



# OBSERVATIONS

NCEO's Quarterly Newsletter—Earth Observation Science to Understand a Changing Planet

October 2016

Welcome to the October edition of the NCEO newsletter, I hope you had an enjoyable and/or productive summer. You will see some nice successes in our news here and on the website. I can also report that our Foundation ODA award, led by Heiko, Martin and myself, was well received, so we shall be researching forests in Kenya, droughts in Ethiopia and large-scale pollution in South-East Asia. And Mat Williams was awarded a BBSRC/NERC award to examine routes to sustainable production of UK food crops. *John Remedios, NCEO Director*

## EO Detective Prize giving at the National Space Centre, 1st October 2016

**Winners and runners-up of the EO Detective competition attended a special event at the National Space Centre in Leicester on 1st October to celebrate World Space Evening and receive their prizes.**

The evening started with an informal reception for the young people and their guests, which featured space themed cupcakes. They then enjoyed talks on space exploration and new approaches to mapping the Earth and were free to view the museum exhibits. There was also a chance for everyone to make their own satellite.

The main event was held in the impressive planetarium, which was filled to capacity. NCEO Outreach officer Catherine Fitzsimons led a fun Earth observation quiz. She encouraged everyone to identify features in images of the Earth and decide whether the image was taken by an astronaut or a satellite. The electronic voting system gave us immediate results, showing that the audience were pretty knowledgeable: only 2% identified a picture of Tim Peake as Buzz Lightyear – sorry Tim!

Libby Jackson from the UK Space Agency then presented the winners and runners-up with their prizes: their requested photographs taken from the International Space Station, and signed by Tim Peake. The images varied from photographs of Angel Falls to Al Zaatari refugee camp. John Remedios, Director of NCEO, commented on how inspiring it had been to read the young people's competition entries. He congratulated the winners for coming up with some excellent ideas that were chosen from over 1000 entries.

A fantastic night was had by all involved, celebrating the children's success. More information is available on the NCEO website.



## Mapping burnt area—fieldwork in Indonesia

**NCEO researchers have been working in Borneo, Indonesia over the summer to measure tropical forests affected by the 2015 wildfires.**

Joao Carreiras of NCEO-University of Sheffield identified peatland-dominated sampling sites in Central Kalimantan affected by the wildfires.

In-situ measurements in Central Kalimantan were still ongoing as *Observations* went to press, focusing on several forest parameters including land use, fire history and severity, and fire impacts on forest structure and above-ground biomass. The campaign was slightly delayed because water levels were too high to visit the sites in July.

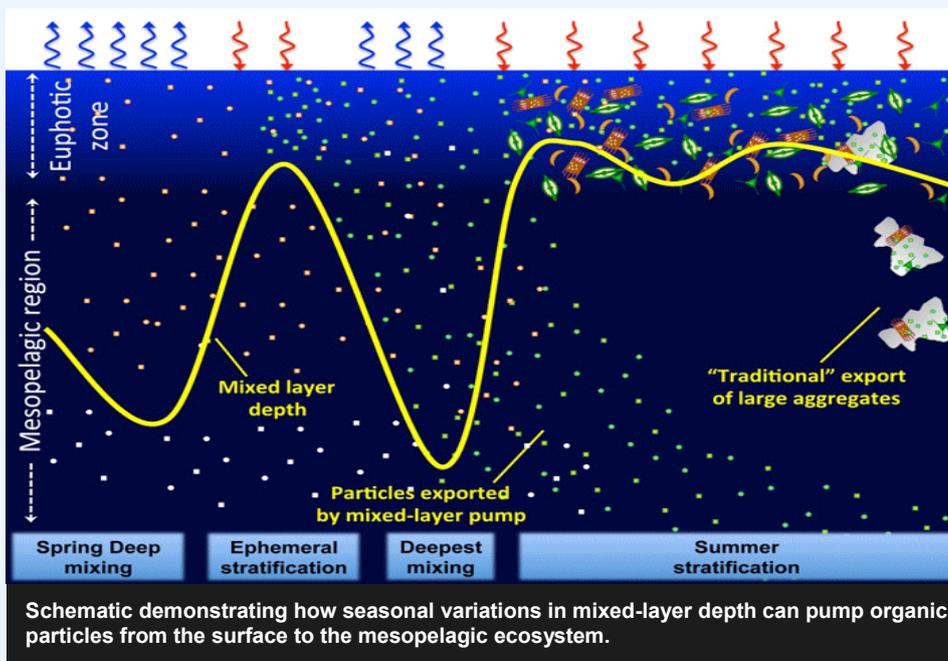
The team is relying heavily on Mark Harrison, co-director for local NGO Borneo Nature Foundation, who is leading execution on the ground. They also have the support and advice of University of Leicester researchers Susan Page and Kevin Tansey.

They will use this 'ground truth' information to validate the ability of an algorithm using C-band SAR Sentinel-1A data to map burnt areas in the region. They plan to test its ability to discriminate degrees of burnt severity in 2015, and to distinguish burnt areas from other forms of land cover change using ancillary data, such as active fire information. They will then be able to assess the implications in terms of carbon emissions.

## CEDA's plans for data management

**CEDA is currently producing the NCEO Data Management Plan, and collating information on all the datasets that will be produced under NCEO.** The data management plan and ongoing data management activities ensure that: (1) A high quality documented data archive of NCEO data is created; (2) Appropriate data support is provided to the data users and creators; (3) Academic credit for data creation is given; (4) Conditions of use, access and deposit are clearly defined and do not infringe on the data creators' rights; (5) Potentially scientifically valuable data are kept for reuse in the long-term and by other disciplines; (6) Risks to project data are managed.

Most NCEO scientists should already have been contacted and requested to provide information on the datasets that they will be producing, but if not please contact Esther Conway (esther.conway@sfc.ac.uk) if you have any questions or new datasets to include.



## Highlight Paper

### What energy source is supporting life in the deep, dark ocean?

Combining satellites and Argo-floats, scientists at NCEO-Plymouth Marine Laboratory have estimated the energy sources supporting life in the deep, dark ocean. The research was published on 26th September in *Nature Geoscience*.

The part of the ocean between 100 m and 1000 m is called the mesopelagic region. It is one of the largest ecosystems on the planet, yet remains a vastly unexplored and poorly understood ecosystem.

Up to now the mesopelagic region was thought to be sustained by a 'rain' of fast-sinking organic aggregates of dead plankton and waste products from surface-living organisms – the so-called biological carbon pump. But marine scientists now think it cannot support the vast numbers of organisms that live in it, and have investigated another mechanism – the seasonal mixed-layer pump.

This pump takes non-sinking particles as well as dissolved organic carbon from surface waters into the depths, and thus supplies an additional pulse of organic carbon to the mesopelagic. During spring-time stormy conditions, strong winds mix the surface waters deep into the ocean. The carbon they contain is then trapped inside the mesopelagic region when the shallow summer mixed layer forms and becomes available as an energy source to mesopelagic organisms.

Dr Giorgio Dall'Olmo, from PML, who led the research, says: "Most methods for measuring carbon transport into the deep ocean have concentrated on the particles that sink at relatively fast rates, but have not measured how neutrally-buoyant or slowly-sinking organic particles are redistributed through the water column. This means that current global estimates of carbon export in the ocean are missing the potentially important contribution from the seasonal mixed-layer pump."

By combining satellite data from the ESA Ocean Colour-Climate Change Initiative with in-situ measurements from by Argo and new Bio-Argo floats, NCEO scientists working with colleagues from France have estimated that the pump moves 300 million tons of carbon each year. In the deeply-mixed high-latitude regions, the figure represents an average of 23%, but deeply in excess of 100% of the better studied flux of faster-sinking, larger particles and aggregates.

Reference: G. Dall'Olmo, J. Dingle, L. Polimene, R. Brewin & H. Claustre, *Nature Geoscience* doi:10.1038/ngeo2818 (2016).

### Send us your stories for the newsletter

Please send any news stories for the newsletter to Rosie Leigh [rg82@le.ac.uk](mailto:rg82@le.ac.uk) or Sophie Hebden [sh631@le.ac.uk](mailto:sh631@le.ac.uk). We are also keen to hear your ideas for blog posts.

Webpage: [www.nceo.ac.uk](http://www.nceo.ac.uk)

Follow us on twitter: @NCEOScience

### Upcoming Events

- **NERC's Into the Blue Showcase** celebrating the environmental science we live and breathe. 4-7th October 2016 RRS Discovery in Liverpool, 25-29th October 2016 Showcase event with FAAM aircraft in Manchester. More info at <http://intotheblue.nerc.ac.uk/>
- **Principia Schools Conference.** University of Portsmouth 2/11/16. University of York 5/11/16. <https://principia.org.uk/schools-conferences/>

## Outreach and Events

- **Farnborough Air Show**, NCEO ran hands-on activities on the UKSA stand at this year's air show 11-17th July.
- NCEO, CEDA, FSF, NEODAAS and NERC ARF hosted an exhibition stand at this year's **RSPSoc Conference** 5-8th September.
- **The EO Detective Prize giving** event was held at the National Space Centre's celebration of world Space Day on 1/10/16. Winners and runners-up were awarded with their requested images signed by Tim Peake.



Tim Peake takes over the NCEO stand at Farnborough Air Show

Contact us: [info@nceo.ac.uk](mailto:info@nceo.ac.uk)

## NCEO 2016 Science Conference, Warwick

Following a staff consultation in 2015 it was agreed that NCEO should hold its own science conference in 2016. NCEO's 2016 Science Conference was held in Warwick, 29 June – 01 July and was attended by 130 people. Plenary sessions included Energy and water cycles; Towards Sentinel data; Atmospheric pollution and the land emissions; Environmental forecasting and data assimilation; International science; Climate data for the Earth system; Instruments and Facilities science; and the Carbon Cycle. We were joined by people from the UK Space community for an afternoon's discussion on Copernicus Science and Future Missions:

planned before the country voted for Brexit, it became an important forum for reaffirming our commitment to collaboration. Talks and poster presentations were selected from submitted abstracts, and the evening poster sessions proved very popular. Whilst most of the conference was plenary, we squeezed in a one-and-a-quarter hour breakout session for discussions on DA strategy; Global challenges; NERC Services, Facilities and Data Centres; Outreach; Visualising EO Data; UKESM and Impact. Prizes for best talks by early career scientists were awarded to Jake Gristey and Matthew Hethcoat. Poster prizes were awarded to the CEDA group and Peter Somkuti.

### Survey Results

In the post-conference survey, 63% of you said you found 75% or more of the conference programme interesting and 81% felt that the process for selecting speakers and poster presenters was fair. 79% favoured NCEO taking a lead in developing a national conference with external partners in future. More news on this soon...



Matthew Hethcoat (left) and Jake Gristey (right) are presented with their prizes for best presentations given by early career scientists at the conference.

## New computing resources for data providers

The Climate data from space Zone on Jasmin - which underpins upcoming research for the NCEO ICDMS working group and other UK data providers - is being developed with NCEO to provide dedicated compute resources to the data provider community. Upcoming in the Autumn will be a tendering process to develop community software for data providers - watch this space for more info.

## International Symposium on Data Assimilation

The 5th International Symposium on Data Assimilation hosted by the University of Reading brought together more than 150 researchers. The international meeting on 18th-22nd July 2016 included many NCEO participants, and was organized by a team from the University of Reading, including many NCEO scientists. It covered the mathematics of DA and advances in methodology.

## JASMIN User Conference

The Centre for Environmental Data Analysis (CEDA) hosted our first JASMIN User Conference, held at Rutherford Appleton Laboratory on 27/28 June 2016 with around 70 attendees.

JASMIN is a high performance "super-data-cluster" designed for data analysis that provides the infrastructure for academic CEMS. Over two days we shared information about the current scale and capabilities of JASMIN, heard about some data-intensive science going on right now, including interesting talks from NCEO's Barry Latter and Owen Embury among others, and learnt about environmental science challenges that JASMIN can assist with.

Workshop sessions helped new and existing users discover how to get the best out of JASMIN's processing and data transfer capabilities, and how scientific collaborations might manage their computing infrastructures within the JASMIN Cloud. Discussions focussed on how scientific software might be managed by a community for its own and wider benefit, and how software tools developed around the JASMIN platform can help distil best practice and enable efficient scientific workflows.

CEDA hope to encourage closer engagement with our user community through a range of future events. More information on all of the talks and notes from the conference can be found here: <http://jasmin.ac.uk/jasmin-users/events/jasmin-conference-2016/>



Prof. Tony Hey (STFC Chief Data Scientist) delivers his presentation on Data Intensive Science at the evening reception of the JASMIN User Conference 2016 (Photo: Matt Pritchard, STFC)

## Also in the news...

### NCEO is working with other NERC centres on a flagship climate project

We are part of NERC's flagship long-term science ACSIS project, led by NCAS. This is one of two long-term multi-centre projects funded at 120%. NCEO is taking a major role in providing and exploiting high quality, cutting edge datasets to study multi-decadal variability in the North Atlantic and its impacts. NCEO partners involved include Chris Merchant (University of Reading), Caroline Poulsen (RAL), and Helen Brindley (Imperial College London).

# Five minutes with Nina Raoult

In this issue we asked Nina, a PhD student from Exeter, five questions about herself and her research.

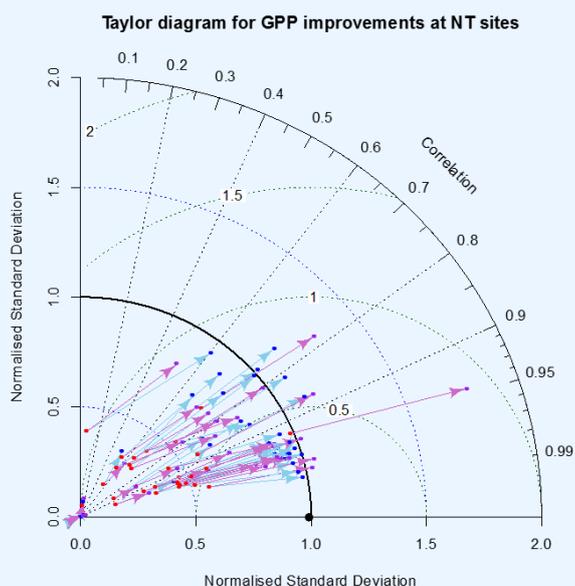
## Nina, tell us a bit about your work...

The JULES land-surface model describes the interactions between the atmosphere and the terrestrial biosphere in terms of mathematical equations that depend on environmental parameters. By confronting model outputs with observations, I aim to find the best possible estimates for each of these parameters and hence improve the model's predictions. I use data assimilation techniques to achieve this - specifically the derivative (or 'adjoint') of the JULES model.

## What are the motivations for your area of research?

Land-surface models are of growing importance in the world of climate prediction. They are crucial components of larger Earth System Models, simulating

the effects of land surface processes on the global carbon cycle. It is important that we continue to improve and develop these models by comparing them with observations.



Taylor diagram described in text

## Can you describe an image from your work?

This 'Taylor diagram' shows the improvements of fit made to carbon flux time-series at some needleleaf measurement sites. Observed time-series (black dot) are compared to modelled time-series (coloured dots). Time-series with a seasonal cycle of the right magnitude lie on the bold arc, while those that correlate well with observations lie on the x-axis. Simulations with the default parameters (red dots) give underestimated seasonal cycles, but this improves noticeably when the model is tuned both at individual sites (blue dots) and across sites (purple dots).

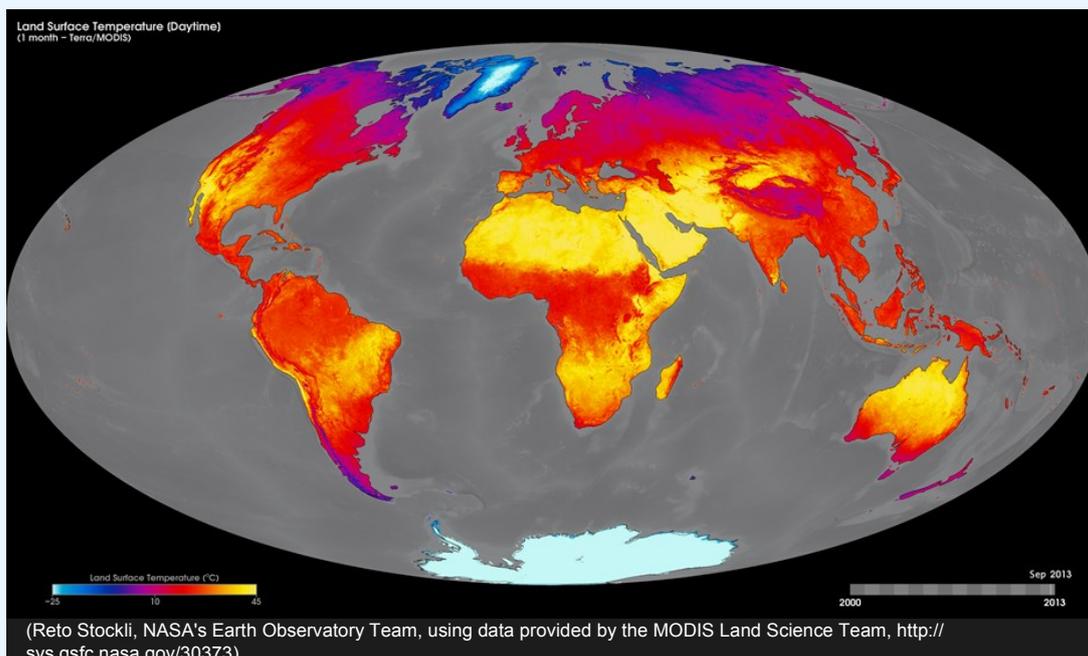
For more information see: Raoult, N. M., Jupp, T. E., Cox, P. M., and Luke, C. M.: Land-surface parameter optimisation using data assimilation techniques: the adJULES system V1.0, Geosci. Model Dev., 9, 2833-2852, doi:10.5194/gmd-9-2833-2016, 2016.

## What inspired you to work in your current research area?

I have always had a passion for mathematics, and a strong interest in environment issues. This project has been a great way to bring the two together.

## What is your favourite image of the Earth from space and why?

I have chosen a MODIS satellite image showing land-surface temperature. Counterintuitively perhaps, most solar energy reaches the lower atmosphere 'from below', having first interacted with the land or ocean. On land, plants and soils control the amount of heat and moisture that the atmosphere receives, and so exert a strong influence on weather and climate. My work aims to improve the accuracy of numerical models of the land surface.



(Reto Stockli, NASA's Earth Observatory Team, using data provided by the MODIS Land Science Team, <http://svs.gsfc.nasa.gov/30373>)