

NCAS, CMS, CEDA and JASMIN: AN OVERVIEW

National Centre for Atmospheric Science (NCAS)



> 200 members of staff employed in 12 universities and research institutes around the UK



Long term global change:

- Climate projections
- Composition changes
- Cloud and aerosol feedbacks



Air Pollution:

- Emissions
- Urban scale pollution
- Health effects
- Interaction and feedbacks



Climate and High Impact Weather:

- Climate projections
- Composition changes
- Cloud and aerosol feedbacks



**National Centre for
Atmospheric Science**

NATURAL ENVIRONMENT RESEARCH COUNCIL



Services and Facilities:

Atmospheric Measurement Facility (AMF)
Facility for Airborne Atmospheric Measurements (FAAM)
NERC Facility for Atmospheric Radar Research (NFARR)
Computational Modelling Services (CMS)
Centre for Environmental Data Analysis (CEDA)

“National capability”

FACILITIES AND SERVICES

Operates instrumented
BAe-146 aircraft provided
by BAE SYSTEMS



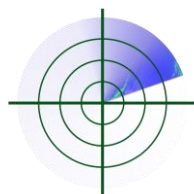
Operates / provides
ground based
observatories and mobile
instrumentation



Provides access to Unified
Model code on UK HPC
facilities



Data archiving and analysis
services in support of UK
atmospheric and EO
science



**NERC
Facility for
Atmospheric
Radar
Research**

Operates Chilbolton radar
and MST radar (Capel
Dewi near Aberystwyth)



**National Centre for
Earth Observation**
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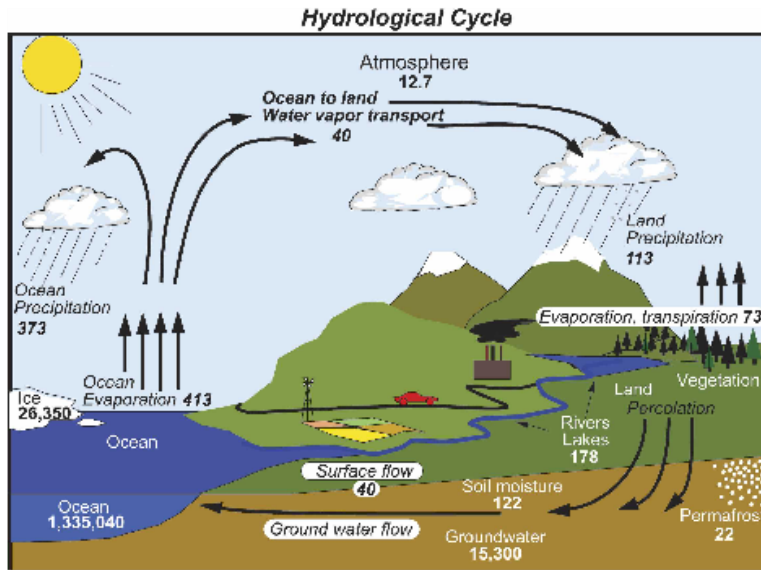
NCAS Computational Modelling Services (CMS)



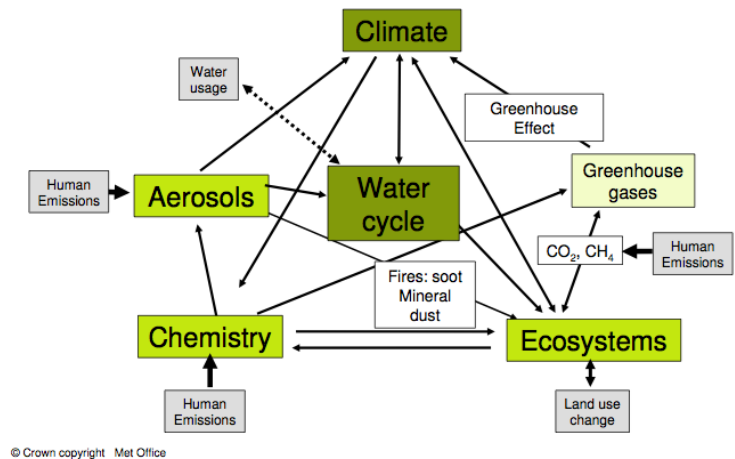
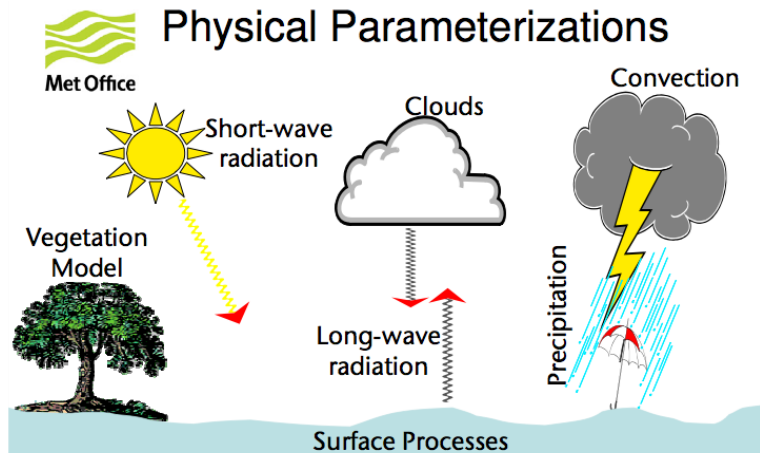
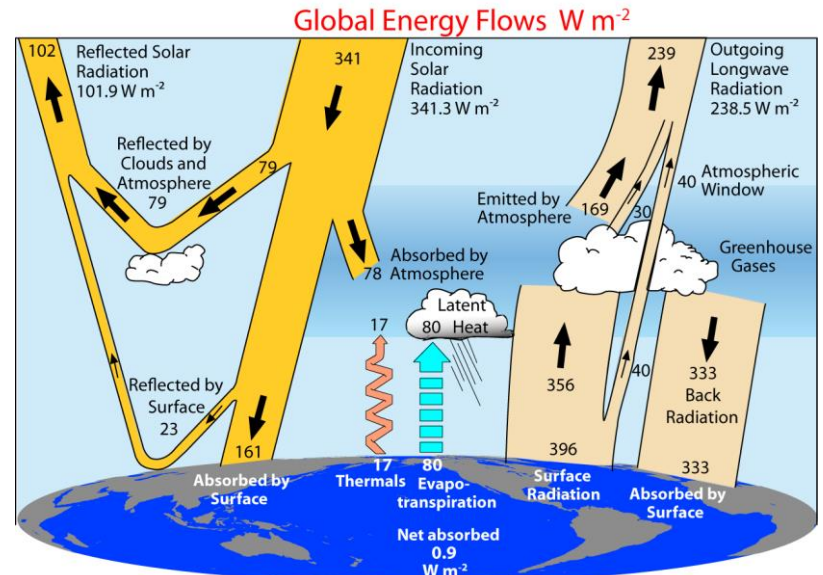
NCAS Computational Modelling Services (CMS)

- CMS staff undertake NCAS activities in support of computational science (particularly High Performance Computing (HPC) and numerical modelling)
- Provide underpinning infrastructure, such as code repositories and workflow management tools, for the UK academic atmospheric and polar science communities.
- Provide training for scientists:
 - NCAS Introduction to Scientific Computing course
 - NCAS Introduction to Unified Model course
 - NCAS CF Python tools course

Climate Modelling



Units: Thousand cubic km for storage, and thousand cubic km/yr for exchanges

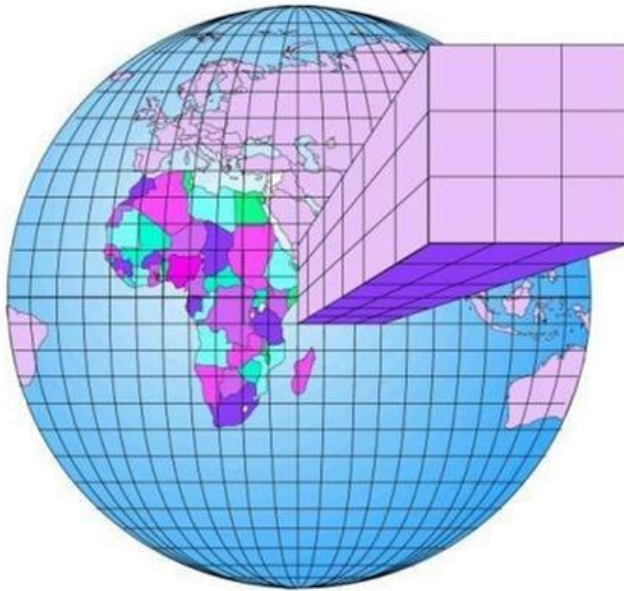
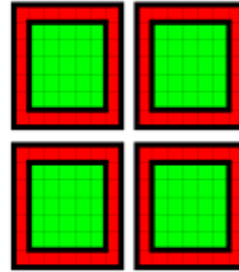


© Crown copyright Met Office

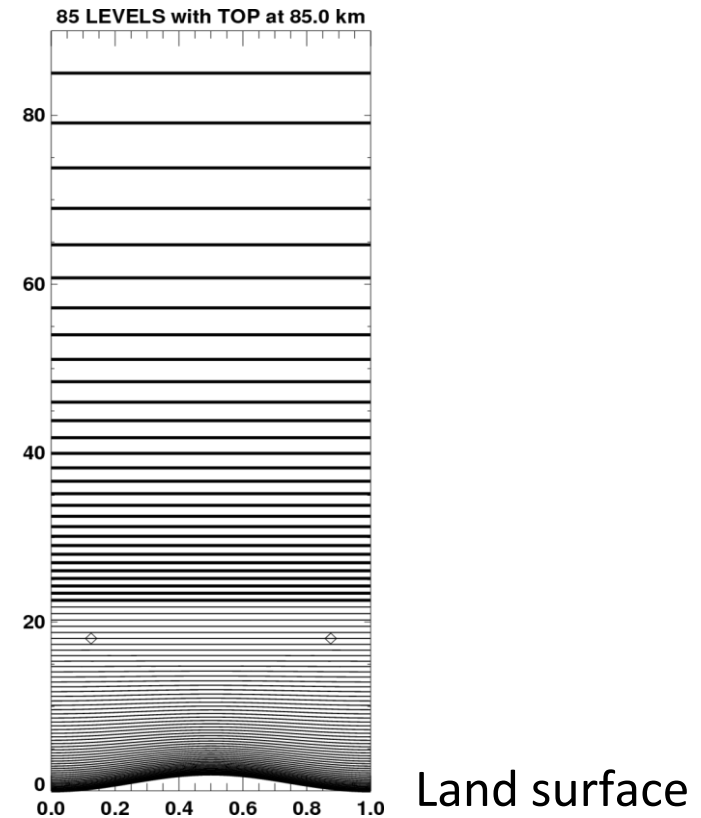
(Trenberth et al, 2007,2009)

PARALLEL Implementation

- Regular, Static, Lat-Long Decomposition
- Mixed mode MPI/OpenMP
- Asynchronous I/O servers
- Communications on demand for advection
- Multiple halo sizes



Horizontal resolution



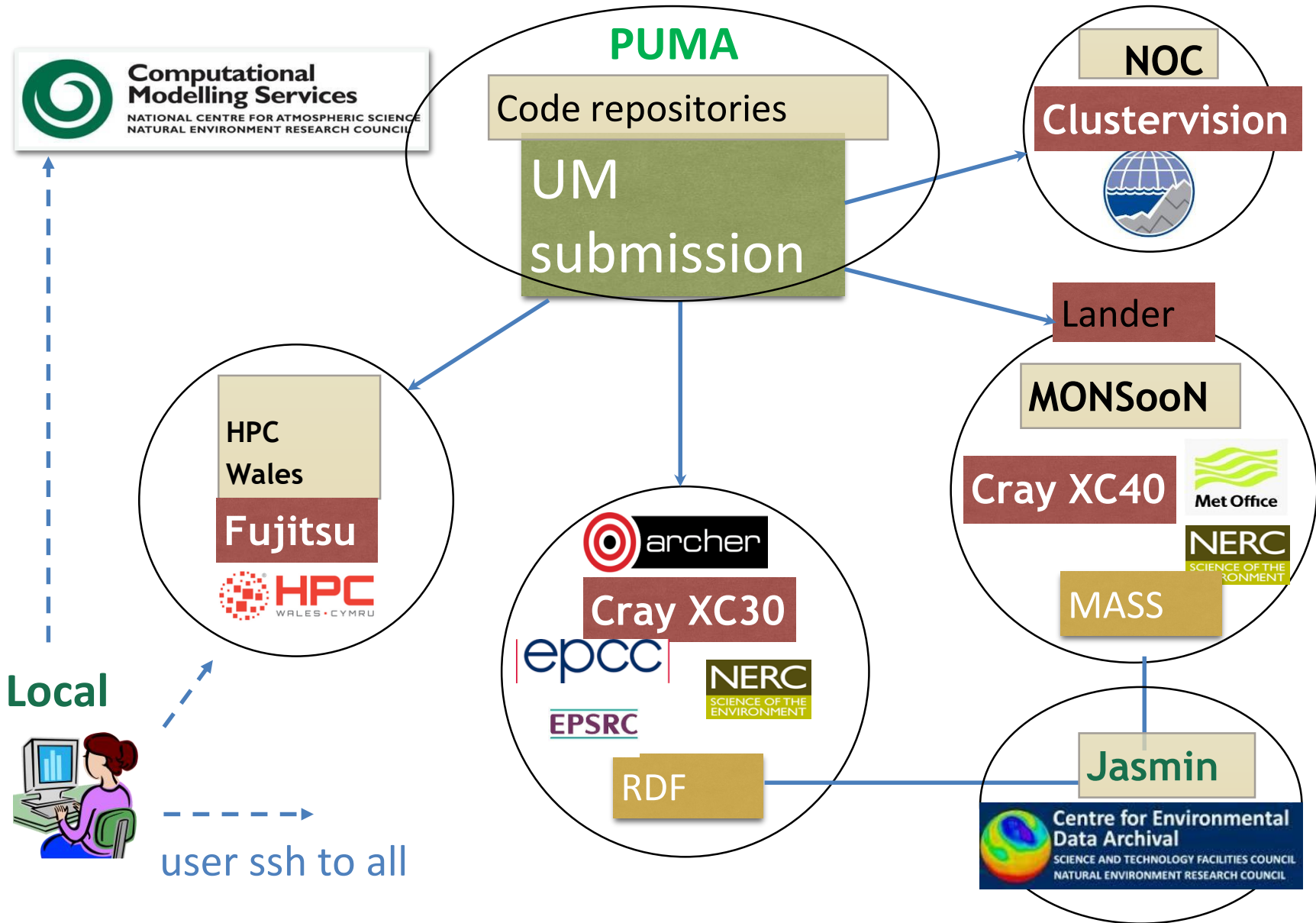
Vertical resolution

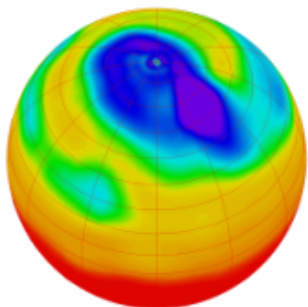
Global Models

N96	N144	N216	N320	N512	N768	N1024	N2048
(192 x 145)	(288 x 217)	(432 x 325)	(640 x 481)	(1024 x 769)	(1536 x 1152)	(2048 x 1536)	(4096 x 3073)
~135 km	~90 km	~60 km	~40 km	~25 km	~17 km	~12 km	~6 km

	NWP	Climate
Run length	10 day operational forecast, 15 day ensemble forecast	Months (seasonal) Years, decades, centuries+
Global resolution	Testing: N320 (40 km) with 15 min ts Operational: N768 (17 km) with 7.5 min ts	Low resolution: N96 (135 km) with 20 min ts High resolution: N512 (25 km) with 15 min ts
Dynamics	Non-bit reproducible	Bit-reproducible

NCAS supported MACHINES





Centre for Environmental Data Analysis

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NATURAL ENVIRONMENT RESEARCH COUNCIL



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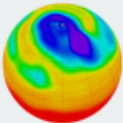
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NERC Data Centres

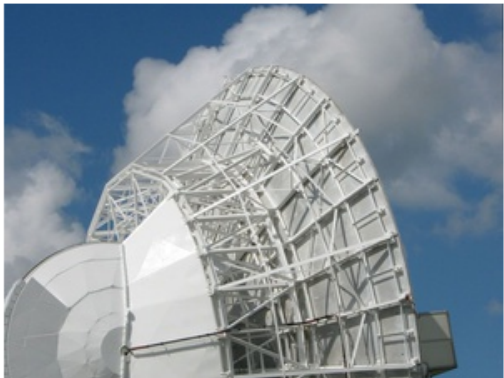
NERC supports five data centres covering a range of discipline areas:

- British Oceanographic Data Centre (Marine)
- Centre for Environmental Data Analysis Archive (Atmospheric and Earth Observation)
- Environmental Information Data Centre (Terrestrial and freshwater)
- National Geoscience Data Centre (Geoscience)
- Polar Data Centre (Polar and cryosphere)





Other services



CEDA also run other key services, such as the IPCC-DDC and UKSSDC data centres. See below for more information.



UKSSDC

The UK Solar System Data Centre (UKSSDC), co-funded by STFC and NERC, curates and provides access to archives of data from the upper atmosphere, ionosphere and Earth's solar environment.

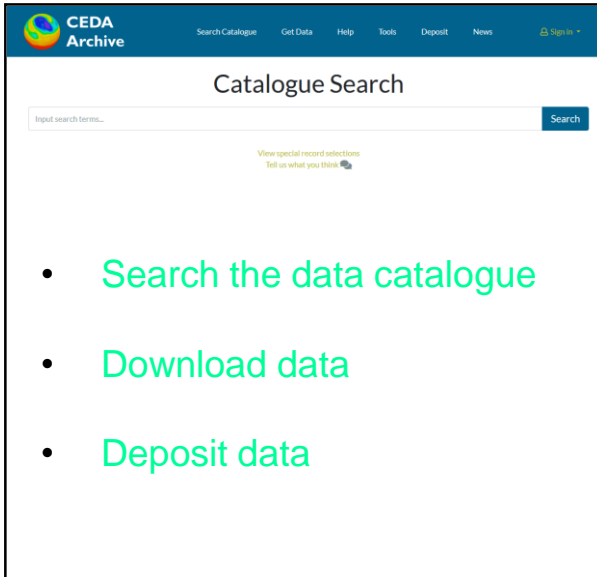
IPCC Data Distribution Centre

The [Intergovernmental Panel on Climate Change \(IPCC\)](#) DDC provides climate, socio-economic and environmental data, both from the past and also in scenarios projected into the future. Technical guidelines on the selection and use of different types of data and scenarios in research and assessment are also provided.

IPCC – Intergovernmental Panel
on Climate Change Data
Distribution Centre
UKSSDC – UK Solar
System Data Centre



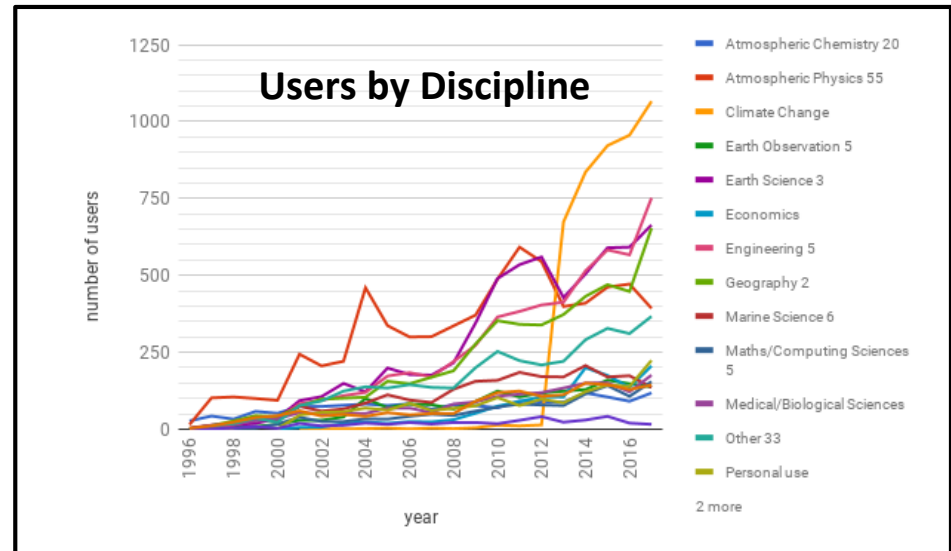
CEDA Archive (March 2019)



The screenshot shows the CEDA Archive website. At the top is a navigation bar with links: Search Catalogue, Get Data, Help, Tools, Deposit, News, and a Sign in button. Below this is a 'Catalogue Search' section with a search input field and a 'Search' button. A small message says 'View special record selections Tell us what you think'. Below the search section are three bullet points in green text:

- Search the data catalogue
- Download data
- Deposit data

Data Type	Data Volume (Petabytes)
Earth Observation	10
Atmospheric Science	3.4
Total	13.4 PB



- **> 5734 datasets**
- **In 630 dataset collections**
- **~ 206 million files**
- **> 55,000 registered users**

https://catalogue.ceda.ac.uk

precipitation

Search

2243 Results

Results per page 20 Sort by Relevance

Filter by record type

- ☐ Datasets (2073)
- ☐ Dataset Collections (41)
- ☐ Projects (38)
- ☐ Instruments (42)
- ☐ Platforms (21)
- ☐ Computations (28)

« previous 1 2 3 4 ... 110 111 112 113 next »



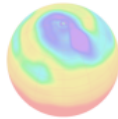
UKCP09: Met Office gridded land surface climate observations - precipitation and temperature indices at 5km resolution

[View related documents\(4\)](#) [View parent collections](#)

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[Explore](#)

[More Info](#)



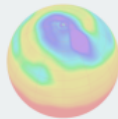
CHIRPS: Quasi-global daily satellite and observation based precipitation estimates over land

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CHIRPS: Quasi-global pentadal daily satellite and observation based precipitation estimates over land

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Global Precipitation Measurements (GPM) Integrated Multi-satellite Retrievals (IMERG) L3 Half Hourly 0.1 degree x 0.1 degree

[View related documents\(2\)](#)

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What is the role of CEDA?

- **Preserve the science record** (for data produced by NERC funded research).
- **Facilitate data use** (for any data that compliments NERC research in Atmospheric sci or Earth Observation (EO)).
- **Support data standards** (for international science community), e.g. ESA Climate Change Initiative; CMIP (Climate Model Intercomparison Project) data request; Climate-Forecast (CF) metadata convention.
- **Engage with global community**. CEDA staff participate in:
 - World Climate Research Programme (WCRP);
 - Committee on Earth Observation Satellites (CEOS);
 - Earth System Grid Federation (ESGF);
 - Intergovernmental Panel on Climate Change (IPCC) Data Distribution Centre.

CEDA Projects



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Projects

Current projects

[Past projects](#)



CCI Open Data Portal

Providing central access to ESA
Climate Change Initiative Data
Products and information



FIDUCEO

Building nine new climate datasets
from Earth Observation using a
rigorous treatment of uncertainty,
informed from the discipline of
metrology



PRIMAVERA

Developing a new generation of
global high-resolution climate models



C3S Climate Projections for CDS



C3S Regional Climate



Pest Risk Modelling in Africa (PRISE)

Lots more



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JASMIN Overview



The JASMIN facility is a "super-data-cluster" which delivers infrastructure for data analysis.

It is a hybrid between super-computer and data-centre which provides a globally unique computational environment.

To address “one of NERC’s most strategically important challenges: the improvement of predictive environmental science.” Prof. Duncan Wingham, NERC Chief Exec.



JASMIN is a world leading, unique hybrid of:

- **44PB** high performance storage by end of 2018
- High-performance computing (**~ 12000 cores**)
- Large scale near line tape storage
- Custom sophisticated network architecture
- Innovative cloud hosting capabilities

Hosted by STFC Scientific Computing Department

“Computing Expertise across length scales from processes within atoms to environmental modelling”

- Applications development and support,
- Compute and data facilities and services
- Research and Training
- Numerical Analysis

Data Services

- STFC: Facility Archives (ISIS, Diamond)
- LHC: UK Hub (Tier 1 archive)
- BBSRC: Institutes data archive
- MRC: Data Support Service
- NERC: CEDA backup and JASMIN elastic tape



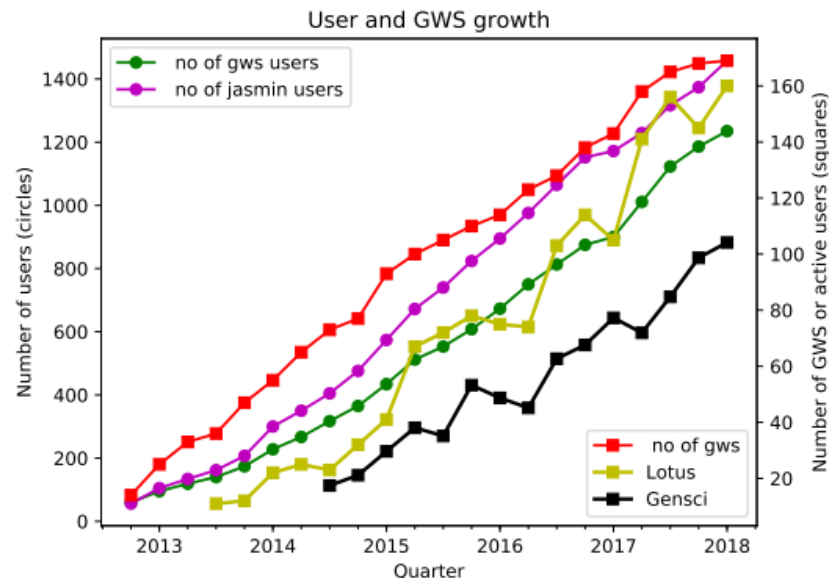
High Performance Computing

- Emerald GPU cluster for Oxford, UCL, Southampton, Bristol.
- SCARF HPC for RAL
- Hartree: Blue Joule bluegene HPC
- Hartree: Blue Wonder idataplex HPC
- JASMIN: NERC super data cluster

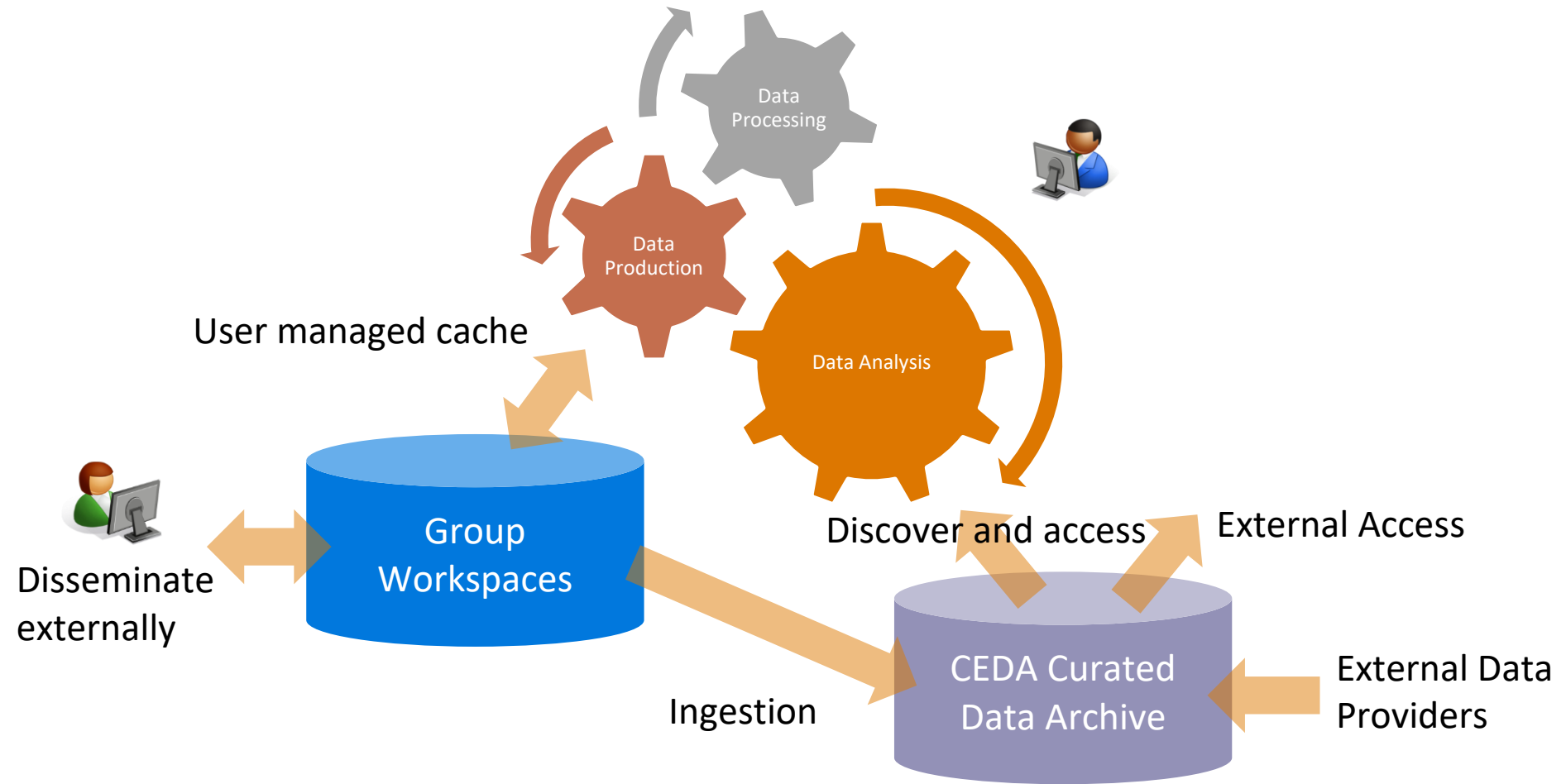
Close working partnership with industry



- >2000 registered JASMIN users
- ~1500 system login accounts
- ~200 active projects
 - Group Workspaces
 - Cloud Tenancies
- Consortia
 - Communities organised by science domain



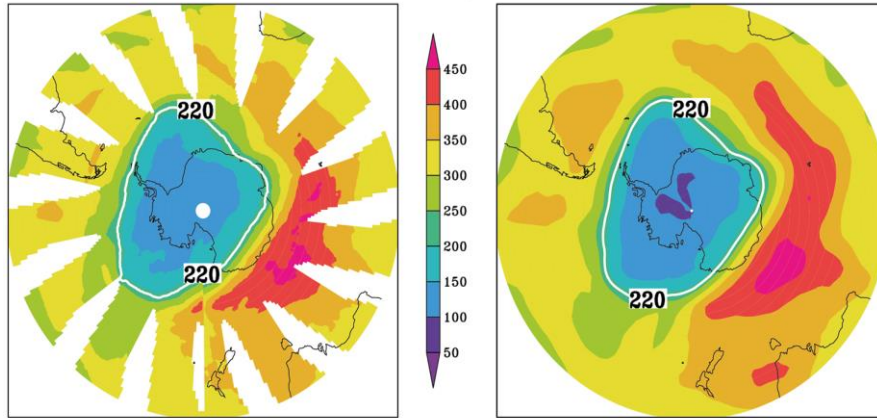
JASMIN brings computational power close to the data



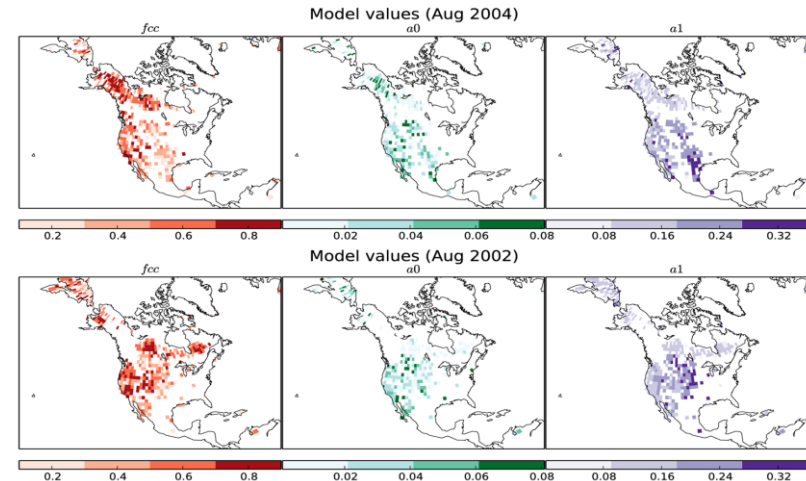
~200 Science projects on JASMIN to date

Antarctic Ozone hole: model vs. observations

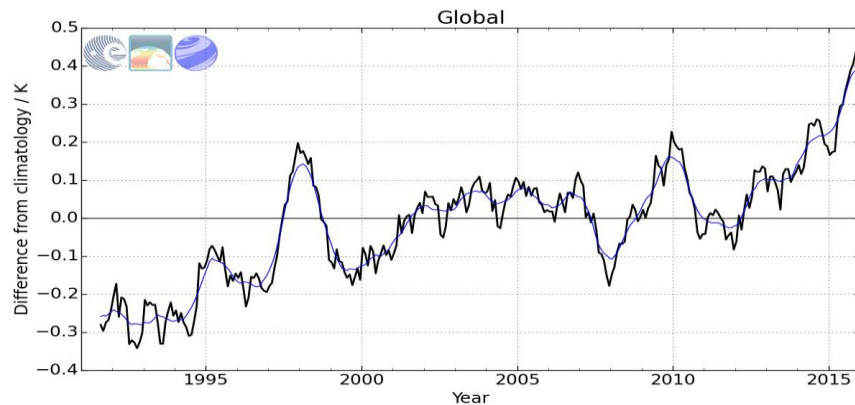
Column ozone OMI satellite October 2, 2011 TOMCAT/Slimcat 3D Model



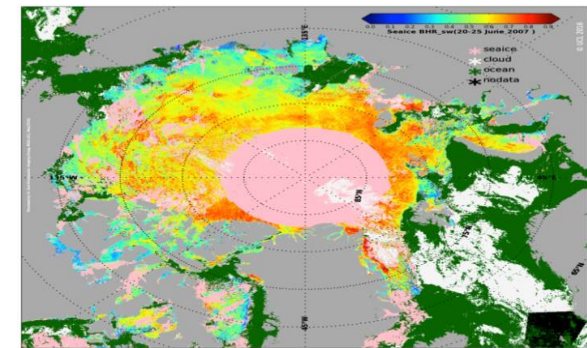
Deriving the impact of fire on vegetation from earth observation data



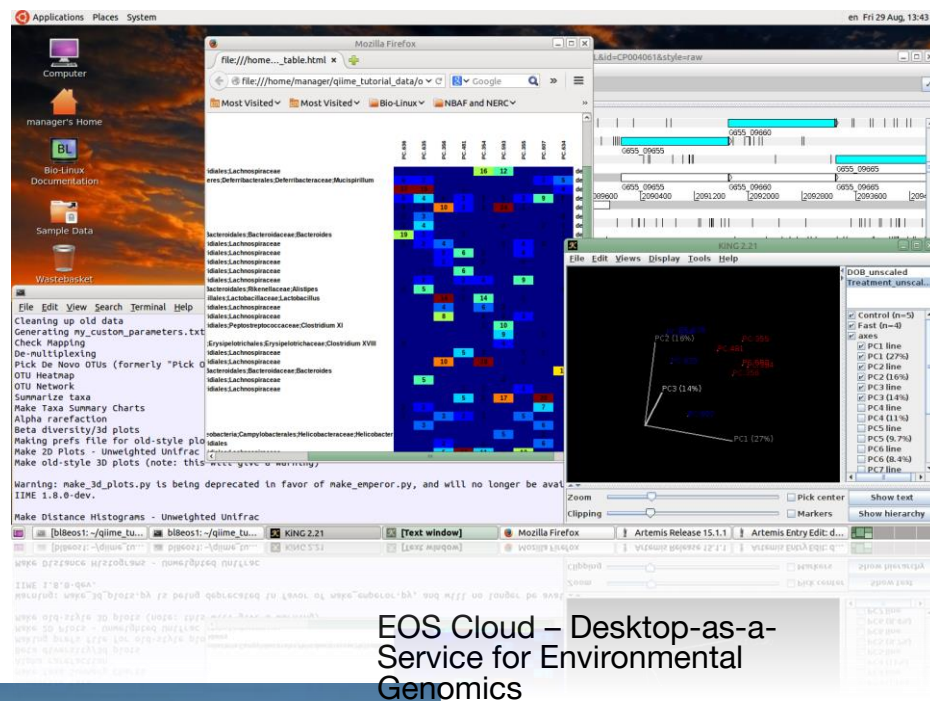
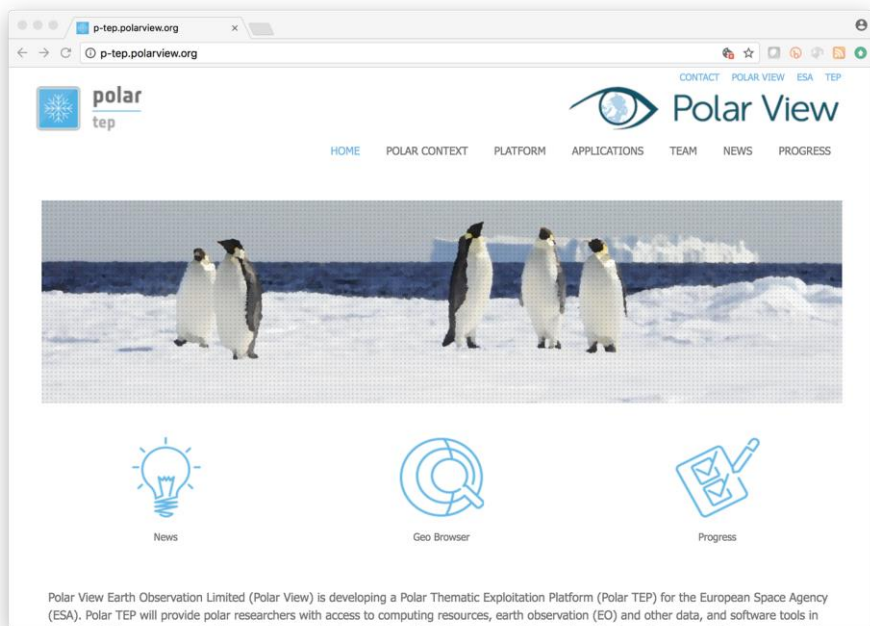
Sea Surface Temperature from satellite observations



Climate variables from European and US instruments/satellites



Virtual research environments on JASMIN

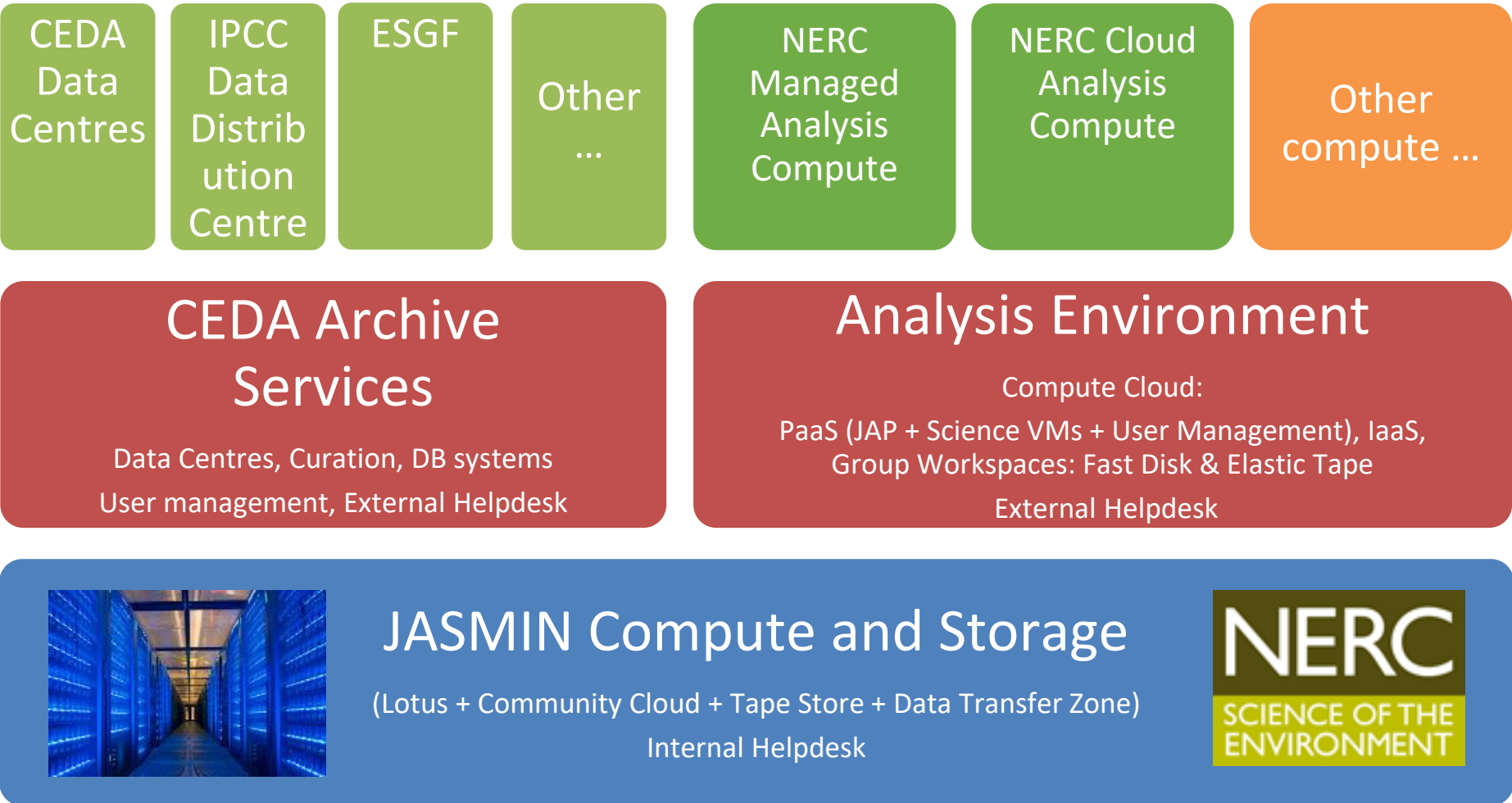


ESA Polar Thematic Exploitation Platform

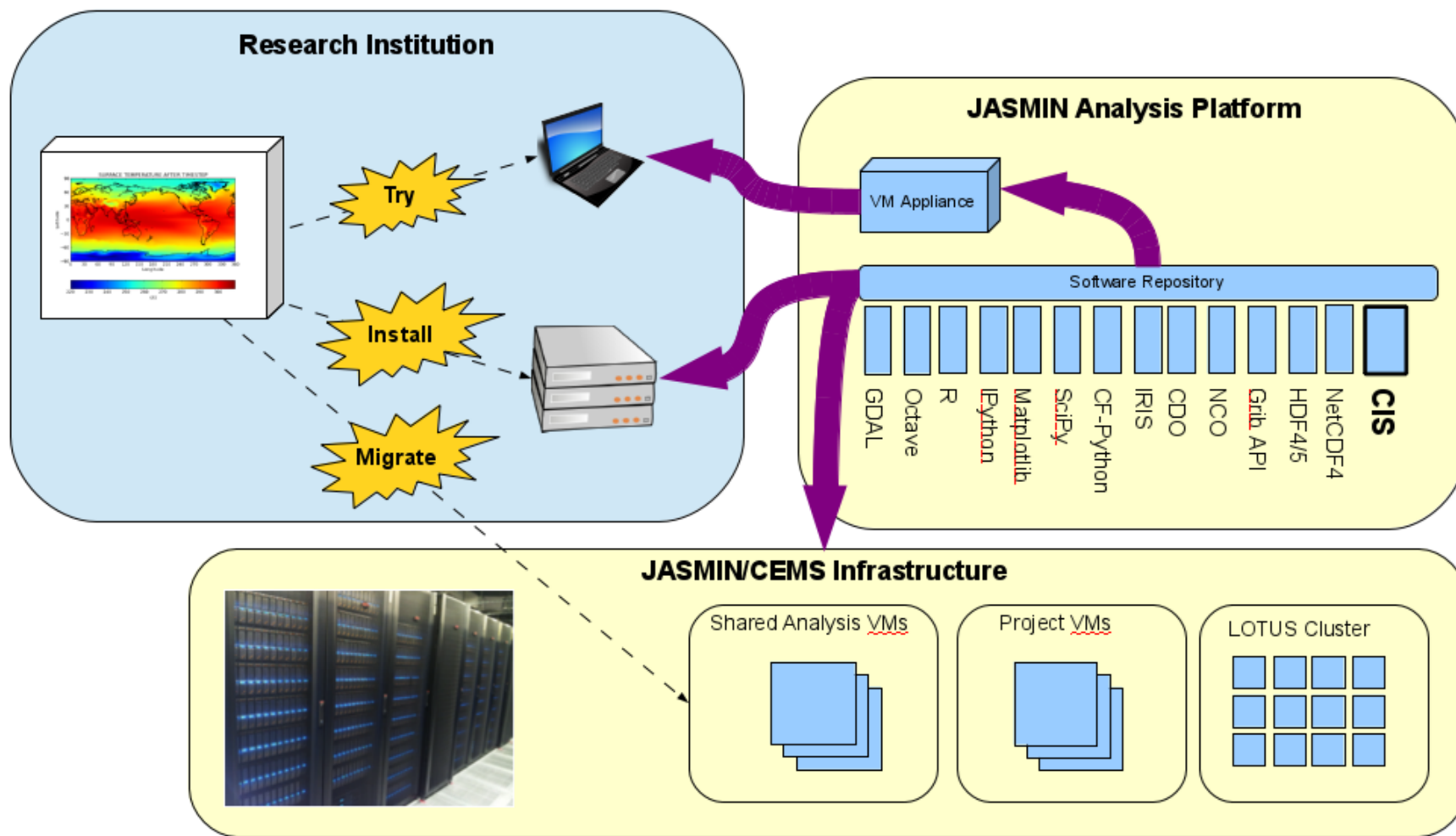


Attendees at ESA Summer school, ESRIN used OPTIRAD
Jupyter Notebook environment
– Credit ESA

Logical View



“JASPy”: a re-usable, re-deployable bundle of common tools



Further Information

- NCAS website: ncas.ac.uk
- CMS website: cms.ncas.ac.uk
- CEDA website: ceda.ac.uk
- JASMIN online help: help.jasmin.ac.uk
- JAP: help.jasmin.ac.uk/article/271-jap
- Social Media: [@CEDAnews](#) | [LinkedIn](#) | [Facebook](#)
- CEDA Help desk: support@ceda.ac.uk
- CMS Help desk: cms-support@ncas.ac.uk