

# OBSERVATIONS

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

June 2016

## Welcome to our new NCEO newsletter

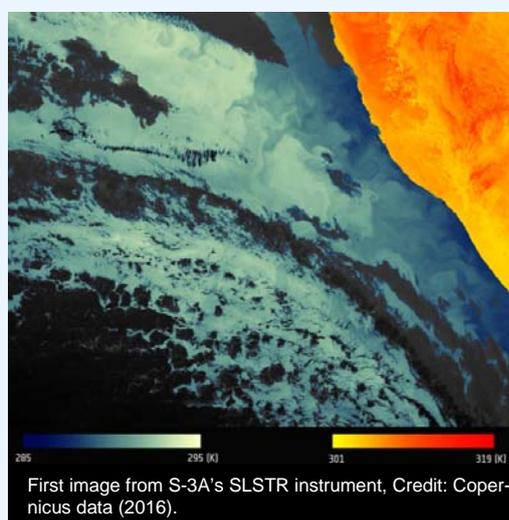
which we hope you will find both easy to read and informative. This has been an exciting few months ranging from the start of the UKESM and ACSIS programmes to the return of Tim Peake from the ISS. Combined with a good budget settlement, we should be very positive in looking to the future with EO prominent in government and providing some fascinating science. I hope we can use our discoveries in environmental science to strongly support the case for EO subscriptions to ESA by the UK in the Ministerial at the end of the year.

*John Remedios, NCEO Director*

## NCEO Scientists work with latest Sentinel data

Following a successful launch, ESA has released the first images from the Sentinel-3A Sea and Land Surface Temperature Radiometer (SLSTR). This measures surface temperatures to an accuracy better than 0.3°C. The first image from the SLSTR thermal infrared channels on Sentinel-3A 05/04/2016, shows the temperature contrasts between Namibia's coastline (in oranges for temperatures 301-319K) and the South Atlantic Ocean (in blues, for 285-295K). Clouds show as black.

Several NCEO scientists are involved in the validation and data analysis from SLSTR, including Martin Wooster, Gary Corlett, Darren Ghent, Chris Merchant, Owen Embury and Peter North.



## EO Detective Competition Winners Announced



Over a thousand entries from all over the UK were received for the EO Detective competition. An extra category even had to be added for younger children. The judges were very impressed by the quality of the entries and after much deliberation winners and runners-up were selected from each age range. Winning image requests included Lake Eyre, Al Zaatari refugee camp in Jordan and pig farms in Indiana, see the full list of winners and runners up on the NCEO website (<https://www.nceo.ac.uk/skills/eo-detectives/>).

The EO Detective project is part of the Principia education programme associated with British ESA astronaut Tim Peake's six-month stay on the ISS and has been jointly funded by NCEO, NERC and the UK Space Agency. Classroom resources and workshops have also been developed as part of the project and are free to download from <http://www.nationalstemcentre.org.uk/timpeake>.

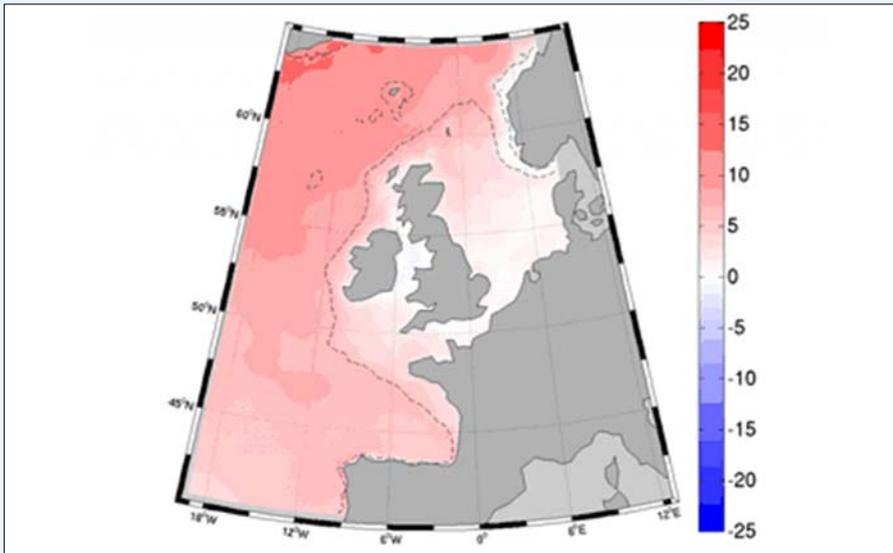


## Shaun Quegan sees important step forward for BIOMASS mission

British satellite companies will lead the construction of ESA's BIOMASS satellite to monitor forest biomass so that researchers can calculate the amount of carbon stored.

The satellite will be assembled by the UK arm of Airbus Defence and Space, which signed a contract with ESA last week (29 April) for £179m.

The science lead for the project is NCEO scientist Professor Shaun Quegan, who is based at the University of Sheffield. ESA selected the BIOMASS mission as its 7<sup>th</sup> Earth Explorer satellite in 2013, from an initial list of six proposals. BIOMASS will create 3D maps of the Earth's forests using a novel radar instrument, which will help to improve our understanding of how carbon is cycled through the Earth system.



Variability in shelf-sea carbon uptake means that a weak carbon source can switch into a sink due to interannual fluctuations of the ecosystem, chiefly due to changing biological processes.

## Highlight Paper

### How oxygen deficiency is threatening Europe's crucial shelf-sea fishing areas

Recent NCEO research confirms that large areas of the shallow shelf-seas around Europe are vulnerable to oxygen deficiency, and that there is more variability in how these areas absorb carbon dioxide than previously thought.

Stefano Ciavatta, who is based at NCEO-Plymouth Marine Laboratory, led a new reanalysis for 1998-2009 that integrates scattered datasets from ocean buoys with coupled physical-biogeochemical models for the northwest European shelf-seas. The team also carried out two policy-relevant case studies to assess the vulnerability of the bottom waters of the shelf to oxygen deficiency and the variability of uptake of atmospheric carbon dioxide.

The research was published online on 12 February 2016 in *Journal of Geophysical Research: Oceans*.

#### Understanding an important natural resource

Shelf-sea ecosystems are a hugely important natural resource, providing about 90% of global fish catches. Worryingly, rising water temperatures and eutrophication is reducing the amount of dissolved oxygen in the water, and could trigger sudden and massive death of marine species with a direct impact on the global community.

Improving our understanding of these ecosystems and how they respond to climate change is vital for marine policy. But they are complex and difficult to model and monitor, being at the interface between processes in the deep ocean, land and sediments, and atmosphere. The work is the first decade-long reanalysis of northwest European shelf-sea biogeochemistry.

Reference: Ciavatta, S., S. Kay, S. Saux-Picart, M. Butenschön, and J. I. Allen (2016), Decadal reanalysis of biogeochemical indicators and fluxes in the North West European shelf-sea ecosystem, *J. Geophys. Res. Oceans*, 121, 1824–1845, doi:10.1002/2015JC011496.

### Send us your stories for the newsletter

Please send any news stories for the newsletter to Jan Fillingham [jan.fillingham@nceo.ac.uk](mailto:jan.fillingham@nceo.ac.uk) or Rosie Leigh [rg82@le.ac.uk](mailto:rg82@le.ac.uk)

### Upcoming Events

- NCEO Annual Science Conference, The University of Warwick, 29th June – 1st July
- Farnborough Air Show– NCEO staff will be representing NCEO on the UKSA exhibition stand, 16 -17th July. If you would like to volunteer on the stand please contact Rosie Leigh ([rg82@le.ac.uk](mailto:rg82@le.ac.uk))

## Outreach and Events

As part of the EO Detective Project several NCEO staff attended the **Big Bang Fair at the NEC**, Birmingham in March. An interactive workshop was run on the UKSA stand allowing both children and adults alike to test their skills as 'Space Photographers'. With over 70,000 visitors over 4 days it was sore throat-inducing, but a hugely successful event.

**ESA Living Planet**– thanks to all of the NCEO staff who helped out on the stand at ESA Living Planet, either giving short talks in the lunch breaks or by manning the stand.

NCEO's Claire MacIntosh and Richard Pope attended the popular **NOC Open Day** on the 21st May, delivering ocean themed activities to 1500 visitors. As always the IR camera was a big hit!

NCEO staff Hilke Oetjen and Catherine Fitzsimons attended the **Cheltenham Science Festival**. They ran hands-on demonstrations as well as presenting EO data.



The NCEO Stand at Cheltenham Science Festival

## New NCEO website launched

Many NCEO staff have commented on how pleased they are with the new NCEO website. It provides people with a first insight into NCEO science, so we have arranged our research by five outward-facing themes.

We can publish research case studies, news, events and uploaded documents in side widgets throughout the website to improve access to information and make the site more dynamic. We aim to regularly upload publications and case studies as well as news, events and blog articles — for research in-progress — so please share your successes with the support team.

We have sections to promote our work with government, space agencies and businesses, as well as our outreach work. The 'training' section is under development: the new ATSR training module is now online.

Other new features include collections of software tools that many of you find useful to help others get up-to-speed and as a quick reference library; and collections of NCEO-led datasets available on CEDA. Researchers are already making use of the new tools section: Tristan Quaife at NCEO-Reading University uploaded a new tool last month used for previously published papers (Bayes LC code for land cover).

This is not the end of website development. Work on phase 2 has already begun, the key element is an internal staff area which we hope will be a 'go to' area for useful information and a full calendar of events.



Professor Martin Wooster (NCEO-KCL) on a field campaign

## Indonesian Forest Fires Contribute to the Largest Increase in Atmospheric CO<sub>2</sub> since the 1950s

**Last year's extensive forest fires in Southeast Asia, most notably Indonesia, contributed to the greatest single-year increase in atmospheric CO<sub>2</sub> concentration ever measured**, according to recent research published involving Martin Wooster of NCEO and King's College London. Writing in *Nature Scientific Reports*, the authors report that last year's record growth in atmospheric CO<sub>2</sub> was caused by a combination of the impacts of El Niño, including the SE Asian fires, combined with the long-term growth in CO<sub>2</sub> emissions from the burning of fossil fuels. The work combined satellite measurements, modelling of the fire's impact on the atmosphere, and the first direct measurements of what was in the smoke being emitted from these enormous fire events.

The fires caused extensive air pollution, resulting locally in some of the worst air quality ever seen, but also to a globally significant increase in the amount of CO<sub>2</sub> present in Earth's atmosphere, which the researchers estimated at 900 million tonnes (the equivalent of the total CO<sub>2</sub> emissions of Europe for a three month period). In 2015, the symbolic threshold of 400 ppm was reached in the global annual mean concentration of atmospheric CO<sub>2</sub>, to which this Southeast Asian fire event contributed significantly.

Martin explained "2015 saw the largest single year increase in global atmospheric concentration of the greenhouse gas CO<sub>2</sub> since records began, more than 40% higher than the last decade's average annual growth rate... major reductions in rainfall associated with the 2015 El Niño led to a much drier situation than normal, and the fires grew far larger and covered much greater areas...Levels of air pollution (locally called 'haze') in some Indonesian cities were amongst the worst ever measured, reaching some far flung locations such as the Philippines, Singapore and Thailand."

"The CO<sub>2</sub> released by these fires represents around 14% of the additional atmospheric CO<sub>2</sub> increase seen in last year, which was a record year, compared with the average of recent years...Other potentially important contributors to this record increase that are related to El Niño include the temporary reduced growth of plants (and hence lower CO<sub>2</sub> uptake) due to prolonged drought in large parts of the tropics" said Martin.

Martin also spoke to the Radio 4 Today Programme on the 10th May, explaining the environmental and health impacts of the wildfires sweeping across Alberta, Canada. The fires forced most residents to evacuate the city of Fort McMurray.

The section of the programme on the fires in Alberta was at 8:48 am on 10th May. The programme is available on the BBC iPlayer (from 2:48:57 into the recording).

**Tweeting about it...**NCEO has been on Twitter since June 2015, using the handle @NCEOScience. We gain about one follower per day and our total audience is currently 471. We are followed by a number of science journalists including the BBC's science correspondent Jonathon Amos. Not bad for 12 months work! If you have any stories you would like us to tweet then please send them to us.

# Five minutes with...Joe McNorton

In this issue we asked Joe McNorton a PhD student from the University of Leeds five questions about himself and his work.

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

I use the JULES land surface model to simulate methane emissions from wetlands, which I then combine with other emissions and input to an atmospheric chemical transport model (TOMCAT). I then compare these with satellite observations of methane to see how accurately our models represent the atmospheric concentration.

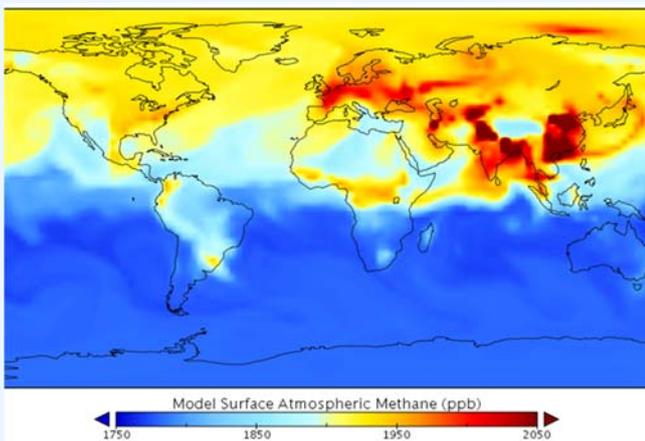


Image showing surface atmospheric methane concentration from the TOMCAT model for December 2014.

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

Methane is the second most important long-lived greenhouse gas after CO<sub>2</sub>, and is relatively short lived in the atmosphere (~9 years). Changes in emissions are likely to have a rapid influence on the Earth's climate, it is therefore important to understand how emissions might change in the future. To do that we need models, and to make sure our models are doing a good job we need observations to compare them with.

## Can you describe an image from your work?

The image (shown left) represents surface methane calculated using an atmospheric chemical transport computer model. It can be compared to similar satellite images to see how well we represent methane in the atmosphere. Assuming the model is doing a good job we can then continue to run the model into the future to predict how methane might change.

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

I always had an interest in space technology and climate science, and this gave me the opportunity to combine those. Methane in particular is an interesting species because there is so much uncertainty surrounding emissions.

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

This famous image is known as *The Pale Blue Dot* and was taken from the edge of the solar system in 1990 by the Voyager 1 space probe.

In it, Earth takes up less than a pixel (that's why I've put a circle round it).

The photo is interesting because it shows just how small the Earth is compared to all the universe around it. The fact that within that dot is every single person on planet Earth is just amazing!



The Pale Blue Dot

## Also in the news...

- UKSA and NCEO announce funding for a project to set up a Climate Data from Space computing zone, full story: <https://www.gov.uk/government/news/providing-a-seemless-supply-of-climate-data-from-space>.
- Professor Mike Cruise is the next Chair of the UKSA Science Programme Advisory Committee (SPAC), with effect from 1 July 2016.
- Tim Peake returned to Earth on Saturday 18th June 2016 after over 6 months in space, full story here: <https://principia.org.uk/news/tim-peake-returns-earth/>