Fig. 1. Irish Sea monitoring system. Yellow dots = tide gauges; red dots = moorings; red dotted lines = possible ferry routes; blue dotted lines = university monitoring routes; shaded area = HF radar coverage; black crosses = CTD, SPM, nutrients survey points; red square = meteorological station; white lines = airborne (satellite, lidar) monitoring. Red box highlights the focus of the Coastal Observatory in Liverpool Bay. Sampling station 1 (located at 53º 32' N 3º 21.8' W) is indicated by a black cross in the red circle.

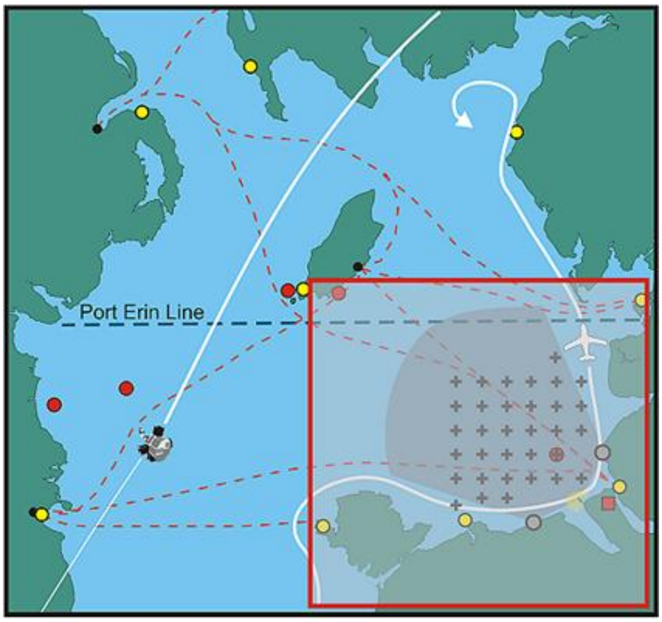

Fig. 2. Model domains for operational models of the POL Coastal Observatory

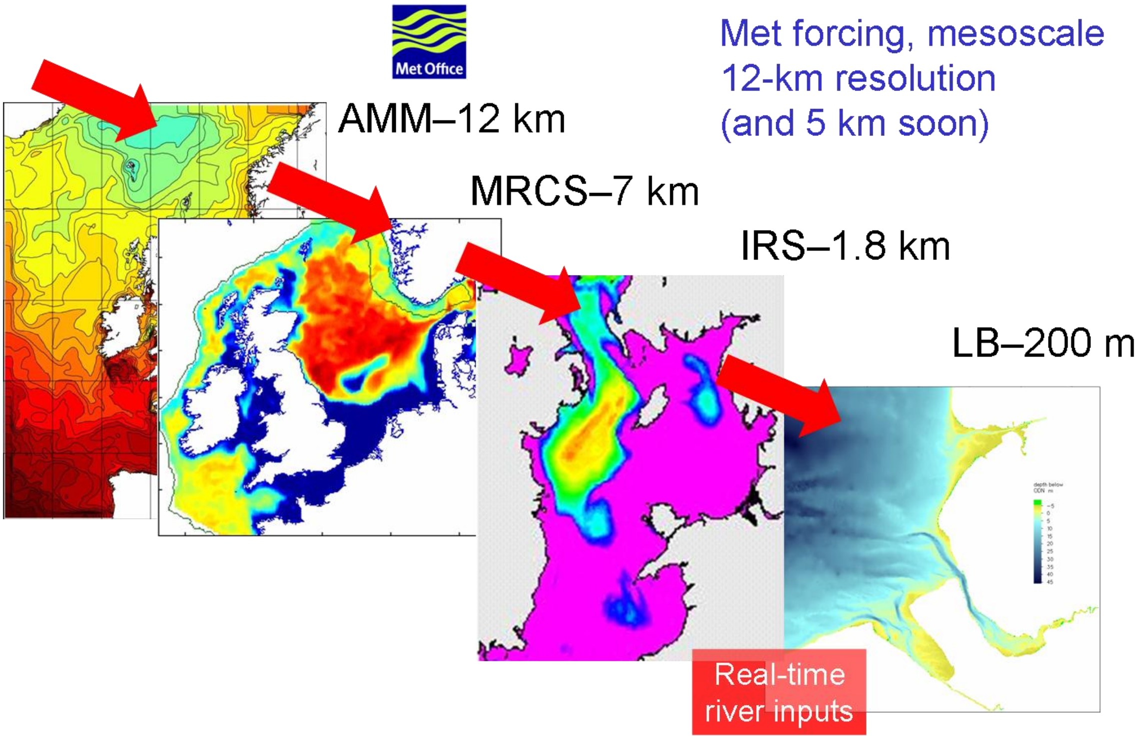

Fig. 3. Coupled POLCOMS-ERSEM ecosystem model schematic

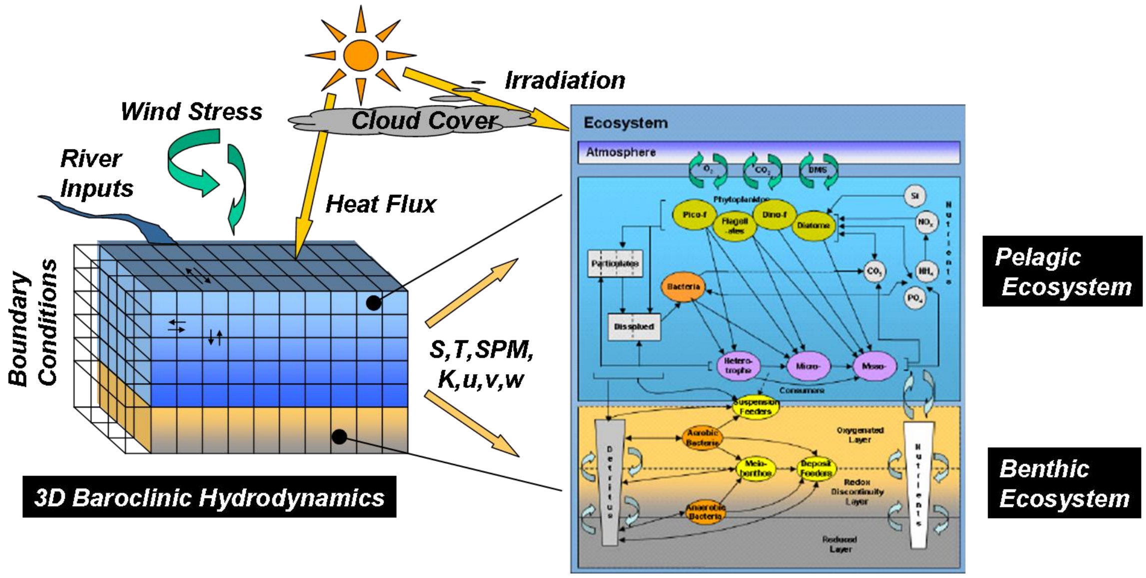

Fig. 4. Examples of the MRCS simulations: distributions of sea surface temperature (SST), near bottom temperature (BT), surface chlorophyll concentration (CHL, mg-chl/m^3) and aggregated zooplankton biomass (ZOO, mg-carbon/ m^3) on 30 April 2005. Note elevated levels of chlorophyll and zooplankton in Liverpool Bay.

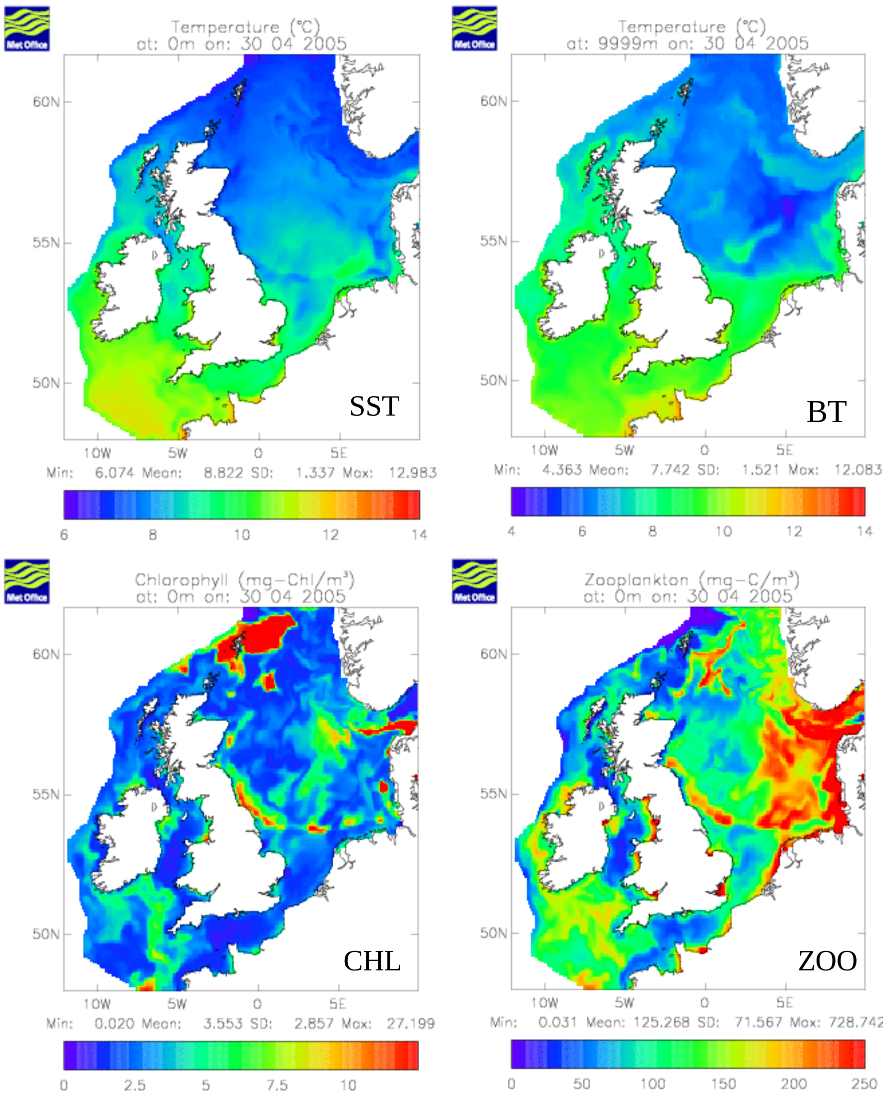

Fig. 5. Surface SPM maps (created by Matlab scripts using the results obtained on the 3 specific cruises). 'SurfSPM' refers to mass concentrations (mg/l). 'SurfV' refers to volumetric concentrations (microlitres/l) measured by LISST.

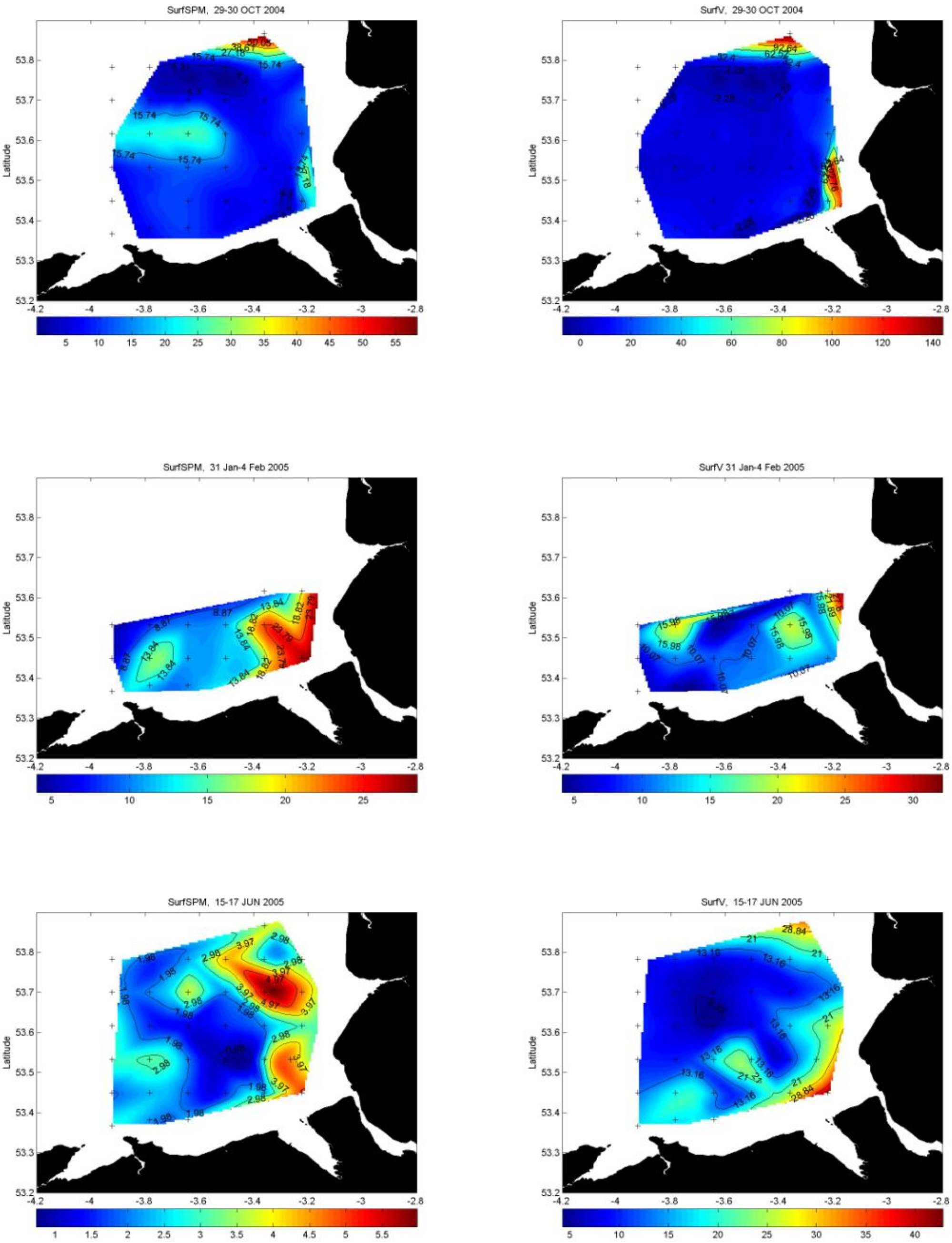

Fig. 6. An example of particle size spectra along the latitudinal profile through station 1 (i.e. along 53degrees 32’ N, from inshore to offshore). For each subplot, vertical axis is volume concentrations in microlitres/l, horizontal axis is particle diameter in microns. Note that stations 1 and 9 have the same location, but station 1 is typically visited at the beginning, whilst station 9 in the second part of a cruise.

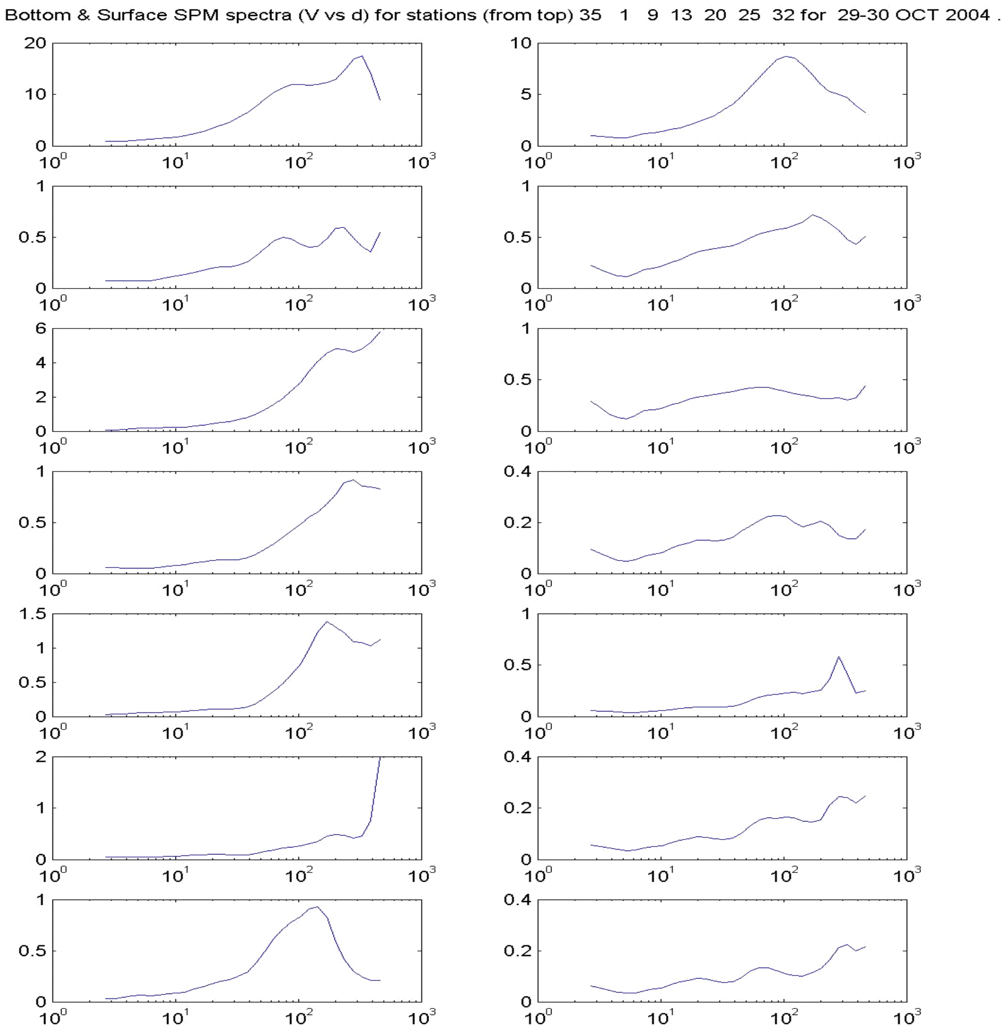

Fig. 7. Profiles of SPM total volume and mean diameter

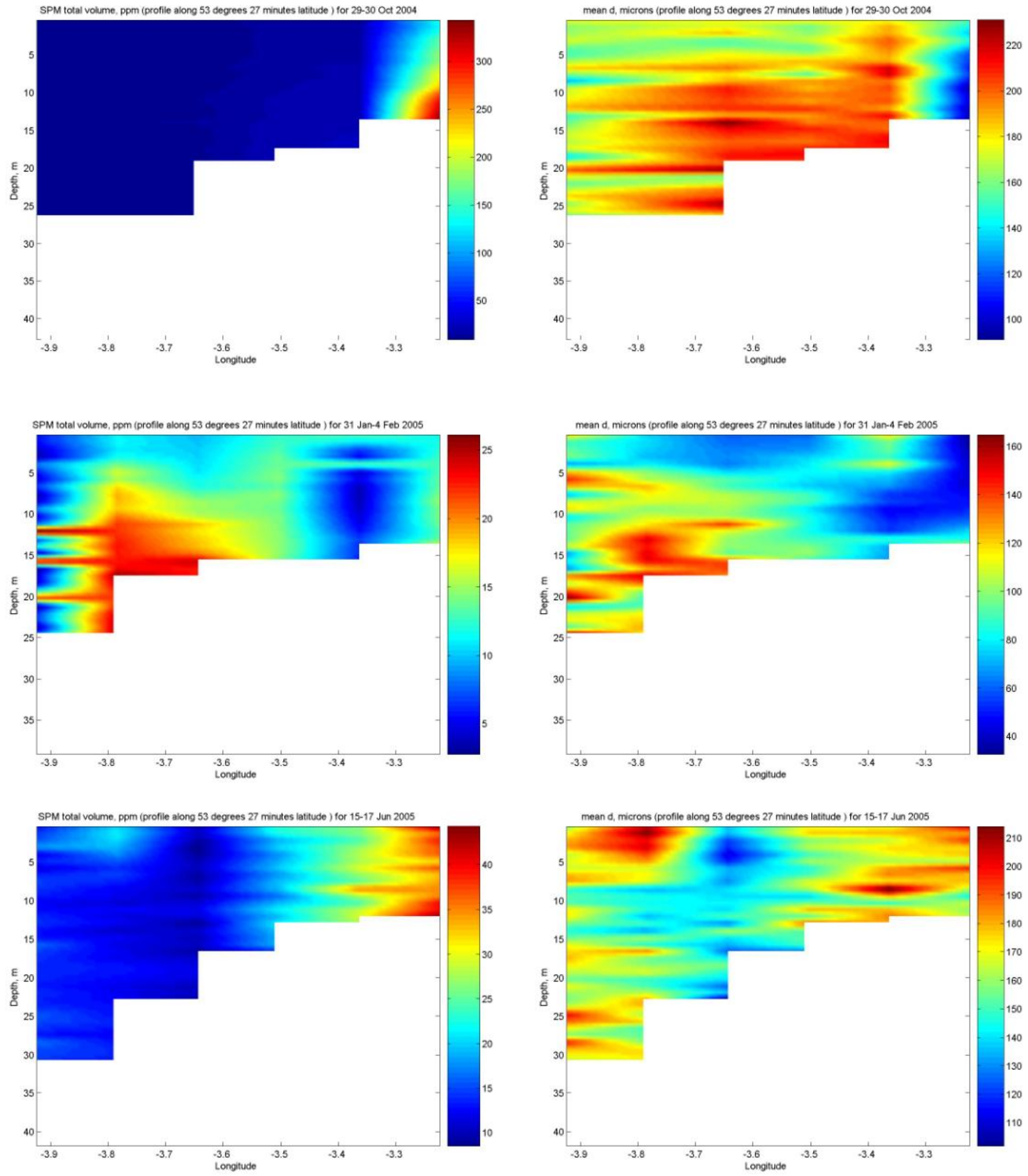

Figure 8. Regression tree to classify bottom [SPM] (data for Oct 2004).

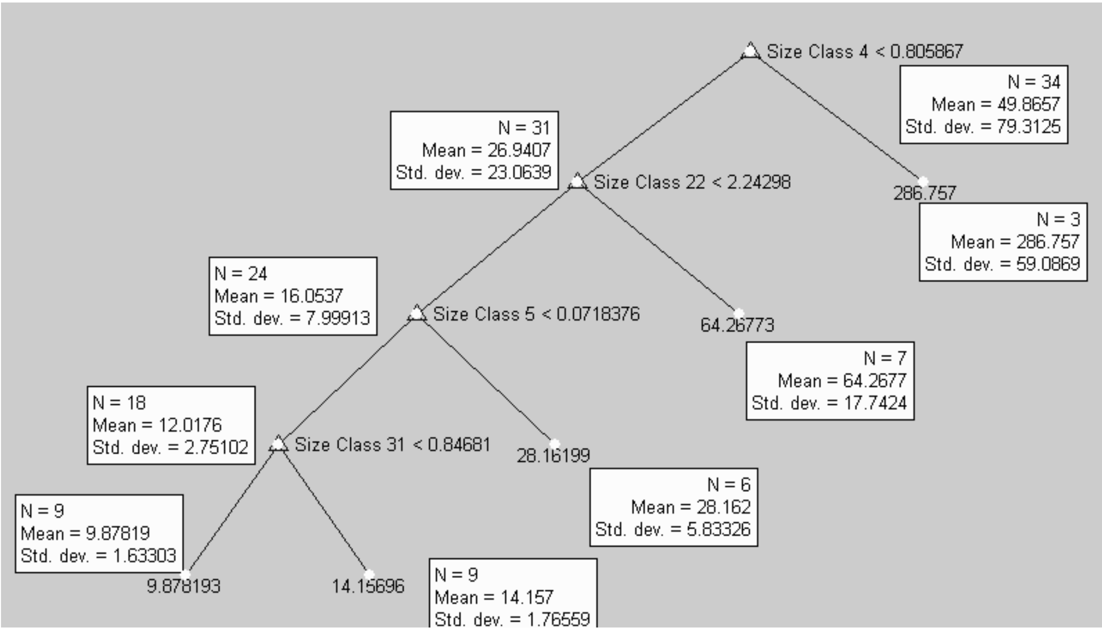

Figure 9. Regression tree to classify surface [SPM] (data for Oct 2004).

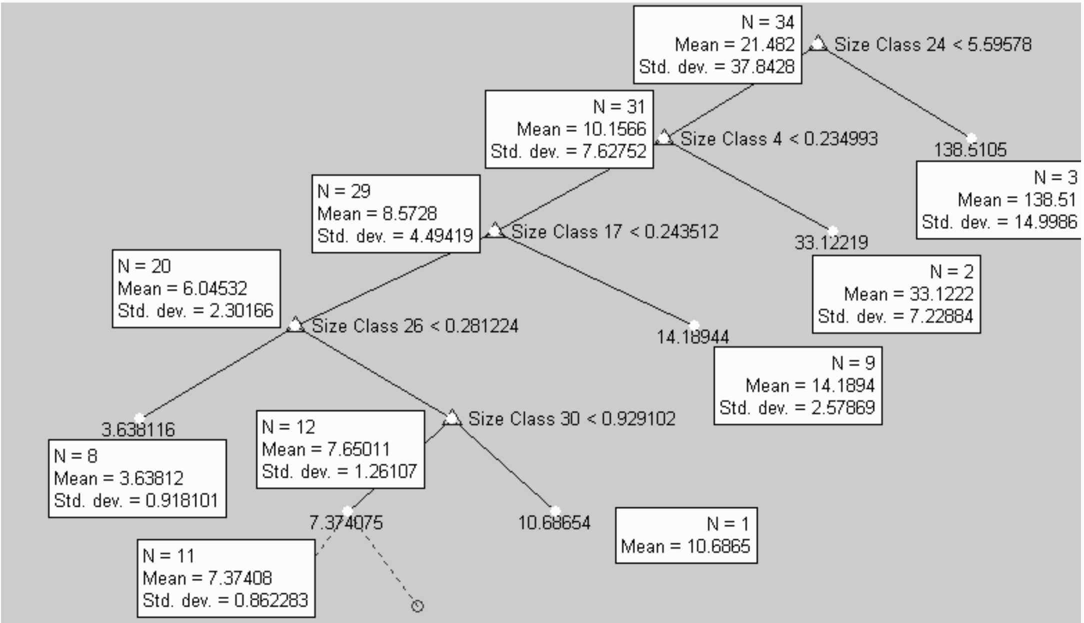

Figure 10. Regression tree to classify bottom [SPM] (data for Jan-Feb 2005).

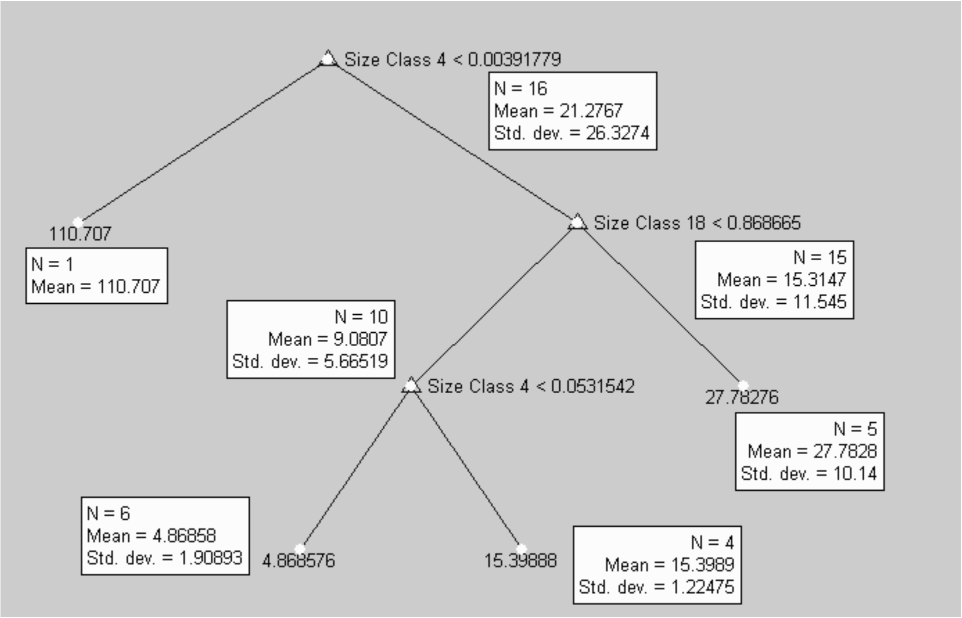

Figure 11. Regression tree to classify surface [SPM] (data for Jan-Feb 2005).

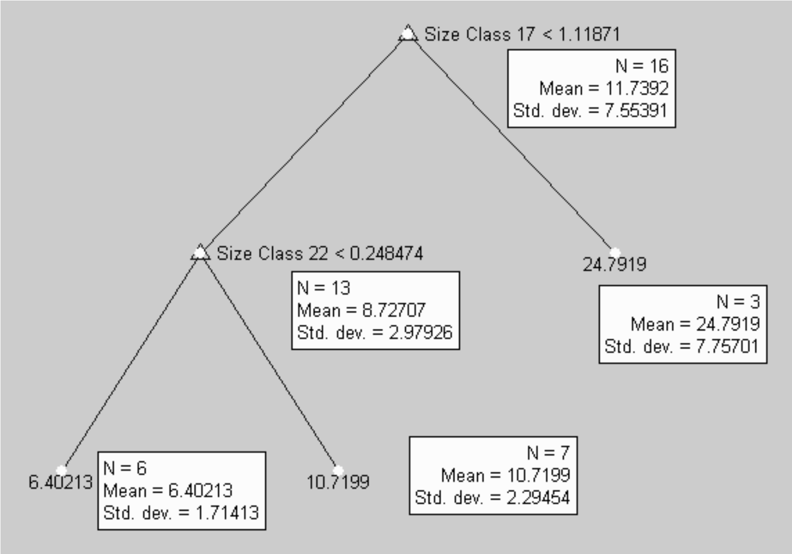

Figure 12. Regression tree to classify bottom [SPM] (data for June 2005).

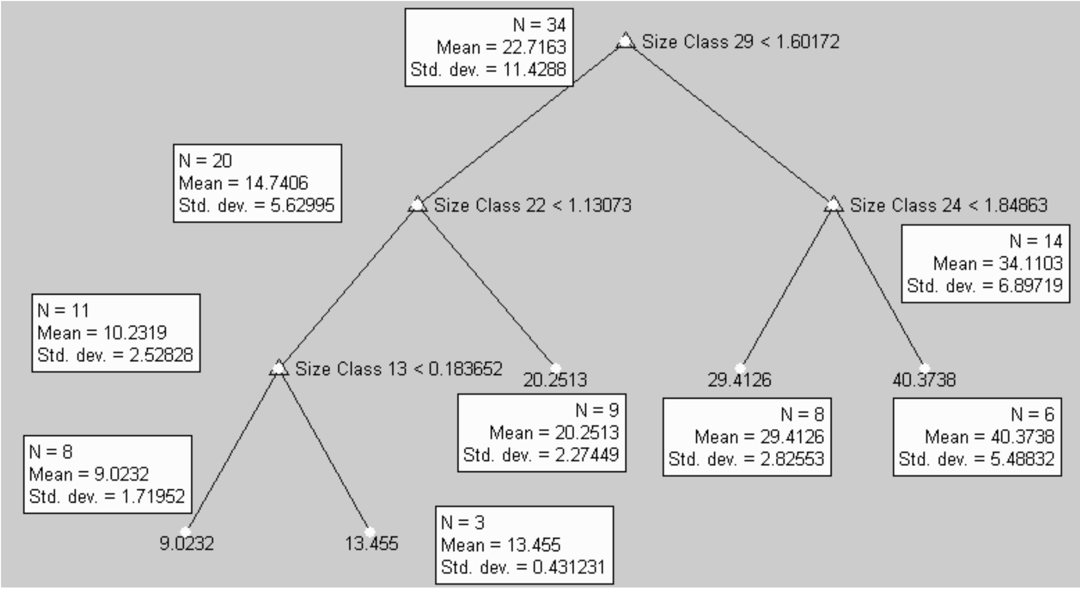

Figure 13. Regression tree to classify surface [SPM] (data for June 2005).

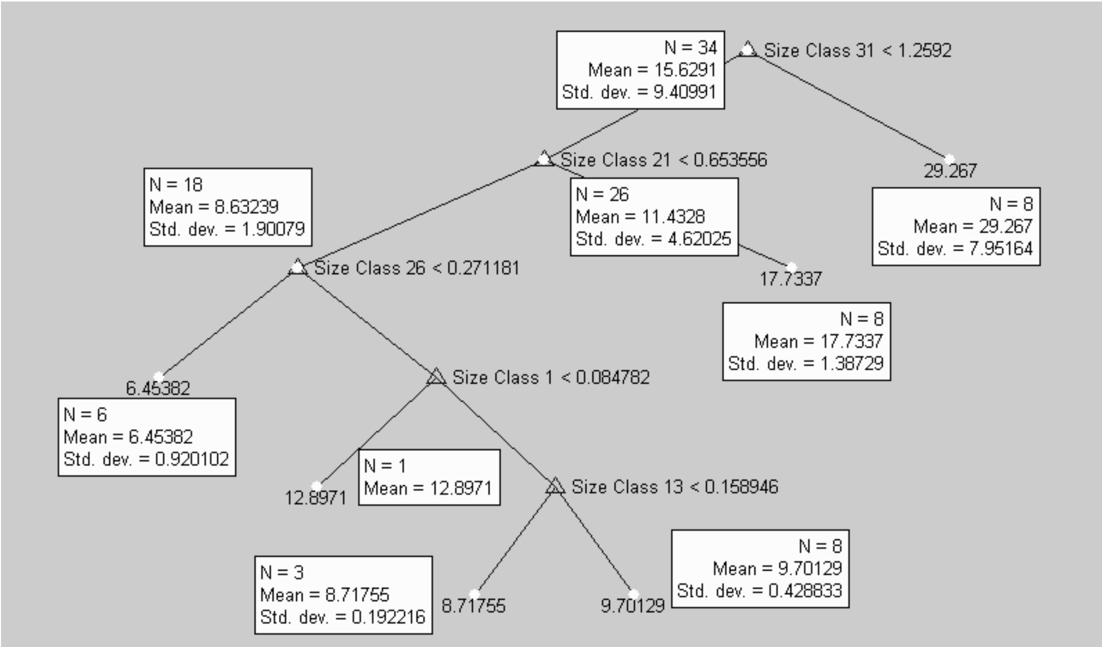

Table 1a. Correlations between LISST and filtering results for 29-30 Oct 2004. NS – not significant. 'SPM ppm' here refers to the mass concentration of suspended particulate matter expressed in mg/l.

	Bottom	**Surface**
SPM ppm/LISST Total V	0.74537	0.78755
SPM ppm/Beam Attenuation	0.78523	0.7535
SPM ppm vs V/d	0.73428	0.81868
SPM ppm/median d	-0.37	NS
LISST Total V/ median d	-0.47	NS

Table 1b. Correlations between LISST and filtering results (31 Jan-4Feb 2005). NS – not significant. 'SPM ppm' here refers to the mass concentration of suspended particulate matter expressed in mg/l.

	Bottom	**Surface**
SPM ppm/LISST Total V	NS	0.63
SPM ppm/Beam Attenuation	0.83	0.84
SPM ppm vs V/d	0.44	0.80
SPM ppm/median d	NS	-0.62
LISST Total V/ median d	0.85	NS

Table 1c. Correlations between LISST and filtering results (15-17 Jun 2005). NS – not significant. 'SPM ppm' here refers to the mass concentration of suspended particulate matter expressed in mg/l.

	Bottom	**Surface**
SPM ppm/LISST Total V	0.61	0.36
SPM ppm/Beam Attenuation	0.56	NS
SPM ppm vs V/d	0.6	0.39
SPM ppm/median d	NS	NS
LISST Total V/ median d	0.56	0.73

Table 2. Stepwise regression models for SPM-related variables vs. environmental variables for the POL cruise 29-30 October 2004. Each column gives coefficients for significant predictors returned by the final stepwise regression model for the variable listed in the first row. The last three rows give the F statistic, the p value, and the total percentages of the variance explained by the final model. The cruise was carried out just after springs, and was characterised by light (5-10 m/s) and variable E-SE winds and low S-W waves (0.2-0.4 m). Note that both wind and tide related variables variously appear among significant predictors for the SPM related variables.

Variables	Bottom SPM (mg/l)	Surface SPM (mg/l)	Bottom total V (microl/l)	Surface total V (microl/l)	Bottom Beam Attenuation	Surface Beam Attenuation	Bottom Median Diameter (microns)	Surface Median Diameter (microns)	Bottom V/D	Surface V/D
Temperature (degrees)			-71.45	-34.93	-6.62					-0.48
Oxygen(micromol/kg)										
Salinity (PSU)						-2.8				
Density (kg/m^3)	-8.96						42.11			
Potential Energy Anomaly (J/m^3)	-0.62	-0.94			-0.4				-0.036	
Tide level (m)	-2.43	-2.56						6.46	-0.085	
Tide current (m/s)										
Tide direction (degrees)							0.21			
Water Depth (m)									0.1	
Epsilon (depth average, W/kg)										
Kolmogorov Scale (m)										
Bottom Tidal Current (m/s)										
Current direction at the bottom										
Surface Tidal Current (m/s)										
Current direction at the surface										
Epsilon (bottom, W/kg)										
Epsilon (surface, W/kg)							563043.9		5657.36	
Kolmogorov scale at the bottom (m)										
Kolmogorov scale at the surface										
Average Wave period (s)										
Dominant Wave Direction (degrees)										
Dominant Wave T (s)					0.56		-14.25			
Significant Wave Height (m)										
MaxBedOrbU^3					-10387798				-2648349	
Wave Energy (J/m^2)										
True Wind Speed (m/s)									-1.28	
True Wind Direction (degrees)										
Wind Epsilon (W/kg)	-1E+06		8225183	3240038	682173.43				554583.3	
Wind-Wave Alignment										
Wind Tide Alignment										
Constant	9212.05	19.63	875.18	430.11	82.45	95.38	-42970.5	111.76	3.59	6.14
Fstat.	11.48	9.76	18.75	15.03	19.13	53.03	19.3	4.61	51.63	30.33
p	0.00001	0.0005	0.00001	0.00003	0	0	0	0.03975	0	0.00001
R^2	0.63	0.39	0.56	0.5	0.78	0.63	0.73	0.13	0.94	0.49

Table 3. Stepwise regression models for SPM-related variables vs. environmental variables for the POL cruise 15-17 Jun 2005 (see Table 2 for format description). The cruise was carried out during neaps, moderate W-SW wind (5-16 m/s), and W-SW waves. Note that although the variables related to turbulence generated by tides, winds and waves show some limited relationships, the most frequent predictor on this occasion is salinity, thus emphasising the importance of the inshore-offshore gradient.

Variables	Bottom SPM (mg/l)	Surface SPM (mg/l)	Bottom total V (microl/l)	Surface total V (microl/l)	Bottom Beam Attenuation	Surface Beam Attenuation	Bottom Median Diameter (microns)	Surface Median Diameter (microns)	Bottom V/D	Surface V/D
Temperature (degrees)				7.93		0.47				0.046
Oxygen(micromol/kg)										
Salinity (PSU)	-1.87	-1.01	-15.51		-0.82		-33		-0.1	
Density (kg/m^3)										
Potential Energy Anomaly (J/m^3)	0.00031									
Tide level (m)					-0.13				-0	
Tide current (m/s)										
Tide direction (degrees)	0.038							0.42		-0.0001
Water Depth (m)										
Epsilon (depth average, W/kg)										
Kolmogorov Scale (m)										
Bottom Tidal Current (m/s)										
Current direction at the bottom	-0.047									
Surface Tidal Current (m/s)										
Current direction at the surface								-0.3		-7.2E-05
Epsilon (bottom, W/kg)						224709.43				
Epsilon (surface, W/kg)										
Kolmogorov scale at the bottom (m)										
Kolmogorov scale at the surface									193	
Average Wave period (s)	1.73									
Dominant Wave Direction (degrees)			0.23							
Dominant Wave T (s)										
Significant Wave Height (m)					-1.01					
MaxBedOrbU^3										
Wave Energy (J/m^2)										2.83E-05
True Wind Speed (m/s)										
True Wind Direction (degrees)										-0.00033
Wind Epsilon (W/kg)				110196						
Wind-Wave Alignment						-0.71				
Wind Tide Alignment						0.14				
Constant	60.72	35.9	471.06	-89.07	27.27	-3.69	1222.09	110.39	3.02	-0.39
Fstat.	13.64	10.11	33.39	22.86	18.89	21.54	23.49	8.89	13.8	49.98
p	0	0.0033	0	0	0	0	0.00003	0.00089	0	0
R^2	0.71	0.24	0.68	0.6	0.72	0.75	0.42	0.36	0.58	0.9