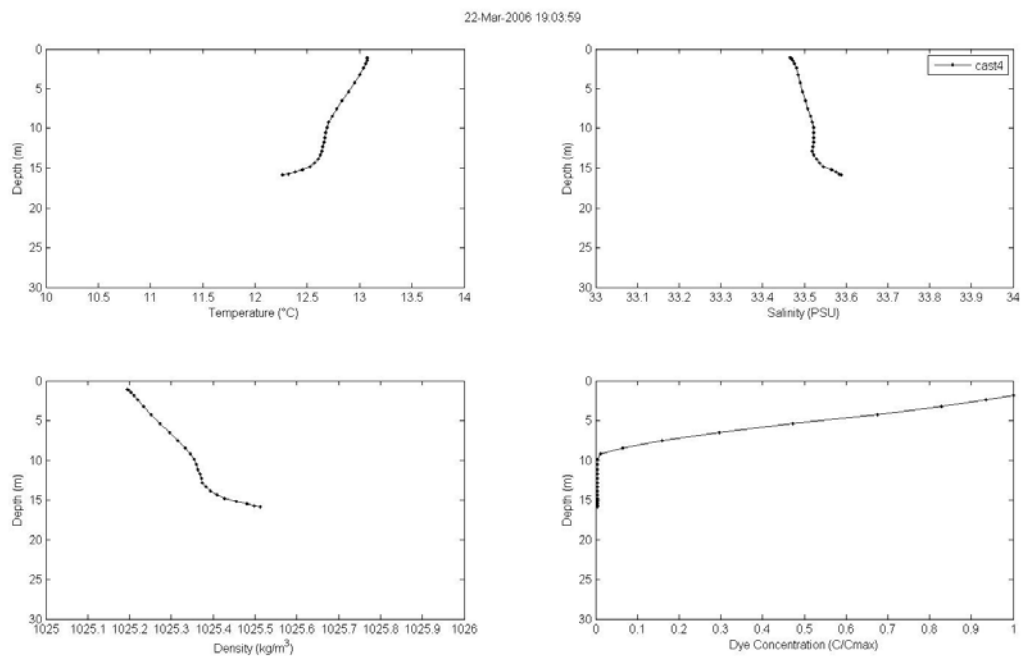


Figure F.3-6. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 4 on 22 March 2006.

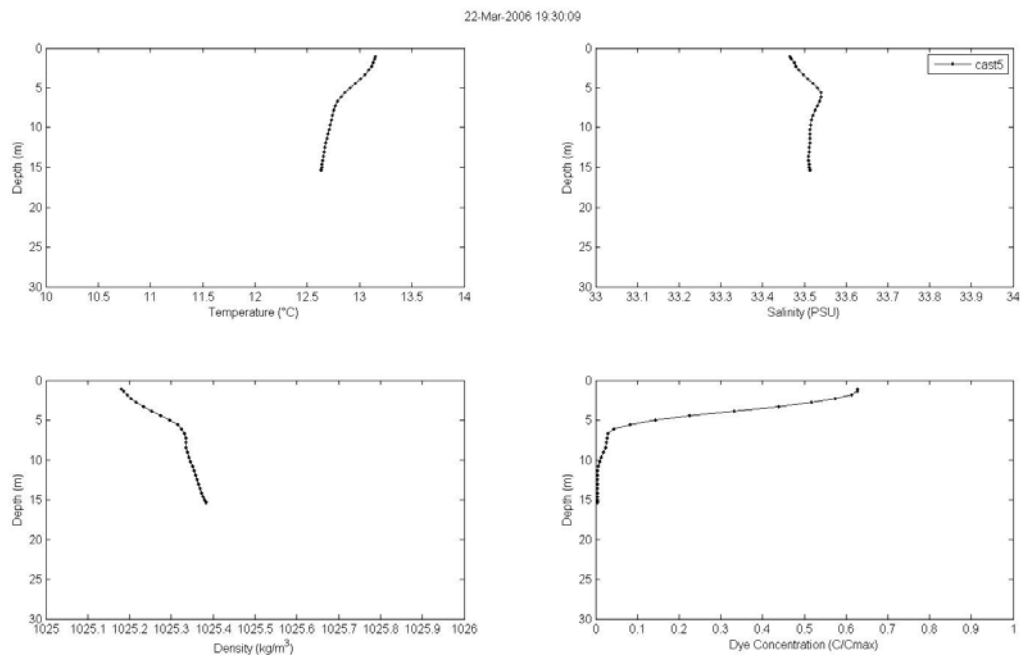


Figure F.3-7. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 5 on 22 March 2006.

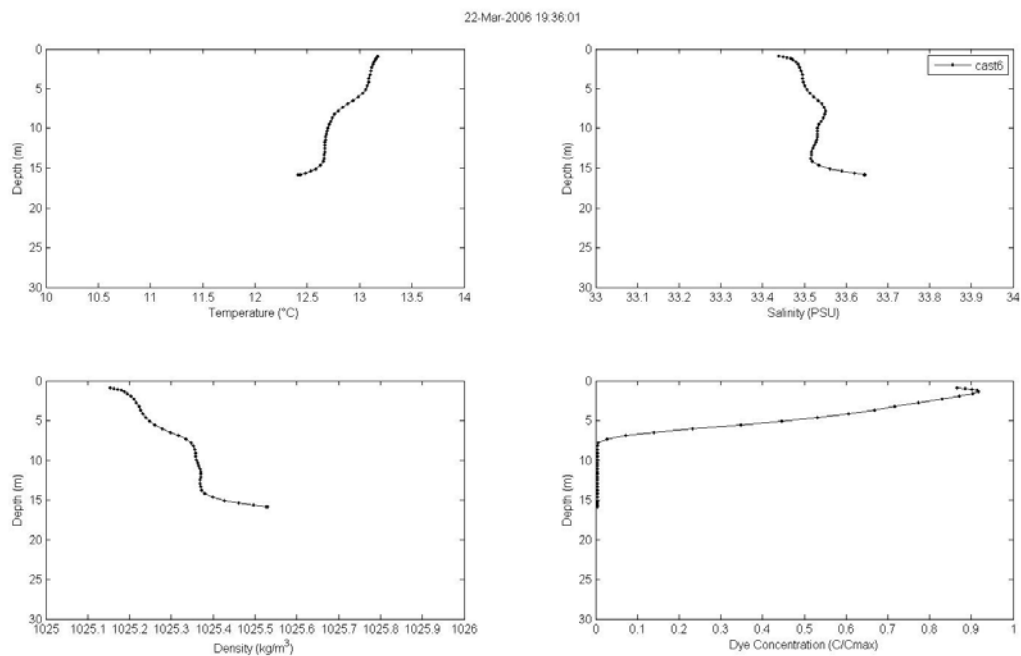


Figure F.3-8. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 6 on 22 March 2006.

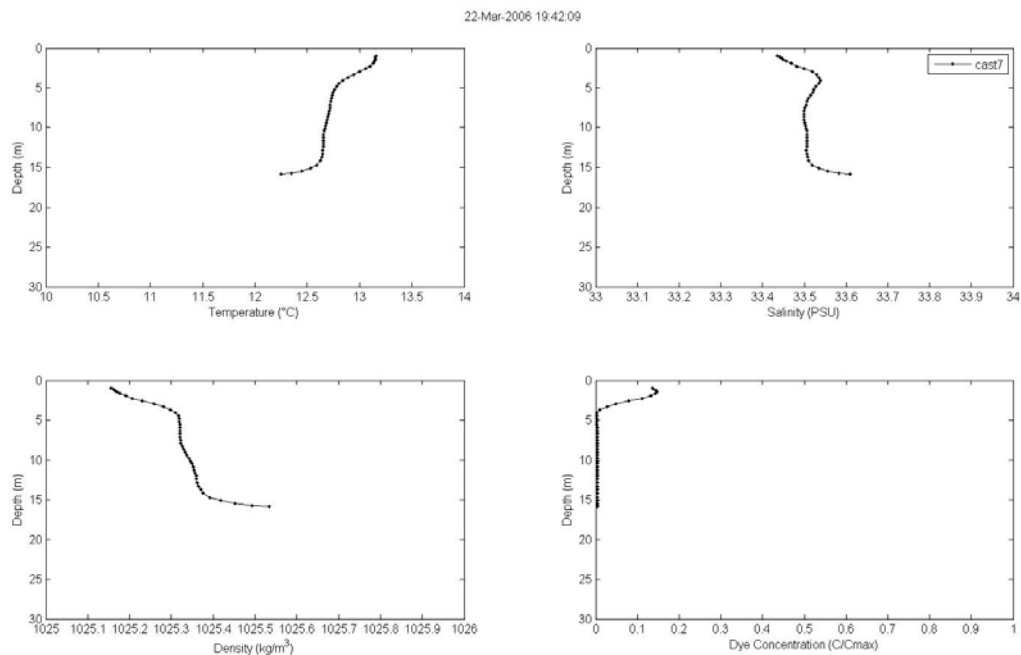


Figure F.3-9. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 7 on 22 March 2006.

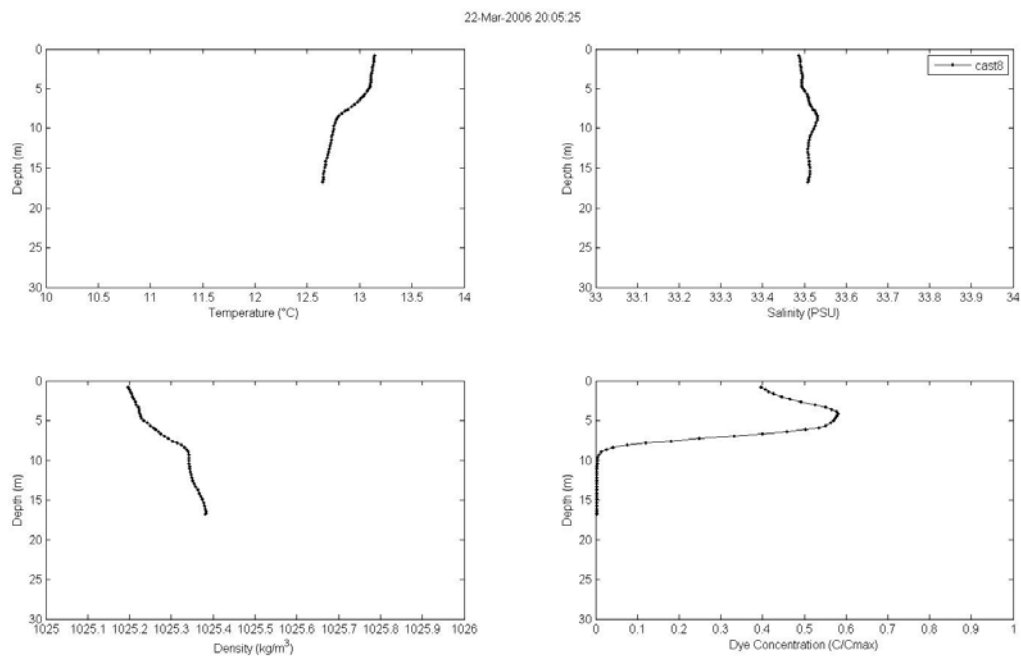


Figure F.3-10. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 8 on 22 March 2006.

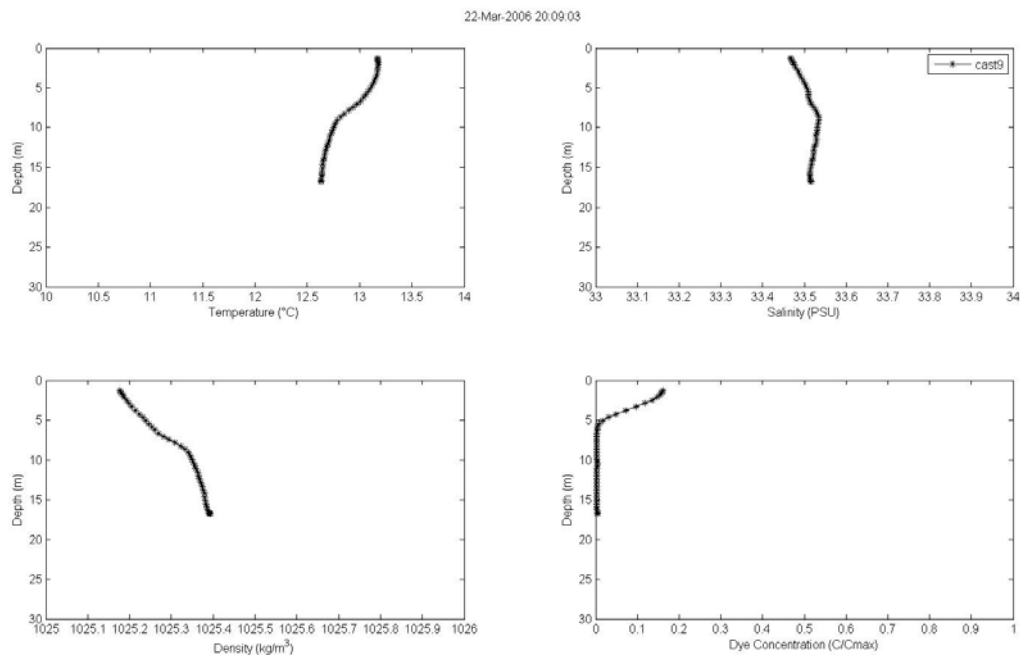


Figure F.3-11. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 9 on 22 March 2006.

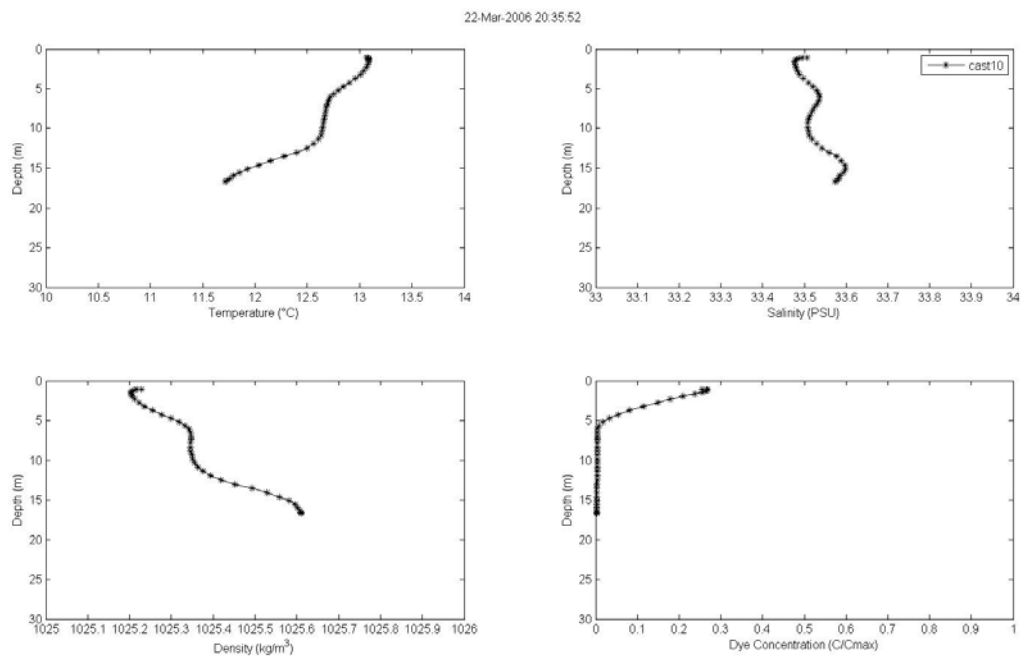


Figure F.3-12. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 10 on 22 March 2006.

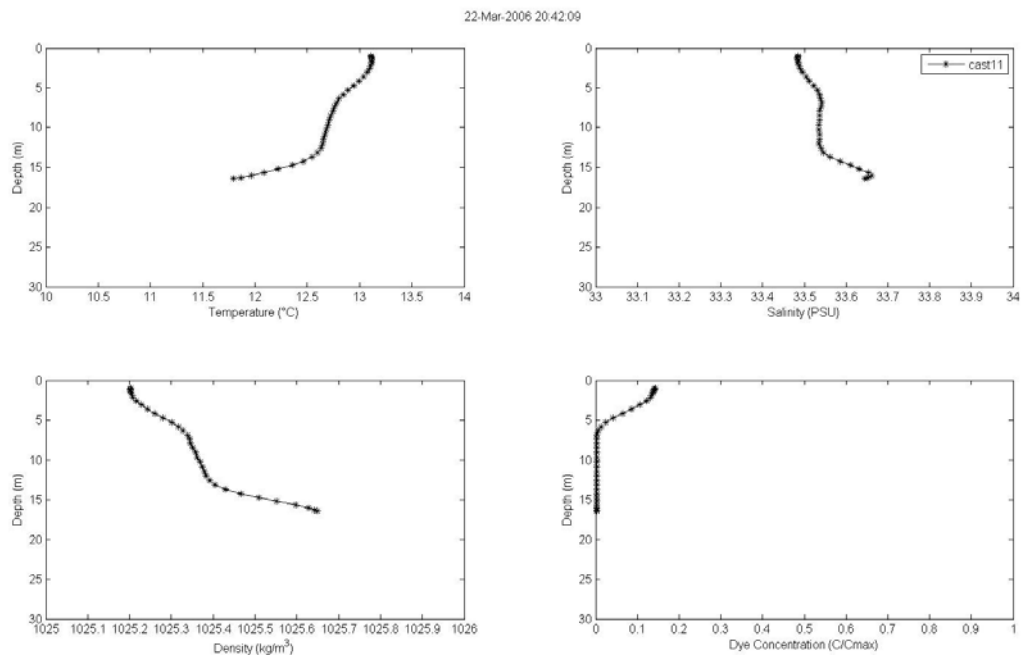


Figure F.3-13. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 11 on 22 March 2006.

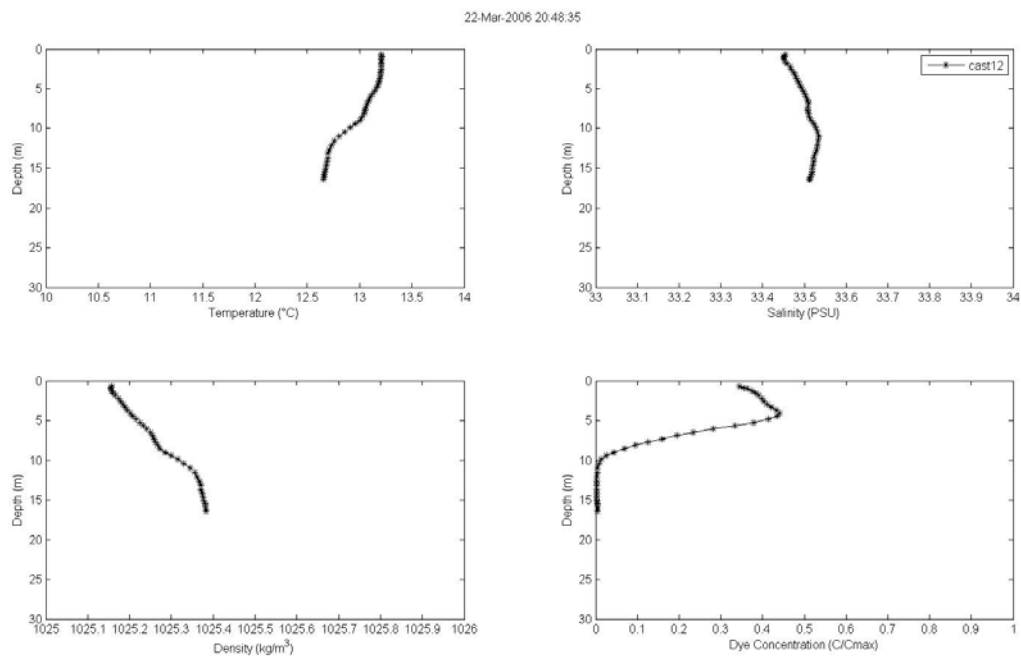


Figure F.3-14. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 12 on 22 March 2006.

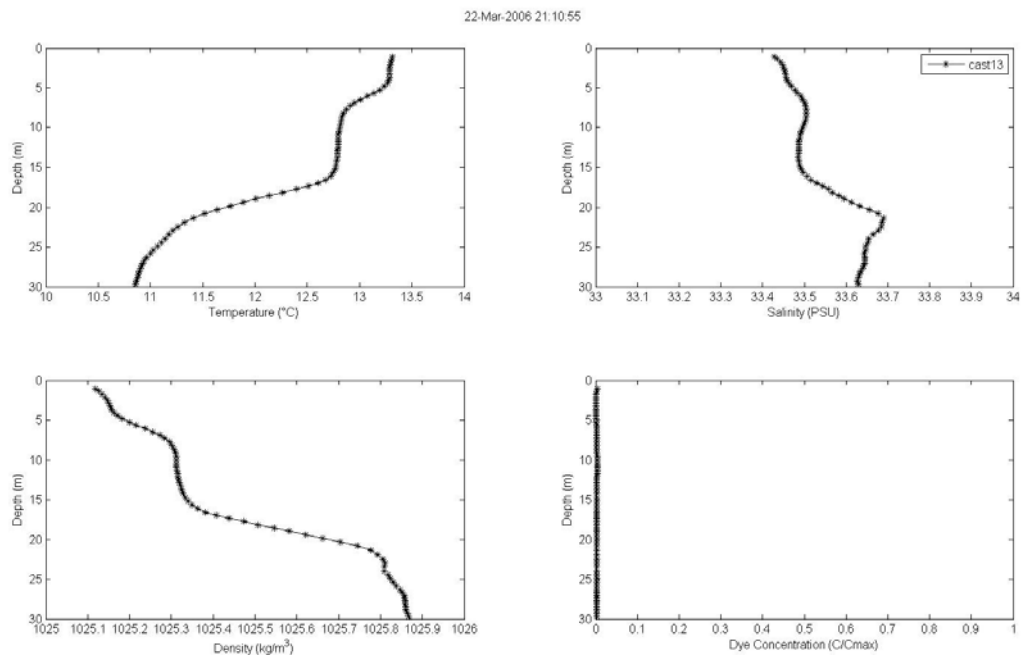


Figure F.3-15. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 13 on 22 March 2006.

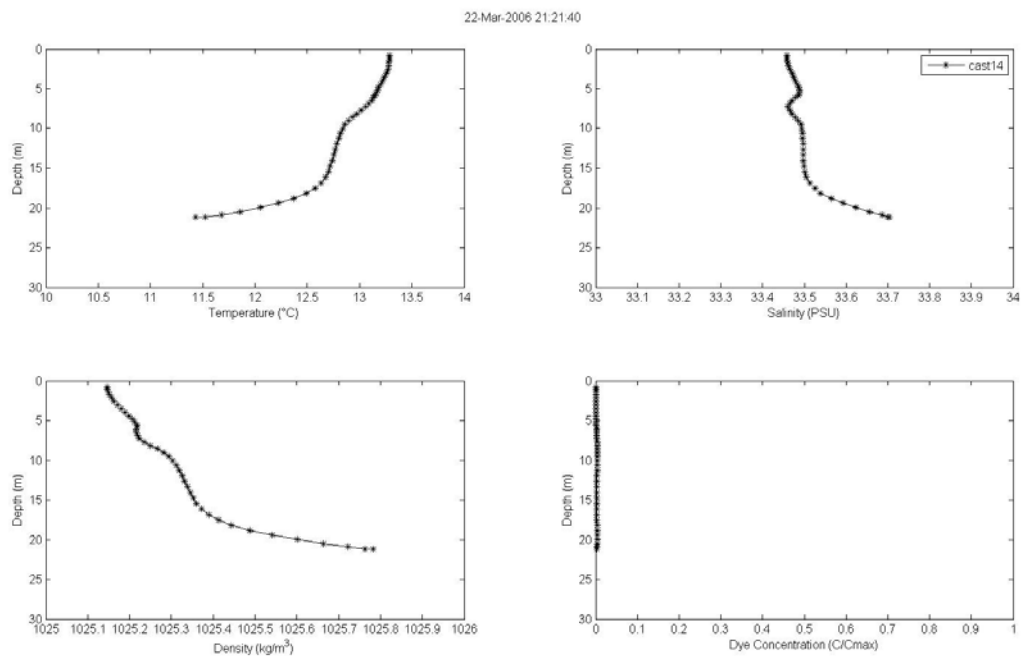


Figure F.3-16. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 14 on 22 March 2006.

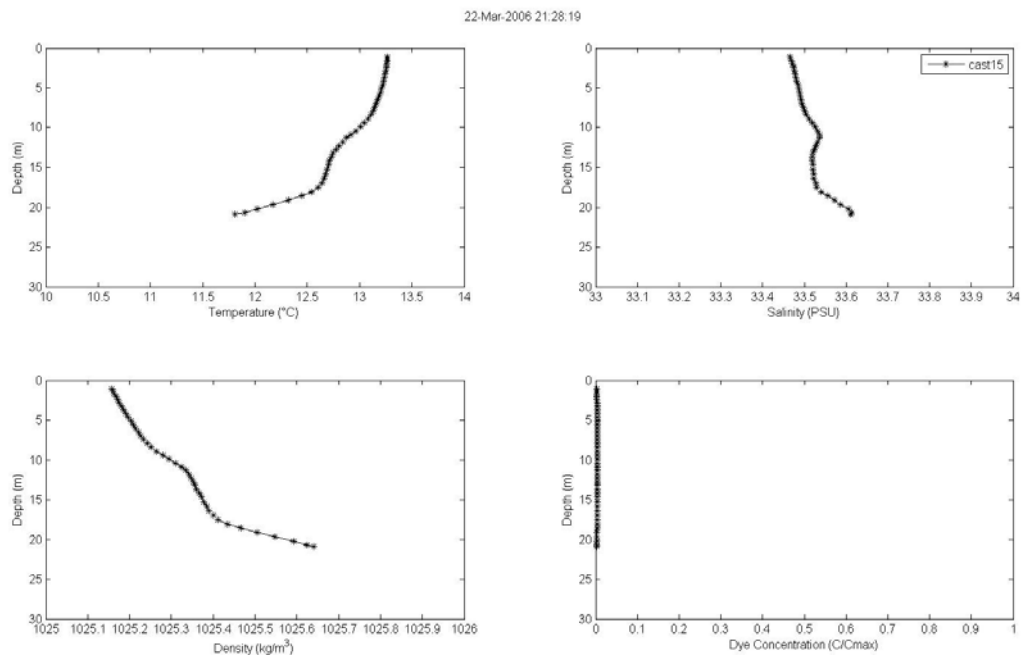


Figure F.3-17. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 15 on 22 March 2006.

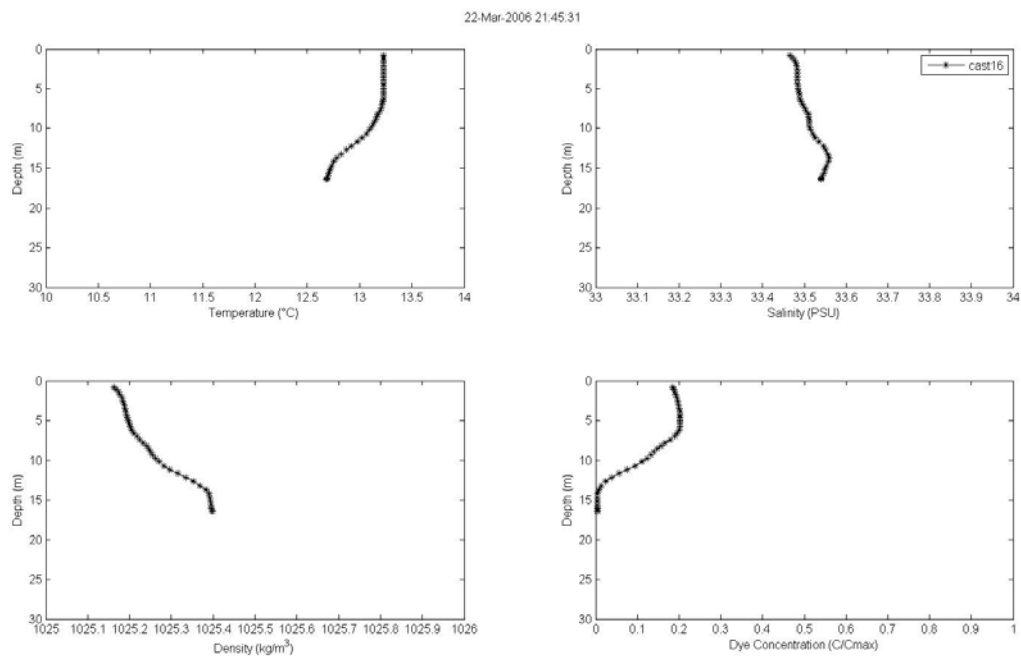


Figure F.3-18. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 16 on 22 March 2006.

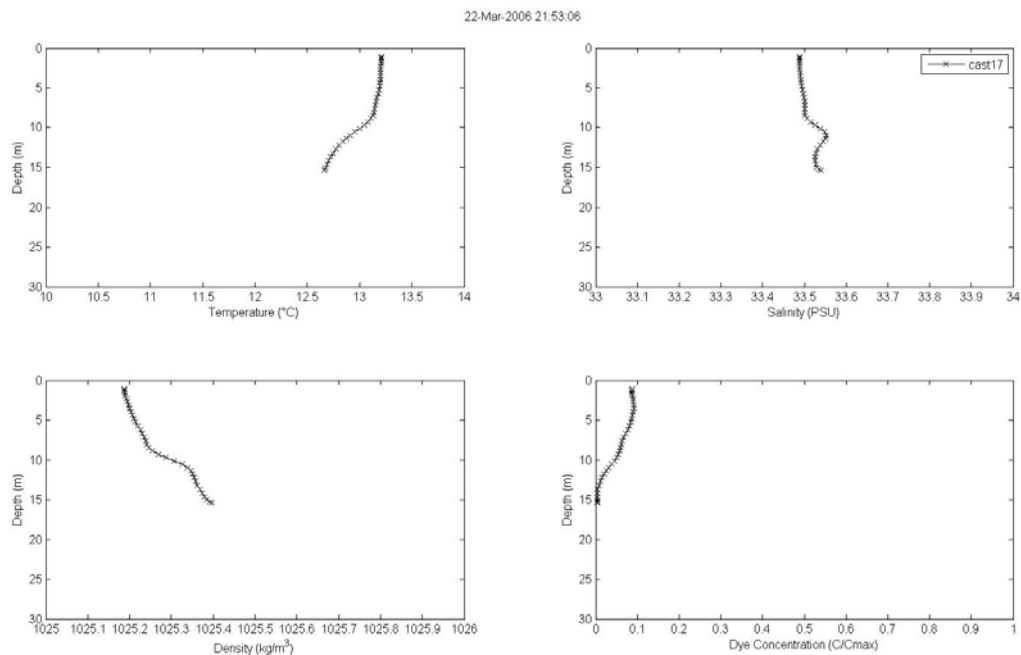


Figure F.3-19. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 17 on 22 March 2006.

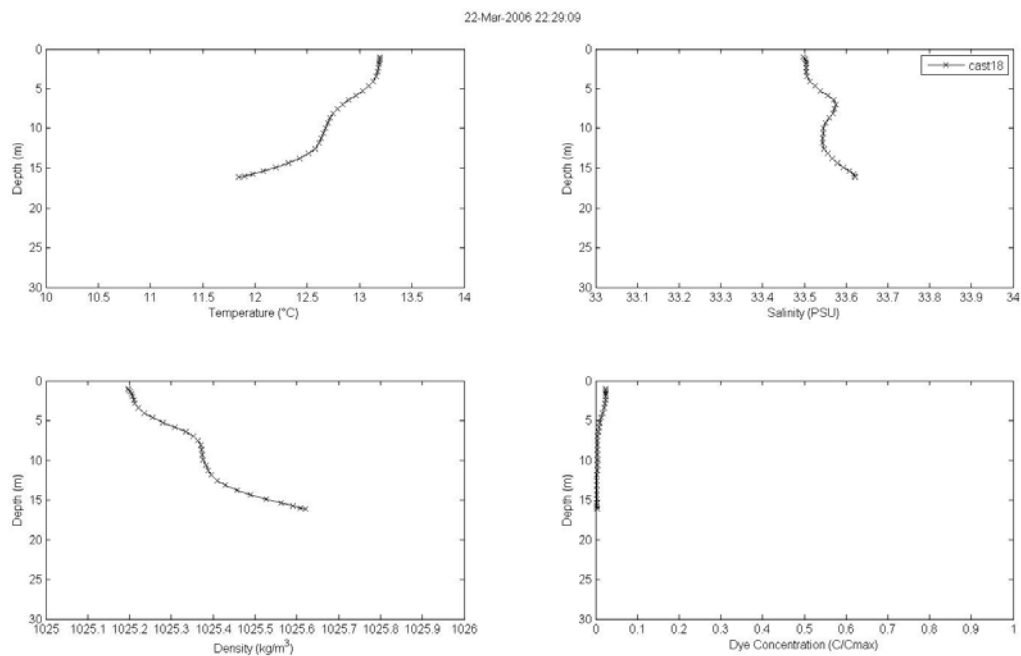


Figure F.3-20. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 18 on 22 March 2006.

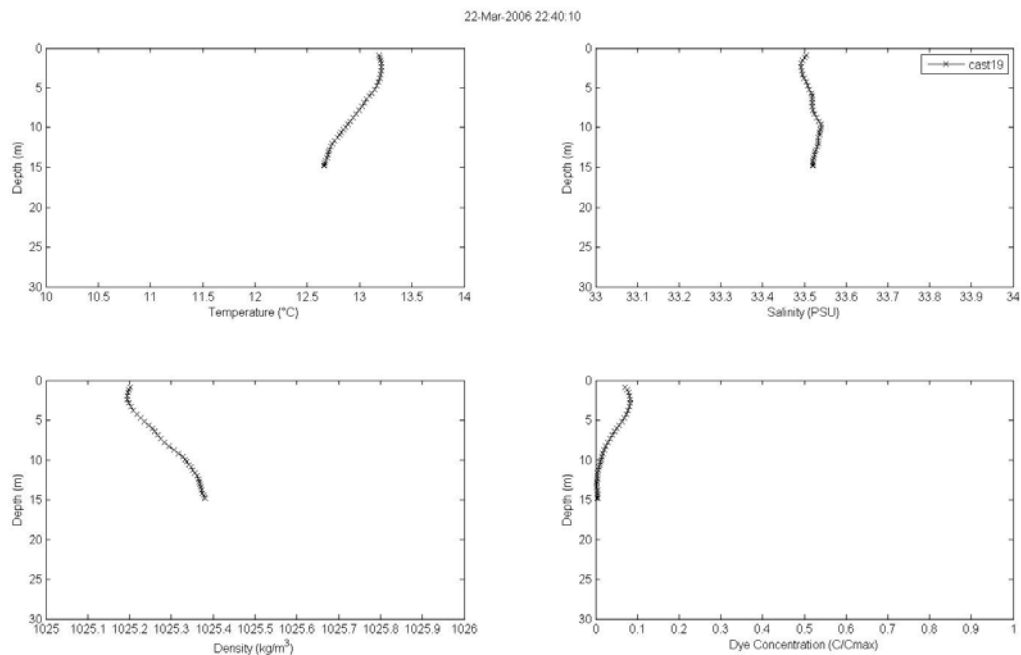


Figure F.3-21. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 19 on 22 March 2006.

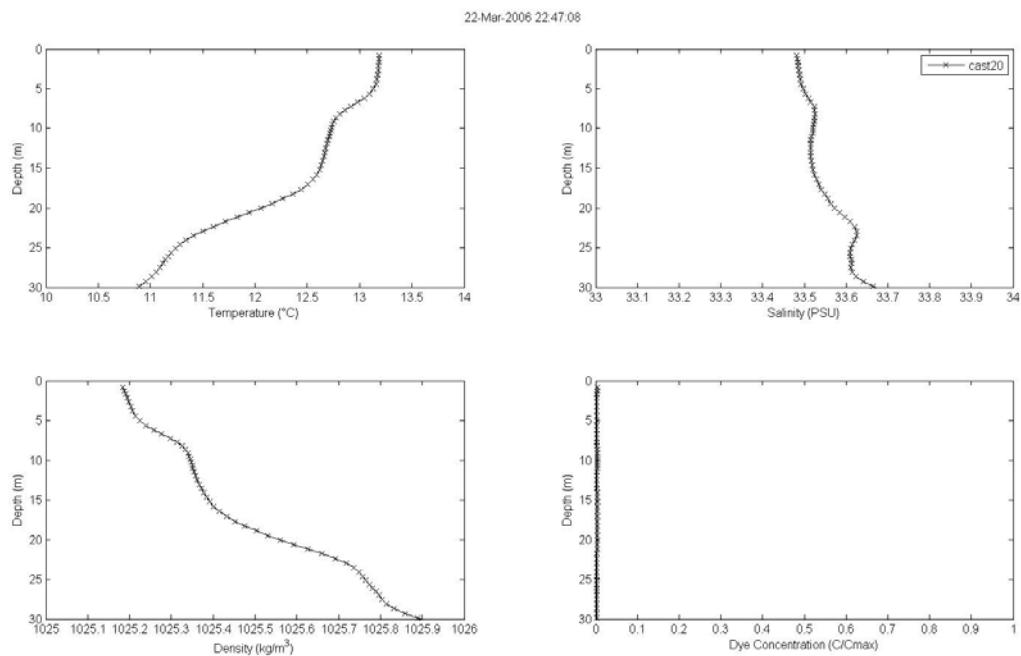


Figure F.3-22. Temperature, salinity, density and fluorescence (as a fraction of the maximum in any cast) for Cast 20 on 22 March 2006.

F.4 Results of June 21, 2006 Experiment

Figures F.4-1 and F.4-2 show the locations of the CTD casts for the 21 June 2006 experiment. The location of the dye release site and direction of drift during the release are shown in Figure F.4-1. Note that the longitude and latitude scales in Figure F.4-1 are of equal degrees.

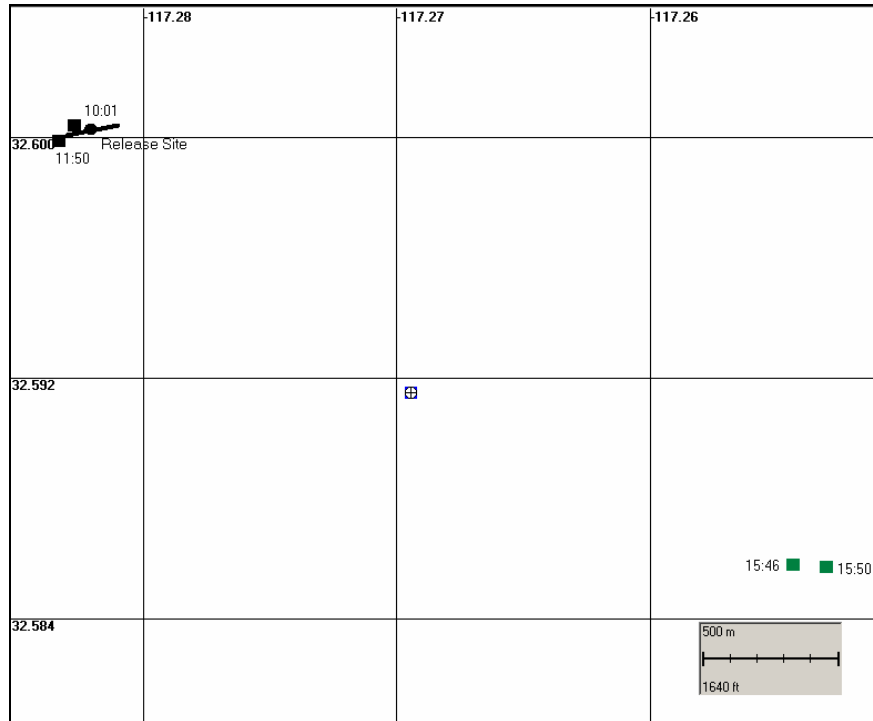


Figure F.4-1. Vertical CTD cast locations and times (local; black = before, green = after dye release) made aboard the USCG Munson on 21 June 2006.

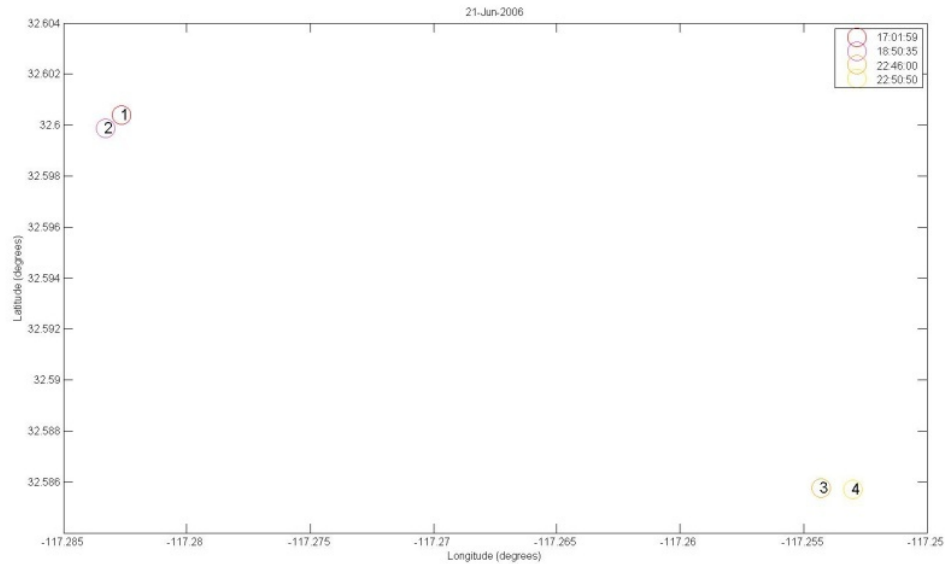


Figure F.4-2. Location of CTD casts 1-4 for 21 June 2006. Legend indicates time of CTD cast in UTC.

Figure F.4-3 plots data recorded by the first of the 4 CTD casts taken during the 21 June OSPR experiment. For cast 1, three figures are displayed which show the oceanographic characteristics of the water column. Top left panel: temperature; top right panel: salinity; bottom left panel: density. Date and time of each cast is listed at the top of each set of figures in coordinated universal time. Casts 2 to 4 were only to 10 m depth and sampling was aborted due to technical difficulties with the equipment.

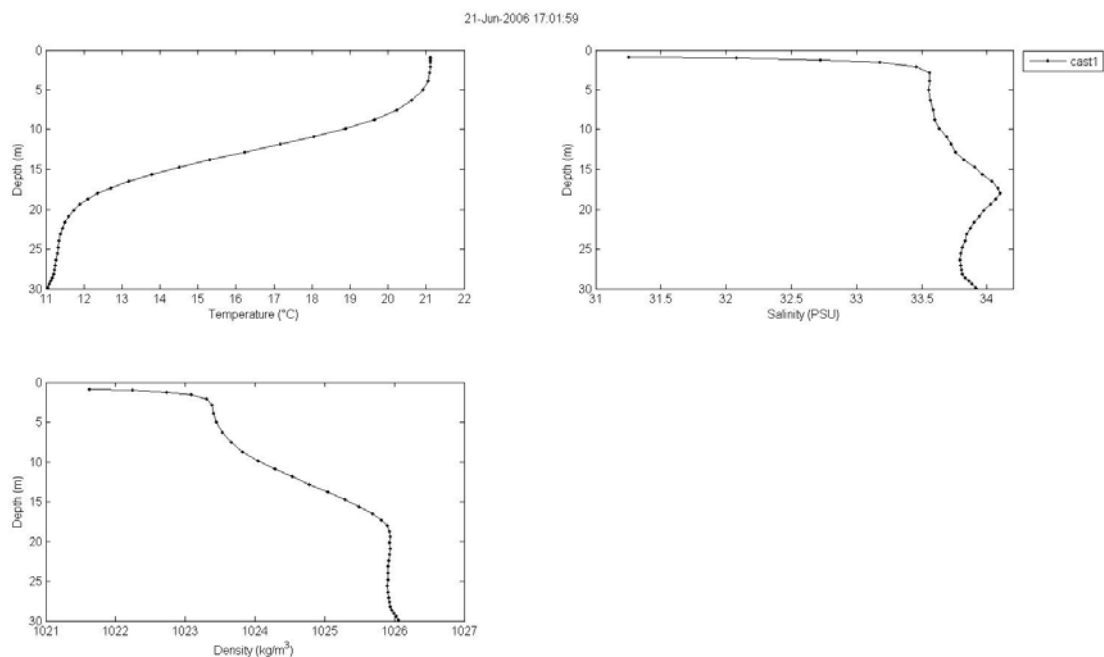


Figure F.4-3. Temperature, salinity, and density versus depth for Cast 1 on 21 June 2006.

F.5 Results of June 22, 2006 Experiment

Figures F.5-1 and F.5-2 show the locations of the CTD casts for the 22 June 2006 experiment. The location of the dye release site and direction of drift during the release are shown in Figure F.5-1. Note that the latitude scale in Figure F.5-2 is exaggerated, whereas the longitude and latitude scales in Figure F.5-1 are of equal degrees.

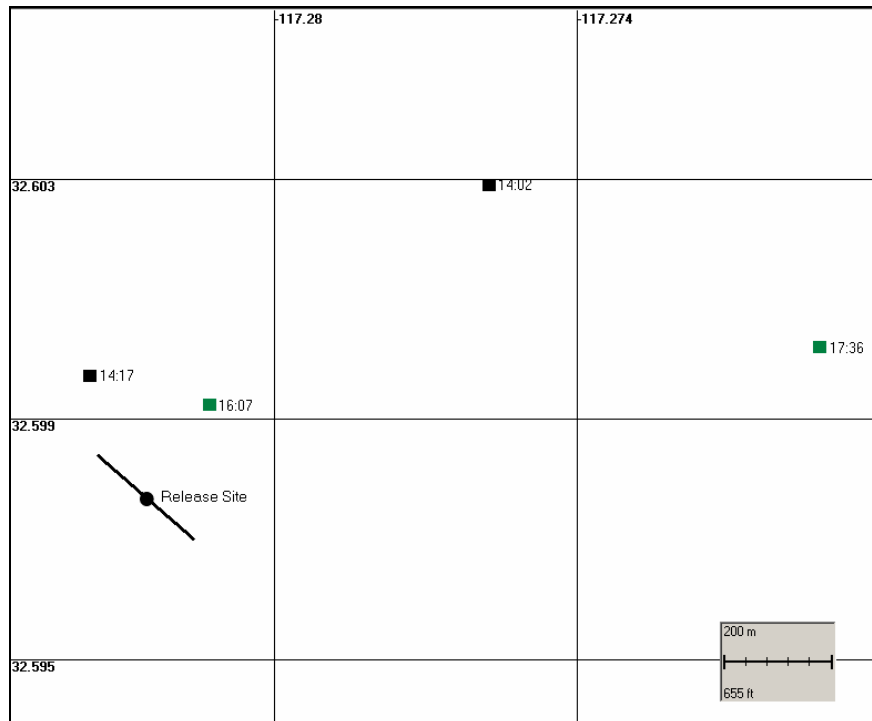


Figure F.5-1 Vertical CTD cast locations and times (local; black = before, green = after dye release) made aboard the USCG *Munson* on 22 June 2006.

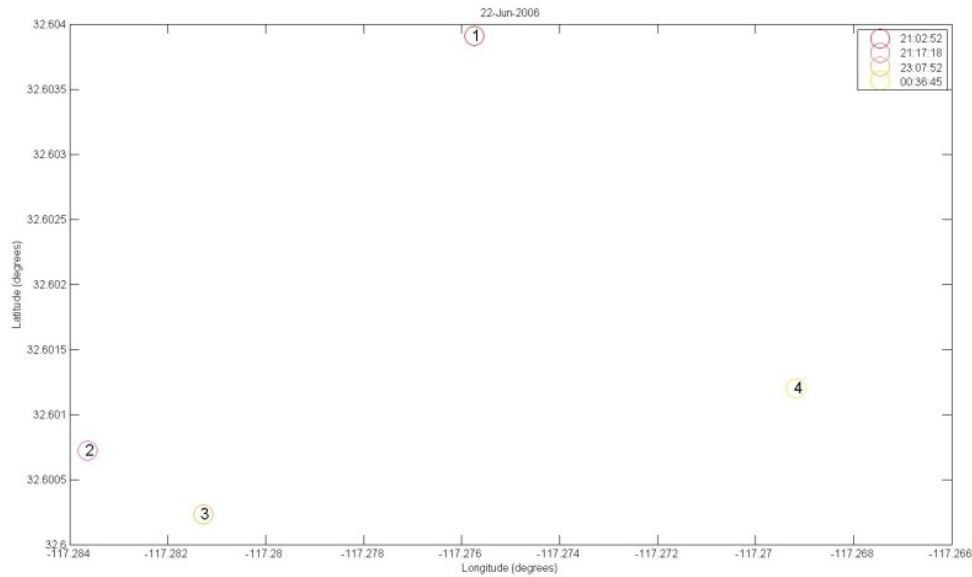


Figure F.5-2. Location of CTD casts 1-4 for 22 June 2006. Legend indicates time of CTD cast in UTC.

Figures F.5-3 to F.5-6 plot data recorded by the 4 CTD casts taken during the 22 June 2006 OSPR experiment. For each cast three figures are displayed which show the oceanographic characteristics of the water column. Top left panel: temperature; top right panel: salinity; bottom left panel: density. Date and time of each cast is listed at the top of each set of figures in coordinated universal time. Cast number is shown in the top right hand corner of the top right panel.

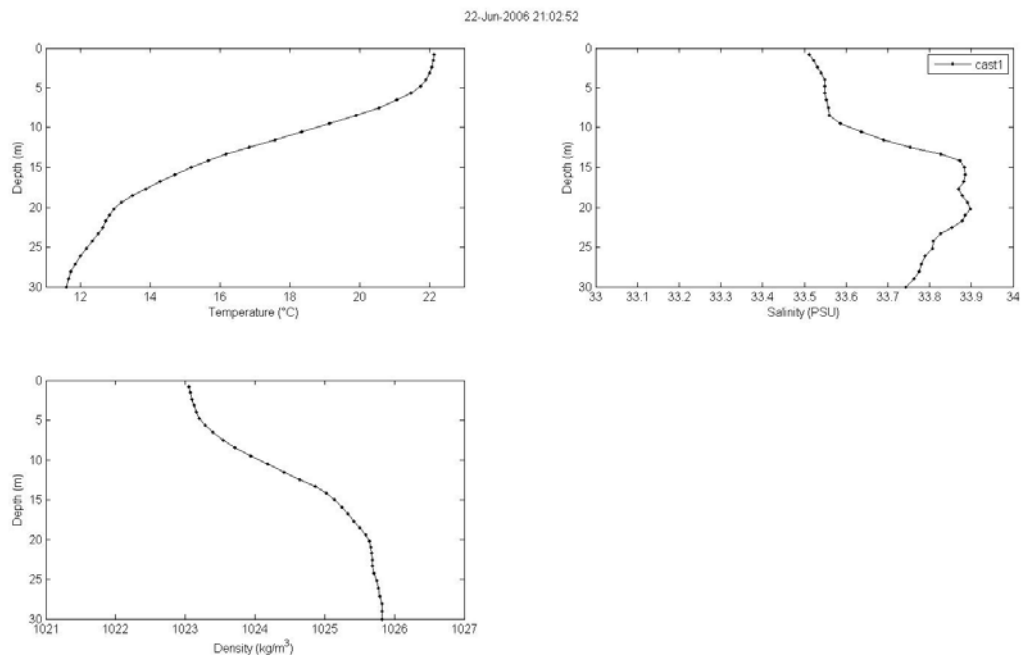


Figure F.5-3. Temperature, salinity, and density versus depth for Cast 1 on 22 June 2006.

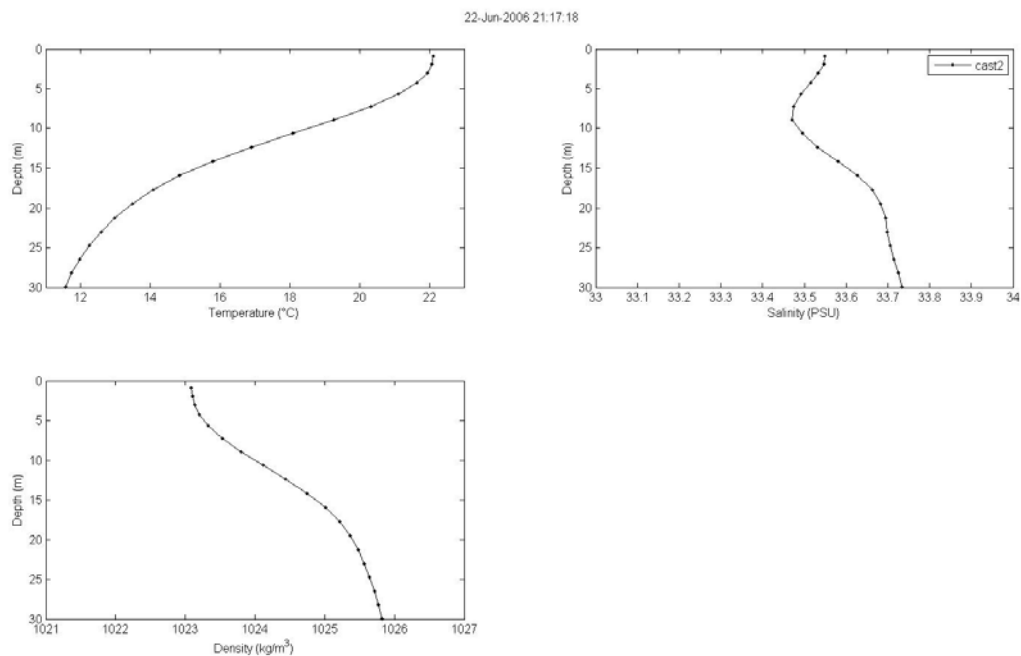


Figure F.5-4. Temperature, salinity, and density versus depth for Cast 2 on 22 June 2006.

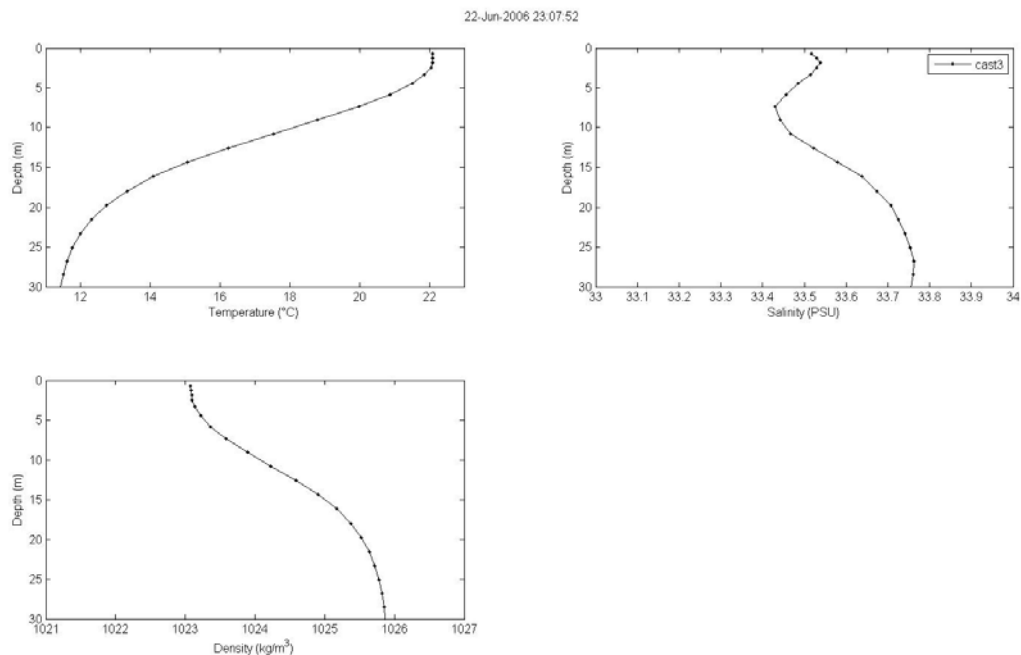


Figure F.5-5. Temperature, salinity, and density versus depth for Cast 3 on 22 June 2006.

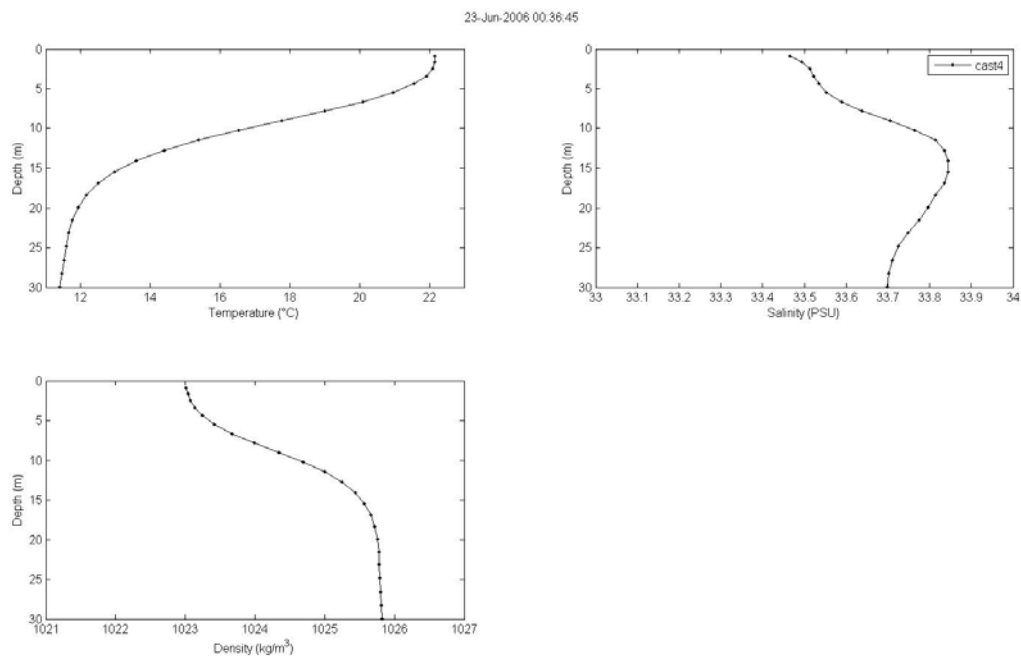


Figure F.5-6. Temperature, salinity, and density versus depth for Cast 4 on 22 June 2006.

F.6 Results of November 1, 2006 Experiment

Figures F.6-1 and F.6-2 show the locations of the CTD casts for the 1 November 2006 experiment. The location of the dye release site and direction of drift during the release are shown in Figure F.6-1.

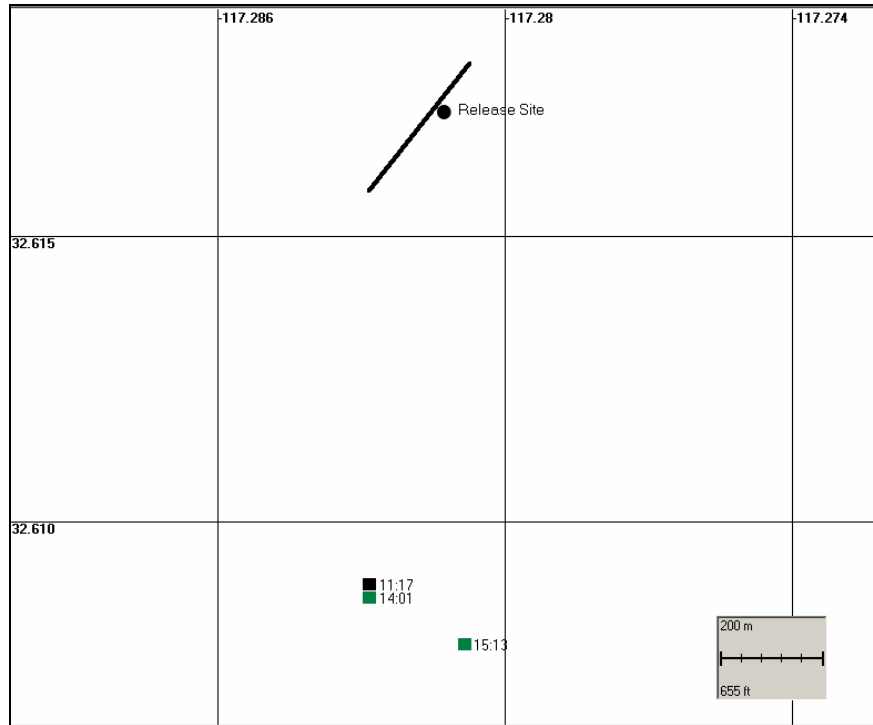


Figure F.6-1. Vertical CTD cast locations and times (local; black = before, green = after dye release) made aboard the SIO *Saikhon* on 1 November 2006.

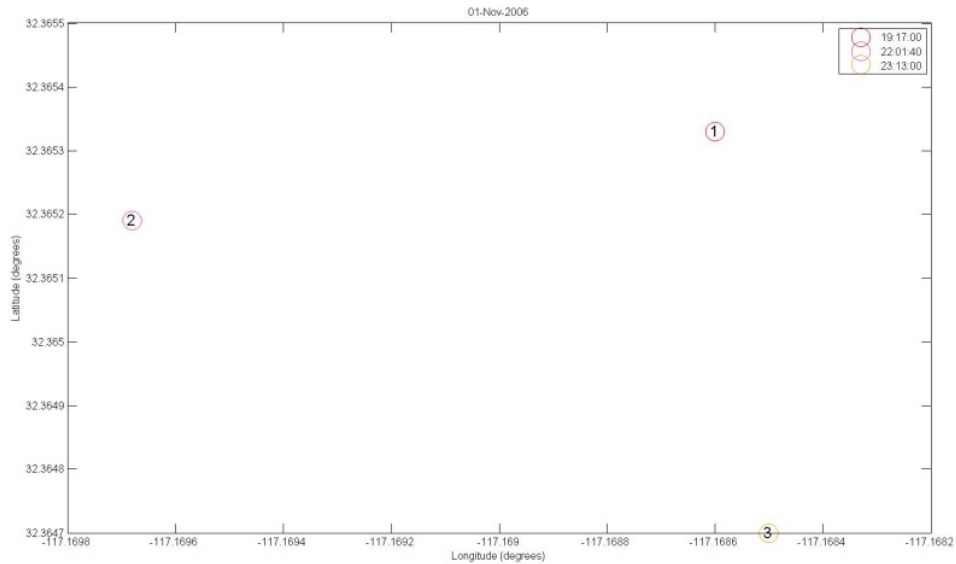


Figure F.6-2. Location of CTD casts 1-3 for 1 November 2006. Legend indicates time of CTD cast in UTC.

Figures F.6-3 to F.6-5 plot data recorded by the 3 CTD casts taken during the 1 November 2006 OSPR experiment. For each cast three figures are displayed which show the oceanographic characteristics of the water column. Top left panel: temperature; top right panel: salinity; bottom left panel: density. Date and time of each cast is listed at the top of each set of figures in coordinated universal time. Cast number is shown in the top right hand corner of the top right panel.

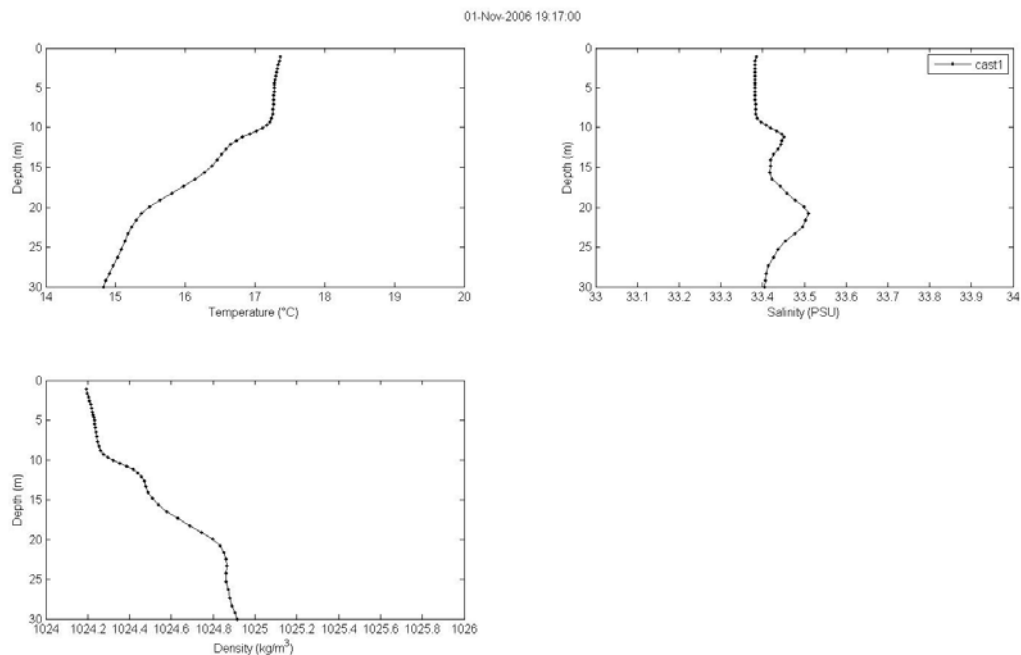


Figure F.6-3. Temperature, salinity, and density versus depth for Cast 1 on 1 November 2006.

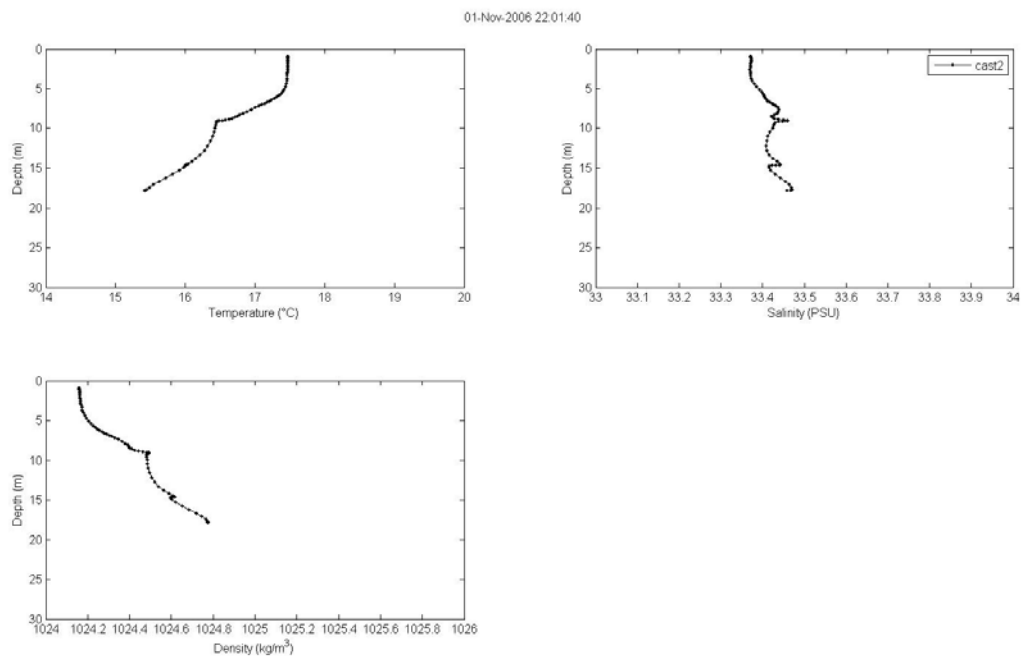


Figure F.6-4. Temperature, salinity, and density versus depth for Cast 2 on 1 November 2006.

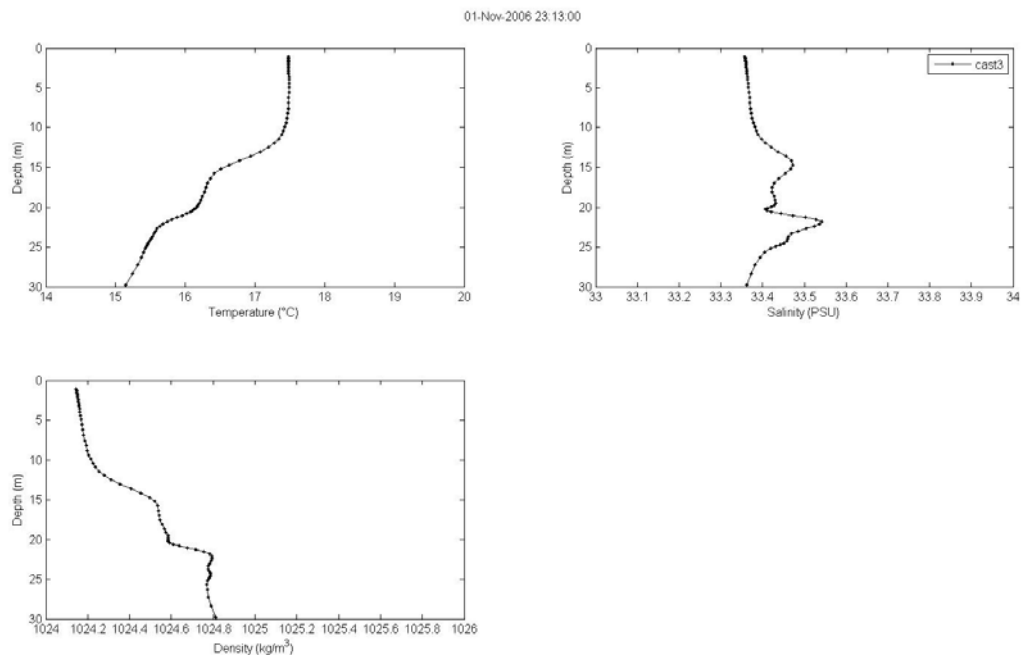


Figure F.6-5. Temperature, salinity, and density versus depth for Cast 3 on 1 November 2006.

F.7 Results of November 2, 2006 Experiment

Figures F.7-1 and F.7-2 show the locations of the 3 CTD casts for the 2 November 2006 experiment. The location of the dye release site and direction of drift during the release are shown in Figure F.7-1. Note that the longitude scale in Figure F.7-2 is greatly exaggerated, whereas the longitude and latitude scales in Figure F.7-1 are of equal degrees.

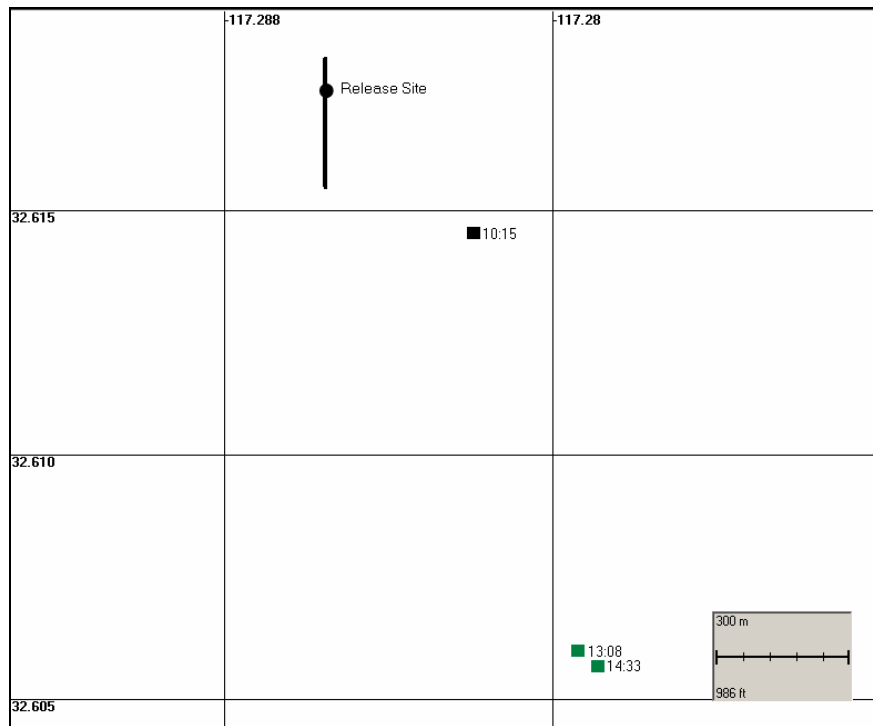


Figure F.7-1. Vertical CTD cast locations and times (local; black = before, green = after dye release) made aboard the SIO *Saikhon* on 2 November 2006.

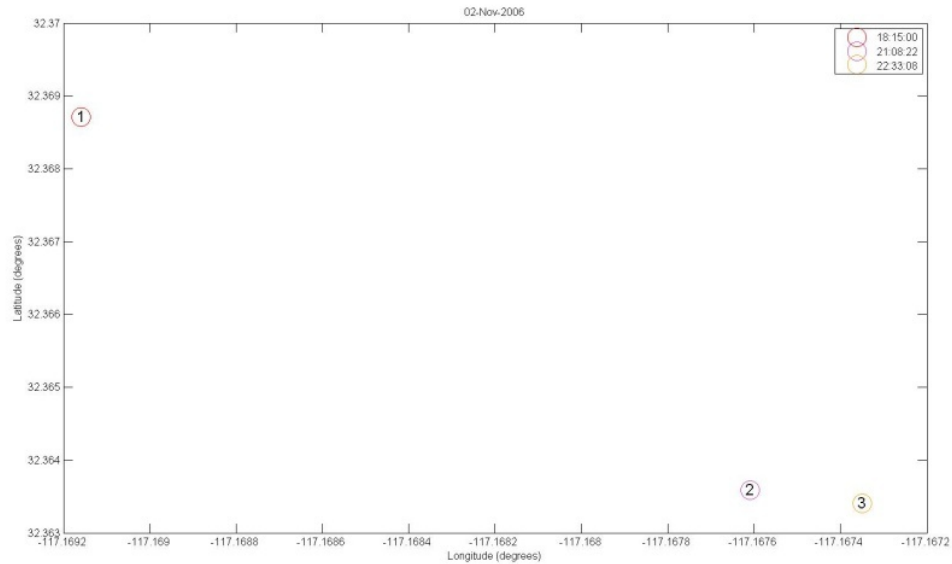


Figure F.7-2. Location of CTD casts 1-3 for 2 November 2006. Legend indicates time of CTD cast in UTC.

Figures F.7-3 to F.7-5 plot data recorded by the 3 CTD casts taken during the 2 November 2006 OSPR experiment. For each cast three figures are displayed which show the oceanographic characteristics of the water column. Top left panel: temperature; top right panel: salinity; bottom left panel: density. Date and time of each cast is listed at the top of each set of figures in coordinated universal time. Cast number is shown in the top right hand corner of the top right panel.

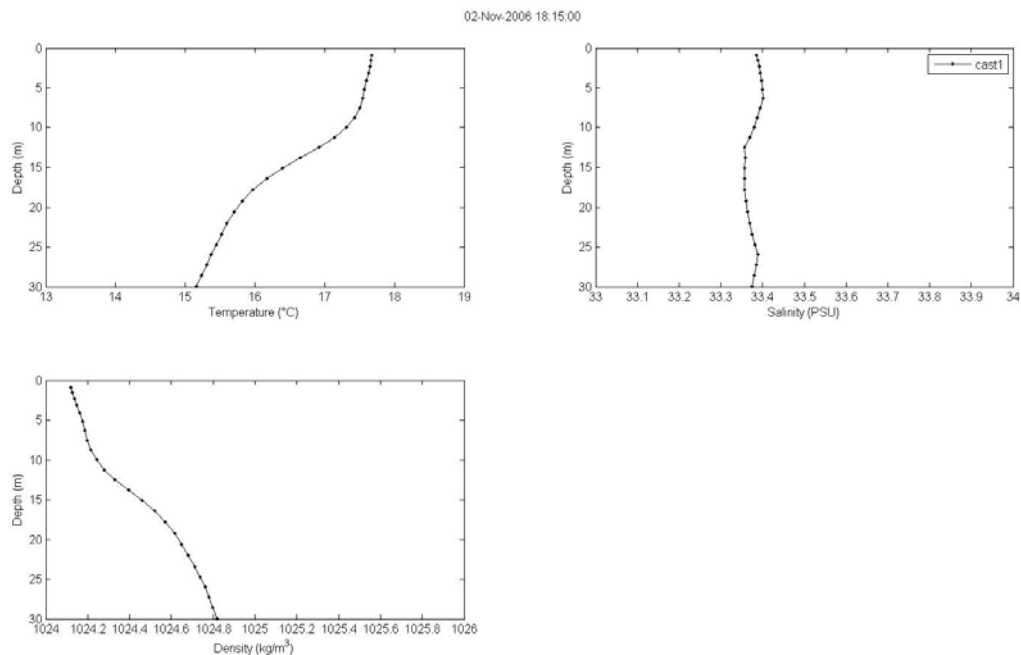


Figure F.7-3. Temperature, salinity, and density versus depth for Cast 1 on 2 November 2006.

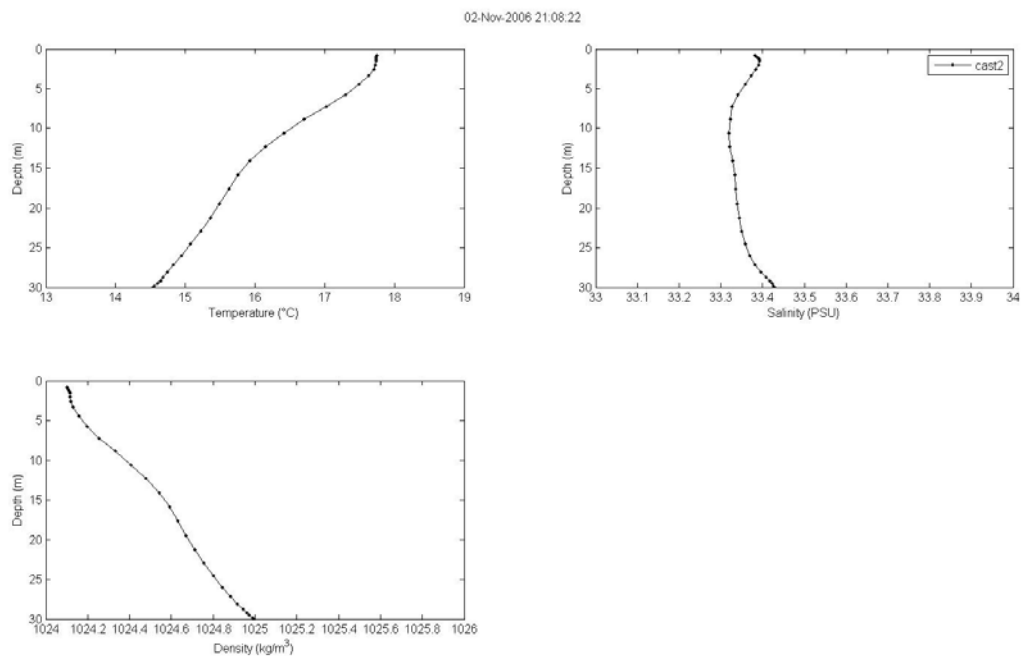


Figure F.7-4. Temperature, salinity, and density versus depth for Cast 2 on 2 November 2006.

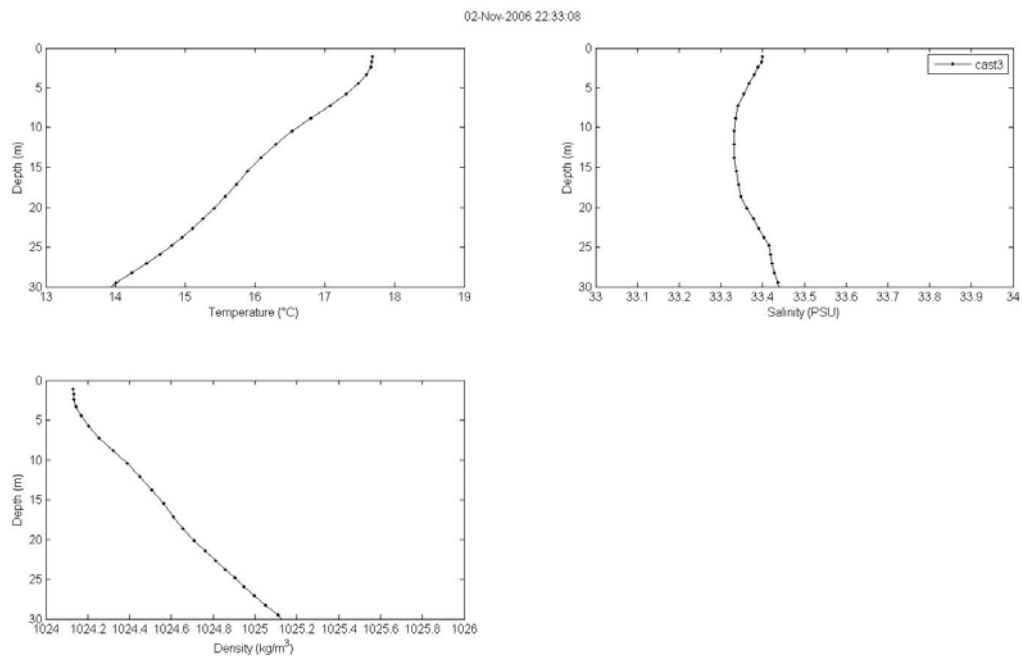


Figure F.7-5. Temperature, salinity, and density versus depth for Cast 3 on 2 November 2006.

F.8 Results of August 9, 2006 Experiment

Figure F.8-1 shows a representative water density profile for the area of the dye release 9 August 2006 during the Safe Seas exercise. Figures F.8-2 to F.8-9 show temperature, salinity and fluorescence profiles taken in the area. The fluorescence profiles appear to be dominated by algal fluorescence rather than dye. Thus, it is not clear whether dye concentrations were measured after the dye release and the data are not useful for that purpose.

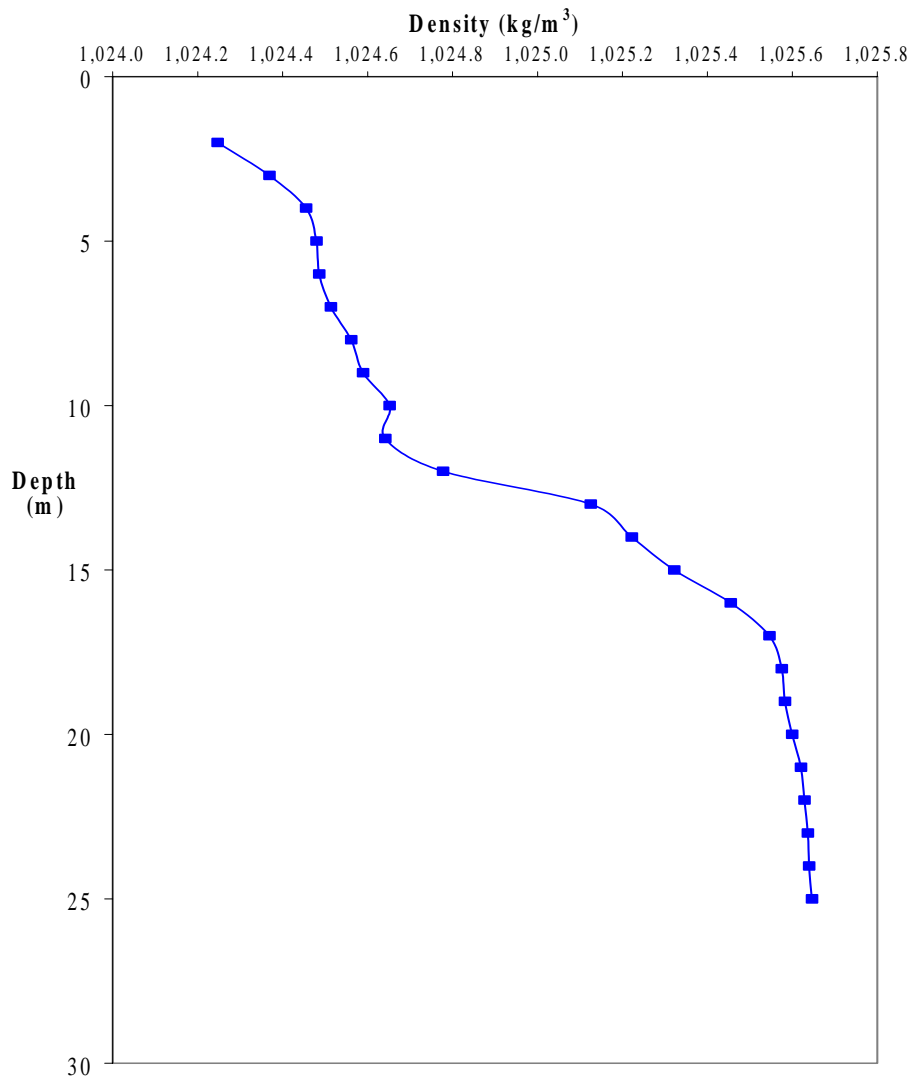


Figure F.8-1. Water density profile for the area of the dye release 9 August 2006 during the Safe Seas exercise.

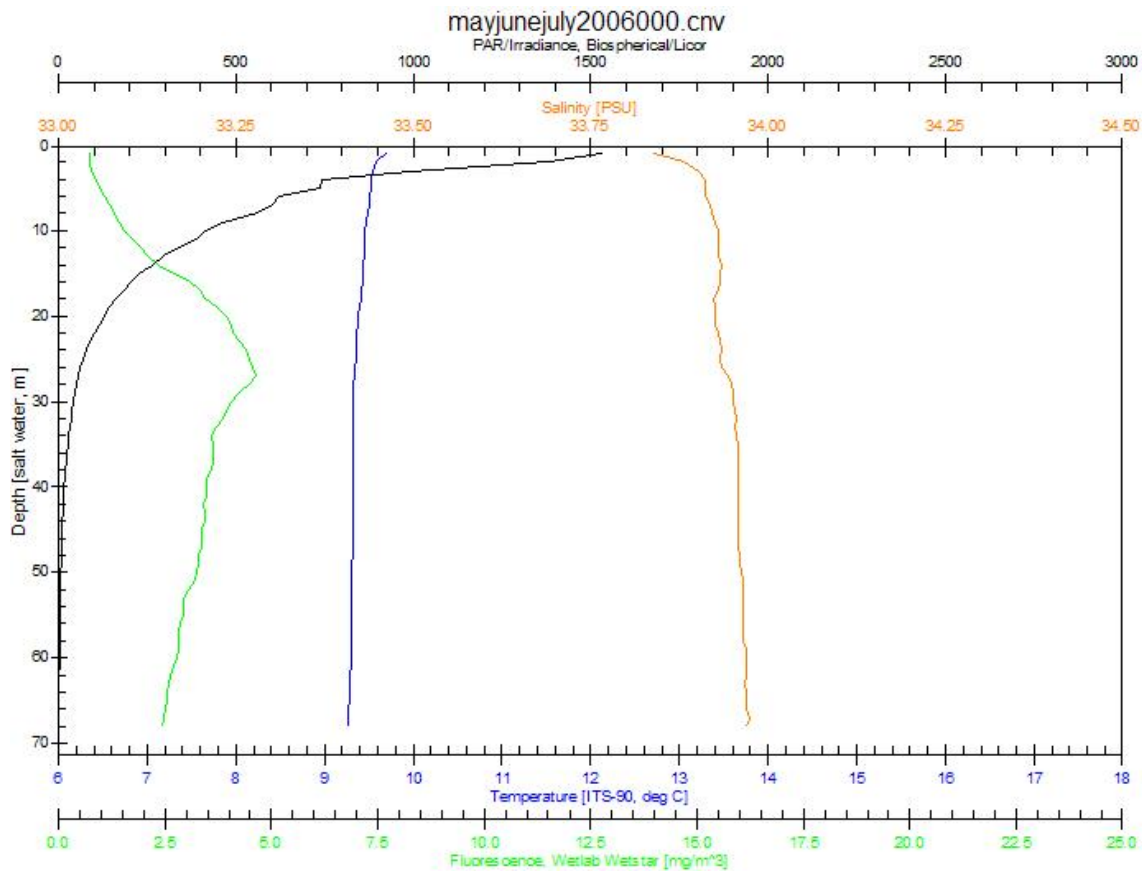


Figure F.8-2. CTD cast #0 including fluorescence measurements for the area of the dye release 9 August 2006 during the Safe Seas exercise.

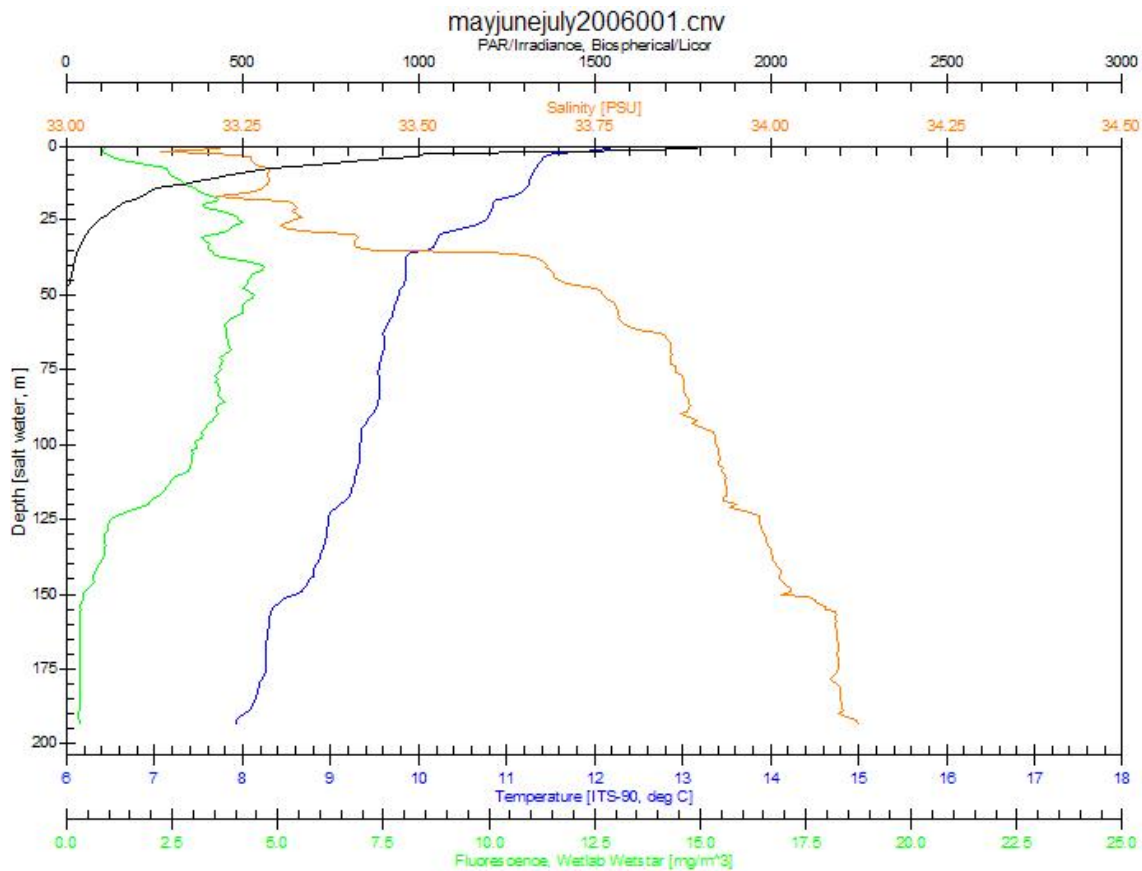


Figure F.8-3. CTD cast #1 including fluorescence measurements for the area of the dye release 9 August 2006 during the Safe Seas exercise.

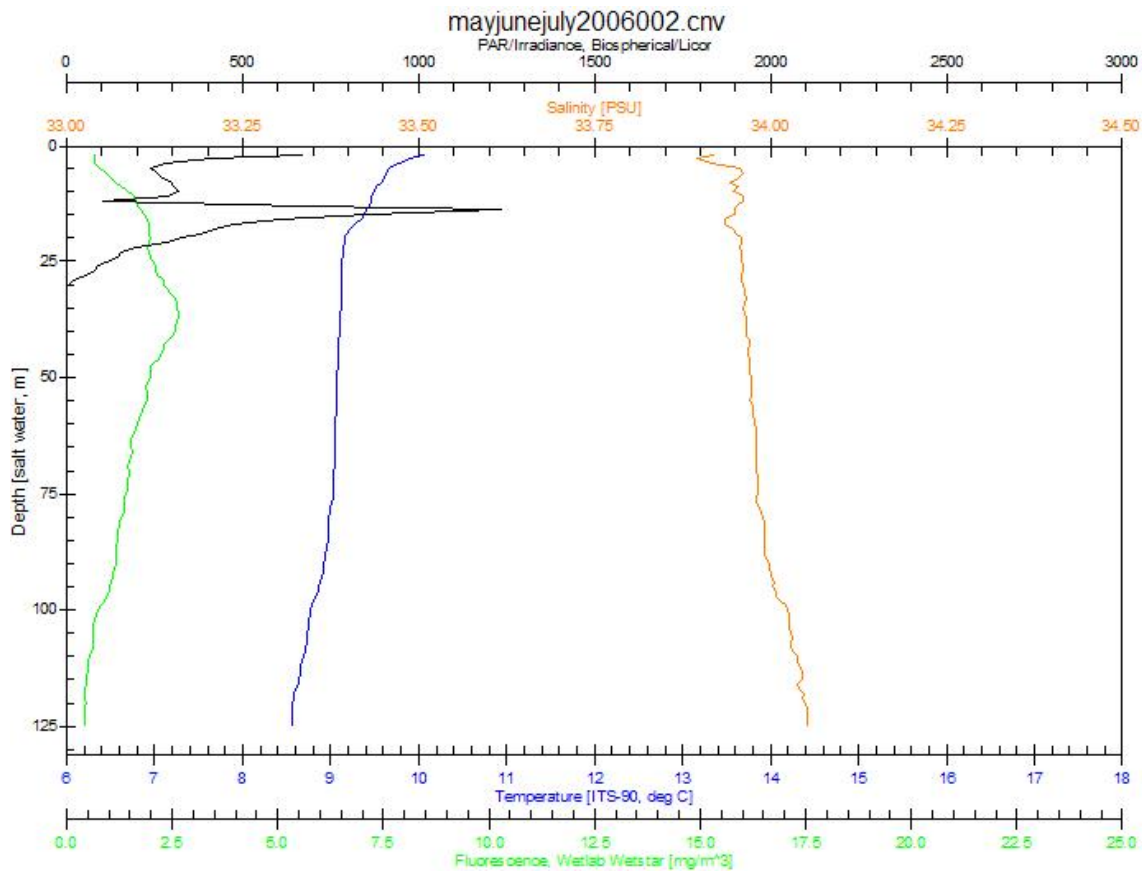


Figure F.8-4. CTD cast #2 including fluorescence measurements for the area of the dye release 9 August 2006 during the Safe Seas exercise.

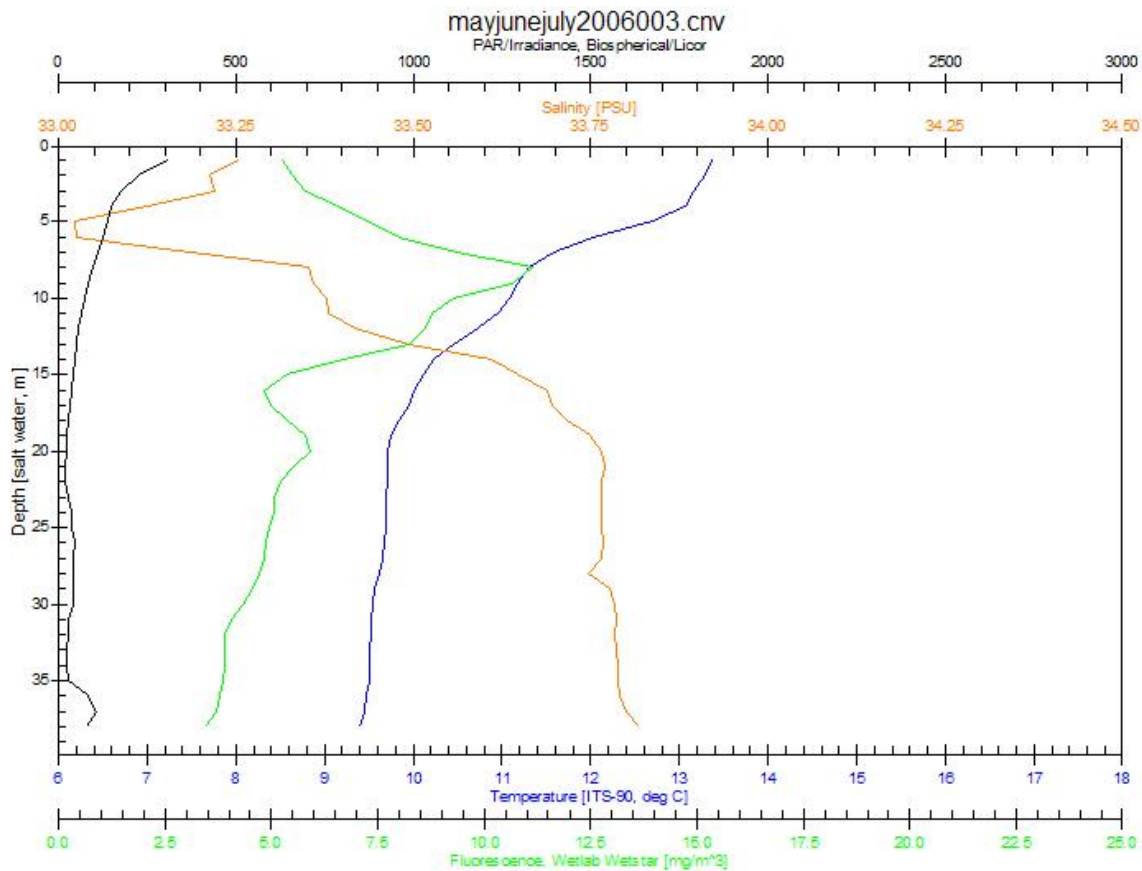


Figure F.8-5. CTD cast #3 including fluorescence measurements for the area of the dye release 9 August 2006 during the Safe Seas exercise.

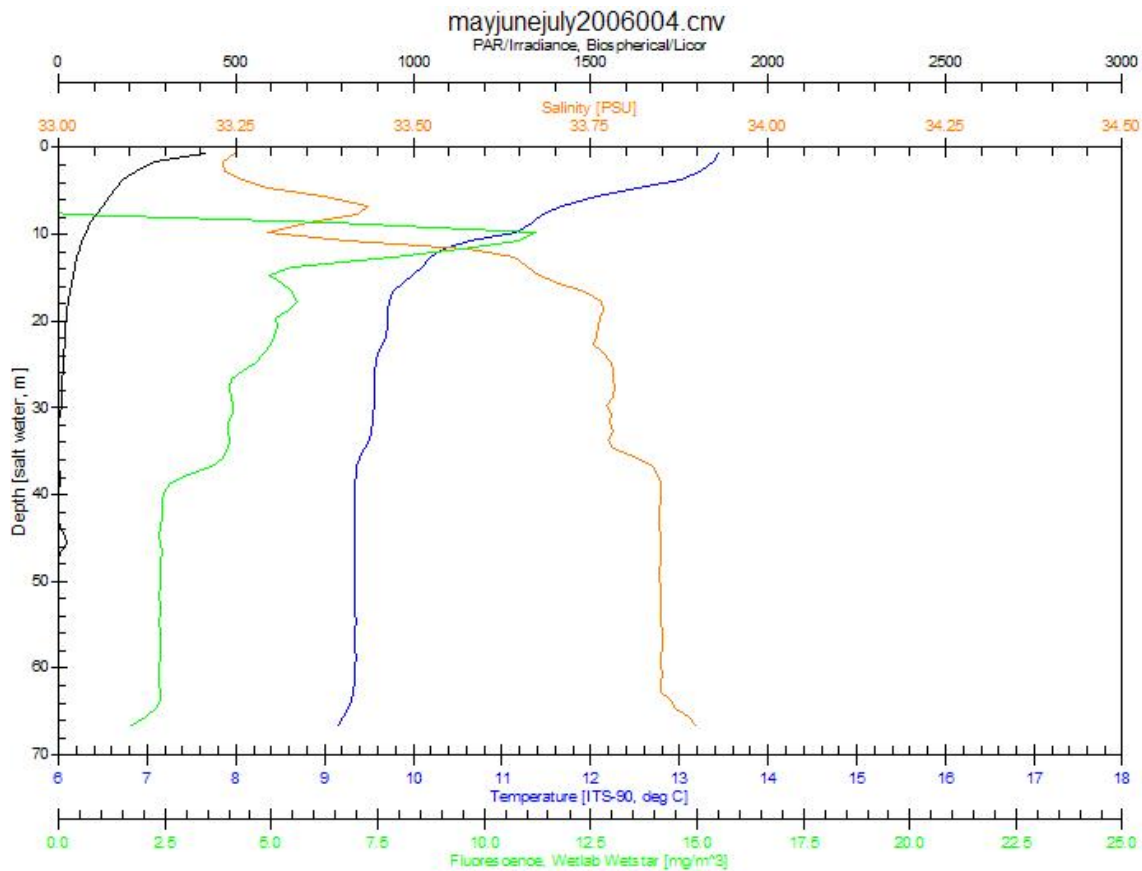


Figure F.8-6. CTD cast #4 including fluorescence measurements for the area of the dye release 9 August 2006 during the Safe Seas exercise.

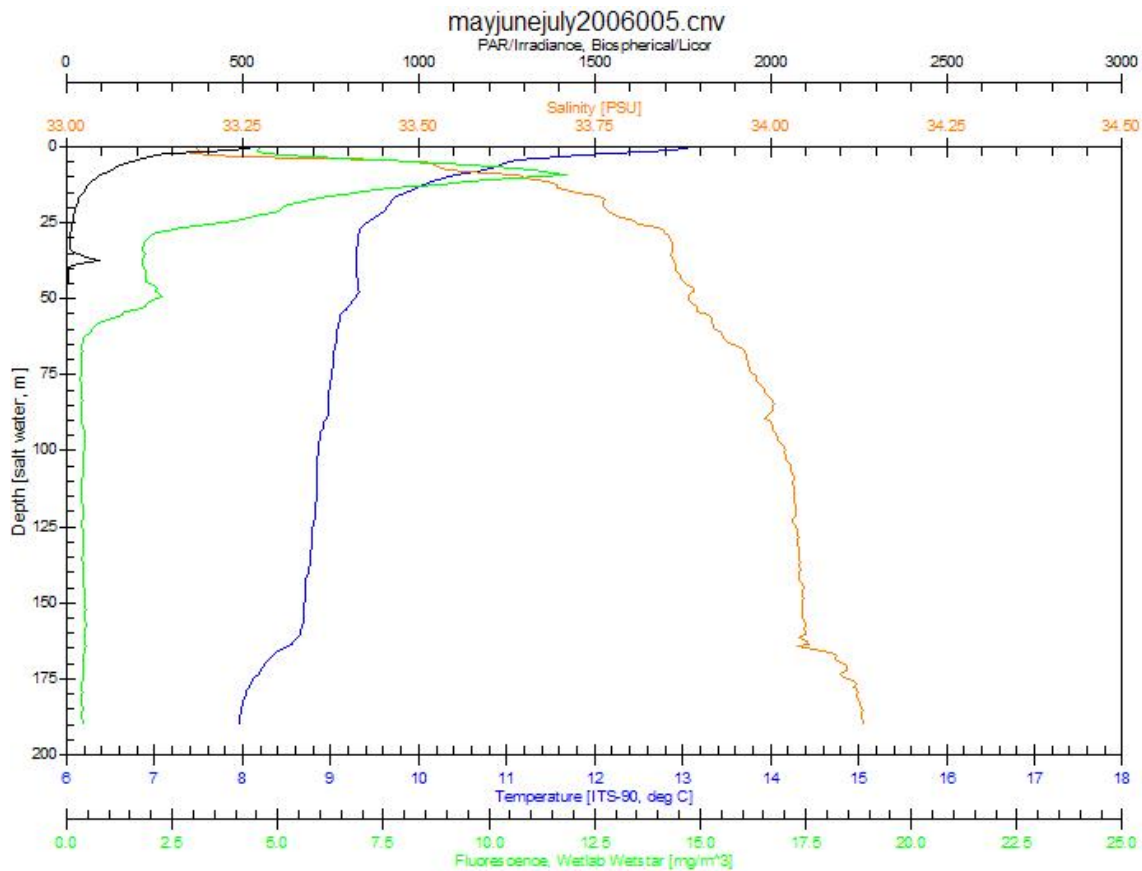


Figure F.8-7. CTD cast #5 including fluorescence measurements for the area of the dye release 9 August 2006 during the Safe Seas exercise.

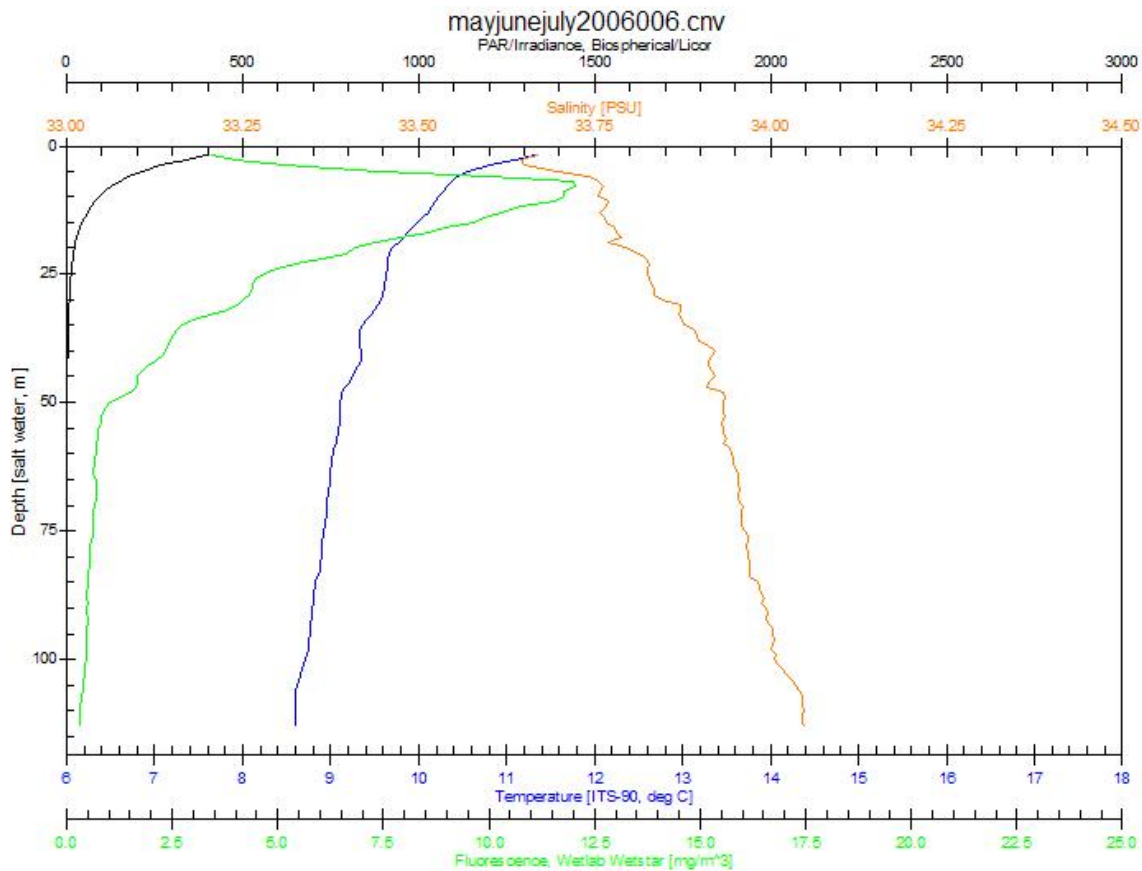


Figure F.8-8. CTD cast #6 including fluorescence measurements for the area of the dye release 9 August 2006 during the Safe Seas exercise.

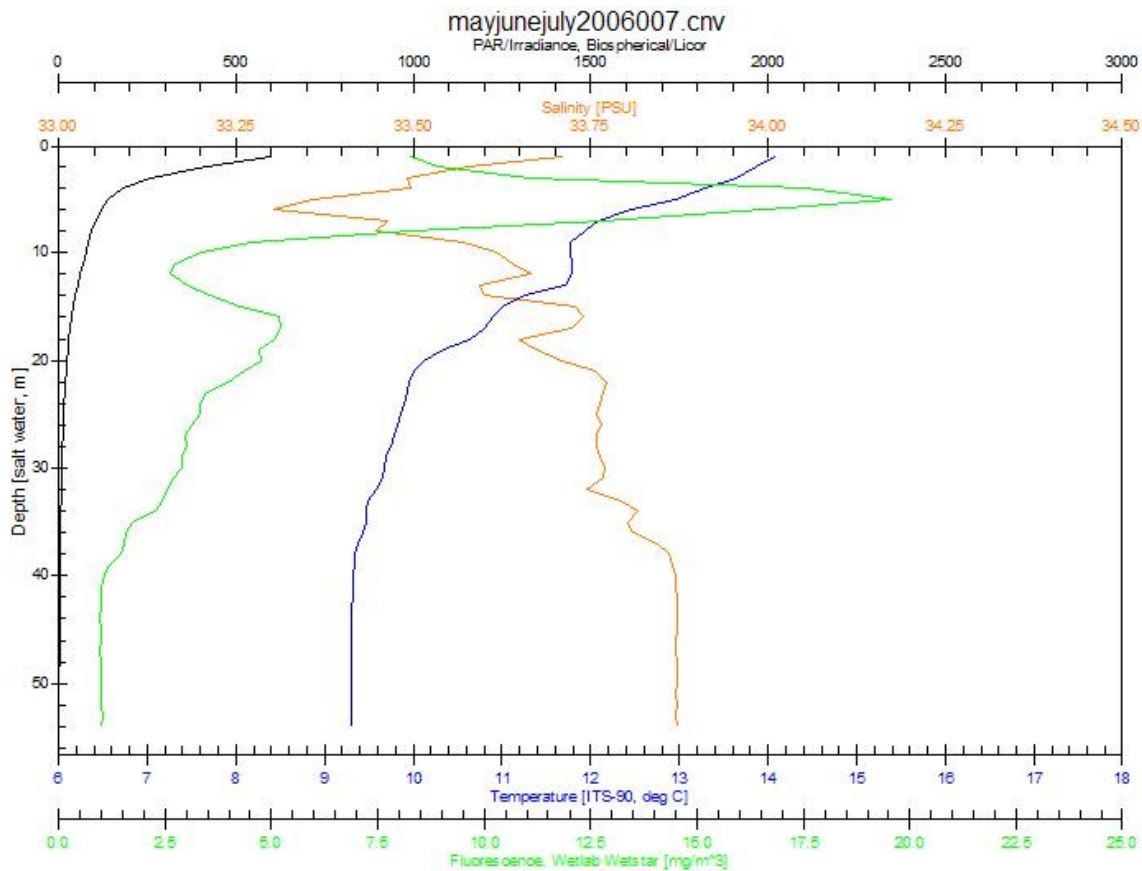


Figure F.8-9. CTD cast #7 including fluorescence measurements for the area of the dye release 9 August 2006 during the Safe Seas exercise.