

Cruise Report - LOIS Airborne Remote Sensing Programme

Vessel and Period

'Sea Vigil', 31st Aug - 3rd Sept - (SV3)

Location

Humber Estuary and plume

Personnel

Responsibility

from PML	D. Plummer G.Siley	Co-ordination/ ground truth measurements UOR deployment
from UoP/PML spectral and	S. Hudson	Flight plan and aircraft liason, UOR, underway data handling
from UoP	K. Hammond (Wed 1st only)	Profiling radiometer

Objective

To obtain measurements of the optical characteristics and water quality of the Humber Estuary during synchronous airborne CASI (Compact Airborne Spectrographic Imager) overflights for the development of algorithms and atmospheric corrections.

Introduction

This survey was the third of a series of three, one-week survey periods during 1993 aimed at ground truthing spectral information obtained from airborne instruments. Intensive aerial observations of the lower estuary were undertaken by the NRA aircraft flying a CASI instrument to survey lines defined by PML (Figure 1) for this purpose. Concurrent in-water observations were made from 'Sea Vigil' on the same day and, for one of the survey lines, at the same instant. Because of the limited accommodation on-board, scientific operations were limited to day work and the scientific party stayed in hotel accommodation overnight.

Outline Report

Tuesday 31st: The scientific party travelled to Hull and loaded equipment on board the 'Sea Vigil' during the evening.

Wednesday 1st: The vessel locked out of the marina at 09:30hr to test equipment and for trials of the Undulating Oceanographic Recorder (UOR). A trial tow was started at 10:15hr and completed by 10:25hr. This done, a vertical profile was

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taken and an axial survey of the estuary was started. The parameters measured during the vertical profiles were:-

light spectra	PRR 600
light penetration	Secchi disc

Underway surveying was started from approximately off North Killingholm and continued along an axial track following the main navigation channel to seaward. Underway measurements were made on board the vessel of:-

salinity	
temperature	
chlorophyll fluorescence	logged by the 'QUBIT' system
suspended solids (unreliable)	along with time and position data
dissolved oxygen (not calibrated)	

At half hourly intervals along this track, water samples were taken from a pumped supply collecting water from 1m below surface for the determination of:

- suspended solids (by gravimetry)
- chlorophyll a (by subsequent acetone extraction)
- particle size distribution (Malvern)
- phytoplankton (Lugols Iodine -preserved)
- salinity (by precision salinometer)
- PAR (Biospherics logged at 15 seconds frequency)

The Undulating Oceanographic Recorder (UOR) was deployed off South Killingholme and was towed out to the Humber Light Float and back to the Spurn Light Float (see Table 1 for details).

The UOR carried sensors for:

- salinity
- temperature
- depth
- fluorescence
- light transmission
- suspended solids
- up and down welling light.

At the Spurn Light float, in-water light profiles were taken to coincide with the aircraft overflights along flight line 3 (Figure 1). Vertical profiles were also carried out at the Humber Light Float and off Bull Sand Fort (see Table 2 for details). The locations of the flight lines are identical to those used in SV2 (2nd-5th August 93).

Thursday 2nd Sept: Instalation of recording instruments from the shore.

Friday 3rd Sept: The scientific party returned to Plymouth.

Scientific observations

Particle size analysis have been completed for this cruise (and the previous cruises: SV1 & SV2). The measurements were carried out using a Malvern, laser-diffraction particle sizer on stored samples. Storage of samples gives rise to processes which may adversely affect the characteristics of the particles: 1) Fragile aggregates can be disrupted during sampling and during bottle filling. 2) Aggregation may occur in sediments in the sample bottles during periods of storage. 3) Biological particles (planktonic cells) may continue to grow and divide initially but may then die and degrade during prolonged storage. These data, particularly the high salinity, low particle concentration results should be viewed with caution and future work should aim for *in-situ* or, at least, on-board size analysis. The results are summarised in Figure 2 and 3 with this report.

The general trend with all three data sets (Figure 2) is for the median particle diameter (diameter of the 50th percentile, volume or mass) to increase with salinity and with decreasing suspended particle load. This is most pronounced in the SV1 data where the offshore region was characterised by very high phytoplankton productivity at the time of sampling. The SV2 and SV3 data sets both cover more restricted ranges of salinity and suspended solids but the three data sets all fit a common, approximately exponential relationship between solids concentration and median particle size (Figure 3). The plot in Figure 3 implies that the suspended particles follow a gradient, or mixing curve, between estuarine and offshore particles. Offshore, where particle diameters range from 30-130um at lowest particle concentrations the majority of the particles might be expected to be of biological origin or highly influenced by the biota. At the other extreme, where particle concentrations maximise, sizes fall to a uniform minimum diameter of 20-30um which is consistent with the majority of material being primarily silt-sized mineral grains.

All the analytical measurements required for the calibration of data collected on the cruises SV1-SV3 have now been completed and data files will be passed to BODC very shortly.

Prepared by Tony Bale

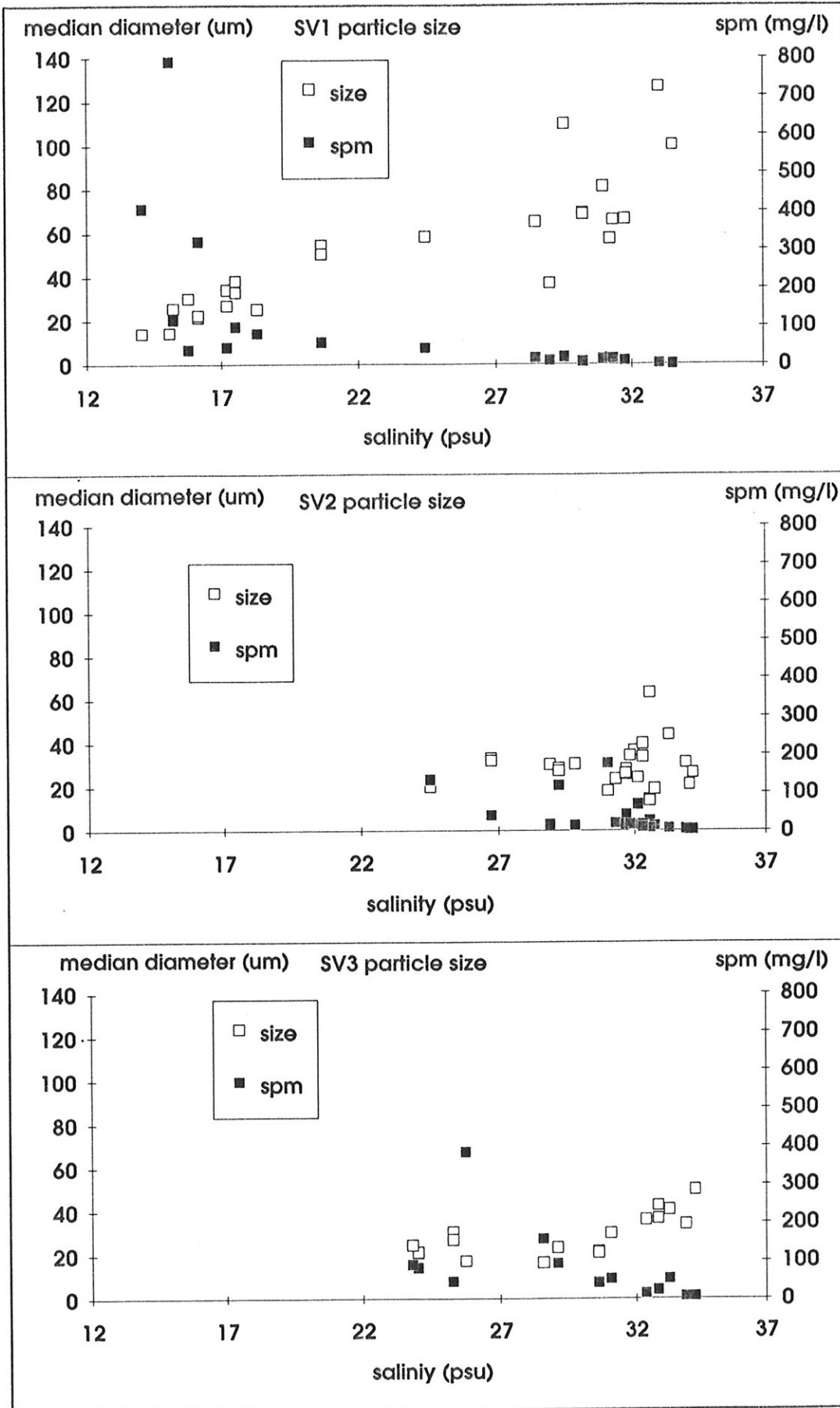
Table 1. Details of the UOR tows: SV3; (times = GMT)

Tow	start time	date	start position	end time	end position
H993012	09:57	01/09	N 53° 40.54 W 00° 13.10	12:38	N 53° 34.31 E 00° 14.45
H993013	13:35	01/09	N 53° 33.99 E 00° 14.42	17:26	N 03° 37.18 W 00° 05.93

Table 2. Details of the vertical profile stations

file	Lat	Lon	date	comments
B	N 53° 33.95	E 0° 14.49	1/9	13:16hr
E	34.29	14.44	1/9	13:35
F	34.36	14.48	1/9	13:40
G	36.20	20.63	1/9	15:44
I	33.90	14.37	1/9	16:31

Figure 2



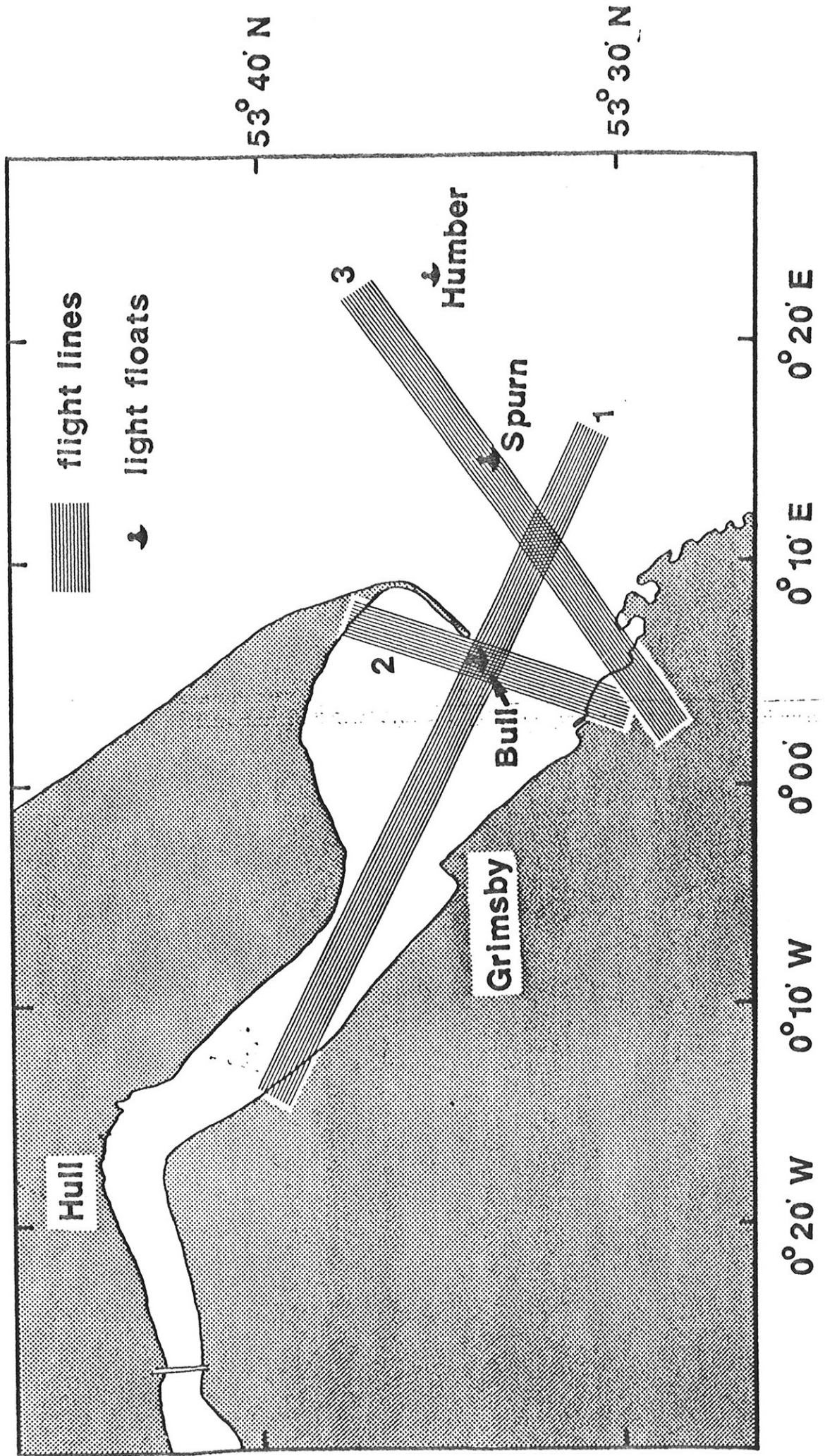


Figure 1

Figure 3

