NERC EARTH OBSERVATION DATA ACQUISITION AND ANALYSIS SERVICE
ANNUAL REPORT APRIL 2014 – MARCH 2015
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ANNEX 1: MISSION STATEMENT

MISSION STATEMENT

of the

NERC Earth Observation Data Acquisition and Analysis Service

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

NEODAAS will:

- routinely acquire and archive direct broadcast data available from various polar orbiting satellites, specifically the European MetOp series and United States NOAA series, Terra, Aqua and NPP.
- acquire other satellite data of value to the community and available through subscription to international agencies such as NASA, NOAA and ESA.
- acquire data from the European Meteosat geostationary satellite and data from non-European geostationary satellites relayed via Meteosat.
- supply data and derived products to customers in a timely fashion appropriate to the customer's reasonable requirements.
- provide services *complementary* to those reliably available through NASA or ESA.
- ensure data products meet international standards for formats or quality where defined.
- provide advice on the availability, use and processing of data to ensure efficient use of resources throughout the community.
- operate procedures for access to services, to ensure the best science is supported.
- support NERC public outreach activities.

In order to achieve its mission NEODAAS will:

- operate a satellite receiving station and associated systems at NEODAAS-Dundee to receive, archive and disseminate data from the satellites of interest;
- operate facilities at NEODAAS-Plymouth for processing and analysis of local (Dundee) data and global coverage data acquired by NEODAAS;
- operate facilities for transfer of data between the NEODAAS nodes for processing and analysis at Plymouth – all new polar satellite data received at Dundee to be network transferred to Plymouth in near-real time;

- produce a backup copy of Dundee archive data for routine transfer and secure storage at the NERC Earth Observation Data Centre;

- maintain a Website with access to facility information and browse imagery for registering users including the public, and access to higher level data and products for eligible users;

- maintain awareness of developments in the Earth Observation/data analysis fields, act as a point of contact with agencies such as NASA, NOAA, JAXA and ESA with a view to acquiring data from future EO satellites, 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 national and international infrastructure in terms of comparable facilities;

- maintain awareness of customer satisfaction and needs through regular contact;

- actively seek funding opportunities for its customers and itself;

- maintain close contact between NEODAAS Plymouth and Dundee staff and with 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 NERC Earth Observation Data Acquisition and Analysis Service provides specialist services to the Environmental Sciences community, through Earth Observation, supporting NERC Council's remit to promote and support high quality research, thereby meeting the needs of the User Communities identified in the NERC Mission. Other users include UK/overseas government and commercial organisations, overseas researchers and individuals using freely available Website facilities for personal interest.

Plymouth Marine Laboratory/University of Dundee/NERC Scientific Facilities and Technology Group – January 2009; reviewed and adapted by NCEO February 2015.

ANNEX 2: STEERING COMMITTEE MEMBERSHIP & TERMS OF REFERENCE

MEMBERSHIP AS AT APRIL 2015

Mr Andrew Fleming (Chair)	British Antarctic Survey Madingley Road	AHF@bas.ac.uk Tel: 01223 221451
12/09	Cambridge CB3 0ET	Fax: 01223 362616
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REMIT AND TERMS OF REFERENCE FOR THE NEODAAS STEERING COMMITTEE

Remit

The NEODAAS Steering Committee exists to:

- review applications for use of data and information from NEODAAS
- monitor outputs from NEODAAS
- provide advice to the NCEO Director (or a nominated representative) on aspects of the operations of the Facility.

Terms of Reference

1. To review applications and, to make suggestions to NCEO for priorities for the Manager of the Facility, for the allocation of those of the Facility's resources funded from the Services and Facilities science budget, taking into account recommendations made through the NERC peer review mechanisms.

2. To review the scientific quality of work undertaken by users utilising the Facility, 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 NCEO Director, and Director and Managers of the Facility, related to the improvement of the Facility's equipment and its service function.

5. To advise the NCEO Director on:

    a. the level and direction of the internal R&D programme for the Facility.

    b. anticipated changes in requirements from the Facility and the anticipated levels of future demand for the Facility.

6. To receive annually a report from the Manager of the Facility and to comment thereon as appropriate prior to submission of the report to the NCEO Director and to NERC Director Science and Innovation and their representatives.

7. To report annually to the NCEO Director and to provide advice at other times as appropriate.

Membership Constraints

Membership of the Committee will be decided by the Science Delivery Director with advice from the Science & Innovation Strategy Board and suggestions from the Committee itself. It will include the Service Heads and a representative from Services and Facilities Management Team.

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 Chair will serve a maximum of four years.

ANNEX 3: EQUIPMENT INVENTORIES

NEODAAS-PLYMOUTH EQUIPMENT INVENTORY

Note the equipment listed is used to fulfil the NEODAAS-Plymouth contract but is not wholly committed to, or purchased through, the contract:

- Dell dual CPU Linux PC's;
- Dell Windows PC's and Laptop PC's;
- Dell Sun Grid Engine with 6 master nodes and 140 processing nodes;
- 2 Petabytes disk storage, LTO drives and jukeboxes, DVD/CD writer.
- 10Gb Cisco networking for servers and backbone with 1Gb connectivity for computing nodes and workstations
- Primary and redundant backup/development webserver
- 4-node "big data" data services cluster
- Primary and redundant database servers
- 1Gb/s JANET internet link
- EUMETCAST reception system
- Access to PML laser and inkjet printers.

NEODAAS-DUNDEE EQUIPMENT INVENTORY

1. Tracking, Data Reception, Ingest and Test Equipment etc.

- NOAA/MetOp HRPT L-band El/Az Tracking Antenna & 2.4m Reflector
    - Tracking Control & Data Ingest PC
    - Motor Controller Unit
    - HRPT Receiver, Bit/Frame Synchroniser & Data Buffer
    - CSCL Programmable Receiver
    - Front-end Polarisation Controller
    - VHF/UHF Signal Multiplexer
- NOAA/MetOp HRPT X/Y L-band Tracking Antenna & 2.8m Reflector
    - Tracking Control & Data Ingest PC
    - Motor Controller Unit
    - HRPT Receiver, Bit/Frame Synchroniser & Data Buffer
    - CSCL Programmable Receiver
    - Front-end Polarisation Controller
    - VHF/UHF Signal Multiplexer
- Terra & Aqua MODIS X/Y X-band Tracking Antenna & 2.8m Reflector
    - Tracking Control & Data Ingest PC
    - Motor Control Unit
    - CSCL Programmable Receiver
    - Programmable X-band Downconverter
    - Antenna and Programmable Downconverter Control Interface
- Terra & Aqua MODIS X/Y X-band Tracking Antenna & 2.8m Reflector

    - Tracking Control & Data Ingest PC
    - Motor Control Unit
    - CSCL Programmable Receiver
    - Programmable X-band Downconverter
    - Antenna and Programmable Downconverter Control Interface
- Terra MODIS El/Az X-band Tracking Antenna & 3.7m Reflector
    - Tracking Control & Data Ingest PC
    - Motor Controller Unit
    - CSCL Programmable Receiver
    - Programmable X-band Downconverter
    - Antenna and Programmable Downconverter Control Interface
- Spare X/Y antenna Motor Controller Unit
- Meteosat EUMETCast C-band Antenna with 3.7m Reflector
    - Data Ingest PC with SkyStar2 DVB Receiver Card
- Meteosat EUMETCast Ku-band Antenna with 1.0m Reflector
    - Data Ingest PC with SkyStar2 DVB Receiver Card
- 3 Trimble GPS antennas/receivers for Station time standard
    - Associated time server PC
    - GPS Interface Unit
- Davis Vantage Pro2 Wireless Weather Station
- Dell 5.6 kVA UPS (3 of)
- MGE Extreme 7 kVA UPS (4 of)
- APC 2 & 3 kVA Smart UPS (3 of)
- Agilent E4438C ESG Vector Signal Generator (250 kHz to 2 GHz)
- Agilent E8257D PSG Analogue Signal Generator (250 kHz to 20 GHz)
- Rohde & Schwarz FSP30 Spectrum Analyser (9kHz to 30 GHz)
- Hewlett Packard 8593E Spectrum Analyser
- Philips PM3065 100MHz Oscilloscope (2 of)

NEODAAS-DUNDEE EQUIPMENT INVENTORY (CONTD.)

2. Data Archiving, Processing and Server Systems etc.

a) Computer Systems:

Hostname	Primary Use	*Model
aceso	Operational duties, tape archiving, CD writing	
argus1,2	Main storage system	Sun 7410 cluster
arke	Remote ingest viewer	
bertha	Backup (held in UoD Tower Building)	
bigdata1..10	Data processing and Virtual Machine hosting	Dell R720
camserver	IP camera recording viewer, status monitoring	
dvbs1,2	Eumetcast geostationary satellite data ingest	
iris	Windows file server	Sun X2270
lara, buffy	General file and application servers	Sun T2000
mac1,2	Remote real-time displays	Apple Mac Mini
metop	Operational duties	
metope1,2	General purpose processing	Sun X2250
mneme	LTO tape archiving	
nagios	System monitoring, mail server	
phoenix	Backup file server (held in UoD Tower Building)	
prism	IP camera recording server, remote ingest viewer	
test0	Spare tracking and ingest PC	
thunderbird5	Spare tracking and ingest PC (older model)	
xena	Database server and internal webserver	
Personal PCs (5)	General admin, software development, etc	
Ingest PCs (5)	Antenna tracking and satellite data ingest	

* Built in-house unless manufacture/model name is indicated.

b) External Tape/Disc Drives, Printers and Other Devices:

Model	Device	Primary Use
Sun DLT7000	Tape drive	Restoring archive data
Transtec autoloader	Tape drive auto-loader	Restoring archive data
Transtec LTO3	Tape drive	Restoring archive data
Transtec LTO4	Tape drive	Archiving live data
Transtec LTO5	Tape drive	Archiving satellite data
Epson R3000	Photo printer	
Ayecka SR1 (2 off)	DVB receiver	Eumetcast geostationary satellite data reception
Netgear XSM7224S	Network switch	High-speed data transfers
Lenovo E530c	Laptop	Presentation and development

ANNEX 4: SUMMARY OF PERFORMANCE INFORMATION

4.1 APPLICATION GRADES

NEODAAS supports UK scientists who have submitted an application form either to NEODAAS-Plymouth or Dundee, though most applications are submitted to Plymouth as supplier of the higher level products. Applications expected to 'cost' greater than £500 are peer-reviewed by the NEODAAS-SC 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 NEODAAS-Plymouth web site, which logs the images accessed by authorised users in a database. Applications are accepted in support of PhD projects; other student applications (e.g. MSc or BSc) are not always reviewed or cost-allocated, but may be undertaken on a best-endeavours basis within the Training/Education remit of NEODAAS.

During this year, NEODAAS supported 29 projects in total through formal applications, 17 of which were new applications that were reviewed. The new applications requiring review were graded as follows:

APPLICATIONS: DISTRIBUTION OF GRADES (Current FY — 2014/15)

	10	**9**	**8/a4**	**7**	**6**	**5**	**4**	**3**	**2**	**1**	**R*/Pilot**	**Reject**
NERC Grant projects	0	2	1	0	0	0	0	0	0	0	0	0
Other academic	0	1	6	4	0	0	0	0	0	0	0	0
Students	0	0	2	1	0	0	0	0	0	0	0	0
Pilot	0	0	0	0	0	0	0	0	0	0	0	0
TOTAL: 17	0	3	9	5	0	0	0	0	0	0	0	0

4.2 DISTRIBUTION OF PROJECTS

NEODAAS supported 29 projects in total through formal applications. A few low-level academic/educational requests were also supported by Dundee without formal applications.

All formal applications (new and ongoing) supported by NEODAAS can be mapped onto NERC's Science Areas and Science Priorities, as a percentage of the Full Cash Cost:

Science Area	**Number of Projects**	**Allocated Cost (%)**
Atmospheric	0.33	1.14
Earth	1	3.45
Marine	21.33	73.55
Terrestrial and Freshwater	0.5	1.72
Earth Observation	5.33	18.38
Science-based Archaeology	0	0.0
Polar	0.5	1.72
TOTAL	**29**	**100**

Science Priorities	**Number of Projects**	**Allocated Cost (%)**
Climate System	5.57	19.21
Biodiversity	7	24.1
Earth System Science	9.07	31.28
Sus. Use of Nat. Resources	4.5	15.48
Natural Hazards	0.5	1.72
Env., Poll. & Human Health	1.16	4.0
Technologies	1.16	4.0
TOTAL	**29**	**100**

4.3 APPLICATIONS SUPPORTED DURING FY 2014/15:

HEI Name (as per HESA list)	PI Surname	App. No.	Application Title	Grade	Fellow	PhD	Complete
NOCS	Hydes	01/20	FerryBox (BICEP)	a4			
Marine Biological Assoc.	Schroeder	05/04	Ushant E. Huxleyi evolution and DNA	a4			1
Plymouth Mar. Lab.	Rees	08/08	Support for AMT-23 cruise	a4			
BAS	Fleming	09/13	Rothera archive improvements	a4			
Universite Blaise Pascal	Harris	MoU	Investigation of volcanos	a4			
NOCS	Martin	12/21	OSMOSIS: Support for three cruises	9		2	1
University of Aberdeen	Scott	13/05	Basking Shark seascape genomics, spatial ecology and conservation	9		1	1
NOCS	Wynn	13/06	Balearic Shearwater (Puffinus mauretanicus)	8		1	1
NOCL	Wolf	13/12	Hydrodynamic model of Scottish shelf waters	8		1	1
University of Aberdeen	Tweddle	13/13	Effect of marine renewables on primary production	8		1	1
University of East Anglia	Williamson	13/14	UK Shelf Sea Biogeochemistry programme	9			
University of Aberdeen	Tweddle	14/01	Firth of Forth MarCRF Cruise	8		1	1
University of Exeter	Watson	14/02	RAGNARoCC	8			1
Bournemouth University	Franklin	14/03	Chlorophyll alteration products	7		1	1
University of Southampton	Hickman	14/05	S2P3-Reg	7			1
University of Bangor	Cambie	14/06	Sustainable use of fisheries resources in Welsh waters	8			1
NOCS	Painter	14/07	Outer Hebrides process cruise (DY017)	8		11	1

HEI Name (as per HESA list)	PI Surname	App. No.	Application Title	Grade	Fellow	PhD	Complete
NOCS	Martin	14/08	Investigation of eddy reactions	8			
NOCS	Henson	14/09	Real-time satellite date for JR304 BAS Western Core Box cruise	8		1	1
Marine Biological Assoc.	Smale	14/10	Ocean warming effects on kelp forests	7			1
University of Plymouth	Ingram	14/11	Physical drivers of predator foraging in the marine environment	8		1	1
NOCL	Brereton	14/12	United Kingdom Environmental Prediction	8			1
University of Glasgow	Wakefield	14/13	Predicting distribution of UK-breeding seabirds at sea	7			
Plymouth Mar. Lab.	Aiken	14/14	Evidence of global warming in N. & S. Atlantic cruises	9			
NOCS	Hartman	14/15	Interannual variability in productivity at PAP	7			
University of Plymouth	Hosegood	14/16	Surface Mixed Layer Evolution at Submesoscales (SMILES)	9			
University of Southampton	Marsh	14/18	Primary productivity in the Celtic Sea	8			
University of Bangor	Hiddink	14/19	IMMERSE	9			

Note that project 14/17 is included in the cost allocations but not elsewhere in this report. This is because this project was withdrawn after the cost allocations were completed.

4.4 (CONTD.) COST ALLOCATIONS FY 2014/15: NEODAAS-DUNDEE

Service Capacity
The unit cost for NEODAAS-Dundee is based on staff effort. For the purpose of Cost Allocations, capacity is measured in terms of operational staff (Shift Technicians) with other staff undertaking support activities, e.g. station management, software/systems administration, maintenance, general administration and clerical duties.

Annual capacity assumes 213 working days per staff member each year as per NERC guidelines.

Total Capacity	=	No. of Operational Staff x Working Days x Shift Duration
	=	2 x 213 x 7.5
	=	3195 hours (or units)

Unit Pricing
For Cost Allocation returns, the operational staff effort involved in producing each product has been estimated to give the number of units for each product (see Table). Consequently, there is only a single unit of pricing. The unit price is calculated as follows:

Facility Budget of DSRS ÷ Total Capacity	=	Unit cost
£ - / 3195	=	-

(Note: Facility Budget allocated by NERC/NCEO for NEODAAS-Dundee 2014/15 was £ -)

Web Site Image Archives and Gallery Facilities
The NEODAAS-Dundee web site provides access to archives of value added image products and a gallery of selected high resolution images for users that register. The facilities are used extensively at all levels including research, training, education and public interest, while images often appear in publications. There are several million image downloads annually. It is not possible to allocate costs against the thousands of individual users and so an overall figure of 20% of NEODAAS-Dundee cost is allocated as a “block figure” to reflect usage of these facilities.

Note:
The procedure for allocating Dundee costs to Plymouth users who are supported using Dundee data was updated a few years ago to simplify the process and avoid duplicating their details on the Dundee return. The notes in the first row of each return explain how this is done.

4.5 NEODAAS-PLYMOUTH AND DUNDEE SINGLE-NODE OUTPUT STATISTICS

The majority of projects, users and publications receive joint support of both nodes of NEODAAS, i.e. through data acquired at Dundee and resulting products derived at Plymouth. As a result, the activities of the two nodes are too entwined to allow clear separation of output performance measures and allocate them to each node. With approval of the Steering Committee, it has been agreed that single node output statistics cannot be provided for NEODAAS.

ANNEX 5: PUBLICATION DETAILS – CALENDAR YEAR 2014

NEODAAS publication outputs are listed below and relate to any activities supported individually by the Plymouth and Dundee nodes as well as activities supported by both nodes in collaboration.
NEODAAS staff members are in bold.

REFEREED PAPERS (71)

Antony, T., Raju, C.S., Mathew, N., Saha, K. & Moorthy, K.K. (2014) A Detailed Study of Land Surface Microwave Emissivity Over the Indian Subcontinent. *IEEE Transactions on Geoscience and Remote Sensing*, 52(6), 3604-3612. doi: 10.1109/TGRS.2013.2274010

Baran, A.J., Cotton, R.J., Furtado, K., Havemann, S., Labonnote, L.-C., Marenco, F., Smith, A. & Thelen, J.-C. (2014) A self-consistent scattering model for cirrus. II: The high and low frequencies. *Quarterly Journal of the Royal Meterological Society*, 140(680), 1039-1057. doi: 10.1002/qj.2193

Barnes, M.K., Tilstone, G.H., Smyth, T.J., Suggett, D.J., Astoreca, R., Lancelot, C. & Kromkamp, J.C. (2014) Absorption-based algorithm of primary production for total and size-fractionated phytoplankton in coastal waters *Marine Ecology Progress Series*, 504, 73-89. doi: 10.3354/meps10751

Birch, C.E., Reeder, M.J. & Berry, G.J. (2014) Wave-cloud lines over the Arabian Sea. *Journal of Geophysical Research - Atmospheres*, 119(8), 4447-4457. doi: 10.1002/2013JD021347

Brewin, R.J.W., Mélin, F., Sathyendranath, S., Steinmetz, F., Chuprin, A. & Grant, M. (2014) On the temporal consistency of chlorophyll products derived from three ocean-colour sensors. *ISPRS Journal of Photogrammetry and Remote Sensing*, 97(0), 171-184. doi: 10.1016/j.isprsjprs.2014.08.013

Bricheno, L.M., Wolf, J.M. & Brown, J.M. (2014) Impacts of high resolution model downscaling in coastal regions. *Continental Shelf Research*, 87, 7-16. doi: 10.1016/j.csr.2013.11.007

Brown, I.J., Torres, R. & Rees, A.P. (2014) The origin of sub-surface source waters define the sea–air flux of methane in the Mauritanian Upwelling, NW Africa. *Dynamics of Atmospheres and Oceans*, 67(0), 39-46. doi: 10.1016/j.dynatmoce.2014.06.001

Caballero, A., Ferrer, L., Rubio, A., Charria, G., **Taylor, B.H.** & Grima, N. (2014) Monitoring of a quasi-stationary eddy in the Bay of Biscay by means of satellite, in situ and model results. *Deep Sea Research Part II: Topical Studies in Oceanography*, 106, 23-37. doi: 10.1016/j.dsr2.2013.09.029

Clark, D., Brown, I., Rees, A., Somerfield, P.J. & **Miller, P.I.** (2014) The influence of ocean acidification upon nitrogen regeneration and nitrous oxide production in temperate shelf seas. *Biogeosciences*, 11, 4985-5005. doi: 10.5194/bg-11-4985-2014

Cui, T., Zhang, J., Tang, J., Sathyendranath, S., **Groom, S.**, Ma, Y., Zhao, W. & Song, Q. (2014) Assessment of satellite ocean color products of MERIS, MODIS and SeaWiFS along the East China Coast (in the Yellow Sea and East China Sea). *ISPRS Journal of Photogrammetry and Remote Sensing*, 87, 137-151. doi: 10.1016/j.isprsjprs.2013.10.013

Diaz, P.A., Ruiz-Villarreal, M., Velo-Suarez, L., Ramilo, I., Gentien, P., Lunven, M., Fernand, L., Raine, R. & Reguera, B. (2014) Tidal and wind-event variability and the distribution of two groups of Pseudo-nitzschia species in an upwelling-influenced Ría. *Deep Sea Research Part II: Topical Studies in Oceanography*, 101, 163-179. doi: 10.1016/j.dsr2.2013.09.043

Grams, C.M., Binder, H., Pfahl, S., Piaget, N. & Wernli, H. (2014) Atmospheric processes triggering the central European floods in June 2013 *Natural Hazards and Earth System Sciences*, 14, 1691-1702. doi: 10.5194/nhess-14-1691-2014

Hartman, S.E. M.C. Hartman, D.J. Hydes, D. Smythe-Wright, F. Gohin, P. Lazure (2014) The role of hydrographic parameters, measured from a ship of opportunity, in bloom formation of Karenia mikimotoi in the English Channel. *Journal of Marine Systems* 140 (2014) 39–49

Helbig, C., Bauer, H.-S., Rink, K., Wulfmeyer, V., Frank, M. & Kolditz, O. (2014) Concept and workflow for 3D visualization of atmospheric data in a virtual reality environment for analytical approaches. *Environmental Earth Sciences*, 72(10), 3767-3780. doi: 10.1007/s12665-014-3136-6

Highfield, A.C., Evans, C., Walne, A.W., **Miller, P.I.** & Schroeder, D.C. (2014) How many Coccolithovirus genotypes does it take to terminate an *Emiliania huxleyi* bloom? *Virology*, 466-467, 138-145. doi: 10.1016/j.virol.2014.07.017

Holley, D.M., Dorling, S.R., Steele, C.J. & Earl, N. (2014) A climatology of convective available potential energy in Great Britain. *International Journal of Climatology*, 34(14), 3811-3824. doi: 10.1002/joc.3976

Hopkins, F.E. & Archer, S.D. (2014) Consistent increase in dimethyl sulfide (DMS) in response to high CO2 in five shipboard bioassays from contrasting NW European waters. *Biogeosciences*, 11, 4925-4940. doi: 10.5194/bg-11-4925-2014

Inness, P. (2014) Weather Images. *Weather*, 69(1), 14. doi: 10.1002/wea.2265
Inness, P. (2014) Weather Images. *Weather*, 69(2), 14. doi: 10.1002/wea.2268
Inness, P. (2014) Weather Images. *Weather*, 69(3), 70. doi: 10.1002/wea.2275
Inness, P. (2014) Weather Images. *Weather*, 69(4), 98. doi: 10.1002/wea.2295
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ANNEX 6: PUBLICITY AND SCIENCE COMMUNICATION ACTIVITIES

- NEODAAS makes a significant contribution to science communication and outreach through its website facilities. They include general information about operations, satellites we receive from and links to related sites. The most popular aspect is processed image products generated from the polar and geostationary satellite data we have collected since 1978. A gallery of high resolution images is also available to illustrate significant features and events from our archives. The site is popular with many categories of user including researchers, teachers, students and the general public. Images are also used operationally by satellite operators, meteorological services, flight planning services and airline pilots, for example.
- Images of significant events are made available to the media when they are received. In recent years they have included images showing severe storms, snow cover, volcanic eruptions and wildfire outbreaks. These images feature regularly in newspapers, television news and associated websites, television documentaries and many other websites. Specific examples for 2014 are outlined later in this annex.
- NEODAAS provided a stand for the exhibition area at the NCEO/CEOI-ST Joint Science Conference in Sheffield during September.
- NEODAAS-Dundee gave presentations on the facility to officials and staff of the Indian Space Research Organisation, Bangalore and the National Remote Sensing Centre, Hyderabad during a visit in December to discuss reception and processing of Oceansat-2 satellite data at Dundee.
- The University of Dundee issued a press release to mark 40 years since installation of the first dish based tracking antenna at the University in January 1975. This led to media coverage of the facility including a local newspaper article and regional television and radio items.
- A selection of our gallery images are used in demonstrations of visualisation facilities at the Satellite Applications Catapult, Harwell and also in an introductory film shown to visitors.
- NEODAAS-Dundee supports University open days for prospective students and guests. Visits are also arranged regularly for individuals and groups interested in the receiving station such as academics, students, school teachers, pupils and local clubs.
- Selected images from the NEODAAS archive are included in the Science Photo Library catalogue and are available for purchase.
- Requests for permission to use selected NEODAAS images on other websites are received on a regular basis and are normally granted subject to a suitable credit being provided.

There are many examples where our images are used for illustrations in books, magazines, newspapers, television etc. Those identified for 2014 are listed below – authors, publishers etc. are asked to credit the facility.

'Climates of the British Isles: Present, Past and Future' (eBook edition) edited by Elaine Barrow & Mike Hulme, published by Routledge January 2014 – textbook providing a comprehensive account of research into climate and changing climates – featured several NEODAAS images.

'Reeds Weather Handbook' by Frank Singleton, published by Thomas Reed January 2014 – a practical guide to weather and forecasting for sailors.

'Understanding Weather' (eBook edition) by Karel Hughes & Julian Mayes, published by Routledge April 2014 – book presenting a visual approach to understanding weather using observations from Earth's surface and remote sensing – extensive use of NEODAAS images.

'Geography for Common Entrance: Physical Geography' by James Dale-Adcock, published by Galore Park August 2014 – school geography textbook for 13+ exam preparation.

Exampro by Doublestruck (part of Assessment and Qualifications Alliance) – permission to use imagery in on-line teaching resource for access to past AQA national exam papers.

'Soccer Planet' produced by NHK (Japan), broadcast February 2014 – featured NEODAAS image of UK storms during February 2014 in Japanese TV programme.

'The Floods That Foiled New Year: Caught on Camera' produced by Pioneer Productions, Channel 4 documentary on UK storms and floods of early 2014, first broadcast 6th March 2014 – featured animated sequences of NEODAAS images showing storm systems.

‘UK floods: weather and storms’ by Alice Philipson and Melanie Hall, The Telegraph (online), 12th February 2014 – featured image showing storm system over the UK.

‘Havoc! As floods hit new areas, 108mph winds cause power cuts, shut motorways and force passengers off trains’ by Mark Duell, Ray Massey and Sam Webb, The Daily Mail (online), 12th February 2014 – featured image showing storm system over the UK.

‘Major emergency’ for Kilkenny stood down as roads reopen’ by Conor Kane, The Irish Times (online), 12th February 2014 – featured image showing storm system over the UK.

‘The Big One’, Metro newspaper (print and online), 13th February 2014, front cover – featured image showing storm system over the UK.

‘Wild Wednesday whips up the most widespread misery yet’ by Gordon Rayner and Sam Marsden, The Daily Telegraph (print and online), 13th February 2014, p2-3 – featured image showing storm system over the UK.

‘100mph winds blast Britain as the rain keeps on falling’ by Simon de Bruxelles and Philip Pank, The Times, 13th February 2014, p6-7 – featured image showing storm system over the UK.

‘Blown to Brits’ by Ben Jackson, The Sun (print), 13th February 2014, front cover – featured image showing storm system over the UK.

‘Britain in the Eye of the Storm’ The Courier newspaper (Central Scotland – print), 13th February 2014, front cover – featured image showing storm system over the UK.

‘Climate change is here now and it could lead to global conflict’ by Nicholas Stern, The Guardian (print and online), 14th February 2014 – featured image showing storm system over the UK.

‘How we ended up paying farmers to flood our homes’ by George Monbiot, The Guardian (print and online), 18th February 2014 – featured image of cloud free England and Wales following storms and floods.

‘This weather phenomenon can be haard to bear’ by Caroline Lindsay, The Courier newspaper (Scotland, online) 25th July 2014 – featured image showing North Sea haar along east coast of UK.

‘UK on flood alert as Hurricane Gonzalo to hit on Tuesday and may even bring snow’ by Levi Winchester, The Daily Express (print and online) 17th October 2014 – featured image showing Atlantic storm system approaching UK & Ireland.

‘Hurricane Gonzalo batters Ireland with gusts of up to 100kmh’ Irish Independent (online) 20th October 2014 – featured image showing Atlantic storm system approaching Ireland.

‘Britain braced for floods as heavy rain is forecasted’ The Telegraph (online) 14th November 2014 – featured image showing Atlantic storm system approaching UK & Ireland.

‘Wild Cornwall’ magazine published by Cornwall Wildlife Trust, June 2014 – featured NEODAAS image in an article on the impact of winter 2013/14 storms.

‘The Planner’ (official magazine of the Royal Town Planning Institute), March 2014 – permission to use image in an article on UK storms and floods.

‘Fisheries Management from Sea to Source’ by Lawrence Talks (ed.), FISH magazine published by the Institute of Fisheries Management, Winter 2014 – featured NEODAAS image illustrating UK soil run-off following floods.

Met Office UK weather summary March 2014 – featured NEODAAS images of Scottish mountain snow cover and UK fog cover in monthly weather summary published on UK Met Office website.

Met Office UK weather summary July 2014 – featured NEODAAS image of fog over the North Sea in monthly weather summary published on the Met Office website.

Met Office UK weather summary October 2014 – featured NEODAAS image of mid-Atlantic low pressure area in monthly weather summary published on the Met Office website.

‘Weather bomb: scary new name for common winter storm’ by Prof Edward Hanna, The Conversation (online news articles sourced from UK academic and research community) 12th December 2014 – featured image showing intense low-pressure system over the UK.

The Open University, April 2014 – permission granted to use NEODAAS imagery in ‘Wild Weather’ course material.

‘Meteorology – Excellence in weather and climate research’ Department of Meteorology, University of Reading research brochure 2014 – featured NEODAAS image.

Paul Ramshaw, Consultant, February 2014 – permission to use this imagery for presentations to Incident Response Managers of Northgate Public Services.

University of Dundee Reports & Financial Statements 2013/14 – cover image from NEODAAS of Iceland’s Eyjafjallajokull volcano erupting.

ANNEX 7: SUMMARY OF INTERNAL R&D OUTPUT

(NOTE: ANNEX IS ALSO OUTLINED IN THE MAIN REPORT)

NEODAAS-PLYMOUTH

- Plymouth systems: Our work was concentrated on transferring our GEOPS processing system to the Climate and Environmental Monitoring from Space (CEMS) high-performance facility at Harwell, with the aim of providing a resilient backup processing capability and significantly extending NEODAAS processing power towards intensive global processing. GEOPS is now working within a 'virtual machine' (VM) environment, so the remaining step is to upload the VM to CEMS for remote processing.
- A large amount of software development was required 'behind the scenes': to prepare our processing systems for a fundamental change to NASA's data delivery format from HDF to netCDF; to consolidate our GEOPS processing chains to work identically for input data at Level 1 or 2; and to improve processing efficiency to maintain the timeliness of our near-real time commitments.
- Ocean colour products:
    - We have developed the expertise to acquire and process high-resolution (15-30m) optical data from Landsat-8's OLI instrument, to support what is likely to be the first application of many. This builds upon collaboration between NEODAAS-Plymouth and the Royal Belgian Institute of Natural Sciences (RBINS).
    - During the year NASA's VIIRS sensor grew in importance as the increasing noise and calibration problems blighted the older Aqua-MODIS sensor data. Hence, we are implementing a processing chain for Level 0 VIIRS data received by Dundee rather than waiting a day for Level 2 from NASA.
    - We reprocessed the entire Aqua-MODIS archive 2002-present for the N Atlantic region, and completed operationalisation of the MEDOC3 Mediterranean regional chlorophyll-a algorithm.
- Sentinel sensors: The first satellite in this series, Sentinel-1A, was launched in Apr. 2014 carrying the C-SAR synthetic aperture radar instrument. We have processed sample scenes using the Sentinel-1 Toolbox, and investigated the potential value to NEODAAS users of surface roughness data and value-added products such as ship detection, oil slick detection, and high-resolution wind speed and direction.
- NEODAAS website: The main NEODAAS website (neodaas.ac.uk) has had a major redesign, to modernise and simplify the user's journey from discovery to data access. Included is a significant new facility for bulk download of Plymouth mapped time-series datasets: this will enable our 'power' users to extend the scope of their applications without further effort by NEODAAS staff. In addition, a WebGIS portal has been implemented, initially allowing a small subset of NEODAAS datasets to be visualised with pan/zoom/time controls as opposed to the traditional fixed map regions.
- Synergy with NCEO: Discussions are in progress to formulate a procedure for transferring published NCEO algorithms to NEODAAS for wider dissemination and exploitation through operationalisation through our archive and near-real time processing chains. As a trial of this strategy, NEODAAS now supports a NCEO-developed algorithm to derive the phenology of phytoplankton (bloom start/end dates and duration) from a long time-series of global or regional ocean colour data (Racault et al, 2012).
- Data delivery guide: A semi-automated report generator was implemented, and has been applied to document each data delivery to Plymouth users for the latter half of this year. This provides our users with a concise but comprehensive professional user guide customised for the requested products, together with essential metadata.

NEODAAS-DUNDEE

- Over 4000 unique SeaWiFS datasets were delivered to NASA for inclusion in its global archive of local area coverage data. These were received at Dundee from the Orbview-2 satellite between 2004 and 2010. SeaWiFS provided high quality ocean colour data and the NEODAAS datasets are now available to international users via NASA's Ocean Biology Processing Group as well as to the NERC community.

- Good progress has been made towards an agreement to receive ocean colour data from India's Oceansat-2 satellite at Dundee. ISRO/Antrix provided a draft agreement and we visited them in December for detailed discussions, during which most of our technical questions were answered. Since then, our efforts have focussed on test and development work. This confirmed that our antennas are capable of receiving from the satellite. We also adapted our own receivers to provide an alternative method of pre-processing received data that is more flexible than they had proposed. ISRO/Antrix have been very helpful. They scheduled a number of transmissions from the satellite to test our receiving systems, provided technical information and support for our development work, and processed data we collected to validate the reception quality and our pre-processing software. As a result, we established that our antennas should receive above 5 deg. and certainly 10 deg. elevations and we will not require Antrix proprietary hardware as originally proposed. They will now provide us with their proprietary data processing software system, to be run on a computer server we can procure, plus installation, testing, training etc. Antrix have updated the draft agreement to reflect clarifications and revised arrangements etc. and Uo Dundee contracts department are currently reviewing this.
- A Suomi-NPP VIIRS active fires algorithm for direct readout groundstations has been implemented in collaboration with CSIR, South Africa. CSIR developed their Advanced Fire Information System (AFIS) to provide near-real time wildfire alerts for Southern Africa based on data collected at their groundstation. NEODAAS is supporting a pilot to extend coverage of AFIS to Europe using MODIS data received at Dundee and has now supplemented this with fire information from VIIRS data.
- As reported previously, in early 2014 we suffered a significant period of downtime for two of the main tracking antennas after a tree fell during a storm and destroyed an overhead section of cables. To bring the systems back into operation as soon as possible, control and reception equipment was relocated to a plant room close to the antennas as a temporary measure. The work to provide a permanent solution was completed this year. A rooftop "garage", originally used to store building maintenance equipment, was completely refurbished and fitted out with power and networking facilities etc. to provide a dedicated room directly below the antennas in which our equipment has been installed. Additional equipment was acquired to support this arrangement, e.g. remote monitoring/control computers, UPS and cooling. This new set-up is much more satisfactory than before. The antennas are remotely monitored and controlled with received data accessed via network, while the risk of vulnerable overhead cables has been eliminated.
- The two EUMETCast receiving systems used to acquire geostationary satellite data were upgraded. New data ingest PCs were built and configured with new receiver hardware, while the data ingest and processing software was also improved. EUMETCast data are transmitted in C-band and Ku-band frequency ranges and our systems cover both ranges for service resilience. The Ku-Band antenna and front-end have also been replaced for better reception quality. The upgrades have improved reliability, reduced data losses and, most important, allowed us to maintain our geostationary satellite data facilities as they are compatible with the new EUMETCast data distribution service introduced during the year.
- A capital award from NERC's Environmental Big Data call was used to purchase a cluster of high performance processing servers, new web servers and UPS provision for them. They were installed and gradually integrated into operations during the year. The processing machines are deployed as a mixture of virtual machine (VM) servers and application servers. There are now three identical servers used for VMs which replaced a single ageing server. The VMs are easily migrated from one server to another so that system maintenance can be carried out without interrupting any processing that is running. The remaining machines do not run VMs. They are used for data processing that requires the best possible hardware performance or does not require VM flexibility, such as archive reprocessing. The new systems are facilitating faster, more reliable data processing and shorter times to make resulting products available. This had become a problem with newer satellites such as Suomi-NPP and MetOp generating greater volumes of data, so processing times with our older systems had increased significantly. The web servers replaced ageing machines and will support further website development and new products.
- One of the two computer systems used for near-real time processing of data for NEODAAS Plymouth suffered hardware failures and was retired. A replacement for this was built inside a virtual machine and it now runs in parallel with the other hardware computer.
- The display system for remote real time viewing of imagery being received at Dundee has been completely redeveloped after the prototype version highlighted various issues. The software now runs in the client's web browser and only requires access to our website. The stand-alone display is based around a Mac Mini, chosen because it is compact and quiet, and this is configured to automatically launch the

browser. “Watchdog” code has been added to restart this if locked-up, which is a common problem with browsers running for long periods. In the receiving station, the web server provides the images and video clips. The real time element has been modified so live imagery is refreshed with less overhead on the remote system. It is also designed so that different log-ons may have different slideshows between live satellite passes. For the display itself we use a standard HD television (~ 50”) that supports portrait mode. It has been extensively tested within the station and at an off-site location. A significant effort went in to handling network problems that occurred for the off-site case, which is not connected to the Uo Dundee network. The display was also taken to a recent one day conference and we believe it is now ready for use at other sites. The main requirement to support its operation is a reliable network connection with reasonable and consistent bandwidth. So far, Dundee Science Centre and NERC Swindon Office are interested in having one of these displays.

- On-going support is provided for the ARIES groundstation system operated by the British Antarctic Survey at Rothera and originally supplied by Dundee in 1992. Following on from the site visit in early 2014 for maintenance and upgrades, we provided support this year with updates and improvements to Dundee software, some in response to changes made by Rothera staff, plus guidance on diagnosing and repairing hardware faults.
- Browse imagery has been produced for all EUMETCast “essential services” geostationary satellite data received during the year. Our complete archives of geostationary satellite images are available to browse for users who register on the website.

Geostationary browse image availability:			
	Meteosat (Europe/Africa)	-	2002-present
	IODC (Indian Ocean)	-	2005-present
	GOES-East (Americas)	-	2006-present
	GOES-West (Pacific)	-	2006-present
	MTSAT (E Asia/W Pacific)	-	2006-present

- Similarly, quicklook browse imagery was produced for all AVHRR, MODIS and VIIRS data received during the year. The entire archives of these polar satellite images are available to browse in quicklook form for users who register.

Polar browse image availability:			
	AVHRR	-	1978-present
	CZCS	-	1979-1986
	SeaWiFS	-	1997-2010
	MODIS	-	2000-present
	VIIRS	-	2012-present

ANNEX 8: FUTURE DEVELOPMENTS

(NOTE: ANNEX IS ALSO OUTLINED IN THE MAIN REPORT)

NEODAAS-PLYMOUTH

- ESA Sentinels: This will be an exciting year for environmental remote sensing, with the launch of Sentinel-2A planned for 23 June and Sentinel-3A on 31 Oct. 2015.
    - The Sentinel-2 Multi-Spectral Instrument (MSI) on provides high-resolution optical data (10-20m), which together with Landsat-8 (and the planned Sentinel-2B) will radically increase the repeat coverage of this quality of data. It is designed for terrestrial remote sensing, though there are also many potential coastal applications as it will be able to observe suspended sediment concentrations and certain types of phytoplankton blooms.
    - Sentinel-3A hosts the Ocean and Land Colour Instrument (OLCI), to reinstate the critical provision of medium resolution (300m) ocean colour data that was lost with the demise of MERIS on Envisat in Apr. 2012.
    - NEODAAS will be implementing processing chains for these instruments during this year as soon as they complete commissioning phase, in partnership with other PML projects and exploiting software toolboxes to be provided by ESA. We will begin operational processing/mapping of Sentinel-1 SAR data to indicate sea-surface roughness for the UK region.
- Ocean colour: We will complete the switch from Aqua-MODIS to VIIRS for operational ocean colour, re-implementing all the Level 2 and 3 products and delayed-time refined processing. Significant effort will be expended to reprocess the entire archive of MODIS and VIIRS products for key regions according to the recent NASA recalibration (R2014.1): this is needed for a majority of user requests and the bulk download tool. NASA has just changed their recommended chlorophyll-a algorithm to OCI (Hu et al., 2012); we will advise NEODAAS users on whether this is appropriate for their applications.
- Synergy with NCEO and wider: We will continue discussions within NCEO to identify priority algorithms for operationalisation and wider dissemination this year. A further venture will be in collaboration with a volcano monitoring group at Université Blaise Pascal, France, involving integrating their software for extracting lava effusion rates from our AVHRR and MODIS near-real time processing.
- Synergy with Copernicus: we will incorporate EO and model data (e.g. metocean, surface currents) from the Copernicus Marine Environmental Monitoring Service (CMEMS, the latest phase of MyOcean) and the ESA Ocean colour Climate Change Initiative (OC-CCI) project into our online and request data offering, acting as a downstream provider. PML involvement in a DEFRA-funded EO feasibility study has given us a useful insight into further products that NEODAAS could develop for applications towards environmental directives.
- Data processing: We will shortly begin running NEODAAS software on the CEMS supercomputer facility, and will develop tools to exploit this both as a backup facility and to begin experiments on global EO data processing.
- Dataset dissemination: We will work with other NCEO-EOIF members to consider instigating a digital object identifier (DOI) system for NCEO/ARSF/FSF/NEODAAS datasets to facilitate their citation in scientific literature.

NEODAAS-DUNDEE

- The introduction of new servers (see Annex 7) has provided the capability to update our existing processing software and this is ongoing. It also provides scope to run additional data processing. For example, official NASA software for creating VIIRS active fire products has already been implemented to support CSIR's fire alert system and these products could be made available to any users. Other products can be investigated, although more storage capacity will be needed to make them routinely available. Additional map projection options will be available and mapping libraries are being considered that would allow products to be merged and have features added.
- The LTO tape drives used for archiving and restoring our data are now over 5 years old and can no longer be covered by the vendor repair service. Although still functioning well, they are central to daily operations and we intend to replace them during the coming year. We will take the opportunity to move to the latest generation of LTO drives with higher capacity and faster read/write speeds. We also plan to redevelop the archiving software so that the same tape may be used to archive data sets from the various satellite instruments we receive. This will provide a single, consistent approach to archiving all of our data, increase archiving efficiency and reduce tape/drive wear and tear due to regular tape changes.
- A mechanical backlash problem was identified with one of our tracking antennas over recent months (see Annex 14). The system has been completely dismantled to investigate and the problem is due to wear in one of its main gearboxes, which cannot be repaired. A new gearbox is being procured and we will use this opportunity to service the system as far as possible. The gearbox for the other axis is being checked and serviced by the supplier. We will also replace mechanical bearings and seals and renew all of the antenna's flexing control and power cables. The system will be down for a few weeks, but operations can be maintained with other antennas, so the impact on reception schedules should be very limited. A similar problem has been noted for one of our other antennas. However, the backlash in this case is significantly less and has not increased over several months or caused reception problems. The intention is to continue monitoring it for now, as the work involved is a major undertaking and likely to cost around £4k if a gearbox and other components have to be replaced.
- The Met Office has approached us regarding the provision of a backup data feed from Dundee. This would be for near-real time L-band NOAA and MetOp satellite data which are important to its operations. This would be available in case the Met Office experiences problems with its own receiving systems and follows a trial period that successfully demonstrated our capabilities. The service would be arranged to deliver data as quickly as possible after reception and facilities set up allowing Met Office staff to remotely start and stop the data feed as required. An SLA/draft agreement has been discussed and can be set up subject to NCEO approval.
- There is a requirement to replace the Sun/Oracle data storage system that provides storage for all data received at Dundee and resulting products. It is central to our operations for acquiring, processing and archiving data and for distribution to users. The existing system has been in operation for several years and will soon be considered "end-of-life" by the manufacturer, while failures occur with increasing regularity. There is also a need for more storage capacity as the archive extends and higher volumes of data are produced by newer sensors. We have identified and costed a preferred solution based on Dell hardware and IBM storage management software. A capital request has been placed on file with NCEO/NERC.
- Higher value capital requests have also been submitted for new equipment to improve capabilities at Dundee. A larger antenna would allow us to receive from more satellites and higher data rate satellites. It will ensure continuity of reception from follow-on missions to those we can support now, e.g. MetOp 2nd generation, JPSS (follows NOAA, Aqua, Terra & NPP) and Oceansat-3. Our existing smaller antennas will not be suitable for some of these. It should also be possible to take data from additional satellites such as Landsat, which we cannot at present. A new antenna would operate along with the older systems for as long as they remain serviceable, but with one of these now over 20 years in operation a new system would also serve as a replacement in time.
- Similarly, our current receiver hardware supports up to 60 Mbit/s data rates, which covers NOAA to Oceansat-2, but future missions such as MetOp 2nd generation will operate at higher speeds. We will require new higher data rate receivers to process these signals.

ANNEX 9: FINANCE

NEODAAS-PLYMOUTH

The 2014/15 NEODAAS-Plymouth *claimed* costs were: £- at the 80%FEC rate and comprised:

- Staff £-
- Indirect costs £-
- Recurrent : T&S, consumables, minor capital and Sandwich Student £-

NEODAAS-DUNDEE

The breakdown of NERC resource allocation for 2014/15 was:

Directly Incurred Staff Costs	-	£ -
Other Directly Incurred Costs (T&S, consumables, minor capital etc.)	-	£ -
Directly Allocated Costs (e.g. Estates, allocated staff)	-	£ -
Indirect Costs	-	£ -
Total Resource Allocation (total approved by NERC)	**-**	**£ -**
Annual Actual Spend (total claimed by UoD)	**-**	**£ -**
Commercial Data Sales Revenue	**-**	**£ -**

ANNEX 10: SERVICE MANAGEMENT

NEODAAS-PLYMOUTH

List of staff with role, status (NERC band equivalents) and percentage of time allocated to NEODAAS duties:

- Mr Steve Groom, Director and science development (20% B3)
- Mr Ben Taylor, Operational manager (53%, B6)
- Dr Peter Miller, Technical lead/SST (14%, B4)
- Dr Jamie Shutler, Data processing manager (8%, B5)
- Dr Mike Grant, Systems (15%, B5)
- Ms Silvia Pardo, Data Analyst (42%, B6)
- Ms Silvana Mallor Hoya, Data Analyst (41%, B7)
- Dr Malcolm Taberner, Ocean colour development (15%, B6)
- Mr Peter Walker, Systems and web development (28%, B6)
- [1]Dr Diane Knappett, non-marine service development (24%, B6)
- Dr Ben Loveday, service developments (22%, B6)
- Mr Oli Clements, Web-GIS developments and user requests (22%, B6)
- [1]Mr Kevin Paxman, User requests (11%, B7)

1 Dr Knappett and Mr Paxman both left PML/NEODAAS and were replaced by Dr Loveday and Mr Clements

(3.26 Full-Time Equivalent including Director)

NEODAAS-DUNDEE

Staff, roles, percentage of time funded by NERC and Uo Dundee grade:

- Prof Steve Parkes, Director (10%)
- Mr Neil Lonie, Station manager (100%, Grade 8)
- Mr Andrew Brooks, Software specialist/Systems manager (100%, Grade 7)
- Dr Paul Crawford, Electronics and Communications engineer (80%, Grade 7)
- Mr Jon Bowyer, Software specialist/Systems administrator (100%, Grade 6)
- Mr Les Moonlight, Maintenance technician (100%, Grade 5)
- Mr Bruce Isabella, Station operator (100%, Grade 4)
- Mr Drew Doig, Station operator (100%, Grade 4)

NOTE: Jon Bower submitted his resignation with effect from 1st April 2015 and a replacement must be recruited.

NEODAAS Scheduled SMAs and Recommendations

NEODAAS was reviewed by the Services Review Group (SRG) in March 2008 and was scored on the standard criteria as follows:

- Need 5.0
- Uniqueness 5.0
- Quality of Service 5.0
- Quality of Science/Training 5.0

Average Score 5.0

SRG comments were:

"NEODAAS is an indispensable facility adding to the only long-term archived continuous record of satellite data. User-community and the uptake by it are increasing. The user-survey was good and showed the community is highly satisfied. NEODAAS has a needy core market in the cruises it supports. This user-community would struggle to get the data from elsewhere. There is also a track record away from the main business of marine science: in atmospheric science and EO. NEODAAS is integral to several NERC programmes. It has a very successful, large outreach judging from the website hits. Lots of publications and many are in high profile journals. SRG was impressed by the quality control. DSRS has a good international reputation. SRG was impressed with the management of the facility, given that it has only been a joint facility for two years."

Due to postponement of SRG meetings for recent years including 2015, the next review of NEODAAS is anticipated in 2016.

ANNEX 11: USER FEEDBACK, SATISFACTION AND COMPLAINTS

The user feedback below has been collated from email and website registration comments, for example. These are some of the comments received over the past year. They provide an indication of user satisfaction as well as illustrating the range of users.

- MANY THANKS FOR SPLENDID SERVICE. Having those images on a daily basis helped enormously for the cruise, and I am sure that a great deal of further use will be made of the final, quality-controlled product. **(Prof. Phil Williamson, UEA, programme co-ordinator for NERC Shelf Seas Biogeochemistry programme)**
- The data was brilliant in helping us to validate our model and the help that accompanied it was sublime! This service has been seamless and you responded to all my queries extremely speedily which was extremely helpful. **(Dr. Ashley Brereton, NOC)**
- Your help was much appreciated. An excellent service, thank you. **(Prof. Judith Wolf, NOC)**
- Many thanks for this and for sorting out the cruise track and extractions. It helps us greatly to see where on the image we are and helps to plan for the next days CTD casts. Service was excellent, and the euphotic depth product extracted along track very useful as a data source for decision making. **(Dr. Tim Smyth, PML)**
- We've started receiving the satellite images for our upcoming cruise - thank you for getting this in place so quickly! **(Dr. Stephanie Henson, NOC)**
- The service was good, and supplied what I needed. Good support when I had questions on the products and on the application. **(Dr. Jacqueline Tweddle, MarCRF Research Fellow, University of Aberdeen)**
- Love the service **(Laura Bush, PhD. student, Bangor University)**
- Thank you so much for the incredibly helpful reply. I thought I was in at the deep end all by myself! **(Dr. Leigh Howarth, University of York)**
- Thanks for providing an excellent service! **(Dr. Dan Smale, Research Fellow, MBA)**
- Can you thank all of the team at NEODAAS for their efforts in sending such great information throughout the cruise, I will see them all next week but please thank them from DY021 and also the SSB programme. (**Dr. Malcolm Woodward, PML)**
- Many thanks for the information and links - incredibly useful. I spend a lot of time spearfishing and diving so information relating to condition of sea is very helpful. I looked at the chlorophyll maps at the weekend, which showed that the typical algal blooms for this time of year (aka May Water) had arrived. This saved me a wasted journey! **(User in the UK)**
- I am very happy to report that we have just received over 15,000 Level-1 SeaWiFS HRPT files from the Dundee Satellite Receiving Station and Naval Research Laboratory, Stennis Space Center which have been ingested and processed and are now being added to the existing archive for distribution to the ocean color community. I would very much like to thank these two organizations for their generosity in opening up their archives and providing us with these previously unavailable data sets. **(Dr Gene Feldman, Ocean Biology Processing Group, NASA/GSFC)**
- The images look really nice and the selected areas include all the features I needed to show in the paper. I would like to thank you again for your kind support. **(Giuseppe Zappa, University of Reading/NCAS)**
- This is to let you know we have included one of your excellent UK satellite images for July 2014 on our UK climate page. Thank you very much for the use of this image. **(Mike Kendon, Climate Scientist, Met Office)**
- The data will be used as part of my PhD project to analyse case studies of extra-tropical cyclones to establish the presence, or not, of sting jets and provide further information to investigate the underlying dynamics of sting-jets. **(Ambrogio Volonte, University of Reading)**
- I just wanted to let you know that the images (NOAA AVHRR and MODIS) have been extremely useful to us whilst monitoring the eruption in Iceland from late August onwards. We have been able to map the active part of the lava very regularly. **(Dr Ingibjörg Jónsdóttir, Institute of Earth Sciences, University of Iceland)**
- These images are excellent. Thank you. **(Dr Kevin Hodges, University of Reading/NCEO)**
- I run a small website and have a page containing satellite images for the UK and W. Europe. I am registered to view your images, which are often the best available, and wonder whether I could display some on my site. **(Simon Hammond, SpireWeather)**
- I have downloaded a gallery image. We would like to use it for educational purposes in an article on the storms that hit Cornwall over the winter 2013/2014 and thought it would look fantastic. **(Sue Hocking, 'Wild Cornwall' Magazine, Cornwall Wildlife Trust)**
- I am looking at impacts of severe storm events over the UK and their effect on surface erosion. Satellite images are used to guide my research for potential affected areas. **(Declan Valters, University of Manchester)**
- These are excellent images and I browse almost daily. Thank you very much. **(User in India)**

- I am a user of Dundee satellite images and wish to download images for June 2013 and 2014. If you can help to download these fast it will be a great help. Thanks for your service to the meteorology community. **(Vinay Kumar, Florida State University, USA)**
- Many thanks for the satellite picture, it looks great! Great service as always! **(User in the UK)**
- First congratulations for your excellent website. It's very useful and easy to use. I work as a broadcast meteorologist in public regional television. We are preparing a book about meteorology and would like to publish four satellite images from your site. **(Eduardo Lolumo, Aragon Television, Zaragoza, Spain)**
- I am a postdoctoral researcher within the mesoscale meteorology group. Access to the HIRES satellite imagery through the website would be very useful as we analyse storms for the possible presence of sting jet features in the cloud structure. **(Neil Hart, University of Reading)**
- I am currently employed aboard HMS ECHO as ships weather forecaster, and have used your products while serving aboard other UK warships. They are very useful in producing daily forecasts. **(User with UK MoD)**
- I would like permission to use the attached images in a book I am preparing "An introduction to tropical meteorology" to be published under the RMetS imprint. By the way, in one of my work roles, I thank you for your continued help allowing images to be used in *Weather*. **(Jim Galvin, Senior Operational Meteorologist, Met Office)**
- We have used a satellite image from your website showing a deep area of low pressure in mid-Atlantic on the Met Office website. We have included a link to your site in the caption. Many thanks for the use of this excellent image. **(Mike Kendon, Climate Scientist, Met Office)**
- I have just looked at the SUOMI NPP VIIRS data on your web site, really fantastic. Can I please order Icelandic data in high resolution from you? **(Dr Ingibjörg Jónsdóttir, Institute of Earth Sciences, University of Iceland)**
- These images are fantastic and precisely what I wanted! Thanks for all your help. **(Undergraduate Student, University of Plymouth)**
- The images are beautiful as always. Thanks very much. **(Dr Peter Inness, University of Reading/*Weather*)**
- I have been a user for several years. I use the site with students to track weather fronts and to attempt, in conjunction with seminar, to make possible future forecasts for our area. **(Michael Gallagher, University of Strathclyde)**
- The image looks really good. We framed it and gave it to the couple, both NERC PhD students, yesterday. It went down very well. Thank-you! **(User in the UK)**
- River Annan Trust was set up to protect and improve the bio-diversity of the river Annan and its associated wetlands. Part of its remit is to raise awareness of the issues that affect these habitats such as land use. I have seen images via twitter that would be very useful in fulfilling this. **(Nick Chisholm, River Annan Trust)**
- Many thanks. The photographs are beautiful and arrived safely. **(User in N. Ireland)**
- I request permission to publish two of your satellite pictures of India/Myanmar in a soaring magazine. Thank you for your excellent service. **(Carsten Lindemann, Free University Berlin, Germany)**
- I am looking for satellite images to provide flight crew with the most pertinent information depending on their destination. I am also using the images to validate an on-board image visualizer **(User with Airbus Flight Test Operations)**
- The image is perfect. Thank you so much. **(User in the UK)**
- We are working on agrometeorological advisory services to farmers in Chhattisgarh state in Eastern India. For this we need to prepare weather forecasts and issue advice to farmers. For this purpose real time images are very useful. **(Dr. A Sastri, Indira Gandhi Agricultural University, India)**
- I use satellite images frequently to perform model evaluation, but would like access to quicklook imagery for case selection and as a control that I am reading in the satellite images in a proper way. **(Kwinten Van Weverberg, Universite Catholique de Louvain, Beglium)**
- I am an amateur meteorologist who operates a local weather service. I am also working towards certification as a weather forecaster via Penn State University and your website will help in improving my satellite imagery interpretation. **(User in USA)**
- I show briefing to pilots that fly to Europe, Africa and USA with images of the flight region. I'd like to access the images to show in my briefings. **(Fernando Carlos G. Murga, Aeronautical Comand, Brasilian Air Force)**
- I am following a summer school of bio-economy in Perugia and our teacher advised us to use this site in our research. Thank you. **(User in Italy)**
- I am teaching climatology and meteorology for graduate students and your website is very informative. **(User at Mangalore University, India)**
- To help plan outdoor video/photo shoots, I have a cron job which fetches the latest UK image and saves a crop as my desktop. I can now mislead myself with my own weather forecasts instead of being misled by others! **(User in the UK)**

USER COMPLAINTS

NEODAAS received no formal complaints during the year.

ANNEX 12: PROJECTS SUPPORTED AND NOT OTHERWISE COVERED

Other projects/organisations that received NEODAAS-Dundee support on a pay-as-you-go basis or limited free access to support non-commercial, research and educational activities:

- A copy of all direct broadcast Orbview2-SeaWiFS data received by NEODAAS from 2004 to 2010 was delivered to NASA and added to its archive for use by the global ocean color community – Dr Gene Feldman, Ocean Biology Processing Group, NASA/GSFC.
- Near real-time AVHRR and MODIS imagery for monitoring ocean current boundaries and sea ice around Iceland and volcanic activity – Dr Ingibjorg Jonsdottir, University of Iceland.
- Near real-time MODIS imagery for operational charting of sea ice around Greenland – Dr Leif Toudal Pedersen, Danish Meteorological Institute.
- High resolution imagery for a case study to evaluate the representation of mesocyclones and polar lows in re-analyses, their climatology and variability – Dr. Kevin Hodges, NCEO, University of Reading
- AVHRR data in support of PhD research into cloud cover and radiation balance changes over Ireland due to aircraft-induced contrails – Gillian Whelan, University College Cork, Ireland.
- MODIS and VIIRS near real-time data to derive fire products and alerts for a pilot project extending the CSIR Advanced Fire Information System (AFIS) for European coverage through NEODAAS-Dundee (AFIS coverage of Southern Africa already provided through the CSIR groundstation) – Dr Philip Frost, CSIR-Meraka Institute, South Africa.
- High resolution imagery for illustrations in various articles for the Royal Meteorological Society's *'Weather'* magazine – Dr Pete Inness, University of Reading/'*Weather'* Editorial Board.
- MTSAT geostationary satellite data for a study of offshore line squall events in SE Asia – Rory Smyth, OceanMetriX Ltd.
- High resolution satellite images to assess possible conditions for landing a Catalina sea plane on a lake in East Greenland. Part of planning for a school expedition – Mr Neal Gwynne, Worksop College.
- Illustrative material for monthly weather summaries published on UK Met Office website – Mike Kendon, Met Office National Climate Information Centre.
- High resolution imagery for papers on storms in southern Britain during June 2014 – Jonathan Webb, Tornado & Storm Research Organisation.
- Illustrative imagery for a paper on the weather of 2013 in the UK – Helen Roberts, Met Office Operational Meteorologist.
- High resolution images for journal papers on gravity waves downwind of the Snowdonia mountains and on mountain waves observed by MST radar and AVHRR – Dr Richard Worthington, Usk, South Wales.
- High resolution imagery for a journal paper on polar lows – Dr Erik Kolstad, University of Bergen, Norway.
- High resolution AVHRR imagery for a case study and conference paper on severe icing of ships during the development of a polar low system – Eirik Samuelsen, Arctic University of Norway/Norwegian Meteorological Institute.
- Illustrative imagery of a polar low system for 'an encyclopedia of low temperature and environment' (Japanese) to be published autumn 2015 – Asst. Prof Wataru Yanase, University of Tokyo, Japan.
- Illustrative material for a report to Scottish Government Ministers – Pamela Blyth, Land Reform Independent Review Group.
- Geostationary satellite data used to support free online weather information and forecast services – Chris Schwerzler, Weather Underground, Michigan, USA.
- MODIS images of Norfolk/Suffolk coast to assess water clarity and sediment levels in support of diving expeditions – Mr Duncan Coles, North Sea Recovery Ltd.
- Data access to support amateur weather research and development of processing software for use by weather enthusiasts – Ferdinand Valk, The Netherlands.
- Feedback from Universities such as Reading and Leeds has indicated that imagery is routinely used in forums that provide an opportunity for academics and students to discuss topical meteorological events.

- Free quicklook Web images are used operationally by national weather services, commercial companies and other organisations, e.g. a few that have indicated they use imagery for analysis include personnel from UK, Irish, US, Dutch, Danish, Czech and Indian weather services, air forces in India, Pakistan and Bangladesh, NOAA, NASA and Surrey Satellite Technology Ltd.

ANNEX 13: WEBSITE USER STATISTICS

The NEODAAS website includes a common portal for access to data and products at both Plymouth and Dundee. The Dundee pages provide image search and browse facilities that are primarily intended for scientific users, but they also contribute to education and outreach. They provide anyone registering with access to value added image products for the complete archives and a gallery of selected high resolution images that illustrate specific features and events in the archives. The information below relates to these facilities.

Registrations for the year:	4,274	Total number of user registrations:	375,502
Total requests/page hits for the year:	22.8 million	Image requests for the year:	4.2 million

Breakdown of user categories for all registrations:

User Category	%
NERC or UK Higher Education Project	17.4 %
Education	11.3 %
Research	7.8 %
Commercial	2.9 %
Personal Interest	60.6 %

Website trends:

Year	2003/04	2004/05	2005/06	2006/07	2007/08	2008/09	2009/10	2010/11	2011/12	2012/13	2013/14	2014/15
User registrations during the year	34,998	39,337	40,389	25,511	15,420	13,018	11,619	10,934	7,574	5,775	5,312	4,274
Total number of user registrations	196,339	235,676	276,065	301,576	316,996	330,014	341,633	352,567	360,141	365,916	371,228	375,502
Pages hit & image requests (million)	18.0	20.3	24.5	23.0	26.6	27.7	24.1	23.0	26.2	31.9	26.9	22.8
Image requests (million)	7.0	7.8	7.7	5.9	6.3	6.9	4.9	4.2	4.7	6.2	4.3	4.2

Notes:

User registrations increased significantly after 2002 and subsequently dropped due to the introduction of password access to geostationary satellite images. This was previously available without registration.

The reduction in image requests from 2008 was a result of changes to availability of Indian Ocean geostationary satellite images. These were previously transmitted on an hourly basis and heavily used in that region during Monsoon season, for example. They were only available on a 6-hourly basis from 2008 until 2014, when 3-hourly images became available.

ANNEX 14: SATELLITE RECEIVING EQUIPMENT PERFORMANCE, FAILURE AND REPAIR

The effects of equipment faults, maintenance and downtime etc. at Dundee are minimised by making full use of available systems, reorganising operations and undertaking prompt repairs, e.g. two antennas are used to track and record data from the same satellite where possible. For NOAA satellites, if a scheduled pass is not received it may be possible to take a replacement pass from an older standby satellite. Staff response to out-of-hours problems also assists in maintaining operations. The facility has an excellent record for successful reception of scheduled satellite passes and this continued during the year

Main points for the year:

• No. of passes received:	NOAA/MetOp – 5248	MODIS – 4609	NPP – 2248
• No. of full passes lost:	NOAA/MetOp – 0	MODIS – 4	NPP – 5
• Success rate:	NOAA/MetOp – 100 %	MODIS – 99.91 %	NPP – 99.78 %

Note: Success rates do not take account of data losses due to spacecraft operations and problems.

- There were no complete failures with antenna systems that resulted in significant outages. One antenna failed to receive a few overnight NOAA/MetOp passes on one occasion due to a motor controller issue, but the data was successfully collected with another antenna until the problem was identified and resolved. Essential electrical maintenance work was carried out in the University's Dental Hospital building over the course of a couple of weekends. Two of our main antennas are located there, but we worked with Estates staff and contractors to provide temporary generator supplies to our systems, so there were no interruptions to our operations.
- An issue arose with one of our X-band antennas when it was noted that significant mechanical backlash had developed in one axis of the system. The drives are designed for zero backlash to provide pointing accuracy. Although the problem did not have enough impact on tracking accuracy to cause data losses, it had to be investigated and repaired which required complete dismantling of the system. The problem was due to wear in the main gearbox of the axis in question, most likely caused by water ingress during its years of operation. The gearbox cannot be repaired, so a new unit is being procured and work is ongoing (See Annex 8).
- There were some problems tracking the Aqua satellite on 5th & 6th September 2014 which resulted in no or partial MODIS data reception for four passes. This was caused by spacecraft manoeuvres and/or suspect orbital information for the satellite leading to inaccurate pass predictions.

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As noted above, reception success rates do not include passes (or partial passes) lost for reasons outside the control of Dundee, e.g. satellite problems and broadcast interruptions by the satellite operator. The main issues are summarised below.

- On 26th October Terra transmitted corrupted MODIS data for several hours before NASA resolved the problem. This resulted in unusable data for three passes received at Dundee.
- Common losses for Terra and Aqua MODIS data:
  - Direct broadcast transmission breaks were common for Aqua while high-rate data were downlinked to a groundstation at Svalbard. These reduced significantly in recent years after we raised the matter with NASA's operations team and they now collect more high-rate data via a groundstation in Alaska instead. Similar breaks occasionally occur for Terra.
  - Short transmission breaks (typically 60 seconds) occasionally occur with Terra close to the Madrid area to avoid interference with NASA Deep Space Missions received there.
- Direct broadcast coverage from MetOp-A is limited because the satellite's transmitter is susceptible to ion radiation. Coverage is available over Europe and the North Atlantic, but only for daytime passes and

areas south of 60˚N. We focussed on NOAA satellites as our primary sources of AVHRR data until MetOp-B began transmitting data in October 2012. MetOp-B provides full direct broadcast coverage.

ANNEX 15: ROUTINE SATELLITE TRACKING SCHEDULE

Approximate pass times for the current daily satellite tracking schedule at NEODAAS-Dundee are listed in the table below. All standard passes from the operational satellites are included in the schedule and there is normally scope for additional passes if required.

Satellite	Approx. Overhead Time (GMT)	Satellite	Approx. Overhead Time (GMT)	Satellite	Approx. Overhead Time (GMT)
NOAA-19	0130	Aqua	0100	NPP	0100
NOAA-19	0300	Aqua	0230	NPP	0230
NOAA-19	0430	Aqua	0400	NPP	0400
NOAA-19	0630	Terra	1000	NPP	1130
MetOp-B	0900	Aqua	1130	NPP	1300
NOAA-19	0930	Terra	1130	NPP	1430
MetOp-B	1030	Aqua	1300		
MetOp-B	1200	Terra	1300		
NOAA-19	1200	Aqua	1430		
NOAA-19	1330	Terra	2030		
NOAA-19	1500	Terra	2200		
MetOp-B	1930	Terra	2330		
MetOp-B	2100				
MetOp-B	2230				