



**National Centre for  
Earth Observation**

NATURAL ENVIRONMENT RESEARCH COUNCIL

## 2016 Science Conference

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## 2016 Science Conference, Scarman House, Warwick

**Wednesday 29 June 2016**

0900-1030	Registration & refreshments	Reception and Lounge
<b>Opening Address</b>		
1030	NCEO 2015-2020 - John Remedios	Lecture Theatre
<b>Energy and water cycles</b>		
1045	Introduction – Helen Brindley	Lecture Theatre
1100	Determination of Earth Outgoing Radiation using a Constellation of Satellites – Jake Gristey	Lecture Theatre
1115	The GEWEX Water Vapor Assessment – Tim Trent	Lecture Theatre
1130	Global diagnosis of observed and modelled soil moisture control on land surface flux partition – Phil Harris	Lecture Theatre
1145	Variability in North Atlantic SST and upper ocean heat content from in-situ and satellite measurements – Claire MacIntosh	Lecture Theatre
1200	Recent changes in rainfall and the onset/cessation of wet seasons across Africa using satellite data – Richard Allan	Lecture Theatre
1215	Lunch	Main Restaurant
<b>Towards Sentinel Data</b>		
1310	Introduction – Martin Wooster	Lecture Theatre
1315	Accuracy of forest change detection products in Forests of Mexico within the International Partnership Space Programme (IPSP) – Pedro Rodriguez Veigo	Lecture Theatre
1330	Monitoring the land surface using heterogeneous EO data. An EO-LDAS application to croplands – José Gómez-Dans	Lecture Theatre
1345 - 1400	Sentinel Data Access at CEDA – Steve Donegan/ Ed Williamson	Lecture Theatre



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<b>Wednesday, continued</b>		
<b>Copernicus Science and Future Missions</b>		
1400	Introduction – Mick Johnson	Lecture Theatre
1405	An observational view on current and future operation of the CAMS services – Richard Engelen (ECMWF)	Lecture Theatre
1415	<i>Carbon Dioxide Missions</i> The need for an operational CO <sub>2</sub> mission – Hartmut Boesch (NCEO) Greenhouse gas instrument concepts – Andy Vick (UK ATC)	Lecture Theatre
1440	<i>Polar Missions</i> Cryosat follow-on – Andy Shepherd (CPOM) Operational polar services – Andy Fleming (BAS)	Lecture Theatre
1505	Discussion – Chaired by Mick Johnson	Lecture Theatre
1520	<b>Refreshment break</b>	<b>Lounge</b>
1550	<i>High resolution Thermal IR Missions</i> The need for a high resolution, thermal imaging mission – John Remedios	Lecture Theatre
1605	<i>Microwave Missions</i> The need for science and operational soil moisture products – France Gerard (CEH) UK passive microwave capability – Yvonne Munro (Airbus DS)	Lecture Theatre
1630	<i>Limb Sounding Missions</i> – Martyn Chipperfield	Lecture Theatre
1645	<i>Hyspectral Visible Missions</i> Solar band hyperspectral instruments – Dan Lobb (SSTL)	Lecture Theatre
1700	Discussion – Chaired by Mick Johnson	Lecture Theatre
<b>Poster session</b>		
1730	Poster session with drinks	<b>Private Dining Room &amp; Courtyard Restaurant</b>
1930	<b>Barbeque</b>	<b>Main Restaurant and Terrace</b>



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**Thursday 30 June 2016**

<b>Atmospheric pollution and the land emissions</b>		
0900	Introduction – Hartmut Boesch	Lecture Theatre
0915	Investigations into global bio/abiogenic Methane Mapping from Space – Ed Malina	Lecture Theatre
0930	Formaldehyde over India: using satellite observations and modelling – Luke Surl	Lecture Theatre
0945	The impact of synoptic weather on UK surface/tropospheric ozone and implications for premature mortality – Richard Pope	Lecture Theatre
1000	El-Nino Driven Fire Emissions Factors for Indonesian Peatlands measured in the field, and used to constrain total Indonesian fire-emitted GHG emissions for 2015 – Martin Wooster	Lecture Theatre
1015	A new integrated canopy fluorescence model based for remote sensing of forest health and productivity – Rocío Hernández-Clemente	Lecture Theatre
1030	Refreshment break	Lounge
<b>Environmental forecasting and data assimilation</b>		
1100	Introduction – Peter Jan van Leeuwen	Lecture Theatre
1115	Data assimilation for coupled atmosphere-ocean models – Polly Smith	Lecture Theatre
1130	Non-Gaussianity in moisture errors in data assimilation – Ross Bannister	Lecture Theatre
1145	Practical use of EOLDAS: application to agricultural monitoring – Phil Lewis	Lecture Theatre
1200	Toward Data Assimilation in JULES – Tristan Quaife	Lecture Theatre
1215	Assimilation of biogeochemical data to improve the simulation, understanding and management of marine ecosystems: experiences in the North West European shelf – Stefano Ciavatta	Lecture Theatre
1230	Lunch	Main Restaurant



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<b>Thursday, continued</b>		
<b>Examples of International Science</b>		
1330	The status of the ESA BIOMASS mission and its role in a global forest observing system – Shaun Quegan	Lecture Theatre
1345	Using model-data fusion to address the influence of fire regimes on large-scale savanna ecosystem traits - Jean-François Exbrayat	Lecture Theatre
1400	EarthCARE: Improved synergy retrievals of rain rate and ice particle density using Doppler radar – Shannon Mason	Lecture Theatre
1415	GHR SST - Group for High Resolution Sea Surface Temperature – Gary Corlett	Lecture Theatre
<p><b>Breakout discussion groups</b>  <b>(Note that these will run twice, at 1430 and repeated at 1510; participants have the option to attend 2 breakouts; please sign up at registration desk)</b></p>		
1430	<ol style="list-style-type: none"> <li>1. Shaping national DA strategy – Peter Jan van Leeuwen</li> <li>2. Global Challenges Research Fund and Overseas Development Assistance – Zofia Stott and Elena Tarnavsky</li> <li>3. What do NCEO Scientists want from future NERC Services, Facilities &amp; Data Centres? – Martin Wooster</li> <li>4. Outreach Training – Rosie Leigh</li> <li>5. Visualising EO Data Online – Dave Moore and Cat Hayer</li> <li>6. Planning your Impact – Andy Shaw and Peter Miller</li> </ol>	Syndicate Rooms 1-8
1430	<i>UKESM (closed meeting) – Helen Brindley</i>	



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Thursday 30 June, continued

<b>Breakout discussion groups</b> (Note that these will run twice, at 1430 and repeated at 1510; participants have the option to attend 2 breakouts; please sign up at registration desk)		
1510	1. Shaping national DA strategy – Peter Jan van Leeuwen 2. Global Challenges Research Fund and Overseas Development Assistance – Zofia Stott and Elena Tarnavsky 3. What do NCEO Scientists want from future NERC Services, Facilities & Data Centres? – Martin Wooster 4. Outreach Training – Rosie Leigh 5. Visualising EO Data Online – Dave Moore and Cat Hayer 6. Planning your Impact – Andy Shaw and Peter Miller	Syndicate Rooms 1-8
1545	Refreshment break	Lounge
<b>Climate data for the Earth system</b>		
1615	Introduction – Helen Brindley	Lecture Theatre
1630	Sea Surface Temperature from the ESA CCI project – Owen Embury	Lecture Theatre
1645	Cloud from ATSR – Caroline Poulsen	Lecture Theatre
1700	Assessment of the variability in the Earth's OLR from several years of IASI observations – Richard Bantges	Lecture Theatre
1715	Cloud Radiative Effect Evaluation using CC4CL Broadband Flux Algorithm – Matthew Christensen	Lecture Theatre
1730	A study of fire emissions using the assimilation of atmospheric composition data – Tim Kesklake	Lecture Theatre
1800	Poster Session with Drinks and Snacks	Private Dining Room & Courtyard Restaurant



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**Friday 01 July 2016**

<b>Instruments and Facilities science</b>		
0900	Introduction – Martin Wooster	Lecture Theatre
0915	The Reference Forward Model – Anu Dudhia	Lecture Theatre
0930	NERC's current airborne and field remote sensing capability, cal/val and airborne demonstrators for future orbital systems – Alasdair MacArthur and Gary Llewellyn	Lecture Theatre
0945	NEODAAS data provision and processing – Ben Taylor	Lecture Theatre
<b>Carbon cycle: Part 1</b>		
1000	Introduction – Hartmut Boesch	Lecture Theatre
1015	Investigating the role of error correlations in 4D-Var to improve predictions of forest carbon balance – Amos Lawless	Lecture Theatre
1030	GLOBBIOMASS Regional Case Studies. Preparing the Ground for Global Forest Biomass Mapping - Heiko Balzter	Lecture Theatre
1045	Challenges of detecting low intensity selective logging with medium resolution imagery – Matthew Hethcoat	Lecture Theatre
<b>1100</b>	<b>Refreshment break</b>	<b>Lounge</b>
<b>Carbon cycle: Part 2</b>		
1130	El Niño impacts on oceanic phytoplankton - Marie-Fanny Racault	Lecture Theatre
1145	Remotely sensing the Red Sea ecosystem – Dionysios Raitsos	Lecture Theatre
1200	Constraining future land carbon cycle feedbacks with in situ observations using adJULES – Nina Raoult	Lecture Theatre



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Friday, continued		
Closing Session		
1215	<i>International Opportunities</i> International EO Science - John Remedios GEOGLAM - Elena Tarnavsky Global Challenges Research Fund and Overseas Development Assistance – Zofia Stott	Lecture Theatre
1315	Prize Giving	Lecture Theatre
1330	Lunch  .. and depart	Main Restaurant
1400- 1600	<i>Closed Meeting:</i> NCEO Science Advisory Committee and NCEO Executive	Meeting room 8



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## ABSTRACTS

<b>Energy and water cycles (Helen Brindley)</b>		
Jake Gristey	Determination of Earth Outgoing Radiation using a Constellation of Satellites	Recent advances in small satellite technology and sensor miniaturisation have created a new and exciting opportunity for Earth outgoing radiation measurements to be made from a constellation of satellites. We perform simulation experiments to assess whether a constellation system would be capable of making Earth outgoing radiation measurements at a sufficient temporal resolution, spatial scale and accuracy for climate change studies.
Tim Trent	The GEWEX Water Vapor Assessment	GEWEX water vapor assessment (G-VAP) has had the major purpose to characterise the current state of the art in satellite water vapour products. The overall goal has been to conduct consistent evaluations and inter-comparisons in order to point out strengths, differences and limitations of long-term satellite data records, in particular with respect to stability. With the submission of the final report to the GEWEX Data and Assessments Panel (GDAP) we present some of the key science highlights.
Phil Harris	Global diagnosis of observed and modelled soil moisture control on land surface flux partition	There are currently no reliable, global observations of land evaporation that can be used to benchmark climate models. We present a method using MODIS land surface temperature during dry spells to characterize the strength of soil moisture limitation on the surface turbulent flux partition globally. This diagnostic is compared with the equivalent calculated from offline land surface simulations and CMIP5 models.
Claire MacIntosh	Variability in North Atlantic SST and upper ocean heat content from in-situ and satellite measurements.	This work is part of the new ACSIS project, which aims to improve the UK's capability to detect, explain and predict changes in the North Atlantic Climate System. We present some initial results investigating the relationship between SST and upper ocean heat content, and address the scope for relatively higher resolution satellite SST CDRs to improve feature resolution of heat content variability in the North Atlantic.
Richard Allan	Recent changes in rainfall and the onset/cessation of wet seasons across Africa using satellite data	A variety of satellite retrievals and gauge-based observations of rainfall over Africa indicate coherent changes and variability since 1983 that relate to both radiative forcing and internal climate variability yet there are regions of substantial disagreement that are strongly determined by changes in surface gauge coverage and how these are used to calibrate satellite estimates. The intensity and timing of the wet and dry seasons are crucial for impacts



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		on societies across Africa and a new algorithm is developed to objectively capture and explore these metrics and how they vary over space and time.
<b>Posters:</b>		
Helen Brindley	Deep convection, upper tropospheric water vapour and OLR: recent insights from GERB	We present recent work probing the links between deep convection, upper-tropospheric water vapour and outgoing longwave radiation, with a focus on elucidating how the strength of the relationships seen differs with temporal and spatial scale.
Kamil Mroz	Hail detection algorithm for the GPM core satellite	By exploiting an abundant number of extreme storms observed simultaneously by the GPM suite of sensors and the NEXRAD ground-based S-band radars over continental US, proxies for the identification of high density ice (hail/graupel) were developed based on GPM observables.
Tim Trent	Assessment of IASI SST Under Clean Sky Conditions	In this study we demonstrate the impact of aerosol on the observed SST from IASI. We first describe a new multi-year collocated data set of (A)ATSR SST and aerosol information with IASI that has been created explicitly for this task. Next we show how the accuracy of IASI SST changes in the presence of aerosol, using the relationship between the Aerosol Optical Depth (AOD) measured by (A)ATSR and the detection of aerosol directly by IASI. This relationship is then used to help contextualise the aerosol effect on IASI SST, such that a first order empirical correction could be applied operationally.
Darren Ghent	A consistent approach to uncertainty estimation for Land Surface Temperature	The GlobTemperature project under the Data User Element of ESA's 4th Earth Observation Envelope Programme (2013-2017) aims to promote the wider uptake of global-scale satellite LST by the research and operational user communities; the key to success depending on the coherence and openness of the interactions between the LST and user communities. Here we present current outcomes from the project, which is achieving some innovative developments: a globally representative and consistent matchup database enabling validation and intercomparison of multi-sensor LST data sets; a combined geostationary earth orbit (GEO) and low earth orbit (LEO) global data set for LST to resolve the diurnal cycle which is a key request from users of LST data; and a first Climate Data Record for LST from the ATSRs.
Darren Ghent	Towards a Climate Data record for Land Surface Temperature from the ATSR and	LST provides the best approximation to the thermodynamic temperature which drives the



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	SLSTR Instruments	outgoing longwave flux from surface to atmosphere and space; its difference with air temperature controls sensible heat. Data from the Advanced Along Track Scanning Radiometer (AATSR) and the MODerate resolution Imaging Spectroradiometer (MODIS) are now used to create highly accurate single-sensor products and the first Climate Data Records for LST.
Alessandro Battaglia	Using a multi-wavelength suite of microwave instruments to investigate the microphysical structure of deep convective cores	This study presents a novel technique able to retrieve the density, mass and effective diameter of graupel and hail in severe convection through the combination of airborne microwave remote sensing instruments. The retrieval is applied to measure solid precipitation properties within two convective cells observed on May 24th 2014 over North Carolina during the IPHEX campaign by the NASA ER-2 instrument suite.
George Petropoulos	Soil moisture operational products accuracy from SMOS & ASCAT at selected ecosystems globally	In this study the accuracy of two operationally distributed products of SSM provided from the SMOS and ASCAT satellite sensors is evaluated at several ecosystems in Europe, USA and Australia. Co-orbital soil moisture in-situ from selected sites belonging to the FLUXNET in-situ monitoring representative of different climatic, environmental, biome and topographical conditions were used. The discrepancy between the two datasets was evaluated including the variability of site characteristics included in our study.
George Petropoulos	SEVIRI PrePro: An open source software for the Pre-processing of SEVIRI Data Products	Here we present an open source software tool we developed for performing basic pre-processing of all the series of the SEVIRI Data Products. We also present case studies demonstrating the use of the software tool using as a basis the SEVIRI ET product distributed by LSA SAF
<b>Towards Sentinel Data (Martin Wooster)</b>		
Pedro Rodriguez Veiga	Accuracy of forest change detection products in Forests of Mexico within the International Partnership Space Programme (IPSP)	An assessment of forest change-detection products generated using different methods and datasets (i.e. Landsat, SRTM-ASTER, and Sentinel-1).
José Gómez-Dans	Monitoring the land surface using heterogeneous EO data. An EO-LDAS application to croplands	Monitoring agricultural landscapes requires dense time series. Due to e.g. cloudiness, no single sensor is likely to be enough to provide adequate temporal sampling. Using data from different sensors is complicated by the different characteristics of each sensor (temporal, spectral, spatial, geometric, ...). We demonstrate the use of the EO-LDAS library, a Bayesian framework for combining different data streams using state-of-the-art radiative transfer models and to provide an inference on the state of the land surface (as well as



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		associated uncertainties) on an agricultural region, showcasing how different sensors can be advantageously combined for this task.
Steve Donegan/Ed Williamson	Sentinel Data Access at CEDA	Access to Sentinel 1a & 2a data is made through CEDA. Shortly also 3a & 1b missions. This talk will highlight how NCEO users can access this data and highlight some of the data management issues affecting what data is collected.
<b>Posters:</b>		
Peter North	Global atmospheric aerosol and surface reflectance products for Sentinel-3	We present new land surface reflectance and global atmospheric aerosol products for the Copernicus Sentinel-3 mission, and first results. The land products use SLSTR and OLCI to provide high accuracy surface reflectance, to facilitate global services such as mapping of albedo, leaf area index and absorbed radiation, land cover classification, and continuity with SPOT-VGT products. An atmospheric product will be operational from 2017, and will provide global aerosol atmospheric optical depth, particle size and absorption properties, both for near real time applications and climate quality archive.
Peter North	Evaluation of Sentinel-3 SYNERGY first products	We present new land surface reflectance and global atmospheric aerosol products for the Copernicus Sentinel-3 mission, and first results. The land products use SLSTR and OLCI to provide high accuracy surface reflectance, to facilitate global services such as mapping of albedo, leaf area index and absorbed radiation, land cover classification, and continuity with SPOT-VGT products. An atmospheric product will be operational from 2017, and will provide global aerosol atmospheric optical depth, particle size and absorption properties, both for near real time applications and climate quality archive.
<b>Atmospheric pollution and the land emissions (Hartmut Boesch)</b>		
Ed Malina	Investigations into global bio/abiogenic Methane Mapping from Space	Isotopic ratios of methane ( $^{12}\text{CH}_4$ and $^{13}\text{CH}_4$ ) can be used to determine the nature of a source of methane (biogenic, abiogenic or thermogenic). We show the atmospheric and surface conditions required by the satellite GOSAT to resolve and measure these isotopic concentrations
Luke Surl	Formaldehyde over India: using satellite observations and modelling	We present initial results from our investigations into formaldehyde over India. Processed satellite retrievals and modelling output are used to assess the quality of current estimations of anthropogenic and biogenic VOC emissions.



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Richard Pope	The impact of synoptic weather on UK surface/tropospheric ozone and implications for premature mortality	We investigate the influence of synoptic weather on UK summer time ozone using both surface and satellite observations. The health impacts associated with enhanced surface ozone from certain weather regimes is then assessed.
Martin Wooster	El-Nino Driven Fire Emissions Factors for Indonesian Peatlands measured in the field, and used to constrain total Indonesian fire-emitted GHG emissions for 2015	In 2015 and El Nino related drought coupled with annual landscape burning in Indonesia led to huge amounts of fire activity, the largest since 1997. We report the first measurements of peatland fire emissions factors for landscape fires in Indonesia burning under these extreme conditions, which led to levels of atmospheric particulate matter 10X worse than those considered "extremely hazardous" in Europe. As well as PM, we focus on carbon and GHG emissions, and used our GHG emissions factors along with FRP data from the Copernicus Atmosphere Services Global Fire Assimilation System (GFAS) to help constrain the overall GHG emissions budget of this huge fire event, unprecedented since 1997.
Rocío Hernández-Clemente	A new integrated canopy fluorescence model based for remote sensing of forest health and productivity	This study provides insight into the influence of scene components and forest structure and composition on the quantification of the fluorescence signal as an early indicator of forest decline and for the validation of current and future Earth System Models. We present first results of the integration of FluorMODleaf with the three-dimensional raytracing model FLIGHT, for investigating these interactions by means of the simulation of forest canopy reflectance and fluorescence signals.
<b>Posters:</b>		
Rob Parker	Atmospheric Methane Observations from GOSAT	We use satellite observations of CH <sub>4</sub> and CO <sub>2</sub> from the Greenhouse gases Observing SATellite (GOSAT) made in large scale plumes from the 2015 El Nino-driven Indonesian fires to probe aspects of their chemical composition.
Tianran Zhang	New Estimates of Smoke Emissions from Eastern China's Agricultural Residue Burning	A dedicated "small fire" detection algorithm is built around 375 m spatial resolution "I-band" imagery provided by the new VIIRS. FRP from VIIRS measurements will be converted into daily FRE estimates using diurnal FRP cycle information gathered from Himawari-8. Biomass burning emission factors measured in-situ with the new smoke measurement system will be used along with the satellite-derived FRE estimates to deliver the final gaseous and particulate emissions inventory in Eastern China.
Daniel Fisher	Tuning, Evaluation and Cross-Sensor Intercomparison of the Satellite Fire Radiative Power MIR Radiance	We present a modification to the MIR radiance method that facilitates its use in the determination of FRP from gas flares. Initially,



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	Approach to Gas Flares	evaluations are made against a multichannel FRP determination approach before we move on to provide a cross-sensor intercomparison of gas flare FRP outputs from the modified algorithm applied to observations from MODIS, VIIRS and Landsat.
Joe McNorton	Role of wetland emissions on renewed growth of atmospheric methane	We have used JULES to estimate wetland emissions from 1993 to 2014. Use of these fluxes in an atmospheric model gives good agreement with surface and satellite observations of CH <sub>4</sub> . In particular, the model captures the positive trend in atmospheric methane after 2007
Hilke Oetjen	Formaldehyde from GOME-2: Observing Biogenic Volatile Organic Compound Emissions from Space	An overview of the HCHO retrievals from the GOME-2 instrument flying on the MetOp satellites will be presented, as well as some first results for validation of the data and for testing isoprene emission schemes in models.
David Moore	Measuring long-term changes in tropospheric organic species with MIPAS	This work presents observed changes in ethane (C <sub>2</sub> H <sub>6</sub> ) and acetylene (C <sub>2</sub> H <sub>2</sub> ) over the past decade, using the MIPAS instrument. Ethane decreased significantly in the upper troposphere over the 2007-2012 period; acetylene concentrations remained unchanged.
Joanne Walker	The RAL IASI/MHS/AMSU retrieval products and impact on methane retrieval	We present the RAL retrieval scheme using IASI/MHS/AMSU data for the retrieval of T, q, and ozone. We show the impact of the scheme when used as a preprocessor for the RAL IASI methane retrieval.
Barry Latter & Brian Kerridge	Tropospheric ozone global data from satellite uv observations	Production of data from five satellite uv sounders spanning 1995-2015 will be summarised, together with the near-real time processing chain for MetOp which has also been established
<b>Environmental forecasting and data assimilation</b> (Peter Jan van Leeuwen)		
Polly Smith	Data assimilation for coupled atmosphere-ocean models	Characterisation of the relationship between errors in the atmosphere and ocean model forecasts in coupled atmosphere-ocean data assimilation is an important but non-trivial problem and if done correctly will allow observations in one fluid to positively influence the analysis in the other. We will present results from experiments using an idealised coupled atmosphere-ocean system to investigate ways of constructing and implementing coupled model forecast error statistics in variational data assimilation.
Ross Bannister	Non-Gaussianity in moisture errors in data assimilation	Simple-minded assimilation of humidity information with atmospheric models leads to some interesting and challenging issues, especially due to non-Gaussianity of humidity errors. Here we examine the merits of three



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		ways of dealing with non-Gaussianity: (i) log humidity, (ii) a so-called 'symmetrising' transform, and (iii) Gaussian anamorphosis.
Philip Lewis	Practical use of EOLDAS: application to agricultural monitoring	We highlight recent changes to EOLDAS and use weak empirical model constraints to solve for biophysical parameters over agricultural areas.
Tristan Quaife	Toward Data Assimilation in JULES	This talk describes various activities lead from UoR preparing for Data Assimilation in JULES. This includes integration with EMPIRE, the PEcAn project and development of observation operators to support various EO observations.
Stefano Ciavatta	Assimilation of biogeochemical data to improve the simulation, understanding and management of marine ecosystems: experiences in the North West European shelf	Shelf-seas and coastal zones provide essential goods and services to humankind, such as fisheries, aquaculture, tourism, and their management can be supported by modelling and data assimilation research. Here we present an overview and perspective on biogeochemical data assimilation using North West European shelf ecosystem models, ranging from the application of novel methods, assimilation of innovative products, and development of a state-of-the-art operational system.
<b>Posters:</b>		
Sylvain Delahaies	Constraining a C-cycle model data fusion problem	We use variational data assimilation to constrain the terrestrial ecosystem model DALEC with monthly MODIS LAI observations. To regularise this rank deficient and ill-posed problem we add constraints based on ecological "common sense", this allows for a large reduction of the uncertainty of the predicted C-fluxes.
Liang Feng	Surface CO <sub>2</sub> and CH <sub>4</sub> fluxes simultaneously inferred from proxy GOSAT XCH <sub>4</sub> :XCO <sub>2</sub> retrievals: Trends and inter-annual variations	We use an ensemble Kalman Filter (EnKF) to infer simultaneously regional CO <sub>2</sub> and CH <sub>4</sub> fluxes from 2009 to 2015 by assimilating proxy GOSAT XCH <sub>4</sub> :XCO <sub>2</sub> retrievals and NOAA in situ data. We investigate the correlation between the inter-annual variation of the resulting CO <sub>2</sub> and CH <sub>4</sub> fluxes over different regions, with El-Nino events from 2009 to 2015.
Chris Wilson	Estimating global CH <sub>4</sub> emissions in 2010 using a 4D-Var inverse model and GOSAT and IASI retrievals	We present an assessment of global methane emissions for 2010 using the TOMCAT Chemical Transport Model and the variational inverse model, INVICAT. We assimilate observations from the NOAA surface measurement network along with the latest versions GOSAT and IASI retrievals.
Tris Quaife / Ewen Pinnington	Understanding the information content in observations of forest carbon balance	We present the Data Assimilation Linked Ecosystem Carbon model. (DALEC2) [1] in a Four-Dimensional Variational (4d-Var) data assimilation framework for parameter and state estimation. Using this method we can analyse the information content in different



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		observations relevant to the carbon balance of a forest, in order to understand which observations are improving our model estimates the most.
Javier Amezcua	A weak-constraint 4D-EnsembleVar	We formulate a 4D EnsembleVar in the presence of model error. We show that the ability to make changes at intermediate times (not only at the time of initial condition) can help alleviate the detrimental effects of static localisation (time-wise) in 4-dimensional covariances.
Nancy Nichols	Accounting for model error: Weak constraint 4DVar	We consider two formulations of the weak constraint variational data assimilation problem and investigate the speed of the iteration procedures for the two systems as a function of background and observation error variances and correlation length-scales, as well as observation configurations. We show how the behaviour depends on the number of assimilation time steps within a window and hence demonstrate how the different systems behave over longer assimilation windows.
Nancy Nichols & Bertrand Bonan	Initialisation of a moving point ice sheet model	We propose to combine a particular moving point method and an Ensemble Kalman Filter to predict efficiently the evolution of ice sheets and track explicitly their moving boundaries. This approach enables the sensitivity of the system to be understood and provides information on the correlations between physical variables and the grid.
Nancy Nichols & Elizabeth Cooper	Improving Inundation Forecasting using Data Assimilation	The poster shows some results from applying an ETKF to an idealised flood model in identical twin experiments. State-only assimilation is shown to give good corrected water levels at the time of assimilating observation but the forecast skill quickly reduces in time. Simultaneously correcting the channel friction parameter along with the state greatly improves the water level forecast over a much greater time.
Nancy Nichols and Joanne Waller	Diagnosing observation error statistics for atmospheric motion vectors	We calculate observation error statistics for atmospheric motion vectors assimilated in the Met Office high resolution model. We use a diagnostic that makes use of statistical averages of background and analysis residuals to calculate these observation error statistics
David Sursham	Advancing marine ecosystem understanding and predictions using a novel data assimilation technique	Shows the results of twin experiments, applying different ensemble-based data assimilation methods to a 1D marine ecosystem model, ERSEM-GOTM. Includes a discussion of the differences in Particle Filters and Kalman Filters when applied to non-linear, high dimensional models.



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Flavia Pinheiro	Exploring synchronisation in nonlinear data assimilation	A new data assimilation method based on synchronisation is being developed to be embedded in a particle filter. The results are very promising, showing accurate long range forecasts, even when only half of the system is observed.
<b>Examples of International Science</b>		
Shaun Quegan	The status of the ESA BIOMASS mission and its role in a global forest observing system	With the signing of the contract to build BIOMASS (Airbus UK is the Prime Contractor) on 29 April 2016, we have entered a new phase of intense activity to ensure that the mission will deliver high quality information about the world's forests straight after launch in 2021. This is not just an instrument issue, but also involves development of a community including ecologists, carbon cycle & climate modellers and resource managers, who are aware of and able to exploit the unprecedented information to be supplied by BIOMASS, complemented by data from the NASA-ISRO L-band radar NISAR and the NASA Global Environmental Dynamics Investigation vegetation lidar, which will both be in orbit at about the same time.
Jean-François Exbrayat	Using model-data fusion to address the influence of fire regimes on large-scale savanna ecosystem traits	We use the CARDAMOM model-data fusion framework to retrieve terrestrial ecosystem parameters, in particular savannas adaptation to fire regimes.
Shannon Mason	EARTHCARE: Improved synergy retrievals of rain rate and ice particle density using Doppler radar	In this talk we demonstrate how Doppler velocity observations help constrain retrievals of precipitation rates in stratiform rain using Doppler radar aboard a high-altitude aircraft during the Tropical Composition, Cloud and Climate Coupling (TC4) campaign. We also show how Doppler velocities can be used to retrieve ice particle riming using ground-based radar observations at the ARM Mobile Facility at Hyttälä, Finland, with independent evaluation against in-situ measurements.
Gary Corlett	GHRSSST - Group for High Resolution Sea Surface Temperature	The provision of observations of sea surface temperature (SST) data by the Group for High Resolution SST, GHRSSST (see <a href="http://www.ghrsst.org">http://www.ghrsst.org</a> ), has grown to a mature, sustainable, and essential service. GHRSSST provides a suite of global high-resolution SST products to support operational forecast systems, climate science, many diverse applications, and to facilitate a wide range of research in the broader scientific community.
<b>Climate data for the Earth system</b> (Helen Brindley)		
Owen Embury	Sea Surface Temperature from the ESA CCI project	A review of the ongoing developments in the ESA SST-CCI project. The talk will also provide a summary of the NCEO/SST-CCI dataset provided for the NERC El Nino call.



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Caroline Poulsen	Cloud from ATSR	We show the latest results from the Cloud CCI project and show how trends in cloud properties are correlated with large scale climate features such as ENSO and NAO and how changes compare with changes in SST and Aerosol.
Richard Bantges	Assessment of the variability in the Earth's OLR from several years of IASI observations	Attempting to get some hot-off-the-press results of how the Earth's spectrally resolved OLR varies over several years of IASI radiance observations on a range of spatial and temporal scales, focusing on whether there are distinct differences in the variability when separating by regime type. NB: If not possible in time, this may become a discussion poster rather than oral presentation.
Matthew Christensen	Cloud Radiative Effect Evaluation using CC4CL Broadband Flux Algorithm	A new broadband radiation flux code has been incorporated into CC4CL (Community Code for CLimate) to study the radiative impacts of clouds on climate. We have applied this code to 17 years of (A)ATSR (Advanced Along Track Scanning Radiometer) observations and demonstrate significant cloud radiative effect responses in trend analysis related to the El Niño–Southern Oscillation.
Tim Keslake	A study of fire emissions using the assimilation of atmospheric composition data	In this study we present results from C-IFS experiments with and without composition data assimilation, in particular exploring how the approach improves the representation of biomass burning influences in the Amazon, comparing to independent observations from the SAMBBA field campaign in 2012.
<b>Posters:</b>		
Adam Povey	Parallel retrieval of aerosol and cloud at 1 km resolution	The ORAC algorithm can be used to retrieve the macroscopic properties of atmospheric particulates by assuming their optical properties (expressed as particle type, such as aerosols or liquid cloud). By considering multiple particle types, this can investigate the twilight zone between aerosol and cloud where current algorithms provide no data due to a lack of confidence in their assumed type.
Sophie Hebden	Investigating Elevation Dependent warming with satellite LST datasets	Whilst the climate has been found to be warming faster in high altitude regions using ground-station datasets, trends have not yet been identified in satellite datasets. This outlines early attempts to look for any elevation dependencies using the new Climate Data Record for Land Surface temperature from the ATSR2 and (A)ATSR sensors, produced at Leicester University. LST dependencies are further investigated using CMIP5 model outputs.



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Chris Banks	Earth Observation of the oceans at the National Oceanographic Centre	
Maria Valdivieso and Keith Haines	The Ocean Reanalysis Intercomparison project: Surface fluxes comparisons and plans to assimilate CCI-SSTs	This study provides overview of ocean reanalysis brought together for comparisons and particularly the variability in surface flux products in comparison with independent data. We also report on plans to assimilate CCI-SST data to improve near surface properties and fluxes in future reanalyses.
<b>Instruments and Facilities Science (Martin Wooster)</b>		
Anu Dudhia	The Reference Forward Model	A general purpose line-by-line model for infrared radiative transfer
Alasdair MacArthur and Gary Llewellyn	NERC's current airborne and field remote sensing capability, cal / val and airborne demonstrators for future orbital systems	NERC supports UK environmental research by funding National Capability Facilities for airborne and field-based remote sensing (NERC ARF and FSF respectively). These state-of-the-art facilities host a well-calibrated and rigorously maintained set of instruments and measurement capabilities, and provide NERC users the expert assistance to exploit these technologies to support their science, both in the UK and around the world. The Facilities have supported cutting-edge research for many years, and their capabilities are available to support development of algorithms and technology (as airborne demonstrators) for future space-borne deployments, and the cal/val activities of new EO missions.
Ben Taylor	NEODAAS data provision and processing	Expands on the very brief talk given at the staff meeting in March to provide more details of NEODAAS' capabilities and the products available through the service
<b>Posters:</b>		
Peter Miller	Satellite applications towards marine impact: Harmful algal blooms and ocean fronts	By covering examples of where NEODAAS satellite data have supported societal impacts, I will find common threads to guide NCEO colleagues on generating more impact from their own research.
Philip Kershaw	JASMIN-CEMS - providing a collaborative computing infrastructure for the research community and shaping its future architecture	Now in its third year of operation, we take a look at some of the examples of the range of applications and workloads being hosted on the infrastructure, examine emerging patterns of use and look at how this is shaping the future architecture for the system.
Gary Llewellyn	NERC's capability for collecting airborne data (NERC ARF)	We present an update on the instrumentation, capability and funding opportunities for obtaining airborne data for EO and for use of the airborne
Victoria Bennett	CEDA and JASMIN services for NCEO	Overview of what we offer, e.g. issuing DOIs for archived data, tools and services, e.g. JASMIN Analysis Platform and Community Intercomparison Suite on JASMIN, data catalogue search, flight finder tool



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Esther Conway	NCEO Data Management Planning	Results from NCEO datasets survey & data management planning for NCEO datasets
Alison Waterfall	The CCI open data portal & importance of metadata standards	CEDA is involved in the development of the ESA CCI Open Data Portal, which will provide a central point for access to data from all the ESA CCI projects. A key aim of this is to make the data widely available and discoverable, and the importance of metadata standards to enhance data discovery will be discussed in this context
<b>Carbon cycle</b> (Hartmut Boesch)		
Amos Lawless	Investigating the role of error correlations in 4D-Var to improve predictions of forest carbon balance	We specify background error correlations with dynamical constraints and observation error time correlations in a 4D-Var assimilation system with a simple model of carbon balance (DALEC2). We show how data assimilation using these new correlations improves 14-year forecasts of net ecosystem exchange.
Heiko Balzter	GLOBBIOMASS Regional Case Studies. Preparing the Ground for Global Forest Biomass Mapping	The ESA GlobBiomass project aims to reduce uncertainties in current estimates of above-ground biomass (AGB) of forests by developing an innovative synergistic mapping approach at five regional sites (Poland, Sweden, Indonesia, Mexico and South Africa) for the epochs 2005, 2010 and 2015 and for one global map for the year 2010. We report on progress in the GlobBiomass Task 5 (Regional Biomass Estimation) and describe the regional methods for generating the regional biomass maps and associated uncertainties
Matthew Hethcoat	Challenges of detecting low intensity selective logging with medium resolution imagery	We assessed the ability of the CLASlite software (Asner et al. 2009; Journal of Applied Remote Sensing) to detect forest degradation from low intensity selective logging (approximately 1 tree ha <sup>-1</sup> ) at a test site in the Jamari National Forest, Rondônia, Brazil. CLASlite could not detect the level of forest degradation present in the Landsat 8 imagery and we show results from attempts to increase detection using a Random Forests algorithm and additional inputs characterizing forest structure (NDVI, radar backscatter, etc).
Marie-Fanny Racault	El Niño impacts on oceanic phytoplankton	The responses of phytoplankton to El Niño variability and the driving physical processes are characterised in the global oceans based on ocean-colour, SST, sea level and wind observations.
Dionysios Raitsos	Remotely sensing the Red Sea ecosystem	The Red Sea is one of the most unexplored Large Marine Ecosystems in the world, making the remotely-sensed ocean colour datasets a vital means to study large-scale biological processes. Adopting a multidisciplinary approach, using satellite observations, ship-borne in situ profiles, and model simulations, we investigate the surface biology of the Red



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		Sea in relation to the regional physics and broader climate oscillations.
Nina Raoult	Constraining future land carbon cycle feedbacks with in situ observations using adJULES	The adJULES parameter estimation system is used to perform multisite optimisations over the plant functional types found in the JULES land-surface model. Best fit parameters and their associated uncertainties are used to create a parameter ensemble which is used in global land carbon cycle simulations within the IMOGEN system.
<b>Posters:</b>		
Weidong Xu	Advanced in Geostationary Fire Radiative Power Observation from Himawari-8	Himawari-8 is next generation of geostationary satellite over Asia and Australia, It provide most high spatial resolution at 2km for thermal bands and temporal resolution at 10 minutes. Here we developed the first fire radiative power observation system based on Himawari-8, it will contribute to a global geostationary fire radiative power observation system.
Bob Brewin	Using underway spectrophotometry along the Atlantic Meridional Transect to evaluate the Ocean Land Colour Instrument on Sentinel 3 and other ocean-colour sensors	Using underway spectrophotometry along the Atlantic Meridional Transect we show a significant improvement in the performance of satellite chlorophyll algorithms over previous studies, with root mean square errors on average less than half that reported previously. This improved performance is likely due to the use of continuous spectrophotometry, that is highly accurate, and samples at a spatial scale more comparable with satellite pixels.
Peter Somkuti (presented by Hartmut Boesch)	Chlorophyll fluorescence retrievals from GOSAT	Sun-induced chlorophyll fluorescence (SIF), as retrieved from GOSAT, reveals information about the photosynthetic activity of vegetation on a continental and global scale. With a data set covering almost 7 years, we are able to detect regional anomalies (e.g. drought periods) in the well-represented seasonal cycles.
Neil Humpage	Latest results from the GreenHouse gas Observations of the Stratosphere and Troposphere (GHOST) airborne shortwave infrared spectrometer	We present the latest progress towards retrievals of carbon dioxide and methane from GHOST radiance spectra, which were measured during two distinct flight campaigns in 2015. These focused on spatial trends in GHG column concentrations over the eastern Pacific Ocean on a regional scale whilst deployed on the NASA Global Hawk UAV, and on localised GHG emissions hotspots within the UK whilst flying on board the NERC Airborne Research and Survey Facility Dornier-228.
Joao Carreiras	The impact of space surveillance stations on ESA BIOMASS mission objectives	BIOMASS, to be launched in 2021 with an expected 5 year mission lifetime, will deliver three primary geophysical products every 6 months: forest above ground biomass density, forest height, and severe forest disturbances. Mission selection was made in full knowledge of coverage restrictions over Europe, North



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		America and parts of Central America imposed by the US Department of Defense Space Objects Tracking Radar (SOTR) stations located in North America and Europe. In this study we attempt to quantify the impact of those stations on BIOMASS objectives in terms of i) forest coverage, ii) above ground biomass carbon stocks, and iii) large scale carbon cycle and Earth System Models.
Joao Carreiras	Improving the separability of secondary forest age classes in the Brazilian Amazon with optical and radar remote sensing data	We attempted the retrieval of Amazonian secondary forest age with single-date optical and radar remote sensing data. Discrimination was possible up to 10 years of age with signal saturating afterwards. Separability is increased when only two secondary forest age classes are considered
Phil Wilkes	Terrestrial laser scanning field protocol for forested ecosystems	Terrestrial Laser Scanning (TLS) is now recognised as a key tool for biophysical parameter estimation in forest ecosystems. Here we present a field protocol for TLS campaigns which covers such practicalities as sampling density, reflector specifications and placement and other considerations.
James Brennan	Burned area model intercomparison project	Burned area products provide valuable datasets for climate modellers, GHG emission modellers and land managers. There are numerous burned area algorithms which take different approaches and rely on various satellite sensor data inputs. Previous intercomparison exercises have not evaluated algorithms on a like-for-like basis independent of sensor sampling. To fully evaluate different algorithmic approaches, sensor sampling issues have to be separated from algorithmic choices. Here we present results from a program to compare various BA products, to quantify differences and assess uncertainties. This is the first time such an intercomparison has been attempted in a systematic way, and the aim is to provide guidance on how BA products can be compared, interpreted, and hopefully improved.
Mat Disney	Measuring tropical forest structure and biomass in Ghana at the ESA AfriSCAT site	We show results from collecting terrestrial laser scanner (TLS) measurements of a forest plot in Ghana covering the footprint of the tower-mounted ESA AfriSCAT RADAR. The work is in support of the ESA BIOMASS mission: the TLS data are being used to develop improved microwave models to characterise the variations that BIOMASS will see, which will be tested and validated using the tower-mounted RADAR data.
Jelizaveta Ross	Ocean Biological Carbon Pump	Our poster will focus on comparing simultaneous in situ measurements of optical



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		properties and particulate organic carbon (POC) in the mesopelagic region of the Atlantic Ocean.
Tris Quaife /Gerardo López Saldaña	Annual land cover change mapping using MODIS time series to improve emissions inventories	The MELODIES project is exploiting diverse sources of Open Data to develop new applications and services that benefit society. This service will create annual land cover maps tailored to identify land cover change and subsequent emissions changes in the UK
Tris Quaife / Renato Braghieri	Evaluating radiative transfer schemes treatment of vegetation canopy architecture in land surface models	A structural parameterisation of vegetation improved the performance of a two-stream radiative transfer by making it achieves comparable results to more complex 3D models calculations under observed conditions for fAPAR and albedo PAR.
<b>Other Posters:</b>		
Sadie Holmes	Identification and mapping of geothermal anomalies	MODIS derived land surface temperature data is analysed in an attempt to map and delineate elevated geothermal gradients that have arisen as a result of hydrocarbon, rifted basins.
Michael Perry	Remote sensing of high spatial resolution land surface temperature and emissivity in the urban environment with ASTER.	We present a retrieval method for high spatial resolution landsurface temperatures and emissivities from ASTER. The method is specialised in adapting to the heterogenous urban environment and aims to produce an accurate and computationally efficient solution with well-defined uncertainties.
Daniel Gerber (presented by Barry Latter/ Brian Kerridge)	LOCUS	We present the concept of the ESA Earth Explorer 9 Candidate Mission LOCUS. The scientific objective is to measure the composition and thermal balance of the Mesosphere - Lower Thermosphere, and its links to climate and space weather.
Phil Wilkes	Using Jupyter notebooks to deliver scientific training materials	The dissemination of new, and often complex techniques, can be a limitation to adoption by others. New applications, such as Jupyter notebooks, allow for training materials to be easily developed and published to the wider community. Jupyter includes the functionality of executing live code, as well as markdown for the inclusion of enhanced text and equations. This presentation will give an introduction and demonstration of Jupyter notebooks.
Catherine Fitzsimons	EO Detective	



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### Conference Attendees

<b>First name</b>	<b>Surname</b>	<b>Institute/Company</b>
Richard	Allan	NCEO Reading
Javier	Amezcuca	NCEO Reading
Heiko	Balzter	NCEO Leicester
Chris	Banks	NOC
Ross	Bannister	NCEO Reading
Richard	Bantges	NCEO Imperial College
Alessandro	Battaglia	NCEO Leicester
Victoria	Bennett	STFC - CEDA
Hartmut	Boesch	NCEO Leicester
James	Brennan	NCEO UCL
Bob	Brewin	PML-NCEO
Helen	Brindley	NCEO Imperial College
Pete	Bunting	Aberystwyth University
Joao	Carreiras	NCEO Sheffield
Martyn	Chipperfield	NCEO Leeds
Matthew	Christensen	STFC/RAL Space
Stefano	Ciavatta	PML-NCEO
Esther	Conway	CEDA
Gary	Corlett	NCEO Leicester
Sylvain	Delahaies	NCEO Surrey
Mathias	Disney	NCEO UCL/MSSL
Steve	Donegan	STFC - CEDA/ RAL Space
Anu	Dudhia	NCEO Oxford
Owen	Embury	NCEO Reading
Jean-François	Exbrayat	NCEO Edinburgh
Liang	Feng	NCEO Edinburgh
Jan	Fillingham	NCEO
Daniel	Fisher	NCEO King's College London
Catherine	Fitzsimons	NCEO
Daniel	Gerber	STFC RAL Space
Darren	Ghent	NCEO Leicester
Jose	Gomez-Dans	NCEO UCL
Don	Grainger	NCEO Oxford
Jake	Gristey	NCEO Reading
Keith	Haines	NCEO Reading
Peter	Hargrave	Cardiff University
Robert	Hargreaves	NCEO Oxford
Phil	Harris	CEH-NCEO
Jeremy	Harrison	NCEO Leicester
Catherine	Hayer	Oxford University
Sophie	Hebden	NCEO Leicester
Rocio	Hernandez-Clemente	NCEO Swansea



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Matthew	Hethcoat	NCEO Sheffield
Sadie	Holmes	NCEO Leicester
Colin	Jones	Met Office
Tim	Jupp	NCEO Exeter
Brian	Kerridge	STFC/RAL Space
Philip	Kershaw	CEDA, STFC RAL
Tim	Keslake	NCEO Leeds
Barry	Latter	STFC/RAL Space
Amos	Lawless	NCEO Reading
Pascal	Lecomte	ESA
Rosie	Leigh	NCEO
Philip	Lewis	NCEO UCL
Gary	Llewellyn	NERC ARF (BAS)
Neil	Lonie	NEODAAS Dundee
Alasdair	MacArthur	NCEO FSF
Claire	MacIntosh	NCEO Reading
Edward	Malina	NCEO UCL/MSSL
Shannon	Mason	NCEO Reading
Joey	McNorton	NCEO Leeds
Christopher	Merchant	NCEO Reading
Peter	Miller	PML-NCEO
David	Moore	NCEO Leicester
Kamil	Mroz	NCEO Leicester
Nancy	Nichols	NCEO Reading
Peter	North	NCEO Swansea
Hilke	Oetjen	NCEO Leicester
Rob	Parker	NCEO Leicester
Michael	Perry	NCEO Leicester
George	Petropoulos	Aberystwyth University
Flavia	Pinheiro	NCEO Reading
Richard	Pope	NCEO Leeds
Caroline	Poulsen	STFC RAL
Adam	Povey	NCEO Oxford
Tristan	Quaife	NCEO Reading
Shaun	Quegan	NCEO Sheffield
Marie-Fanny	Racault	PML-NCEO
Dionysios	Raitsos	PML-NCEO
Nina	Raoult	NCEO Exeter
John	Remedios	NCEO
Ciaran	Robb	NCEO Leicester
Pedro	Rodriguez Veiga	NCEO Leicester
Jelizaveta	Ross	PML-NCEO
Ian	Roulstone	NCEO Surrey
Andy	Shaw	Terreflexion



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Polly	Smith	NCEO Reading
Zofia	Stott	NCEO
Luke	Surl	NCEO Edinburgh
David	Sursham	PML-NCEO
Elena	Tarnavsky	NCEO Reading
Ben	Taylor	PML-NCEO
Simon	Tett	University of Edinburgh
Tim	Trent	NCEO Leicester
Peter Jan	van Leeuwen	NCEO Reading
Andy	Vick	STFC / UK ATC
Jo	Walker	STFC RAL
Alison	Waterfall	STFC- CEDA
Phil	Wilkes	NCEO UCL
Ed	Williamson	STFC -CEDA
Chris	Wilson	NCEO Leeds
Martin	Wooster	NCEO King's College London
Weidong	Xu	NCEO King's College London
Tianran	Zhang	NCEO King's College London



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### Attending 'Copernicus Science and Future Missions' only

John	Bone	Telespazio
Christopher	Brownsword	Qinetiq
Jon	Budzynski	UKSA
Geoff	Burbidge	Airbus
Victoria	Carter-Cortez	Deimos Space UK Limited
Janet	Charlton	JCR Systems
Ralph	Cordey	Airbus
Richard	Engelen	ECMWF
Andy	Fleming	BAS
Celestino	Gómez Cid	GMV Innovating Solutions
Beth	Greenaway	UKSA
Christopher	Hall	UKSA
Catherine	Holt	Innovate UK
Mick	Johnson	Airbus
Hugh	Kelliher	Space Connexions
Peter	Knowles	Leonardo Land & Naval Defence Electronics
Michael	Lawrence	Deimos Space UK Limited
Dann	Lobb	SSTL
Craig	Molford	COM DEV UK
Yvonne	Munro	Airbus
Chetan	Pradhan	CGI
Roger	Saunders	Met Office
Rob	Scott	CEOI - ST
Andy	Shepherd	CPOM
Bradley	Smith	Deimos Space UK Limited
Martin	Townend	Thales Space