SERVICES & FACILITIES ANNUAL REPORT - FY April 2008 to March 2009

SERVICE	FUNDING	AGREEMENT	ESTABLISHED as S&F	TERM
NERC Earth Observation Data Acquisition and Analysis Service (NEODAAS)	Block	Dundee - R8/H10/04 Plymouth - R8/H10/32	Dundee: 1981, Plymouth: 1995 Combined: 2006	5 Years

TYPE OF SERVICE PROVIDED:

NEODAAS is a dual node facility linking two sites whose close partnership has 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 Remote Sensing Group at Plymouth Marine Laboratory (NEODAAS-Plymouth) provides data processing and analysis services.

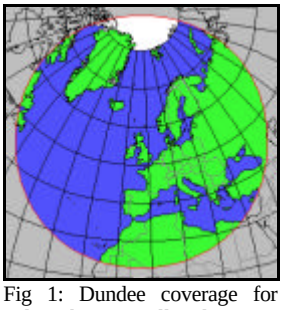

Fig 1: Dundee coverage for polar orbiting satellite data.

NEODAAS-Dundee receives data from several direct broadcast polar orbiting satellites. It has a partially unique geographical coverage (Fig 1) 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 satellites (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.

NEODAAS-Plymouth undertakes scientific data processing and delivery to end users. It provides many unique products for UK scientists and has global coverage through access to the ESA rolling archive for MERIS and ASAR data and through subscriptions with 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 supports NERC users across most science areas with Marine, Atmospheric and Earth scientists forming the majority of the user base. Other categories of user such as overseas researchers and commercial can also receive support on a "pay-as-you-go" basis. Archive maintenance work is also carried out and a secure copy is held at the NERC Earth Observation Data Centre. The facility provides free web access to imagery and information, underpinning NERC science communication activities. Users undertaking their own processing and analysis can access data and image products direct from Dundee or Plymouth. Usage statistics show enormous worldwide interest and the facilities are highly regarded and widely used by the public and in education.

ANNUAL TARGETS AND PROGRESS TOWARDS THEM

NEODAAS Key Output and Performance Measures: In 2008-9 NEODAAS contributed to 123 publications (about 20% greater than the three-year average) including 37 peer-reviewed papers (about the same as the average) in a variety of different disciplines (see below). There were 448 days of cruise support undertaken, including immediate pre-cruise lead-in (see table below). There were 20 new applications to the facility (excluding MSc projects), in line with last year, and including ongoing requests we supported 183 users via formal applications. Almost 7 million images were requested from the NEODAAS website with over 0.5 million from the ".ac.uk" domain. Acquisition and Archiving of New Data: Satellite receiving equipment was used daily throughout the year with no significant downtime. Data acquisition statistics during the year for polar satellites are: Scheduled recordings = 11096, Scheduled recordings lost = 6, Success rate = 99.95%.

SCORES AT LAST REVIEW (each out of 5)			Date of Last Review:	March 2008
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% **Plymouth 100%**	**Dundee:** Uo Dundee Funded – Director (10%). 100% S&F Funded – Manager (OR3), 2 Software/Systems (ALC2), 1 Research Asst. (RA2), 3 Technical (C). **Plymouth:** PML Funded: Groom, Director (10%); S&F Funded: Miller (Manager 25%); Hutson (Analyst, 66%); Shutler (58%); Smyth (5%); Land (10%); Saux-Picart (23%); Walker (11%): Total 2.1 FTE inc. Director	**2013**	**2014**

FINANCIAL DETAILS: CURRENT FY

Total Resource Allocation £k	Unit Cost £k						Capital Expend £k	Income £k	Full Cash Cost £k
	Unit 1	Junior hour	Routine image	Archive image	Comp. image	Real-time			
Dundee: £339.15k	(Operations Hour) 0.148k	-	-	-	-	-	£28.52k	£7.19k	£471.50k
Plymouth: £185.30k	Staff effort (0..10)	Data quantity (0..10)		Real-time support days			£0k	£0k	£214.06k
	0.492	0.480		0.120					

FINANCIAL COMMITMENT (by year until end of current agreement) £k (*Actual claimed, †At agreed FEC rate[+] inc. SOLAS supplement)

NEODAAS Dundee	**2008-09**	*320.98k	**2009-10**	†396.98k	**2010-11**	†397.85k	**2011-12**	†398.15k	**2012-13**	†398.15k
NEODAAS Plymouth	**2008-09**	[+]185.30k	**2009-10**	†325.0k	**2010-11**	†316.2k	**2011-12**	†316.2k	**2012-13**	†316.2k

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

APPLICATIONS: DISTRIBUTION OF GRADES (current FY — 2008/09)								
	a **5**	a **4**	a **3**	a **2**	a **1**	b	**R*/Pilot**	**Reject**
NERC Grant projects*	0	9	0	0	0	0	0	0
Other academic	0	3	1	0	0	1	0	0
Students	1	4	0	0	0	0	1	0
Pilot	0	0	0	0	0	0	0	0
TOTAL	1	16	1	0	0	1	1	0
APPLICATIONS: DISTRIBUTION OF GRADES (per annum average previous 3 financial years —2005/2006, 2006/2007 & 2007/2008)								
	a **5**	a **4**	a **3**	a **2**	a **1**	b	**R*/Pilot**	**Reject**
NERC Grant projects*	0.33	6.67	0.00	0.00	0.00	0.00	0.00	0.00
Other Academic	0.33	5.33	1.33	0.00	0.00	0.00	0.33	0.00
Students	1.00	4.33	0.67	0.00	0.00	0.00	0.33	0.00
Pilot	0.00	0.00	0.00	0.00	0.00	0.00	0.33	0.00
TOTAL	1.67	16.33	2.00	0.00	0.00	0.00	1.00	0.00

PROJECTS COMPLETED (current FY – 2008/09)							
	a **5**	a **4**	a **3**	a **2**	a **1**	b	**R*/Pilot**
NERC Grant projects*	0	7	0	0	0	0	0
Other Academic	0	6	2	0	0	0	0
Students	0	1	0	0	0	0	0
Pilot	0	0	0	0	0	0	0

USER PROFILE - funding type (current FY – 2008/09)											
Grand Total	**Infrastructure**					**PAYG**				
	Supplement to NERC Grant *	**Student**		**NERC C/S**	**Other**	**NERC Grant***	**Student**		**NERC C/S**	**Other**
		NERC	**Other**				**NERC**	**Other**		
183	120	10	11	2	18	0	0	0	0	22
USER PROFILE - funding type (per annum average previous 3 financial years - 2005/2006, 2006/2007 & 2007/2008)										
Grand Total	**Infrastructure**					**PAYG**				
	Supplement to NERC Grant *	**Student**		**NERC C/S**	**Other**	**NERC Grant***	**Student**		**NERC C/S**	**Other**
		NERC	**Other**				**NERC**	**Other**		
81.33	10.33	10.00	8.00	13.33	13.00	0	0	0	0	26.67

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

USER PROFILE - user type (current FY – 2008/09)				
Academic	**Centre/Survey**	**NERC Fellows**	**PhD**	**Commercial**
134	2	4	21	22
USER PROFILE - user type (per annum average previous 3 financial years - 2005/2006, 2006/2007 & 2007/2008)				
Academic	**Centre/Survey**	**NERC Fellows**	**PhD**	**Commercial**
23.67	14.67	2	14.33	26.67

OUTPUT & PERFORMANCE MEASURES (current year)										
Publications (by science area & type) (calendar year 2008)										
SBA	**ES**	**MS**	**AS**	**TFS**	**EO**	**Polar**	**Grand Total**	**Refereed**	**Non-Ref/ Conf Proc**	**PhD Theses**
0	4	75	11	3	17	13	**123**	37	84	2
Distribution of Projects (by science areas) (FY 2008/09)										
SBA		**ES**		**MS**		**AS**		**TFS**	**EO**	**Polar**
0		1.5		30.5		1.5		1	10.5	4
OUTPUT & PERFORMANCE MEASURES (per annum average previous 3 years)										
Publications (by science area & type) (Calendar years 2005, 2006 &2007)										
SBA	**ES**	**MS**	**AS**	**TFS**	**EO**	**Polar**	**Grand Total**	**Refereed**	**Non-Ref/ Conf Proc**	**PhD Theses**
0	4	58	13	4.67	20.33	3	**103**	39.33	58	5.67
Distribution of Projects (by science areas) (FY 2005/2006, 2006/2007 & 2007/2008)										
SBA		**ES**		**MS**		**AS**		**TFS**	**EO**	**Polar**
0		1		40.33		6		2.33	9	4

Distribution of Projects by NERC strategic priority (current FY 2008/09)						
Climate System	**Biodiversity**	**Earth System Science**	**Sustainable Use of Natural Resources**	**Natural Hazards**	**Environment, Pollution & Human Health**	**Technologies**
13.58	12.58	9	5.92	2.92	4.75	0.25

**Combined Responsive Mode and Directed Programme grants*

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

NEODAAS-Plymouth

OVERVIEW & ACTIVITIES IN FY (2008/09):

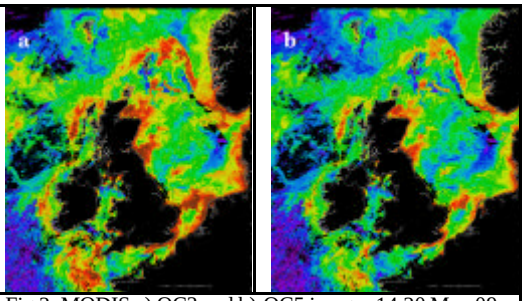

Fig 2: MODIS a) OC3 and b) OC5 images 14-20 May 09

Cruise support: During the year NEODAAS-Plymouth supported 12 cruises with a total of 448 days of near-real time updates; this was despite the postponement of two major cruises (SOLAS upwelling, Dr Robinson, U. East Anglia and ECOMAR Prof Priede, U. Aberdeen) due to problems with *RRS Discovery*. On a positive note scientists on a number of non-NERC ships were supported including *RV Knorr*, USA, *RV Odin*, Sweden, and *RV Belgica*, Belgium. **Service Developments** A number of new services and products were made available during the year including: ESA MERIS 300m data processing and data supply via the web – it is believed that NEODAAS are the 1st group in Europe to accomplish this; SST products derived from Dundee data started to be provided operationally to the international GHRSST project; processing of METOP data was implemented extending the AVHRR archive; MERIS and MODIS regional water quality algorithms were implemented including two Mediterranean-specific algorithms (Bricaud et al., 2002 and MedOC4, Volpe et al., 2007) and the IFREMER OC5, considered better for coastal waters: see Fig 2 a) OC3 the standard NASA chlorophyll algorithm compared to b) OC5. **Service resilience** was improved through a number of activities including: implementation of NAGIOS (industry standard software) for system monitoring; enhancing backup processing at Dundee to include MERIS; installing new processing nodes at Dundee and Plymouth. **Staff developments:** There were major changes in personnel during the year reflecting staff departures and promotion. Two new staff joined NEODAAS: Mr Peter Walker, who was previously in the PML computing support group and Dr Stephane Saux-Picart, who was previously at IFREMER. Mr Rory Hutson left NEODAAS in Dec 2008 to work at the UK Met Office and his successor Mr Stelios Charalamoulou started on 3 June 2009; Dr Jamie Shutler was a awarded a prestigious ESA fellowship in March 2009 to develop air-sea gas exchange science based on Envisat data and so will only be involved in NEODAAS for ~20% and relinquish the technical development manager role. Towards the end of the year Mr Ben Taylor took over as NEODAAS operational manager from Dr Peter Miller who has undertaken the role since 2000 but will continue involvement as senior development lead. Mr Taylor is also operational manager of the ARSF-Data Analysis Node. **Other projects:** PML is participating in the GMES marine core service MyOcean, funded by the EC Framework 7, as the regional provider in the Ocean Colour team. This will undoubtedly impact upon NEODAAS data processing as systems are brought in line with other partners. NEODAAS will also investigate accessing other MyOcean data as a downstream provider. PML was also successful in another EC project DevCoCast whereby data will be processed in Plymouth and transmitted to developing countries via the Eumetsat distribution system.

SCIENCE HIGHLIGHTS:

Comparison and validation of models with satellite data. This is a growing area of exploitation of NEODAAS data. For example, Ellis et al. (2008) used SeaWiFS data from Feb – Nov 2000 to compute mineral suspended sediment (MSS) concentration in the Irish Sea. The satellite derived MSS were found be in close agreement to modelled concentrations of fine sediments within the turbidity maximum both seasonally and spatially (see Fig 3 a,b). As part of a collaboration with the UK Met Office Allen et al (2008) used weekly chl-a maps to quantitatively evaluate model skill in forecasting high biomass bloom events. Both papers show the value of continuous satellite monitoring of water quality in shelf seas.

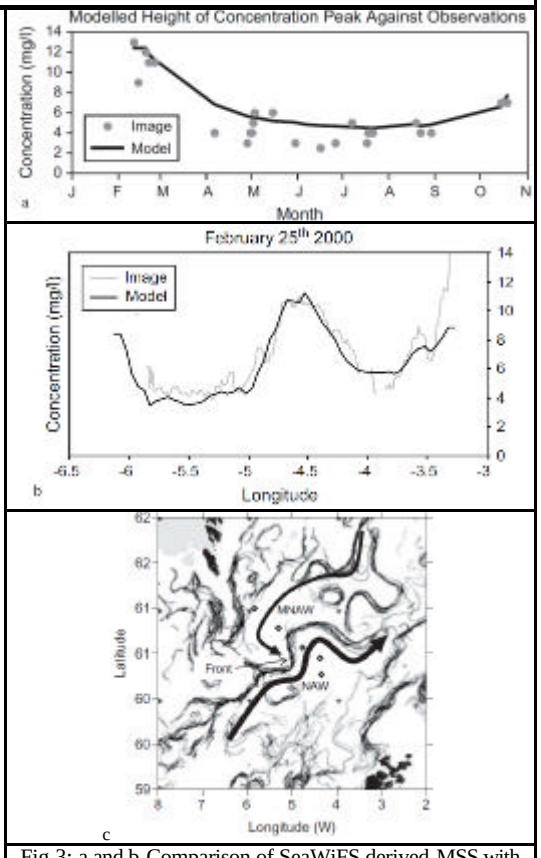

Fig 3: a and b Comparison of SeaWiFS derived MSS with outputs from a model (Ellis et al., 2008) c) The flow of surface waters between Faroe and Shetland during a week in May 1996 at a time of strong mesoscale activity overlaid on NEODAAS AVHRR front map (Sherwin et al., 2008).

Polar research. Arctic and Antarctic research featured highly in NEODAAS-Plymouth activities and user publications in 2008-9. Nine cruises (see table below) were supported in the Southern Ocean and southern South Atlantic (for BAS, NOCS and PML) looking at a variety of physical, chemical and biological phenomena whilst two cruises were supported in the Arctic, one looking at clouds and air-sea interaction as part of SOLAS (University of Leeds) and the other studying coccolithophore blooms (NOCS). Two papers published in 2008 utilised NEODAAS images to show physical structures in Arctic waters: Sherwin et al. (2008) published a front-location map to show structures around the Faroe Islands and an SST map of the same region was published in Larsen et al. (2008). Clarke et al (2008) used NEODAAS data to set the wider context of their study into seasonal and interannual variability in temperature, chlorophyll and macronutrients in northern Marguerite Bay, Antarctica

Surface Ocean Lower Atmosphere Study (SOLAS) A SOLAS paper was published (Rijkenberg et al, 2008) from researchers at NOCS that used NEODAAS chlorophyll and SST data to observe changes in surface structure before and after a small Saharan dust storm as part of their study into iron speciation. Data were also used to observe the airborne dust. NEODAAS provided support of a cruise on RV Oden (Brookes, U. Leeds) and participated in the annual science meeting.

The study of cetaceans in relation to environmental factors has attracted a number of applications to NEODAAS in recent years. In a recent paper Tetley et al. (2008) related sighting per unit of survey effort (SPUE) of northern minke whales in the Moray Firth to mesoscale oceanographic features from monthly composite images of AVHRR-SST and SeaWiFS Chl-a 2000-4. "From SST two oceanographic features appeared to dominate the region: a cold water current (Fig. 4) and a warm water plume. The results show that the SPUE of the Minke whales was significantly higher during warm plume events than when the cold current was dominant Levels of phytoplankton biomass also appeared to be substantially greater during warm water plume events. In conclusion, it is hypothesised that areas of highest minke SPUE are directly related to the presence of targeted prey attracted by high

densities of phytoplankton. Although these whales were found to occur across the survey area, throughout the study period, their distribution is concluded to be highly dependent upon the presence of co-occurring mesoscale features. " (Tetley et al. (2008).

NEODAAS-Plymouth Supported Papers:

Allen et al. (2008) How well can we forecast high biomass algal bloom events in a eutrophic coastal sea? *Harmful Algae*, **8**, 70-76.

Clarke et al. (2008) Seasonal and interannual variability in temperature, chlorophyll and macronutrients in northern Marguerite Bay, Antarctica. *Deep Sea Res. II*, **55**, 1988-2006.

Ellis et al. (2008) A model of turbidity maximum maintenance in the Irish Sea. *Estuarine Coastal and Shelf Science*, **76**, 765-774.

Larsen, K.M.H., Hansen, B. & Svendsen, H. (2008) Faroe Shelf Water. *Continental Shelf Research*, **28**, 1754-1768.

Rijkenberg et al. (2008) Changes in iron speciation following a Saharan dust event in the tropical North Atlantic Ocean. *Mar. Chem*, **110**, 56-67.

Sherwin, et al. (2008) Wind-driven monthly variations in transport and the flow field in the Faroe-Shetland Channel. *Polar Research*, **27**, 7-22.

Tetley et al. (2008) The summer distribution of coastal minke whales (Balaenoptera acutorostrata) in the southern outer Moray Firth, NE Scotland, in relation to co-occurring mesoscale oceanographic features. *Rem. Sens. Env.*, **112**, 3449-3454.

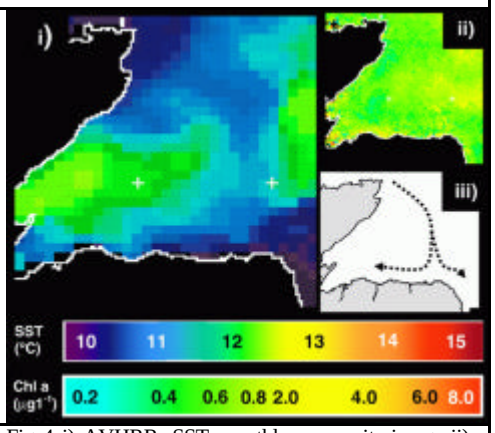

Fig 4 i) AVHRR SST monthly composite image ii) SeaWiFS monthly composite image, Chl-a, both June 2001 iii) illustration depicting the location and direction of the cold water current (Tetley et al, 2008).

FUTURE DEVELOPMENTS/STRATEGIC FORWARD LOOK

With the renewal of NEODAAS for a five year period we shall investigate some of the areas highlighted in the renewal document as proposed in the customer survey. These include, *inter alia*:

- Improved dust observation products
- Conversion of level 1 data to other formats
- SAR imagery including flood monitoring products (using both optical and radar)
- Wind and wave products
- AVHRR/MODIS hybrid volcano monitoring products
- Provision of data and tools to enable easier model validation/comparison and data assimilation - this is becoming more important and is something that NEODAAS have started
- near-real time validation/comparison work - developing the on in-situ/Ferry box comparisons

In order to prioritise the areas to be investigated we will consult with the NEODAAS steering committee and request input from the NCEO and NERC theme leaders. We hope to achieve some of the above using existing staff and the new non-marine post:

- As noted above Dr Jamie Shutler has been awarded an ESA fellowship and this will enable him to develop methods to study air-sea interaction using Envisat altimeter (RA-2), SAR and AATSR data. The methods to be developed will be operationalised for NEODAAS customer use and address the user survey responses above.
- With the changes to NEODAAS personnel we have access to a broader range of expertise including Dr Saux-Picart, soil moisture mapping
- The funding by NERC of a non-marine post will enable NEODAAS-Plymouth to investigate terrestrial, Earth or Polar science products and applications to complement the existing marine and atmospheric services.

RESEARCH CRUISES SUPPORTED IN NEAR-REAL TIME BY NEODAAS-PLYMOUTH

Start Date	End Date	Focus of the Cruise	Principal/NERC Scientist	Ship
19/02/2008	10/04/2008	BAS: Bellingshausen Sea	Rob Larter, BAS	James Clark Ross 179
13/04/2008	05/05/2008	BAS: Acoustics, box core, Stanley to Ascension.	Peter Enderlein, BAS	James Clark Ross 186
29/04/2008	20/05/2008	Autonomous measurements of carbon fluxes in the North Atlantic bloom. Reykjavik to Station India (59N 19W)	Mary Jane Perry, Maine; Patrick Martin, NOCS	Knorr 107291 (US Navy)
06/05/2008	24/05/2008	PEACE: Role of pelagic calcification and export of carbonate production in climate change. Cork to northern Biscay. (Break 15-18 May)	Steve Groom, PML, Lei Chou, ULB	Belgica
28/06/2008	21/07/2008	Celtic Sea: Horizontal patchiness in thermocline mixing; Predator-prey behaviours.	Dr Jonathan Sharples	James Cook 025
23/07/2008	21/08/2008	Coccolithophores: Southampton to Svalbard	Toby Tyrrell, NOCS	James Clark Ross 210
01/08/2008	09/09/2008	Arctic Summer Clouds Ocean Study and Arctic Mechanisms of Interaction between Surface and Atmosphere	Dr Ian Brooks, UoLeeds	R/V Oden (Swedish)
03/10/2008	10/11/2008	Atlantic Meridional Transect (AMT)-18. UK to Falklands	Malcolm Woodward, PML	James Clark Ross 218
10/12/2008	19/12/2008	BAS: Drake Passage	Graham Quartly, NOCS	James Clark Ross 194
12/01/2009	18/02/2009	BAS: Scotia Sea	Rob Larter, BAS	James Clark Ross 224
03/02/2009	03/03/2009	Coccolithophores: Southern Ocean Drake Passage from Punta Arenas to Antarctic to Montevideo. Toby Tyrrell.	A. Charalampopoulou and E. McDonagh, NOCS	James Cook 31
12/03/2009	18/04/2009	BAS: South Atlantic	Rebecca Korb, BAS	James Clark Ross 200a

NEODAAS Dundee

OVERVIEW & ACTIVITIES IN FINANCIAL YEAR (2008/09):

Fig 5: One of the new Programmable Receivers (top) and an associated IF Multiplexer (bottom).

Reception Systems: Five new Programmable Receivers (Fig 5 - top) have been manufactured and installed to upgrade the reception capability at Dundee. They replace a mix of older, obsolete and failed receivers, although some of these are retained as spares. Each one is part of a reception chain for the five steerable/tracking antennas used to collect the polar satellite data sets distributed by NEODAAS. The receivers were built to a design developed by one of the NEODAAS-Dundee team for X-band frequency reception. Additional hardware was built so that the receivers can be used for a wider range of satellites than originally designed for, including the S-band frequency range. This means the receivers will support current and future satellite missions due to be received at Dundee over the next few years and we also have the benefit of a common design for each tracking antenna reception chain.

For S-band reception, it was necessary to provide the additional hardware mentioned above in the form of IF Multiplexers (Fig 5 - bottom). This selects the appropriate input signal line depending on the satellite being tracked and carries out "upconversion" of the frequency in the case of S-band satellites. The output from the multiplexer is then compatible for input to the receiver for either X or S-band satellite missions.
Other work was carried out for X-band reception to improve the dynamic range and filtering to limit the effects of local interference.

Online Storage: NERC capital of £94k was provided to acquire a new online storage system. The existing systems have greatly benefited our operations, but they are increasingly difficult to maintain and their replacement is overdue. The new system will provide much improved performance and significantly higher storage capacity to accommodate all of our polar satellite archives and new data acquired over the next few years. This will enable us to improve services and investigate other enhancements. Procurement has been a slower process than anticipated, partly due to staff changes. Detailed research was carried through meetings with vendors, site visits and seeking advice from colleagues including NEODAAS-Plymouth and elsewhere. This was used to establish realistic specifications for our budget and for the tender documentation. Following assessment of the twelve tenders received, a contract was awarded to Latitude UK for a Sun "open storage" solution. Features include dual components for high availability/no single point of failure, fast read/write performance, high bandwidth connections between storage and processing nodes and very competitive future expansion costs. Installation and commissioning of the new system was being carried out at the end of March prior to acceptance testing.

Server Room: This room houses much of the Station's computer and network equipment and has recently been extended to provide three times the original area. This was essential to accommodate existing equipment as well as the new storage system. Power, network and UPS facilities were prepared to relocate equipment and in preparation for new systems. Additional air conditioning has been installed so that we have two units that can independently cool the entire area if the other fails.

Plymouth Processing: The server room extension also allowed NEODAAS-Plymouth to proceed with plans to expand their Dundee hosted processing system by adding several processing nodes and a backup master node to increase processing capacity and reliability. Our real-time data are copied to this system so that products can be created and distributed very quickly after reception.

Image Gallery: Functionality of the recently launched online gallery of enhanced images has been improved and several hundred new images have been added. This is a resource to identify case studies for academic and student projects as well as supporting education and general interest. Several encouraging notes of feedback on the gallery have been received from users, e.g. *"I found your image gallery very helpful in finding nice examples of images for my book – it's a great tool."* **(Dr Pete Inness, Meteorology Dept, Reading Univ.)**

Software Developments: These included website updates for consistent page styles, more robust antenna tracking and data ingest software in the event of faults and greater scheduling flexibility to receive more partly coincident satellite passes.

Staffing: Our Software/Systems Specialist left at the end of February 2008. His replacement, Jon Bowyer, was appointed in August.

SCIENCE HIGHLIGHTS:

Publications: In terms of impact factors for the journals they appeared in, the following refereed publications are most impactful of those supported directly by NEODAAS-Dundee in 2008.

Blechschmidt, A.M. (2008) A 2-year climatology of polar low events over the Nordic Seas from satellite remote sensing. *Geophysical Research Letters*, 35(9). **(IF = 2.7)**

Condron, A., Bigg, G.R., Renfrew I.A. (2008) Modeling the impact of polar mesocyclones on ocean circulation, *Journal of Geophysical Research-Oceans*, 113(C10) Article No. C10005. **(IF = 3.0)**

Gohin, F., Saulquin, B., Oger-Jeanneret H., et al. (2008) Towards a better assessment of the ecological status of coastal waters using satellite-derived chlorophyll-a concentrations, *Remote Sensing of Environment*, 112 (8), 3329-3340. **(IF = 3.0)**

Renfrew, I.A., Petersen, G.N., Outten, S., et al (2008) The Greenland flow distortion experiment. *Bulletin of the American Meteorological Society*, 89 (9), 1307-1324. **(IF = 3.5)**

Although Polar science dominates this list, supported publications were also identified across the other science areas including Atmospheric, Marine, Earth, Terrestrial and Earth Observation and several appeared in journals with impact factors higher than 2.

Polar Meteorology: It is clear from the short list of publications above that NEODAAS-Dundee is widely recognised as a major resource for scientists studying Arctic Polar meteorology and provides a great deal of support in this area. Indeed, there are several other supported publications for the year in this area and around half of the presentations during a 2-day workshop on Polar Lows at the Geophysical Institute, Bergen, featured our imagery.

Blechschmidt's paper on Polar Lows (Fig 6) made extensive use of our images to identify these intense polar cyclone events over a 2-year period for the Nordic Seas region. The paper was identified as an American Geophysical Union journal highlight by the editors of *Geophysical Research Letters* and also caught media attention with newspaper and television coverage in Germany and Switzerland.

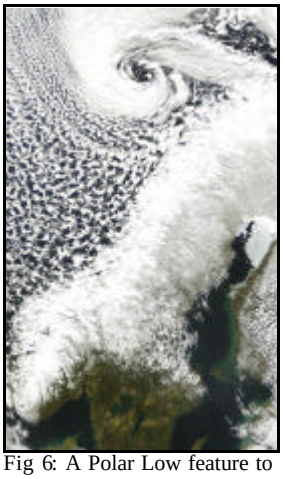

Fig 6: A Polar Low feature to the North West of Norway.

The paper by **Renfrew et al** results from the previously reported Greenland Flow Distortion Experiment (GFDex), an International Polar Year project that was supported by NERC and involved an international team of scientists. Dundee provided near real-time services to support the aircraft flying campaign and data collected during the campaign was supplied to the team for later analysis.

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:

- Near real-time MODIS imagery for operational charting of Greenland sea ice – Danish Meteorological Institute.
- Black Sea/Mediterranean climate change & variability associated with the ocean-atmosphere system – Marine Hydrophysical Institute, Ukraine.
- Hydrology research & management of water resources – Norwegian Water and Energy Administration.
- Assessment of the state of sea ice in the Svalbard archipelago for a proposed expedition – The Glasgow Academy.
- Geostationary satellite images used for research in to earthquake clouds and short-term prediction – Earthquake Prediction Center, New York.
- Data access facilities for HEIs, colleges and schools etc. support discussion forums, training, education etc. and also amateur enthusiast research.
- Dundee imagery is also used for illustrations by the media and in many other publications e.g. educational books and reports by weather services.

FUTURE DEVELOPMENTS/STRATEGIC FORWARD LOOK

Online Storage: Once commissioning and testing have been satisfactorily completed, we can begin to integrate the new system into our operations. The first priority will be to transfer all archive data from the old equipment and ensure they can be accessed to maintain existing services. We can then begin to use the increased storage capacity for other data, e.g. the MODIS archive, which is only stored on tapes at present. All of the Station's polar satellite data will then be available online and we can look to enhance the existing facilities and investigate other areas of development. Possibilities include easier access to and navigation of higher resolution imagery for eligible users, investigating standard products that we may be able to provide using freely available processing software and providing access to other instrument data contained in the direct broadcast data streams received at Dundee. We may also be able to make Meteosat geostationary satellite data available at more regular intervals, while there will also be scope for Plymouth's processing system to benefit from local access to the full Dundee archive and the additional storage resources.

Satellite Missions: Recent developments and upgrades mean the Station is well prepared to receive from other direct broadcast satellites of interest to our users. The last of the NOAA series has been launched and we will receive data routinely soon after it is operational. The US NPP/NPOESS series will replace the NOAA series, Terra and Aqua. It is currently scheduled for launch early in 2011. We are prepared as far as possible for this and further preparations will be carried out as more information becomes available.

Other missions of particular interest at the moment are the Chinese FengYun-3 series of meteorological satellites and India's Oceansat-2. Information on the Chinese satellites is limited and although we have been able to receive and process data at a basic level, we need instrument and data format information, for example, to interpret the received data. Oceansat-2 is due to launch soon and carries an ocean colour instrument that is of interest to our colleagues at Plymouth and to the marine science community. Direct reception of Oceansat-2 data is supposed to be available by commercial agreement, but so far we have received no information despite several enquiries to the relevant bodies. Higher levels contacts may be required to make progress with the Chinese and Indian missions and so we have requested advice/assistance through the NERC EO Programme and BNSC.

NASA indicated in September that they were looking at the possibility of resuming access to SeaWiFS data for non-US receiving stations. This has not been available since late 2004, although we have collected encrypted data since then. We responded positively and NASA confirmed they were extremely keen to have Dundee rejoin the network. There have been no further developments so far.

General Developments:

- A new version of a circuit board is being designed for our tracking antennas. This is the main interface between the antennas and their control computers and also provides control functions. Components from the original design are obsolete, so the new version will use replacements and will include design improvements for better fault diagnosis, surge protection and power consumption.
- Software developments may include a new database driven search facility to improve access to our geostationary satellite images, while there is scope for further improvements to system administration facilities that monitor and provide alerts for many of the Station's systems. A new intranet site is being implemented to record and track tasks, problems, support requests etc. This can be expanded to provide additional features, e.g. creating an internal knowledge base/wiki is being considered.
- We will consider producing copies of our older data on the tape media we currently use, so that offline copies of all data are stored in a consistent way. Data management tasks like this will be much easier once all data are available on the new storage system.
- The use of AVHRR data distributed through the EUMETCast system can be investigated to provide coverage beyond the normal Dundee footprint, if there is a requirement for this in user community, e.g. for specific user projects such as research cruises.

Non-Mandatory Facility-specific OPMs

Web Statistics: NERC science communication activities are greatly supported by free Web based access to information and non-scientific 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
316,996	13,018	Approx. 27.7 million	Approx. 6.9 million

Breakdown of registrations by user categories:

Personal interest	NERC/UK HEI Project	Education	Research	Commercial
62 %	17 %	11 %	7 %	3 %