

**SERVICES & FACILITIES ANNUAL REPORT - FY April 2010 to March 2011**

<b>SERVICE</b> NERC Earth Observation Data Acquisition and Analysis Service (NEODAAS)	<b>FUNDING</b> Block	<b>AGREEMENT</b> Dundee - R8/H10/66 Plymouth - R8/H10/67	<b>ESTABLISHED as S&amp;F</b> Dundee: 1981, Plymouth: 1995 Combined: 2006	<b>TERM</b> 5 Years
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**TYPE OF SERVICE PROVIDED:**

NEODAAS is a dual node facility linking two sites that have supported NERC users for many years with a comprehensive service from raw satellite data reception to scientific product delivery. Dundee University's Satellite Receiving Station (NEODAAS-Dundee) provides direct satellite data acquisition, dissemination and archiving and the Plymouth Marine Laboratory (NEODAAS-Plymouth) provides data processing and analysis services. NEODAAS supports NERC users across most science areas with Marine and Atmospheric scientists forming the majority of the user base. Users undertaking their own processing and analysis can access data and image products direct from Dundee or Plymouth. The facility underpins NERC science communication activities by providing free web based access to information and imagery, e.g. see Fig. 1. Usage statistics show worldwide interest and that the facilities are highly regarded and widely used by the public and in education.



Fig. 1: Eyjafjallajökull eruption 17<sup>th</sup> Apr. 2010.

**NEODAAS-Dundee** receives data from many direct broadcast polar orbiting satellites. It has a partially unique geographical coverage and a wholly unique frequency of coverage and archive time series. The archive is an increasingly important resource for long-term monitoring as it extends. It includes data collected from NOAA series satellites (1978-present) and NASA's Terra and Aqua (2000-present), while archives of SeaWiFS (1997-2004) and CZCS (1979-86) data are also available. Geostationary satellite data are also received and provide users with full global observations. Users such as overseas researchers may purchase Dundee data. The income is used for minor upgrades and offsets capital bids. Archive maintenance work is also carried out and an offsite copy of Dundee's raw polar satellite data archive is stored securely at the NERC Earth Observation Data Centre.

**NEODAAS-Plymouth** undertakes scientific data processing and delivery to end users. It provides many unique products for UK scientists and has global coverage through direct access to the ESA rolling archive for MERIS and AATSR data and through NASA (MODIS and SeaWiFS) and NOAA (AVHRR). Data from these sources are generally available within ~6 hours from overpass. All Dundee data are systematically delivered to Plymouth for immediate processing and rapid product availability. This is a vital feature for applications with near-real time requirements, such as research cruises. NEODAAS-Plymouth exploits the results of extensive research undertaken within PML funded by the EC, ESA and other NERC sources. Hence, users benefit from a much greater range of products and developments than would be possible purely through service and facilities funding.

**ANNUAL TARGETS AND PROGRESS TOWARDS THEM**

**NEODAAS Key Output and Performance Measures:** In 2010 NEODAAS contributed to 102 publications including 48 peer-reviewed papers; there were 1300 citations of papers in the ISI supported by NEODAAS (or DSRS/RSDAS) since 1995. In FY 2010-11 there were 469 days of cruise support. There were 27 successful applications to the facility, which is the highest yearly total, and ~50% higher than FY09-10. Including ongoing requests NEODAAS supported 50 projects via formal applications. There were 300 users (excluding commercial) cf to 260 in FY09-10 and 161 in 08-09, showing continued growth in use of the service. The non-marine focussed support scientist at NEODAAS-Plymouth made a successful start in developing new polar and terrestrial applications (see below). Over 4.2 million free access images were requested from the NEODAAS website. Acquisition/Archiving of New Data: Satellite receiving equipment was used throughout the year with no significant impact from downtime. Data acquisition statistics for polar satellites were: Scheduled recordings = 10357, recordings lost = 13, Success rate = 99.87%.

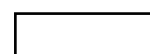
SCORES AT LAST REVIEW (each out of 5)			Date of Last Review:	
Need	Uniqueness	Quality of Service	Quality of Science & Training	Average
5.0	5.0	5.0	5.0	5.0

CAPACITY of HOST ENTITY FUNDED by S&F	Staff & Status	Next Review (March)	Contract Ends (31 March)
Dundee 100%	Dundee: 10% S&F Funded – Director; 100% S&F Funded – Manager (OR3), 2 Software/Systems (ALC2), 1 Res. Asst. (RA2), 3 Technical (C).	2013	2014
Plymouth 100%	Plymouth: S&F Funded: Groom, Director (15%); Taylor (Manager, 37%); Miller (technical manager, 20%); Christodoulou (79%); Prieto-Blanco (95%); Shutler (20%); Land (5%); Taberner (56%); Walker (19%) Total 3.46 FTE inc. Director		

FINANCIAL DETAILS: CURRENT FY						
Total Resource Allocation £k	Unit Cost £k			Capital Expend £k	Income £k	Full Cash Cost £k
Dundee: £399.57k	Operations Hour: £0.130k			£4.95k	£9.57k	£415.87k
Plymouth: £325.86k	Staff effort	Data quantity	Real-time support days	£0k	£0k	£349.40k
	0.712k	0.707k	0.195k			

FINANCIAL COMMITMENT (by year until end of current agreement) £k (*Actual claimed, †At agreed FEC rate)										
NEODAAS Dundee	2010-11	399.57k	2011-12	†399.86k	2012-13	†399.86k	2013-14	†399.86k	2014-15	-
NEODAAS Plymouth	2010-11	325.86k	2011-12	†335.06k	2012-13	†325.68k	2013-14	†325.68k	2014-15	-

STEERING COMMITTEE	Independent Members	Meetings per annum	Other S&F Overseen
NEODAAS	6	1	None
ARFSFC (report for info)	7	2	ARFS



APPLICATIONS: DISTRIBUTION OF GRADES (current FY — 2010/11)								
	α5	α4	α3	α2	α1	β	R*/Pilot	Reject
NERC Grant projects*	1	6	0	0	0	0	0	0
Other academic	0	15	2	0	0	0	5	0
Students	0	3	0	0	0	0	0	0
Pilot	0	0	0	0	0	0	0	0
<b>TOTAL</b>	1	24	2	0	0	0	5	0

APPLICATIONS: DISTRIBUTION OF GRADES (per annum average previous 3 financial years —2007/2008, 2008/2009 & 2009/2010)								
	α5	α4	α3	α2	α1	β	R*/Pilot	Reject
NERC Grant projects*	0	6.67	0	0	0	0	0	0
Other Academic	0	5.67	2.33	0	0	0.33	0	0
Students	0.67	2.67	0.33	0	0	0	0.67	0
Pilot	0	0	0	0	0	0	0.67	0
<b>TOTAL</b>	0.67	15	2.67	0	0	0.33	1.33	0

PROJECTS COMPLETED (current FY – 2010/11)								
	α5	α4	α3	α2	α1	β	R*/Pilot	
NERC Grant projects*	0	9	0	0	0	0	0	0
Other Academic	0	10	3	0	0	0	0	2
Students	1	3	0	0	0	0	0	0
Pilot	0	0	0	0	0	0	0	0

Note: Pilot/R\* proposals completed used no NEODAAS effort and merely used existing data obtained by the user from the NEODAAS web site. Alpha-3 proposals were supported on a best-endeavours basis.

Project Funding Type (current FY – 2010/11) (select one category for each project)										
Grand Total	Infrastructure					PAYG				
	Supplement to NERC Grant *	PhD Students		NERC C/S	Other	NERC Grant*	PhD Students		NERC C/S	Other
		NERC	Other				NERC	Other		
60	15	3	2	10	30	0	0	0	0	0

Project Funding Type (per annum average previous 3 financial years - 2007/2008, 2008/2009 & 2009/2010)										
Grand Total	Infrastructure					PAYG				
	Supplement to NERC Grant *	PhD Students		NERC C/S	Other	NERC Grant*	PhD Student		NERC C/S	Other
		NERC	Other				NERC	Other		
56.33	15.33	7	3.33	10.66	20	0	0	0	0	0

User type (current FY – 2010/11) (include each person named on application form)				
Academic	NERC Centre/Survey	NERC Fellows	PhD Students	Commercial
194	88	2	16	53

User type (per annum average previous 3 financial years - 2007/2008, 2008/2009 & 2009/2010)				
Academic	NERC Centre/Survey	NERC Fellows	PhD Students	Commercial
75.67	67	2.67	14.67	41.33

Note: Prior to 2008 users were counted as one per project. From 2008 we have counted the number of users per project individually.

OUTPUT & PERFORMANCE MEASURES (current year)										
Publications (by science area & type) (calendar year 2010)										
SBA	ES	MS	AS	TFS	EO	Polar	Grand Total	Refereed	Non-Ref/ Conf Proc	PhD Theses
0.0	4.5	44.66	23.84	2.84	22.66	1.5	102	48	51	3 <sup>†</sup>

Distribution of Projects (by science areas) (FY 2010/11)							
Grand Total	SBA	ES	MS	AS	TFS	EO	Polar
60	0	2.5	43	2.5	2.5	8	1.5

OUTPUT & PERFORMANCE MEASURES (per annum average previous 3 years)										
Publications (by science area & type) (Calendar years 2007, 2008 & 2009)										
SBA	ES	MS	AS	TFS	EO	Polar	Grand Total	Refereed	Non-Ref/ Conf Proc	PhD Theses
0.1	1.76	58.76	19.26	10.79	16.26	7.59	107.33	45	56.33	6

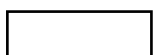
Distribution of Projects (by science areas) (FY 2007/2008, 2008/2009 & 2009/2010)							
Grand Total	SBA	ES	MS	AS	TFS	EO	Polar
49.66	0	1.33	32.5	3	0.83	8.5	3.5

Distribution of Projects by NERC strategic priority (current FY 2010/11)							
Grand Total	Climate System	Biodiversity	Earth System Science	Sustainable Use of Natural Resources	Natural Hazards	Environment, Pollution & Human Health	Technologies
60	11.55	15.73	15.63	7.16	2.58	4.15	3.07

\*Combined Responsive Mode and Directed Programme grants

<sup>†</sup> PhD students are counted in the user profile in each year of the 3-year registration period, but resulting theses count only in the publication year.

NOTE: All metrics should be presented as whole or part of whole number NOT as a %



## OVERVIEW & ACTIVITIES IN FINANCIAL YEAR (2010/11):

### Dundee:

**Antenna Systems:** One of the main elements for each tracking antenna system is the Motor Control Unit. All antenna cabling is routed through this and it houses power and interface circuits plus antenna motor drives. A complete new unit has been built to provide spares cover for three of our operational antennas. Main components can be easily swapped between units if required, while the drives have long lead times for ordering, so spares guard against extended downtime in case of failures.

Antennas we use for S-band satellites were originally configured for signals broadcast with standard polarisation, but there have been cases of satellites using non-standard polarisation. To increase our options, we have modified the antennas and added control hardware to automatically switch polarisation depending on the satellite. The new capability was utilised successfully during the year.

**Online Storage:** Our new storage system is now integrated into operations as the main online repository for data and software. It has been populated with all of our satellite data including the MODIS archive that was previously only available from tape. Metadata, documents and software are also stored on the system and the superior performance benefits operations through increased processing efficiency and resilience. This has also allowed us to retire ageing systems that would have impacted on operations had they failed.

**Software Developments:** Antenna software saw a range of improvements such as better handling and reporting of hardware glitches. A notable change is scheduling overlapping passes when satellites are within range simultaneously. Previously only one pass could be tracked. It is now possible to manually select the pass tracked in its entirety with others truncated, but tracked for as long as possible. New interfaces also assist manual intervention. This capability was useful during extended downtime for one antenna (see below).

Data reception and processing software provides more monitoring, reports and graphs, enhanced noise detection, and improved coastline overlays. The real-time display of received data shows antenna and satellite angles for any point in the image to help identify noise/drop-out locations and causes. Some processing has been migrated from Sun computers to lower cost hardware running Linux.

**Website:** In the image gallery, a page is now available for easy access to recent images instead of only the latest image. RSS feeds have been implemented so that users can subscribe to latest images, specific types or custom searches and be notified automatically when images with matching criteria are added. A Facebook page and Twitter feed automatically post information about new images.

**System Administration:** Our Nagios server for centralised systems and software monitoring has been completely upgraded in terms of hardware, operating system and software. It now has compatibility with add-ons and software tools we can consider using. Our e-mail system has been replaced by a cloud-based Google solution that is free to academic institutions. It offers powerful facilities, convenient mobile and web access, features such as shared documents and our staff are no longer required to maintain the system.

**Equipment Failure/Repair:** No issues significantly impacted operations, but a motor failure left one S-band antenna off-air for several weeks. This required us to completely dismantle the system. We were hampered by the timing during the winter holiday, severe weather and the turnaround time for the motor repair. Reception schedules were maintained by temporarily converting another antenna for S-band work and using our backup antenna. The latter is sited on a low building with coverage restrictions, but we made good use of our recent developments to maintain coverage by scheduling partially overlapping passes from different satellites and having the facility to merge sections of a pass from different antennas to create one data set.

**Publicity:** Images we made available to the media again achieved wide coverage. Of particular note were those showing the Eyjafjallajökull eruption (Fig. 1) and severe weather and snow across the British Isles. They featured extensively in newspapers, television news and associated websites, television documentaries and many other websites. For a period, one image reached 'most read' and top 10 'most shared' on the BBC News website. The coverage led to features about our facility on a BBC Radio Scotland science and nature programme and the main North-East Scotland newspaper.

### Plymouth:

**Cruise guidance** again constituted a major activity in Plymouth with 469 days and 14 individual cruises supported.

**Service developments:** Lake monitoring was established in support of an  $\alpha 5$  NERC Airborne Research and Survey Facility (ARSF) project lead by University of Stirling covering lake Balaton, Hungary (see Fig. 2). This exploited the developments to MERIS 300m processing implemented in the previous year; the images gave good coverage during the flights with chl-a values comparable to those measured in situ, and a publication is planned. The processing has been continued to exploit and publish a long time series from MERIS. The work inspired an  $\alpha 4$  NEODAAS application also lead by U. Stirling, with CEH, Lancaster and CEH Edinburgh, to set up UK lake monitoring. Ocean colour products: We have extended the capabilities of our Global EO Processing System (GEOPS) for MERIS 300m using NASA's SeaDAS algorithms, including automated near-real time 7-day composites and efficient scene selection for large batch requests. For the ESA and NASA sensors, we are mid-way through a major transition towards in-house processing from Level 1 to Level 2 (for atmospheric correction and ocean products), rather than the existing system of downloading and mapping Level 2 products generated externally. The advantage of this change is to enable greater flexibility in ocean colour processing, including the use of leading-edge algorithms being developed within ESA and EC projects. Also, whenever a significant software update is released, we will be able to reprocess our archive from Level 1 data rather than have to download another complete set of Level 2 products. The Aqua-MODIS processing chain is now working successfully from Level 1 data. As NEODAAS downloads and processes through NASA and ESA, efficiency is becoming ever more important. We have implemented a 'supervisor' system to apply the

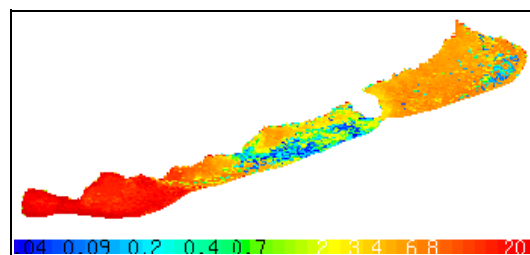


Fig 2: MERIS 300m algal\_2 chl-a product for Lake Balaton, Hungary, 22 August 2010

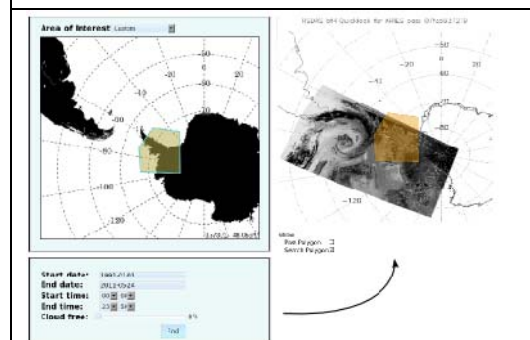


Fig 3. Screenshot from Antarctic AVHRR data viewer.



whole GEOPS processing chain to each data granule on a single grid node, significantly reducing network traffic and processing time. Ocean temperature products: near-real time processing of SST products from the AATSR sensor on ESA's Envisat satellite, was started, complementing existing AVHRR and Aqua-MODIS data. This builds upon developments from the recent PML project on CO<sub>2</sub> fluxes for ESA. Oceanic front detection technique development and validation has continued within PML research projects, to the benefit of NEODAAS users who can exploit these novel products for studies of the distribution of cetaceans and basking sharks. Non-marine products implemented include real-time daily and 7-day vegetation indices from Terra-MODIS data for the UK region, disseminated on the MultiView website. Links have been forged with terrestrial science institutions to discuss how NEODAAS can contribute EO expertise and capability to the non-marine fields of environmental science. The NEODAAS-Plymouth website for providing access to BAS's unique archive of AVHRR data received at the Rothera station has been considerably improved, and is now undergoing internal testing prior to external evaluation by BAS scientists (see Fig. 3).

**Staff developments:** Dr Malcolm Taberner was recruited during the year to work on ocean colour data processing systems; his post is part funded by the ESA Ocean Colour Climate Change Initiative. Malcolm was previously at the EC Joint Research Centre and also brings extensive experience in terrestrial vegetation remote sensing which we hope to implement in Plymouth.

**Other projects:** As noted above, NEODAAS benefits from results from commissioned research earned by PML from other funding sources: this would not be possible if NEODAAS was operated away from a research environment. Notable projects include the European Space Agency funded CoastColour, to improve and exploit MERIS 300m data products, ESA's flag-ship Ocean Colour Climate Change Initiative, to improve global ocean colour fields for use with climate models. This started in Aug 2010 and is lead by PML. A new project in negotiation is the European Commission funded EarthServer to serve large parts of the PML/NEODAAS archive and PML's model output (>20TB) via an image database. Finally, PML has an enhanced role in the EC funded GMES marine core service, MyOcean2 project. These CR projects provided capital funding to store data on-line and undertake data processing.

### SCIENCE HIGHLIGHTS:

**Atmospheric Science:** A significant number of supported publications were in this area, reflecting wide use of NEODAAS by the community. One of the higher impact factor (IF) papers was on modelling extratropical cyclones (Catto et al., 2010) for which all three authors were NERC supported. Two papers studying mountain waves over Northern Scandinavia and the 2003 European heat-wave were among several by overseas authors, demonstrating that the NEODAAS website is an internationally recognised resource. This shows that the free access browse images can be exploited for research purposes with authors acknowledging their use in determining synoptic situations. Authors of articles that feature in the Royal Met Society's *Weather* magazine continue to make regular use of our images for illustrative material, as do authors of educational textbooks. Fig. 4 shows an example from a book published in 2010.

**Terrestrial & Freshwater Science:** A University of Dundee PhD, successfully completed in 2010, investigated the potential of remote sensing to extract European lake water quality information. Support from both NEODAAS nodes was fundamental through access to the long-term archive and processing of higher level products. On a related theme, a recently identified publication from late 2009 on European lakes and future effects of climate change acknowledged use of NEODAAS browse imagery (Thompson et al., 2009).

**Marine Science:** Two papers published in 2010 demonstrated the value of near-real time cruise support and post-cruise analyses; they also provided further examples of NEODAAS involvement in international collaboration. Suykens et al (2010) and Harlay et al (2010) investigated the biogeochemistry of coccolithophore blooms and their impact on CO<sub>2</sub> partial pressure and air-sea exchange in shelf-edge waters to the SW of the UK from four cruises between 2004 and 2008. Chl-a data for May 2007 from SeaWiFS are shown in Fig 5a together with the cruise in-water pCO<sub>2</sub> data (Fig 5b). Other papers from this project were published in 2009 and are in press for publication in 2011.

**Earth observation:** a number of papers reported basic research into EO data validation (e.g. ESA MERIS data, Cui et al., 2010) and improved methodology for EO exploitation (e.g. coccolithophore detection, Shutler et al., 2010) and included NEODAAS Plymouth co-authorship.

**Polar Science:** Another paper with a NERC funded lead author investigated glacier response to a nitrogen enrichment event (Hodson, et al, 2010): meteorological conditions during the event were characterised using browse imagery from our website.

**Earth Science:** NEODAAS archive data were used by Lisi et al., (2010) in a paper on the 2009 Abruzzo earthquake published in an open access, but lower IF, ISI listed journal. Images of the 2010 Eyjafjallajökull eruption (Fig. 1) were used in an invited fast-track paper led by a NERC funded user (Davies et al, 2010), while University of Iceland scientists were provided with data before and during this eruption for real-time monitoring and they continue to use data for ongoing research.

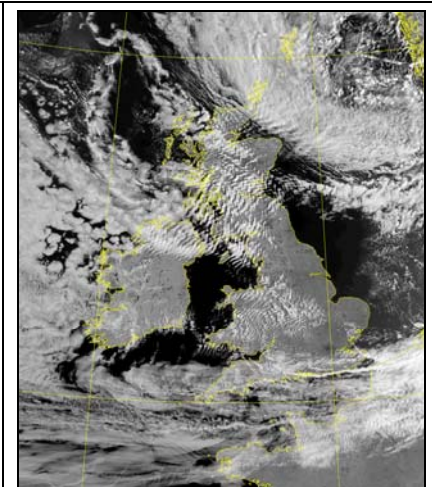


Fig. 4: Wave trains, N British Isles, 21<sup>st</sup> Aug. 1980 from 'Fundamentals of Weather & Climate' (2<sup>nd</sup> ed.) by Robin McIlveen.

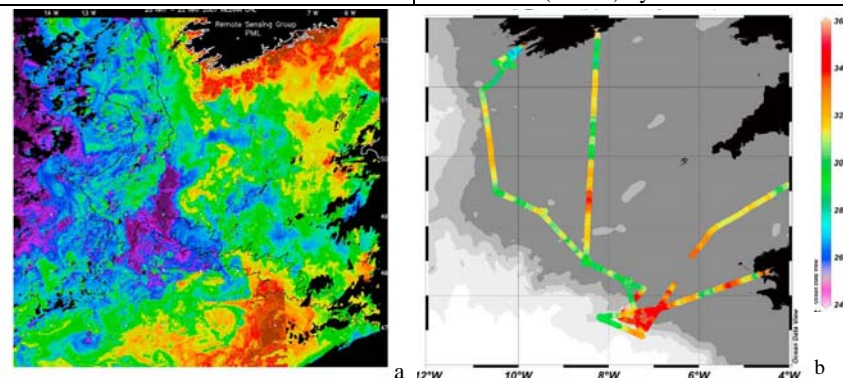
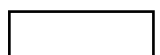


Fig 5. a) NEODAAS SeaWiFS chl-a for May 2007 and b) partial pressure for CO<sub>2</sub> during the 2007 cruise (Suykens et al., 2010).



**Citations:** in calendar year 2010 there were 1300 citations noted in the ISI of papers supported by NEODAAS (or DSRS and RSDAS the precursors to NEODAAS) since 1995 (see Fig. 6). Note this is a conservative figure since DSRS papers from 1978 - 1995 were not included at this stage.

**Papers Cited Above:**

- Catto, et al. (2010) Can Climate Models Capture the Structure of Extratropical Cyclones?, *Journal of Climate*, 23 (7), 1621-1635. **(IF = 3.4)**
- Cui, et al. (2010) Validation of MERIS ocean-color products in the Bohai Sea: A case study for turbid coastal waters *Remote Sensing of Environment*, 114, 2326-2336. **(IF = 3.6)**
- Davies, et al. (2010) Widespread dispersal of Icelandic tephra: how does the Eyjafjöll eruption of 2010 compare to past Icelandic events?, *Journal of Quaternary Science*, 25, 605-611. **(IF = 3.1)**
- Hodson, et al (2010). Glacier ecosystem response to episodic nitrogen enrichment in Svalbard, European High Arctic, *Biogeochemistry*, 98 (1-3), 171-184. **(IF = 2.8)**
- Lisi et al. (2010) A study on the Abruzzo 6 April 2009 earthquake by applying the RST approach to 15 years of AVHRR TIR observations, *Nat. Hazards & Earth Sys. Sci.*, 10, 395-406, **(IF = 1.4)**
- Harlay et al. (2010) Biogeochemical study of a coccolithophore bloom in the northern Bay of Biscay (NE Atlantic Ocean) in June 2004. *Progress In Oceanography*, 86, 317-336. **(IF=3.6)**
- Shutler et al. (2010) Coccolithophore bloom detection in the north east Atlantic using SeaWiFS: Algorithm description, application and sensitivity analysis. *Remote Sensing of Environment*, 114, 1008-16. **(IF = 3.6)**
- Suykens et al. (2010) Dissolved inorganic carbon dynamics and air-sea carbon dioxide fluxes during coccolithophore blooms in the northwest European continental margin (northern Bay of Biscay). *Global Biogeochemical Cycles*, 24(GB3022). **(IF=4.3)**
- Thompson, et al. (2009) On the climate and weather of mountain and sub-arctic lakes in Europe and their susceptibility to future climate change, *Freshwater Biology*, 54, 2433-2451. **(IF = 2.9)**

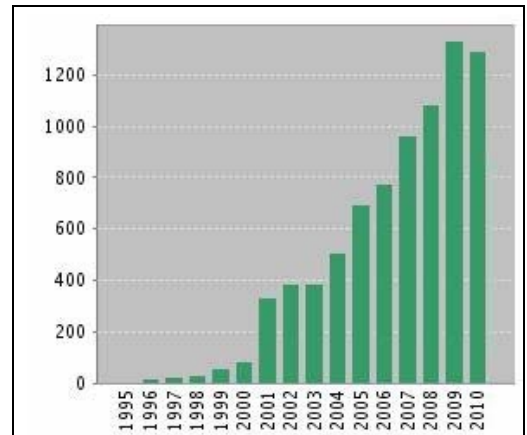


Fig 6. NEODAAS ISI citations for papers since 1995

**FUTURE DEVELOPMENTS/STRATEGIC FORWARD LOOK**

**Dundee**

**Satellite Missions:** The situation for existing and future polar satellites that Dundee is capable of receiving is summarised below.

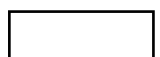
- We continue to receive NOAA-AVHRR data. Although the last of this satellite series is in orbit, four others are operational, with limitations in some cases, so we anticipate extending the 33-year archive for a few more years. NASA’s Terra and Aqua-MODIS satellites are received at Dundee and continue to operate reliably despite being beyond the 5-year design life. We continue to receive encrypted SeaWiFS ocean colour data after a NASA funded licence expired in 2004 until the satellite failed late in 2010.
- MetOp is the European side of the joint US/European follow-on to the above missions. MetOp-A provides limited coverage due to transmitter problems, so we continue to focus on NOAA satellites for now. This should be resolved after launch of MetOp-B, currently scheduled for spring 2012. The US contribution was to be the NPOESS series combining civilian and military needs and beginning with the demonstrator NPP. Delays and cost overruns culminated in programme restructuring. Launch readiness for NPP is currently reported as October 2011. It will now be followed by the NOAA-led JPSS, thought to be low-risk NPP clones.
- India’s Oceansat-2 is of interest. Reception is within our station's capability, but requires proprietary data processing items. The commercial wing of the Indian Space Research Organization (ISRO) recently indicated costs of \$175k (US) for proprietary elements plus \$40k annual reception license - these are not viable for us. It is understood that access for NEODAAS was to be discussed at a recent high-level meeting including ISRO and UK Space Agency representatives, but the outcome is not yet known.
- Chinese and Russian satellites can provide other data sources, but lack of information to interpret their data continues to be the main problem. A contact in Russia assisted with pre-processing sample data we collected. Resulting imagery suggests noisy infra-red channels for the current mission, but we hope to develop processing if possible for use with future satellites in this series.

**General Developments:**

- No major antenna work is planned, but we may replace the main junction box of our oldest operational antenna with an improved design following water ingress. We may acquire a spare motor as cover for three antennas following the failure reported above.
- Some Uninterruptible Power Supplies are due for replacement. We will review current needs taking account of a more reliable electrical infrastructure and assessing the priority systems for UPS support in terms of those that would cause greatest disruption.
- Dundee will be a secondary groundstation for UK Space Agency’s UKube-1 nanosatellite. This is a pilot mission for low cost satellites to test new technologies and support research, training and education. Our backup antenna will be used with normal operations taking priority. This is an opportunity to develop UK Space Agency and other links and increase awareness of our facilities.
- Improved terms to process our encrypted SeaWiFS data may allow us to extend the archive to cover the satellite’s full 13-year life.
- Archive management is easier now that all of our satellite data are available on the new storage system. We intend to prepare a tape based copy of the entire MODIS archive for offsite storage at NEODC, alongside a recently updated AVHRR archive copy. Other plans for the storage are to rewrite software to improve processing efficiency and increase the range of website products from simple quicklooks to include reprojected images, UK close-ups and higher resolution full pass images across complete archives.
- Display software is being developed to monitor live data reception from different locations of the Station or remote sites. We will look to extend this so that it can be set up at sites such as museums to display live imagery being received at Dundee.

**Plymouth**

The planned developments in Plymouth largely result from “spin offs” from commissioned research earned by PML that will be of



benefit to NEODAAS complementing the small NEODAAS funded developments. We will:

- Increase data provision via the Internet using netCDF and international standards for geospatial data. The EC NETMAR project is developing this capability.
- Move towards global 1km processing of ocean colour data, required by the ESA-funded Climate Change Initiative (CCI). This will need to tackle a number of scalability issues in the processing chain and data storage, but will bring benefits in our ability to provide 1km data time-series to NEODAAS users for any region globally.
- Implement alternative ocean colour processing algorithms, to be specified through the ESA CoastColour project (for MERIS 300m data) and CCI (for 1km data).
- Invest effort in unifying and simplifying the GEOPS system in order to improve the reliability and efficiency by which we can incorporate data from new sensors and maintain and improve existing sensors. Additional sensors of interest include: GOCI (geostationary ocean colour data) for which PML has been awarded an NERC/NCEO grant, ASAR (surface roughness) and SMOS (ocean salinity and soil moisture).
- Development of non-marine products will continue. As noted above, we will investigate various options for lake monitoring from MERIS 300m data using existing algorithms and those developed in ESA CoastColour and through research at University of Stirling. We also expect to implement cutting edge algorithms developed at the JRC on FAPAR (Fraction of Absorbed Photosynthetically Active Radiation).
- FY2011-12 will see a major upgrade to computing resources used by NEODAAS. It is expected that we will purchase ~250TB of data storage, of which one quarter will be supported by NERC and the remainder by ESA and PML, though all data will be available to NEODAAS. Likewise we expect to double our processing capability with funding from ESA.

### Non-Mandatory Facility-specific OPMs

**Web Statistics:** NERC science communication activities are greatly supported by free Web based access to information and browse image products through the Dundee node. The statistics below relate to these facilities rather than the higher level data services available to scientific users.

Total user registrations	Registrations for the year	Pages hit/images for the year	Image requests for the year	
352,567	10,934	Approx. 23.0 million	Approx. 4.2 million	
<b>Breakdown of all registrations by user categories:</b>				
Personal interest	NERC/UK HEI Project	Education	Research	Commercial
61.3 %	17.2 %	11.0 %	7.5 %	3.0 %

**Other Users:** In addition to users eligible for NERC support, others including international users, receive support on a commercial basis or are provided with limited free access, in some cases to support research and training. Examples for the year are listed below:

- 10-year data set for a PhD study of cloud cover and radiation balance change over Ireland due to aircraft contrails – Univ. College Cork, Ireland.
- Near real-time MODIS imagery for operational charting of sea ice around Greenland – Danish Meteorological Institute.
- UK temperatures and range around the no fly period of April 2010 due to the Iceland volcanic eruption – Charldon Hill Research Station.
- Geostationary satellite data for online weather information and forecasts – Weather Underground, USA.
- Data access for an MSc dissertation, examining impact of forest cover on snowmelt and run-off in Northumberland – Newcastle University.
- Assessment of pack ice and ice drifting pattern for the east coast of Greenland to plan a school sailing expedition – The Glasgow Academy.
- High resolution images to study latest weather and support teaching of remote sensing to senior pupils – Kantonsschule, Wettingen, Switzerland

### Research cruises supported in near-real time by Plymouth

Start Date	End Date	Focus of the Cruise	Principal/NERC Scientist	Ship
2010-03-17	2010-04-11	Antarctic Deep Water Rates of Export (ANDREX)	Dr. Naveira Garabato, NOCS	James Clark Ross 239
2010-04-26	2010-05-10	Iron Biogeochemistry in the High Latitude North Atlantic Ocean	Prof. Achterberg, NOCS	Discovery 350
2010-05-26	2010-07-05	Thermocline nutrient pump	Prof. Sharples, NOCL	Discovery 352
2010-05-26	2010-07-03	Ecosystem of the Mid-Atlantic Ridge at the Sub-Polar Front and Charlie Gibbs Fracture Zone (ECOMAR). St Johns, Newfoundland to Vigo, Spain	Prof. Priede, Univ. Aberdeen	James Cook 048
2010-06-12	2010-07-26	Oceans 2025 Theme 1: Climate, Ocean Circulation and Sea Level	Dr. Leakey, SAMS	James Clark Ross 219
2010-07-09	2010-08-11	Iron Biogeochemistry in the High Latitude North Atlantic Ocean	Prof. Achterberg, NOCS	Discovery 354
2010-09-06	2010-10-15	GENUS: Geochemistry and Ecology of the Namibian Upwelling System	Dr. Buchholz, AWI	Discovery 356
2010-09-09	2010-10-01	Cape Farewell arctic expedition 2010	Dr. Iglesias-Rodriguez, NOCS	S/V Noorderlicht
2010-10-12	2010-11-25	Atlantic Meridional Transect (AMT)-20. UK to S. America	Dr. Rees, PML	James Cook 053
2010-10-17	2010-11-25	UK GEOTRACES: Ocean micronutrient cycles	Prof. Henderson, Univ. of Oxford	Discovery 357
2010-11-30	2011-01-08	BAS: UK-DIMES	Dr. Naveira Garabato, NOCS	James Cook 054
2010-12-04	2010-12-16	BAS: Hydrographic Measurements in Drake Passage	Dr. King, NOCS	James Clark Ross 242
2010-12-24	2011-01-21	BAS: Krill grazing in the Southern Ocean	Dr. Atkinson, BAS	James Clark Ross 247
2011-02-07	2011-03-19	Nutrient and trace element supply to the diazotroph community in the (sub-)tropical Atlantic	Prof. Achterberg, NOCS	Discovery 361

