

**REMOTE SENSING DATA ANALYSIS SERVICE
ANNUAL REPORT APRIL 2002 – MARCH 2003
ANNEXES**

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MISSION STATEMENT
of the
REMOTE SENSING DATA ANALYSIS SERVICE FACILITY

The mission of RSDAS is to research & develop, implement, and operate systems for cost effective processing and analysis of remote sensing data in collaboration with, or on behalf of, the NERC and UK academic communities.

- * RSDAS will supply data products to customers in a timely fashion appropriate to customer's reasonable requirements.
- * RSDAS will provide services *complementary* to those reliably available through NASA or ESA.
- * RSDAS will ensure data products meet international standards for formats or quality where defined.
- * RSDAS will provide advice on processing satellite data to ensure efficient use of resources throughout the community.

In order to achieve its mission the RSDAS will:

- maintain awareness of developments in the remote sensing/image analysis fields, and act as a point of contact with NASA-GSFC, NASA-JPL, NOAA, NMC, to ensure changes or updates to processing systems, or new methodologies, are implemented in a timely manner, and to ensure advice is up-to-date;
- maintain awareness of its customers' needs through regular contact;
- actively seek funding opportunities for its customers and itself;
- maintain close contact with the Dundee Satellite Receiving Station staff and the NERC Earth Observation Data Centre;
- provide services to customers through peer-reviewed application and will itself apply for funding through peer-review;
- undertake small exploratory research and development projects to investigate the feasibility and scope of new services or research areas, and to justify CR funding.

User Communities

The NSS Remote Sensing Data Analysis Service will provide specialist services to the Environmental Sciences community supporting Council's remit to promote and support high quality research thereby meeting the needs of the User Communities identified in the NERC Mission.

PML/SPD May 2000

ANNEX 2: STEERING COMMITTEE MEMBERSHIP AND TOR

REMIT AND TERMS OF REFERENCE FOR THE NERC SATELLITE RECEIVING STATION STEERING COMMITTEE

Remit

The NERC Satellite Receiving Station Steering Committee exists to:

- review applications for use of data from the Satellite Receiving Station
- monitor outputs from the Satellite Receiving Station
- provide advice to Director, Science Programmes on aspects of the operations of the Satellite Receiving Station .

Director, Science Programmes, in turn, provides advice to the Science and Technology Board of Council on Services and Facilities relevant to their remit.

Terms of Reference

1. To review applications and establish priorities, for the Head of the Station, for the allocation of those of the Station's resources funded from NSS science budget, taking into account recommendations made through the NERC peer review mechanisms.
2. To review the science quality of work undertaken by users utilising data from the Station based on reports and publications.
3. To monitor the level of user satisfaction with the service and to analyse the user base.
4. To give guidance to the Head of the Station on improvement of the Station's equipment and on its service function.
5. To advise Director, Science Programmes on:
 - a. the level and direction of the internal R&D programme for the Station.
 - b. anticipated changes in requirements from the Station and the anticipated levels of future demand for data from the Station.
6. To receive annually a report from the Head of the Station and to comment thereon as appropriate prior to submission of the report to the Director, Science Programmes.
- 6a. To also receive annually a report from the NERC Earth Observation Data Centre and to comment thereon as appropriate prior to submission of the report to the Director, Science Programmes.
- 6b. To also receive annually a report form the Remote Sensing Data Analysis Service and to comment thereon as appropriate prior to submission of the report to the Director, Science programmes.
7. To provide advice to the Director, Science Programmes at other times as appropriate.

Membership Constraints

Membership of the Committee will be decided by Director, Science Programmes with advice from the Science and Technology Board and suggestions from the Committee itself. It will include the Head of the Station and a representative from the Science Programmes Directorate.

Members, other than ex-officio members will be invited to serve for a term of up to four years with a maximum extension of a further two years. The Chairman will serve a maximum of four years.

**NERC DUNDEE SATELLITE RECEIVING STATION STEERING COMMITTEE
MEMBERSHIP AS AT OCTOBER 2001**

Mr Trevor Guymer (Chairman) 6/00	James Rennell Division for Ocean Circulation & Climate Southampton Oceanography Centre European Way Southampton SO14 3ZH	thg@soc.soton.ac.uk Tel: (+44) 23 80596 430 Fax: (+44) 23 80596 204
Dr Gay Mitchelson-Jacob 6/00	Centre for Applied Oceanography Marine Science Laboratories Menai Bridge Anglesey LL59 5EY	egm@bangor.ac.uk Tel: +44 1248 713808 Fax: +44 1248 716729
Dr Steven Wilson 6/00	Earth Observation Programme British National Space Centre 151 Buckingham Palace Road London SW1 9SS	steven.wilson@nerc.ac.uk Tel: 020 7215 1422 Fax: 020 7821 5387
Dr Jo D Haigh 6/00	Imperial College Space and Atmospheric Physics The Blackett Laboratory Imperial College of Science, Technology London SW7 2BZ	j.haigh@ic.ac.uk Tel: 020 7594 7671 Fax: 020 7594 7900
Dr John Turner 10/01	British Antarctic Survey High Cross Madingley Road Cambridge CB3 0ET	j.turner@bas.ac.uk Tel: 01223 221485 Fax: 01223 362616
Dr Robert Bryant 10/01	Department of Geography University of Sheffield Winter Street Sheffield S10 2TN	r.g.bryant@sheffield.ac.uk Tel: 0114 222 7966 Fax: 0114 279 7912
<u>Ex Officio</u>		
Dr Steve Parkes	NERC Satellite Receiving Station Department of Applied Computing University of Dundee Dundee DD1 4HN	sparkes@computing.dundee.ac.uk Tel: +44 01382 345194 Fax: +44 01382 202575
Mr Stephen Groom	RSDAS Plymouth Marine Laboratory Prospect Place West Hoe Plymouth PL1 3DH	sbg@pml.ac.uk Tel: 01752 633150 Fax: 01752 633101
Dr Peter Miller	RSDAS Plymouth Marine Laboratory Prospect Place West Hoe Plymouth PL1 3DH	pim@pml.ac.uk Tel: 01752 633485 Fax: 01752 633101

Dr Stuart White	Room 119, Building R25 Rutherford Appleton Laboratory (RAL) Space Sciences Department Chilton Didcot OX11 0QX	s.j.white@rl.ac.uk Tel: 01235 446168 Fax: 01235 445848
Dr Lin Kay	NERC Science Programmes Directorate Polaris House North Star Avenue Swindon SN2 1EU	rlfk@wpo.nerc.ac.uk Tel: 01793 411600 Fax: 01793 411610
Mr Peter Purcell	NERC Science Programmes Directorate Polaris House North Star Avenue Swindon SN2 1EU	ppu@wpo.nerc.ac.uk Tel: 01793 411649 Fax: 01793 411610
Mr Neil Lonie (Secretary)	NERC Satellite Receiving Station Satellite Receiving Station Department of A.P.E.M.E University of Dundee Perth Road Dundee DD1 4HN	ntl@sat.dundee.ac.uk Tel: 01382 344409 Fax: 01382 202575

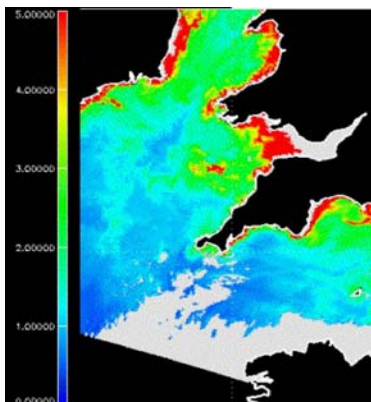
ANNEX 3: EQUIPMENT INVENTORY

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ANNEX 4: FUTURE DEVELOPMENTS

RSDAS is undertaking four development activities, as noted below, supported through the NERC funding. Due to the impending review of RSDAS by the next Services Review Group in January 2004 we aim to complete significant parts of each for inclusion with the paper submission in Nov. 2003. We would, however, welcome advice from the DSRSSC on the relative priorities.

1) MODIS Ocean Colour RSDAS have received additional funding from NERC to enable development of ocean colour products from the NASA Moderate Resolution Spectroradiometer series of instruments. There are two MODIS instruments in orbit on-board Terra & Aqua. Data from both system are transmitted in near-real time and are received & archived at Dundee. MODIS is important since it is NASA's principal ocean colour, SST and medium resolution land observation instrument and will be followed by similar instruments over the next 12 years. Furthermore, SeaWiFS has a nominal lifetime of 5 years from launch in 1997 and so is now in "borrowed time". Up to Dec 2002 the University of Wisconsin level 1 (IMAPP) software had been implemented, but the NASA Level 1-2 ocean colour software was only provided in Jan 2003. Dr Land attended the MODIS users' meeting in Feb 03 at Boston, and was advised to use the NASA version of the level-1 software instead of IMAPP. The implementation to run with Dundee MODIS is ongoing and by June/July 2003 we expect to have a near real time MODIS service running.



MODIS level 2 chlorophyll-a image for 7 April 2002.

2) PANORAMA re-write As reported last year a start has been made on re-writing much of PANORAMA, the automated processing system at the heart of RSDAS near-real time support, to take advantage of new equipment and new methods and to allow for addition of new sensors. The development will continue during the coming year with an aim of finishing the project during the financial year.

3) Upgrade of computing facilities: As noted above the RSDAS file, backup, and web servers have or will be upgraded along with addition of significant new disk storage

4) Airborne Remote Sensing Sensor Atmospheric Correction: the work detailed in the overview and activities section will be continued during 2003/4. The aim is to upgrade the case 1 AC and complete implementation of the case 2 algorithms.

PML will also undertake research and development funded externally to RSDAS but which will enable upgrades to the service perceived by NERC users:

- **Envisat Data:** the new ESA Envisat satellite has a number of new sensors that can support new and improved areas of science such as MERIS high quality 300m resolution ocean colour. Through EC funding PML will be investigating near-real time capabilities of MERIS. The results would be available as a possible additional RSDAS service.
- **Spatially enabled internet applications/e-Science:** funding from the EC will support the establishment of an Open GIS Consortium compliant MapServer based system to serve georeferenced images for use in coastal monitoring systems or models.
- **Marine Productivity:** NERC and EC funding has enabled development of methods for the production of phytoplankton primary production maps; during the year these will be made available through the standard RSDAS mechanisms.
- **Link with BADC:** RSDAS is pursuing joint funding with the NEODC to enable MODIS and other data to be made available through the data centre.

ANNEX 5: SUMMARY OF PERFORMANCE INFORMATION

5.1 APPLICATION GRADES

RSDAS supports UK scientists who have submitted an application form either to RSDAS or DSRS. Applications expected to 'cost' greater than £500 are peer-reviewed by the DSRSSC on an ongoing basis, so that the grading is known before undertaking the work. Applications are also accepted on-line for access to pre-processed imagery available via the RSDAS web site, which logs the images accessed by authorised users in a database.

During this year RSDAS supported 36 applications, 18 of which were new applications. All applications were successful, occasionally following clarification of queries raised by reviewers. The new applications were graded as follows:

APPLICATIONS: DISTRIBUTION OF GRADES (Received during current FY only — 2002/03)								
	$\alpha 5$	$\alpha 4$	$\alpha 3$	$\alpha 2$	$\alpha 1$	β	R*/Pilot	Reject
NERC Grant projects		4						
Other academic		6	3					
Students		1	4					
Pilot								
TOTAL: 18		11	7					

5.2 DISTRIBUTION OF PROJECTS

The applications can be mapped onto NERC's Science Areas and Environment and Natural Resource Issues (ENRI's), as a percentage of the Full Cash Cost:

Science Area	Number of Projects	Allocated Cost (%)
Science-based Archaeology	-	0
Earth	1	5
Marine	24	76
Atmospheric	1	1
Terrestrial and Freshwater	2	11
Earth Observation	8	7
Polar	-	0
TOTAL	36	100

ENRI	Number of Projects	Allocated Cost (%)
Biodiversity	8	21
Environmental Risks	13	12
Global Change	27	24
Natural Resource Mgmt.	22	35
Pollution and Waste	6	8
Other	0	0
TOTAL	-	100

5.3: APPLICATIONS SUPPORTED DURING FY 2002/2003

Name of User (Surname First)	University/ Institute	Proposal title	Funding Mode	Funding type	NERC Ref. No	Grading	Biodi- versity	Env Risks	Global change	Nat RM	P & W	Other
Lavender Dr Sam	Univ. Plymouth	Development of algorithms for processing ocean colour imagery from European coastal waters		O		a5			1	1	1	
Turrell Dr Bill	Mar. Lab. Aberdeen	Monitoring the Atlantic Inflow toward the Arctic (MAIA)		O		a4			1			
Harris Dr Andy	Open University	Emplacement of lava flow fields and tube systems at Etna volcano: satellite insights		O		a4		1				
Srokosz Dr Meric	SOC	FISHES	CS	O		a4			1	1		
Lane Dr Andrew	Proudman Oc. Lab.	Spatial and temporal distribution of suspended sediments in the Southern North Sea	CS	O		a4				1	1	
Mitchelson-Jacob Dr	Univ Wales Bangor	Suspended particulate matter concentrations in shelf seas from remotely-sensed colour imagery	NT	S		a3	1			1	1	
Macleod Ms Kelly	Nat. Resources Inst.	Habitat assessment of cetaceans off the west coast of Scotland		S		a3			1	1		
Da Silva Dr Jose	SOC	Multi-sensor imaging of ocean organic films and sea surface slicks		O		a4			1	1		
Robinson Prof Ian	SOC	Study of coastal processes in the North Sea by combined analysis of satellite imagery from ERS-2 SAR, AVHRR and SeaWiFS		O		a4			1			
Groom Mr. Steve	Plymouth Mar. Lab.	In-house research	INF	O		-		1	1	1		
Moffat Dr Collin	Mar. Lab. Aberdeen	Investigation into harmful algae bloom in Shetlands	CS	O		a3		1		1		
Burrows Dr Mike	Dunstaffnage Mar. Lab.	SAMS Northern Seas Programme	T	R	GST/02/2757	a4	1		1	1		
Sims Dr David	Marine Biological Assoc	Effects of zooplankton gradients in fronts on the foraging and migration behaviour of basking sharks		O		a4			1	1		
Gaffney Mr Sean	Univ. Wales Bangor	Inherent optical properties of marine particle suspensions and influence on Case II R.S. reflectance	NT	R	GR3/12903	a4		1	1			
Bowers Dr David	Univ. Wales Bangor	Suspended sediment dynamics in the Irish Sea: testing ideas against satellite observations	NT	S	NER/S/A/2001/06379	a4			1	1		
Hydes Dr David	SOC	Biophysical interactions and controls on export production (BICEP): FerryBox	CS	O		a4			1	1	1	
Tyrrell Dr Toby	SOC	Modelling the seasonal succession of <i>Emiliana huxleyi</i> and other phytoplankton in the Bering sea.	CS	S		a4			1			

Evans-Jones Dr Kate	Plymouth Mar. Lab.	In-house development: rewrite processing software	INF	O		-		1	1	1		
Proctor Dr Roger	Proudman Oc. Lab.	POLCOMS development	CS	O		a4		1	1	1	1	
Turrell Dr Bill	Mar. Lab. Aberdeen	Relationship between mesoscale circulation and biological productivity of the Faroe-Shetland Channel.		S		a3			1	1		
Weeks Dr Alison	SOC	SCIPIO: Validation of MERIS in Mascarene Ridge, Indian Ocean	CS	O		a4	1		1	1		
Gimona Dr A.	Mar. Lab. Aberdeen	Acoustic and satellite remote sensing to estimate abundance of North Sea Herring		O		a3				1		
Horsburgh Dr Kevin	Univ. Wales Bangor	Novel observation of frontal exchange and recirculation (NOFEAR)	NT	R	NER/M/S/2001/00091	a4		1		1		
Cunningham Dr Alex	Univ. Strathclyde	Relating satellite imagery to seawater composition in Case II shelf seas	NT	R	GR3/12903	a4				1		
Attrill Dr Martin	Univ. Plymouth	Large scale spatial patterns of sandy beach macrofauna community composition		S		a3	1					
Holligan Prof Patrick	SOC	Physical-biological control of new production within the seasonal thermocline	NT	R	NER/A/S/2001/00449	a4			1	1		
Robinson Prof Ian	SOC	Evaluation of ISAR radiometer in the Western English Channel, Bay of Biscay and Celtic Sea area	CS	O		a4		1	1			
Huntley Prof David	Univ. Plymouth	Further analysis of current meter data using satellite data and imagery	NT	S	NER/S/M/2001/06579	a3		1	1			
Robinson Prof Ian	SOC	Synergy between SAR and other remote sensors in European coastal waters	CS	O		a3		1	1			
Lavender Dr Sam	Univ. Plymouth	Accuracy of MICROTOPS sun photometer		S		a3			1			
Korb Dr Rebecca	British Antarctic Survey	Phytoplankton and zooplankton production throughout the Scotia Sea, Southern Ocean	NT	S		a3	1			1		
Carbone Dr Chris	Institute of Zoology	Determinants of body size variation in Marine Iguanas		O		a4	1		1			
Lampitt Dr Richard	SOC	Biophysical interactions and controls on export production (BICEP): ANIMATE	CS	O		a4			1			
Mountford Dr Nick	Marine Biological Assoc	Marine Environmental Change Network (MECN)		O		a4		1	1	1		
Belmont Dr Mike	Univ. Exeter	First deterministic sea-wave prediction (DSWP) system for moving ship and fixed site applications		O		a4						
Jones Dr Leigh	English Nature	Marine Natural Areas project		O		a3	1	1			1	
Lavender Dr Sam	Univ. Plymouth	Atlantic Meridional Transect (AMT) Programme	Consortium	R	NER/O/S/2001/00680	a4	1		1			

Allen Dr John	SOC	How are ocean phytoplankton affected by mesoscale eddies and fronts?	CS	S		a4			1			
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SERVICES AND FACILITIES COST ALLOCATIONS FORM 2002/3

Scientific Service: Remote Sensing Data Analysis Service

Full Cash Cost = 154140.00

UNIT PRICING		Enter price here
Unit Price 1	H50 hours	£28
Unit Price 2	S0/A50 hours	£18
Unit Price 3	Routine/web images	£3
Unit Price 4	Archive/external images	£5
Unit Price 5	Composite images	£13
Unit Price 6	Real-time support days	£100

NERC	University/Centre	Department/NERC site	Name of User (Surname First)	Funding Mode	Funding Type	NERC Ref No	A	E	M	T	E	S	P	B	E	G	N	P	O	Unit 1: H50 hrs	Unit 2: S0 hrs	Unit 3: Routine	Unit 4: Archive	Unit 5: Comp.	Unit 6: Cruise	£s
	Univ. Plymouth	Marine Studies	Lavender Dr Sam		O															1	5	88			382	
	Mar. Lab. Aberdeen	Fisheries Research	Turrell Dr Bill		O															1	5	67			319	
	Open University	Earth Sciences	Harris Dr Andy		O															5	10	1566		30	8,018	
Y	SOC		Srokosz Dr Menic	CS	O															1	5	1162			3,604	
	Proudman Oc. Lab.		Lane Dr Andrew	CS	O															4	20		3375		17,887	
	Univ. Wales Bangor	Ocean Sciences	Mitchelson-Jacob Dr	NT	S															10	5	346	33		1,573	
	Nat. Resources Inst.		Macleod Ms Kelly		S															1	5	25			193	
	SOC	Ocean and Earth Sci.	Da Silva Dr Jose		O															1	5	1165			3,613	
	SOC	Ocean and Earth Sci	Robinson Prof Ian		O															1	5	20			178	
Y	Plymouth Mar. Lab.	In-house research	Groom Mr. Steve	INF	O															40	40				1,840	
	Mar. Lab. Aberdeen	Fisheries Research	Moffat Dr Collin	CS	O															5	5	70		3	740	
Y	Dunstaffnage Mar. Lab.	SAMS	Burrows Dr Mike	T	R	GST/02/2757														1	10	962			3,094	
Y	Marine Biological Assoc		Sims Dr David		O															1	5	1735			5,323	
Y	Univ. Wales Bangor	Ocean Sciences	Gaffney Mr Sean	NT	R	GR3/12903														2	10	5	5		276	
Y	Univ. Wales Bangor	Ocean Sciences	Bowers Dr David	NT	S	NER/S/A/2001.06379														1	5	17			169	
Y	SOC	George Deacon Division	Hydes Dr David	CS	O															20	30	1095	118		5,971	
Y	SOC		Tyrell Dr Toby	CS	S															10	15		693	44	17	6,306
Y	Plymouth Mar. Lab.	In-house development	Evans-Jones Dr Kate	INF	O															200	150				8,300	
Y	Proudman Oc. Lab.		Proctor Dr Roger	CS	O															10	5	1075			3,595	
	Mar. Lab. Aberdeen		Turrell Dr Bill		S															1	5	1305	116	58	11,392	
Y	SOC	Ocean and Earth Sci.	Weeks Dr Alison	CS	O															20	40		738	53	54	11,082
	Mar. Lab. Aberdeen		Gimona Dr A		O															5	10		214	1	1,403	
Y	Univ. Wales Bangor	Ocean Sciences	Horsburgh Dr Kevin	NT	R	NER/M/S/2001.00091														10	5	130			23	3,060
Y	Univ. Strathclyde	Physics and Applied Physics	Cunningham Dr Alex	NT	R	GR3/12903														1	5	144	14		24	3,138
	Univ. Plymouth	Benthic Ecology Research	Atrill Dr Martin		S															10	10	4654	127		16,129	
Y	SOC	Ocean and Earth Sci.	Holligan Prof Patrick	NT	R	NER/A/S/2001.00449														7	5	504	70	28	5,539	
Y	SOC	Ocean and Earth Sci.	Robinson Prof Ian	CS	O															5	10	640			2,240	
Y	Univ. Plymouth	Marine Studies	Huntley Prof David	NT	S	NER/S/M/2001.06579														2	20			23	725	
Y	SOC	Ocean and Earth Sci.	Robinson Prof Ian	CS	O															1	10		210		1,258	
	Univ. Plymouth	Marine Studies	Lavender Dr Sam		S															5				10	274	
Y	British Antarctic Survey		Korb Dr Rebecca	NT	S															30	10		1384	494	63	20,879
Y	Institute of Zoology		Carbone Dr Chris		O															1	5				140	
Y	SOC	George Deacon Division	Lampitt Dr Richard	CS	O															5	5				230	
	Marine Biological Assoc		Mountford Dr Nick		O															2	5		267		3,734	
	Univ. Exeter	Engineering, Comp, Maths	Belmont Dr Mike		O															5		100			440	
	English Nature		Jones Dr Leigh		O															5	30			12	841	
	Univ. Plymouth	Marine Studies	Lavender Dr Sam	Consortium	R	NER/O/S/2001.00680														1	1				196	
	SOC	Ocean and Earth Sci	Allen Dr John	CS	S															2					56	
																									0	
																									0	
Totals																				443	540	16875	6652	1349	300	154,140
Total value per unit £																				12,404	9,720	50,625	33,260	18,131	30,000	

ANNEX 6: RSDAS PUBLICATIONS FOR CALENDER YEAR 2002

RSDAS staff in bold.

REFEREED PAPERS (32)

- Alvarez-Salgado, X.A., S. Beloso, I. Joint, E. Nogueira, L. Chou, F.F. Perez, S. **Groom**, J.M. Cabanas, A.P. Rees, and M. Elskens, New production of the NW Iberian shelf during the upwelling season over the period 1982-1999, *Deep-Sea Research Part I*, 49, 1725-1739, 2002.
- Archer, S.D., F.J. Gilbert, P.D. Nightingale, M.V. Zubkov, A.H. Taylor, G.C. Smith, and P.H. Burkill, Transformation of dimethylsulphoniopropionate to dimethyl sulphide during summer in the North Sea with an examination of key processes via a modelling approach, *Deep-Sea Research Part II-Topical Studies in Oceanography*, 49 (15), 3067-3101, 2002.
- Archer, S.D., G.C. Smith, P.D. Nightingale, C.E. Widdicombe, G.A. Tarran, A.P. Rees, and P.H. Burkill, Dynamics of particulate dimethylsulphoniopropionate during a Lagrangian experiment in the northern North Sea, *Deep-Sea Research Part II-Topical Studies in Oceanography*, 49 (15), 2979-2999, 2002.
- Barlow, R.G., J. Aiken, P.M. Holligan, D.G. Cummings, S. Maritorena, and S. Hooker, Phytoplankton pigment and absorption characteristics along meridional transects in the Atlantic Ocean, *Deep-Sea Research Part I-Oceanographic Research Papers*, 49 (4), 637-660, 2002.
- Borges, A.V., and M. Frankignoulle, Distribution of surface carbon dioxide and air-sea exchange in the upwelling system off the Galician coast, *Global Biogeochemical Cycles*, 16 (2), art. no.-1020, 2002.
- Bowers, D.G., S. Gaffney, M. White, and P. Bowyer, Turbidity in the southern Irish Sea, *Continental Shelf Research*, 22 (15), 2115-2126, 2002.
- Burkill, P.H., S.D. Archer, C. Robinson, P.D. Nightingale, S.B. **Groom**, G.A. Tarran, and M.V. Zubkov, Dimethyl sulphide biogeochemistry within a coccolithophore bloom (DISCO): an overview, *Deep-Sea Research Part II-Topical Studies in Oceanography*, 49 (15), 2863-2885, 2002.
- Caldeira**, R.M.A., S.B. **Groom**, P.I. **Miller**, D. Pilgrim, and N.P. Nezlin, Sea surface signatures of the island mass effect phenomena around Madeira Island, NE Atlantic, *Remote Sensing of the Environment*, 80, 336-360, 2002.
- da Silva, J.C.B., A.L. New, M.A. Srokosz, and T.J. **Smyth**, On the observability of internal tidal waves in remotely-sensed ocean colour data, *Geophysical Research Letters*, 29 (12), art. no.-1569, 2002.
- Fileman, E.S., D.G. Cummings, and C.A. Llewellyn, Microplankton community structure and the impact of microzooplankton grazing during an *Emiliania huxleyi* bloom, off the Devon coast, *Journal of the Marine Biological Association of the United Kingdom*, 82 (3), 359-368, 2002.
- Froidefond, J.M., S. Lavender, P. Laborde, A. Herbland, and V. Lafon, SeaWiFS data interpretation in a coastal area in the Bay of Biscay, *International Journal of Remote Sensing*, 23 (5), 881-904, 2002.
- Harris, A.J.L., and M. Neri, Volumetric observations during paroxysmal eruptions at Mount Etna: pressurized drainage of a shallow chamber or pulsed supply?, *Journal of Volcanology and Geothermal Research*, 116 (1-2), 79-95, 2002.
- Huthnance, J.M., H.M. Van Aken, M. White, E.D. Barton, B. Le Cann, E.F. Coelho, E.A. Fanjul, P. **Miller**, and J. Vitorino, Ocean margin exchange - water flux estimates, *Journal of Marine Systems*, 32 (1-3), 107-137, 2002.
- Joint**, I., S.B. **Groom**, R. Wollast, L. Chou, G.H. Tilstone, F.G. Figueiras, M. Loijens, and T.J. **Smyth**, The response of phytoplankton production to periodic upwelling and relaxation events at the Iberian shelf break: estimates by the C-14 method and by satellite remote sensing, *Journal of Marine Systems*, 32 (1-3), 219-238, 2002.
- Lampert, L., B. Queguiner, T. Labasque, A. Pichon, and N. Lebreton, Spatial variability of phytoplankton composition and biomass on the eastern continental shelf of the Bay of Biscay (north-east Atlantic Ocean). Evidence for a bloom of *Emiliania huxleyi* (Prymnesiophyceae) in spring 1998, *Continental Shelf Research*, 22 (8), 1225-1247, 2002.
- Lefevre, N., J. Aiken, J. Rutllant, G. Daneri, S. Lavender, and T. **Smyth**, Observations of pCO₂ in the coastal upwelling off Chile: Spatial and temporal extrapolation using satellite data, *Journal of Geophysical Research-Oceans*, 107 (C6), art. no.-3055, 2002.
- Martin, A.P., and M.A. Srokosz, Plankton distribution spectra: inter-size class variability and the relative slopes for phytoplankton and zooplankton, *Geophysical Research Letters*, 29 (24), 66.1-66.4 (Supported cruise), 2002.
- Popova, E.E., C.J. Lozano, M.A. Srokosz, M.J.R. Fasham, P.J. Haley, and A.R. Robinson, Coupled 3D physical and biological modelling of the mesoscale variability observed in North-East Atlantic in spring 1997: biological processes, *Deep-Sea Research Part I-Oceanographic Research Papers*, 49 (10), 1741-1768 (Supported cruise), 2002.
- Popova, E.E., M.A. Srokosz, and D.A. Smeed, Real-time forecasting of biological and physical dynamics at the Iceland-Faeroes Front in June 2001, *Geophysical Research Letters*, 29 (4), art. no.-1055, 2002.
- Rees, A.P., E. Malcolm, S. Woodward, C. Robinson, D.G. Cummings, G.A. Tarran, and I. Joint, Size-fractionated nitrogen uptake and carbon fixation during a developing coccolithophore bloom in the North Sea during June 1999, *Deep-Sea Research Part II-Topical Studies in Oceanography*, 49 (15), 2905-2927, 2002.
- Relvas, P., and E.D. Barton, Mesoscale patterns in the Cape Sao Vicente (Iberian Peninsula) upwelling region, *Journal of Geophysical Research-Oceans*, 107 (C10), art. no.-3164, 2002.
- Ridgwell, A.J., Dust in the Earth system: the biogeochemical linking of land, air and sea, *Philosophical Transactions of the Royal Society of London Series a-Mathematical Physical and Engineering Sciences*, 360 (1801), 2905-2924, 2002.

- Robinson, C., C.E. Widdicombe, M.V. Zubkov, G.A. Tarran, A.E.J. Miller, and A.P. Rees, Plankton community respiration during a coccolithophore bloom, *Deep-Sea Research Part II-Topical Studies in Oceanography*, 49 (15), 2929-2950, 2002.
- Robinson, C., P. Serret, G. Tilstone, E. Teira, M.V. Zubkov, A.P. Rees, and E.M.S. Woodward, Plankton respiration in the Eastern Atlantic Ocean, *Deep-Sea Research Part I-Oceanographic Research Papers*, 49 (5), 787-813, 2002.
- Scourse, J.D., and W.E.N. Austin, Quaternary shelf sea palaeoceanography: recent developments in Europe, *Marine Geology*, 191 (3-4), 87-94, 2002.
- Sherwin, T.J., M.E. Inall, and R. Torres, The seasonal and spatial variability of small-scale turbulence at the Iberian margin, *Journal of Marine Research*, 60 (1), 73-100, 2002.
- Sims, D.W., and E.J. Southall, Occurrence of ocean sunfish, *Mola mola* near fronts in the western English Channel, *Journal of the Marine Biological Association of the United Kingdom*, 82 (5), 927-928, 2002.
- Smyth**, T.J., G.F. Moore, S.B. **Groom**, P.E. **Land**, and T. Tyrrell, Optical modelling and measurements of a coccolithophore bloom, *Applied Optics*, 41 (36), 7679-7688, 2002.
- Smyth**, T.J., S.B. **Groom**, D.G. Cummings, and C.A. Llewellyn, Comparison of SeaWiFS bio-optical chlorophyll-a algorithms within the OMEX II programme, *International Journal of Remote Sensing*, 23 (11), 2321-2326, 2002.
- Steinke, M., G. Malin, S.D. Archer, P.H. Burkill, and P.S. Liss, DMS production in a coccolithophorid bloom: evidence for the importance of dinoflagellate DMSP lyases, *Aquatic Microbial Ecology*, 26 (3), 259-270, 2002.
- Tarling, G.A., T. Jarvis, S.M. Emsley, and J.B.L. Matthews, Midnight sinking behaviour in *Calanus finmarchicus*: a response to satiation or krill predation?, *Marine Ecology-Progress Series*, 240, 183-194, 2002.
- Wilson, W.H., G.A. Tarran, D. Schroeder, M. Cox, J. Oke, and G. Malin, Isolation of viruses responsible for the demise of an *Emiliania huxleyi* bloom in the English Channel, *Journal of the Marine Biological Association of the United Kingdom*, 82 (3), 369-377, 2002.

NON-REFEREED PUBLICATIONS AND CONFERENCE PROCEEDINGS (34)

- Amorim, A., M.T. Moita, and P. Oliveira, Dinoflagellate blooms related to coastal upwelling plumes off Portugal (Poster Abstract), in *Xth International Conference on Harmful Algae*, Florida, 2002.
- Binding, C.E., D.G. Bowers, and E.G. Mitchelson-Jacob, An algorithm for the retrieval of suspended sediment concentrations in the Irish Sea from SeaWiFS ocean colour satellite imagery (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Fileman, E., and P. Burkill, The spatial and seasonal distribution of microzooplankton at the NW Iberian margin (Poster Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Froidefond, J.M., P. **Miller**, A.M. Jégou, and P. Lazure, Surface structures observed on the Bay of Biscay continental shelf from SeaWiFS data (Abstract), in *8th International Symposium on Oceanography of the Bay of Biscay*, pp. 4, Gijón, Spain, 2002.
- Holt, J., R. Proctor, J. Blackford, and J.I. Allen, Three-Dimensional Eddy Resolved Modelling in the Irish Sea: A test bed for ecosystem models (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Howarth, J., P. Knight, R. Proctor, A. Lane, and J. Walkley, The POL Coastal Observatory (Poster Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Hydes, D.J., A. Yool, J.M. Campbell, N.A. Crisp, J. Dodgson, B. Dupee, M. Edwards, S.E. Hartman, B.A. Kelly-Gerreyn, A.M. Lavin, C.M. González-Pola, and P. **Miller**, Use of a Ferrybox system to look at shelf sea and ocean margin processes, in *3rd EuroGOOS Conference: Building the European Capacity in Operational Oceanography*, Athens, Greece, 2002.
- Jégou, A.M., P. **Miller**, J.M. Froidefond, and P. Lazure, Seasonal thermal structures from remote sensing on the Bay of Biscay continental shelf (Abstract), in *8th International Symposium on Oceanography of the Bay of Biscay*, pp. 5, Gijón, Spain, 2002.
- Jorgensen, P.V., G.H. **Tilstone**, J. Hokedal, and W. Schoenfeld, Intercomparison of spectral backscattering coefficients measured in-situ using several Hydrosat instruments: Results from PlymCal-2 and REVAMP cruises, in *Proceedings of ENVISAT Validation Workshop*, European Space Agency, Frascati, Italy, 2002.
- Mahaffey, C., G. Wolff, R. Williams, and W. Anderson, Supplies of Nitrogen to subtropical gyres of the Atlantic Ocean (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- McGrane, P., and R. Raine, Celtic Voyager Cruise 02/01, 11-15 May 2001: Coccolithophorid blooms on the Continental Shelf west of Ireland, pp. 40, Martin Ryan Marine Science Institute, NUI Galway, 2002.
- Miller**, P., A.M. Jégou, and J.M. Froidefond, Composite front maps for improved visualisation of retention structures in Bay of Biscay (Abstract), in *8th International Symposium on Oceanography of the Bay of Biscay*, pp. 7, Gijón, Spain, 2002.
- Moore, C.M., M.I. Lucas, J.T. Allen, R.J. Davidson, D.A. Smeed, and A.T. Mustard, Mesoscale controls on phytoplankton community structure, physiology and production within a eutrophic open ocean frontal region (Poster Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- NERC, Putting NERC science to work: Space-saving device (monitoring of Mount Etna volcano), in *NERC Annual Report 2001-2002*, pp. 19, 2002.
- Pollard, R., S. Hay, and others including P. **Miller** and S. **Groom**, RRS Discovery cruise 258. Biophysical studies of zooplankton dynamics in the northern North Atlantic: winter, 1 Nov.-18 Dec. 2001, pp. 112, NERC, Swindon, 2002.
- Puillat, I., P. Lazure, and A.M. Jégou, Hydrological variability on the French continental shelf of the Bay of Biscay (Abstract), in *8th International Symposium on Oceanography of the Bay of Biscay*, pp. 10, Gijón, Spain, 2002.

- Revilla, R., E. Nogueira, X.A.G. Moran, L. Valdes, C. Gonzalez-Pola, J.M. Rodriguez, T. **Smyth**, and E. Cabal, Surface chlorophyll-a estimates in the Central Cantabrian Sea (Cape Peñas area) from SeaWiFS data (Poster Abstract), in *8th International Symposium on Oceanography of the Bay of Biscay*, pp. 60, Gijón, Spain, 2002.
- Richards, K., and others including P. **Miller**, K. **Evans-Jones**, T. **Smyth**, and S. **Groom**, RRS Discovery cruise 262. Biophysical studies of zooplankton dynamics in the northern North Atlantic: spring, 18 April - 27 May 2002, pp. 103, NERC, Swindon, 2002.
- Ridgwell, A.J., A dirty planet is a happy planet, in *Planet Earth*, pp. 6-7 (summer), 2002.
- Robinson, C., J. Aiken, and P. Holligan, The Atlantic Meridional Transect Programme (Poster Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Robjant, M., E.G. Mitchelson-Jacob, T.J. Sherwin, and W.R. Turrell, Influence of mesoscale circulation on biological production in the Faroe-Shetland Channel (Poster Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Savidge, G., L. Brown, R. Sanders, J. Read, M. Moore, M. Lucas, and S. **Groom**, Primary production in the Iceland Basin and adjacent waters during the spring bloom, May 2001: the FISHES Cruise (Poster Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Serret, P., C. Robinson, and E. Fernández, Biogeographic differences in the balance between plankton photosynthesis and respiration in the unproductive open ocean (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Sherwin, T.J., M.E. Inall, and R. Torres, The seasonal and spatial variability of small scale turbulence at the Iberian Margin (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Slesser, G., Cruise Report: FRV Scotia Cruise SC200211: 23 September - 7 October 2002, Marine Laboratory Aberdeen, Aberdeen, 2002.
- Sunderland Marine, Annual Review 2001, pp. 33 (Figure p. 24), Sunderland Marine Mutual Insurance Company, Sunderland, 2002.
- Tarran, G.A., A. Cunningham, P.H. Burkill, and C. Widdicombe, Autonomous phytoplankton analysis using CytoSub and Autosub: studying phytoplankton communities around the Isles of Scilly, May 2001 (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Tilstone**, G.H., V. **Martinez-Vicente**, R. Rottgers, K. Sorensen, and J. Hokedal, An inter-comparison of coloured dissolved organic material and phytoplankton absorption coefficients: Implications for MERIS data validation, in *Proceedings of the ENVISAT Validation Workshop*, European Space Agency, Frascati, Italy, 2002.
- Torres, R., E.D. Barton, P. **Miller**, and E. Fanjul, Upwelling and downwelling response to spatial patterns of wind off northwest Spain, in *European Geophysical Society XXVII General Assembly*, Nice, 2002.
- Turrell, W.R., Charter Cruise Report: FRV Cirolana Cruise CZ200202: 15 - 28 May 2002, Marine Laboratory Aberdeen, Aberdeen, 2002.
- Ufermann, S., I.S. Robinson, J.C.B. da Silva, and J.A. Johannessen, The role of synergy in developing a marine SAR analysis and interpretation system, in *Proceedings of the International Geoscience and Remote Sensing Symposium (IGARSS'02)*, Toronto, 2002.
- Watson, A., V. Smetacek, D. Bakker, P. Nightingale, U. Riebesell, V. Strass, M.-J. Messias, L. Goldson, M. Liddicoat, and C. Law, Southern Ocean iron fertilization experiments: a comparison between EISENEX and SOIRÉE (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Williams, R.G., C. Mahaffey, and E.M.S. Woodward, Physical supply of nutrients to the upper ocean over the N. Atlantic (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.
- Woods, K., I. Joint, S. **Groom**, and P. Holligan, A seasonal study of primary production in the Western English Channel and comparison with remote sensing estimates (Abstract), in *Challenger Centenary Conference: Marine Science 2002*, Plymouth, 2002.

PHD THESES (3)

- Leblanc, K., Role of the Northern Mediterranean Current in the biogeochemical silicon cycle in the Gulf of Lions, Unpublished PhD thesis, University of Marseille, 2002.
- MacLeod, K., An investigation into the effect of oceanographic and submarine topographic factors on minke whale (*Balaenoptera acutorostrata*) distribution in the Hebrides, Scotland, Unpublished PhD thesis, University of Greenwich, 2002.
- Ufermann, S., Investigations of Case-II water optical properties in the Rhine region of freshwater influence (?), Unpublished PhD thesis, University of Southampton, 2002.

MEDIA ARTICLES AND COVERAGE

- Hall, S., Coccolithophore and Gyrodinium blooms: interview with **Peter Miller**, in *BBC Southwest Spotlight News*, Plymouth, 14 August, 2002.
- Marsden, S., Algae blooms create red tide off the coast: interview with **Peter Miller**, in *Westcountry News*, pp. 9, Plymouth, 19 August, 2002.
- NERC, Putting NERC science to work: Space-saving device (monitoring of Mount Etna volcano), in *NERC Annual Report 2001-2002*, pp. 19, 2002.

- Palmer, T., In deep space: high hopes as city marine lab uses satellite to study the oceans, in *Evening Herald*, pp. 3, Plymouth, 22 February, 2002.
- Ridgwell, A.J., A dirty planet is a happy planet, in *Planet Earth*, pp. 6-7 (summer), 2002.
- Sutton, T., Cornwall's worst red tide for many years confirms increasing incidence of killer-algae phenomenon: interview with **Steve Groom** and **Peter Miller**, in *BBC Wildlife*, November, 2002.
- Teeman, T., Hot weather brings country to life: interview with **Peter Miller**, in *The Times*, pp. 6, 17 August, 2002.

ANNEX 7: TARGETS AND MILESTONES

RSDAS utilisation runs at 100% of capacity, with greater effort applied to in-house research and development whenever there is a lull in customer requests. Response times have not been recorded, but average between 2-3 weeks from application grading to data delivery. This year RSDAS has received frequent favourable comments from customers and no formal complaints.

ANNEX 8: FINANCE

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ANNEX 9: SERVICE MANAGEMENT

List of staff with role, status, and percentage of time allocated to RSDAS duties:

- Steve Groom, Head of Service (15 % PML funded, B4)
- Dr Peter Miller, RSDAS manager (33%, B6)
- Dr Tim Smyth, MODIS Development (25%, B6)
- Dr Peter Land, ARSF/MODIS Development (60%, B6)
- Dr Kate Evans-Jones, Development (100%,B6)
- Mr Gareth Mottram, Data Analysis (80%,B7)

(2.98 Full-Time Equivalent)