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# Multi-platform data delivery workflows for CMIP6 and beyond

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# Outline

- Background to CMIP5 & 6
- The task for CMIP6
- Climate Data Dissemination System (CDDS) structure
- CDDS outside the Met Office: JASMIN
- CDDS Beyond CMIP6

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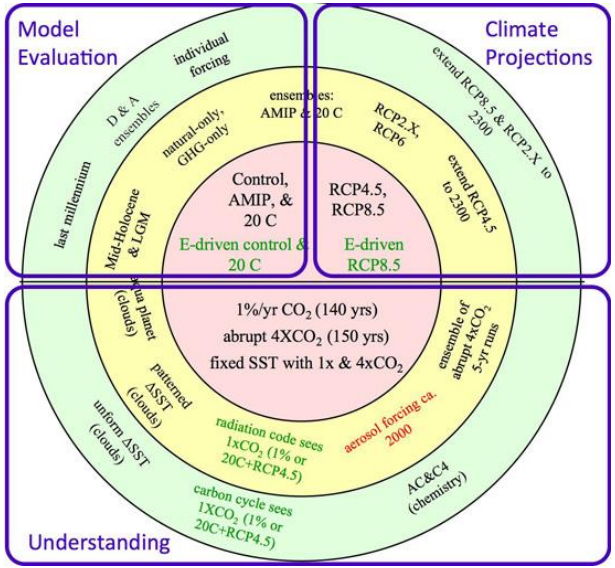
# CMIP5 background




- Around 30 experiments
- Met Office submission of 80 TB output data for 4 models (3 HadGEM2 variants plus HadCM3) across ~180 simulations
- Data produced on MO HPCs and archived to tape
- CREM/DDS (Mark Elkington & Jamie Kettleborough) ran on two dedicated servers each processing ~60GB/day
- Data copied to British Atmospheric Data Centre for archiving and ESGF publication
- CREM/DDS used for CORDEX, CCMI, QBoI, CLIVAR HWG

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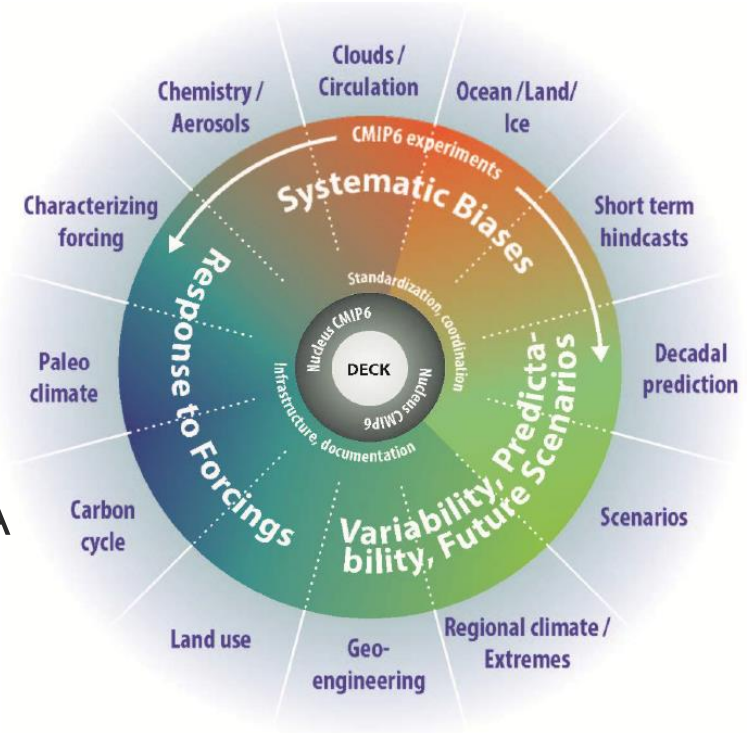
# CMIP6




- 20+ MIPs owning 250+ experiments
- Wider range of user communities
- 3 core models: 2 x HadGEM3 + UKESM1
- Models used by MOHC, NERC, NIWA, KMA
- Core submission expected to be ~1.5 PB (other MIPs extra)
- Need to be able to process data
  - On multiple platforms; MO and JASMIN for academic and international partners
  - In a reasonable time frame
- Some requirements clearly specified, others less so

# Climate Data Dissemination System (CDDS)

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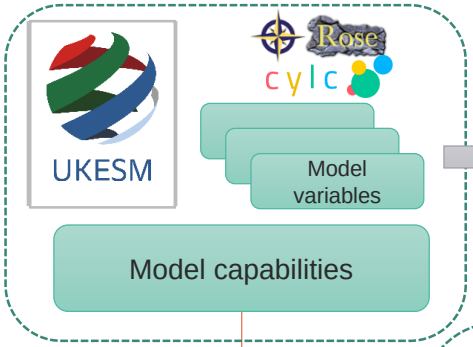
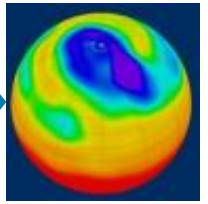



PP

netCDF

Archive (MASS)

Publication process



CEDA ESGF node

User Queries

CDDS

Suite information and metadata

Climate Research Experiment Management (CREM) database

ES-DOC Earth System Documentation

CMIP6 Data Request

CDDS-Prepare

Requested variables lists

CDDS-Extract

CDDS-Configure

CDDS-Convert

CDDS-QC

CDDS-Transfer

SPICE processing cluster

User / MIP requirements

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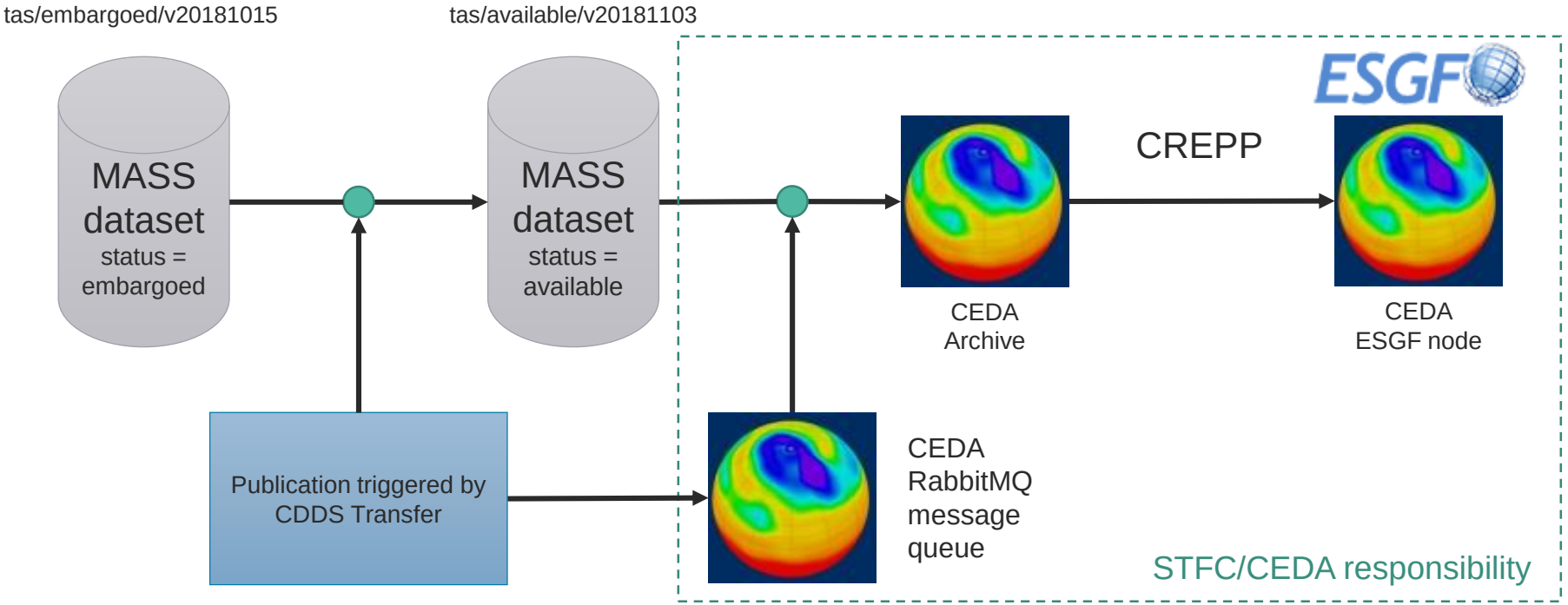
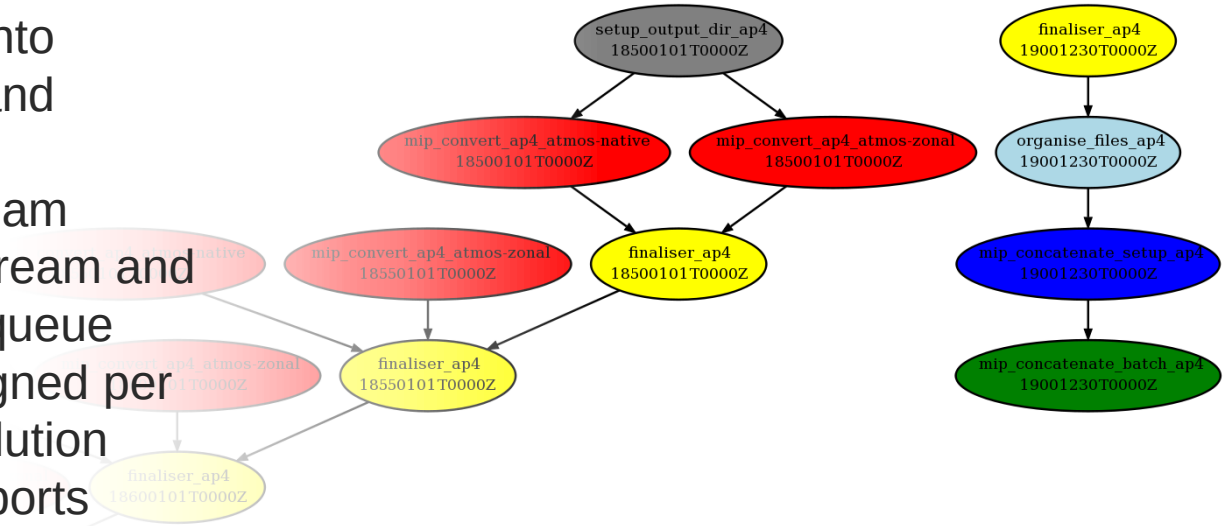
# Publication notification process



# Conversion suite structure

- Model data organised into streams by frequency and component
- Setup directory per stream
- MIP convert task per stream and “grid” limited by a cylc queue
- Cycling frequency assigned per stream and model resolution
- Finaliser per stream reports progress and triggers concatenation process
- `ncrcat` based concatenation




Cylc graph extract

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# The multi-platform bit

- We (MO) cannot do all data processing for everyone using HadGEM3/UKESM1 models
- NERC, NIWA and KMA to use JASMIN
- Not enough resources to support our database & admin interface tools for everyone
- Limited set of CDDS components planned to be used
- We (MO) do not want to be responsible for answering questions about data we did not produce

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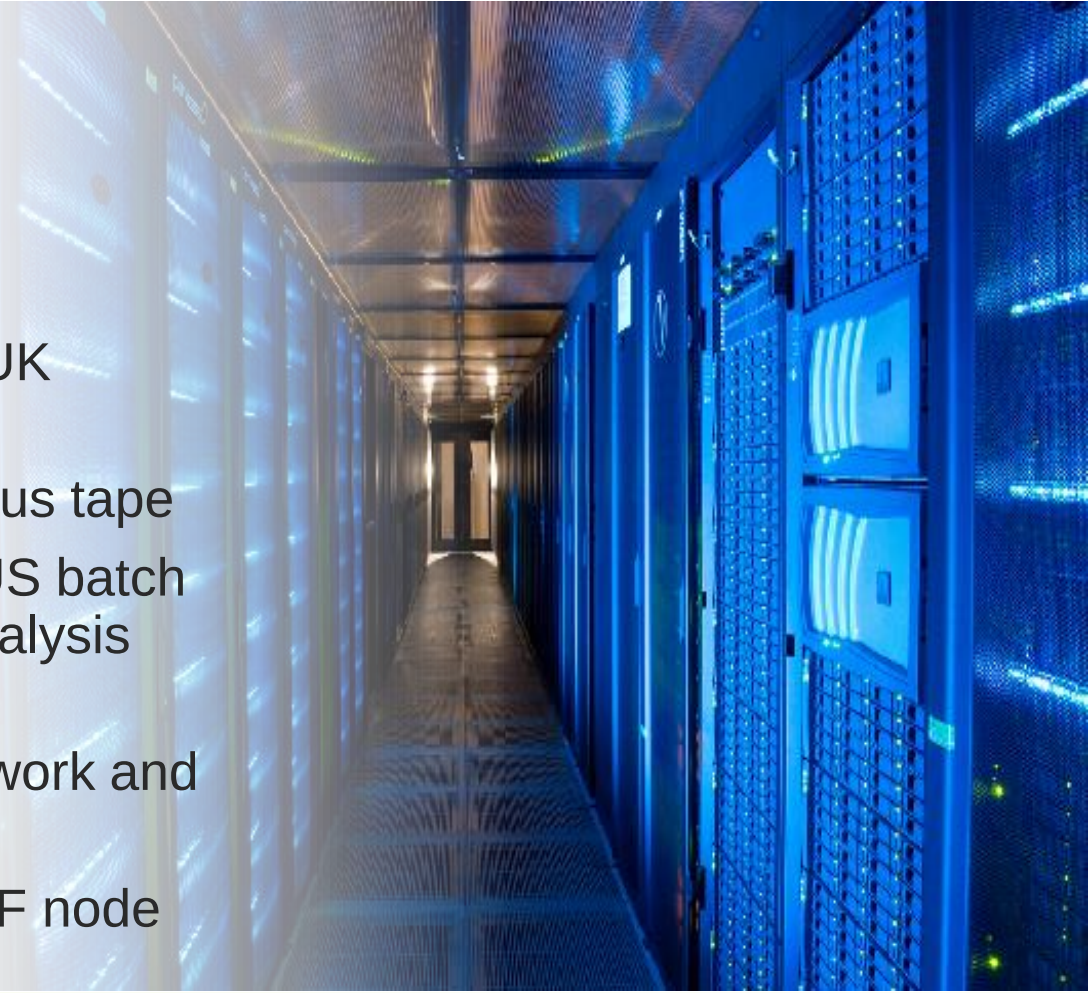
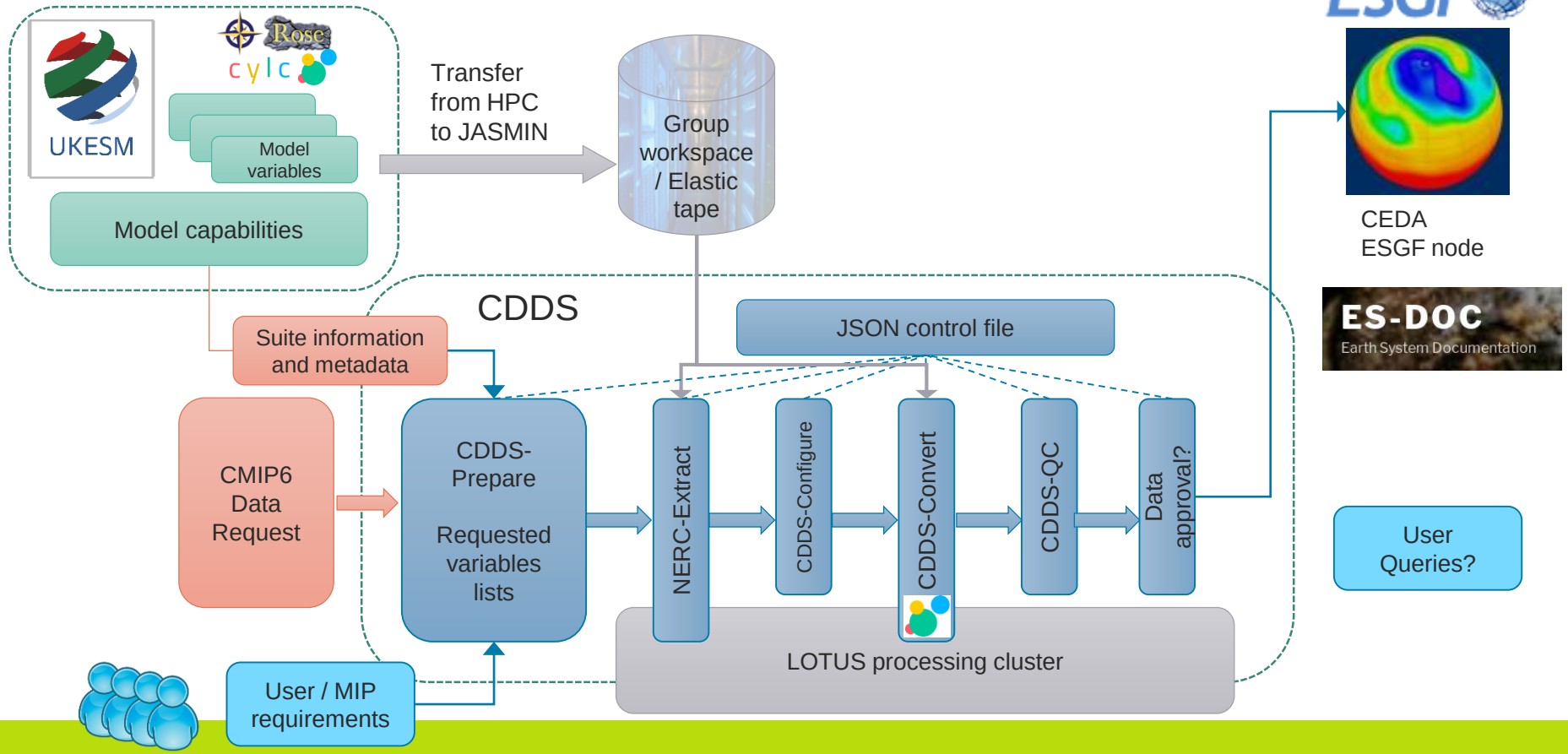
# JASMIN

- Managed by STFC CEDA for UK environmental science
- 38 petabytes of disk storage plus tape
- 5,000 compute cores on LOTUS batch cluster plus interactive data analysis servers
- High-performance internal network and connections to the internet
- Hosts CEDA Archive and ESGF node



# CDDS Flow (JASMIN)



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# Phased delivery of data

Stage 1:  Monthly data (~400TB)

- All reviewed mappings available
- Any experiments ready

Stage 2: Daily data (~400TB)

- Introduce science users with some training
- One MIP at a time
- Catch up anything left over from stage 1

Stage 3: Sub-daily data (~800 TB)

- Everything else
- Ensemble class experiments (possibly stage 2)

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Rose cylc

# Beyond CMIP6

- Greater Rose / Cylc integration for archive extraction, Quality Control and archiving
  - More efficient use of processing and storage resources
- Process routine model development simulations for analysis
  - Inefficient to maintain two ways of working; one for model development the other for inter-institute/international projects
- Configure models to give only the required output (stable data request)
- Grids, time slices and new models?
- Model output configuration through XIOS?

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# Summary

- Evolution not revolution for CMIP6
  - CDDS has a similar structure to CMIP5 system
- CDDS uses a Rose/cylc suite for the management of the conversion process
- Beyond CMIP6 requires more of a revolution;
  - Work towards a Rose/cylc suite for the whole of CDDS
  - Replace management database with an atomic management function
  - Support model development as well as data publication
  - New models (LFRic) and output configurations (XIOS)