Global Coupled model development across timescales

CAWCR 9th Annual Workshop, BoM Melbourne, 19−22 October 2015

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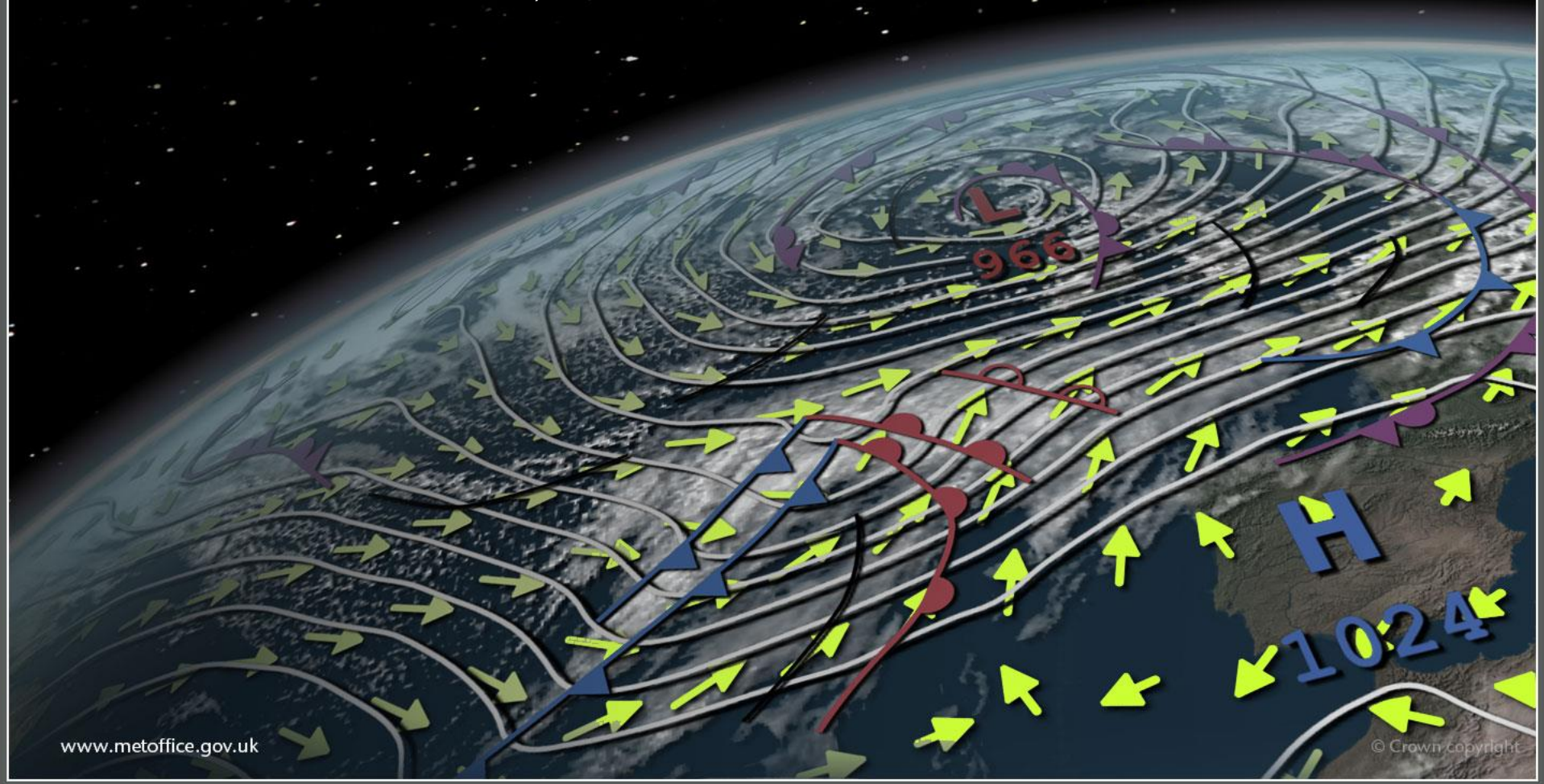

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Outline

This presentation covers the following areas

- Global Atmosphere development across timescales
- Global coupled model development
  - Seasonal-to-climate
  - Global coupled NWP
- Global Coupled development across timescales

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Global Atmosphere development across timescales

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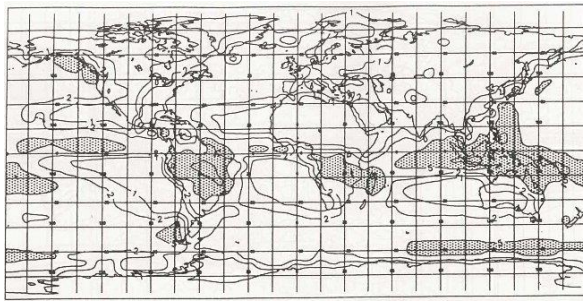
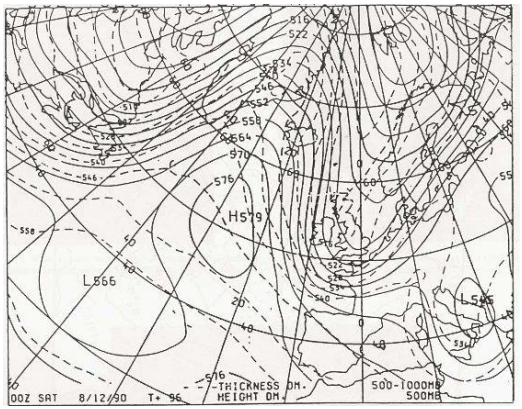
Unified forecast/climate model

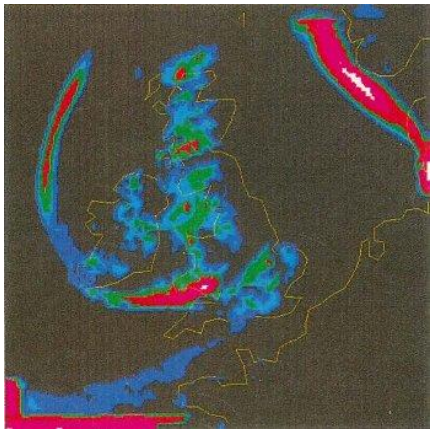
Cullen (1993)



Global coupled climate



Global NWP



Mesoscale NWP

- Common control/infrastructure
- Common grid structure/dynamical core
- Access to common set of parametrisation schemes selected by user
- Common diagnostic/processing code
- Later drive to make model portable across architectures

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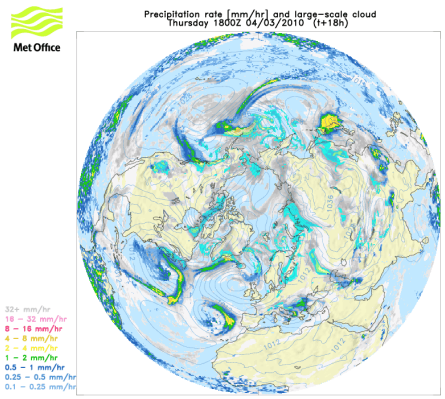
Unifying the Unified Model

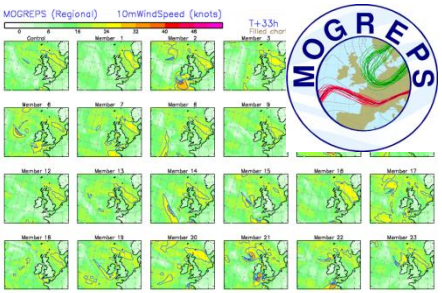
Synergies between NWP models and GCMs

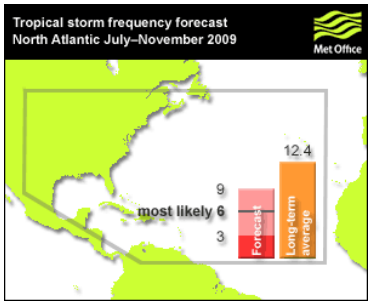
Senior et al. (2010)

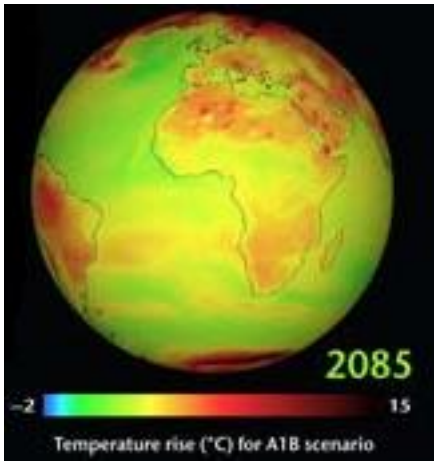
Timescale

Resolution









- Many model characteristics present across all timescales
- Long runs to compare NWP models with climatologies
- Short runs with assimilation to study error growth in climate models

UM community well placed to take advantage of these synergies

→ Develop single scientific configuration for use at all timescales

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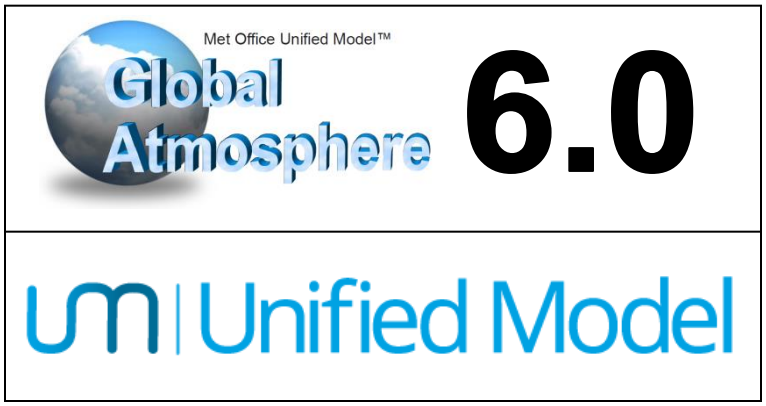
Global Atmosphere 6.0

UM Global Atmosphere Configuration

https://code.metoffice.gov.uk/trac/GA



N96 (~135km) ⟶ ~12km

What is Global Atmosphere/GA6.0?

- Science config. of Unified Model
- Defined set of physics/dynamics settings
- Non-convection permitting resolutions
  - Global N96 → Regional 12km?
- Timescales from day 1 to 100s years
- Various system dependent options
  - e.g. energy/moisture conservation
  - Prognostic vs. clim. Aerosols
- Developed with community of UM partners and academic collaborators

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Global Land 6.0

JULES Global Land Configuration

https://code.metoffice.gov.uk/trac/GL

What is Global Land/GL6.0?

- Science config. of JULES model
- Developed for use with UM GA configs
- Can also be run in offline JULES
- Developed with UM GA developers with increased input from JULES modelling community anticipated

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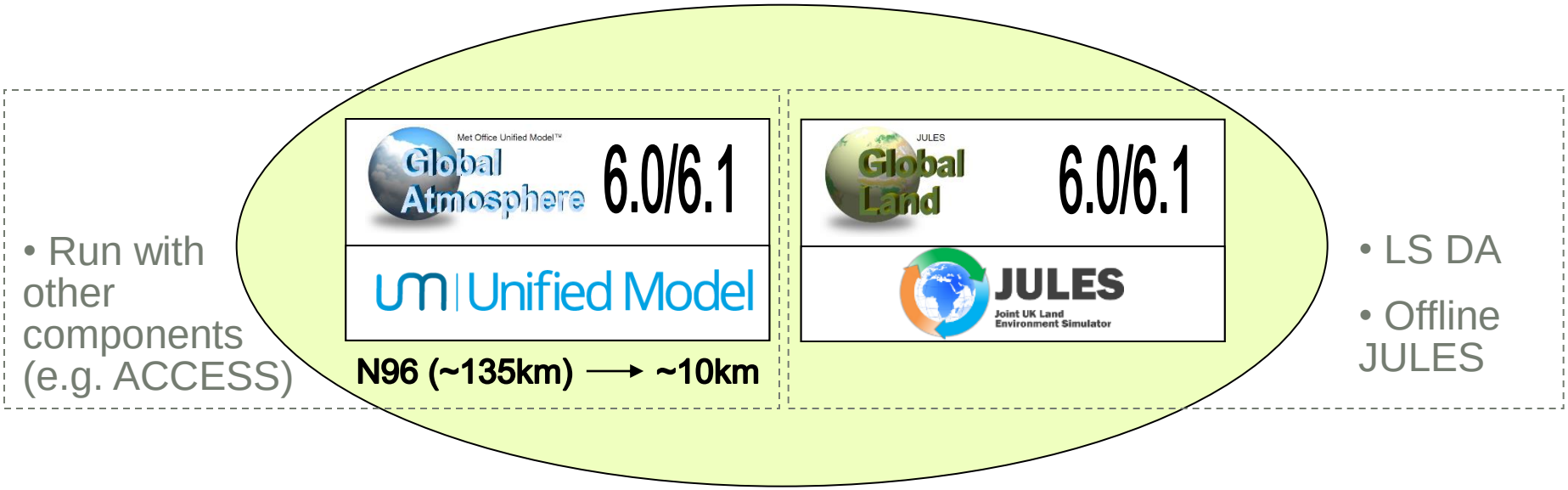
GA6.0/GL6.0 & GA6.1/GL6.1

Combined GA/GL configurations

Global/regional deterministic NWP

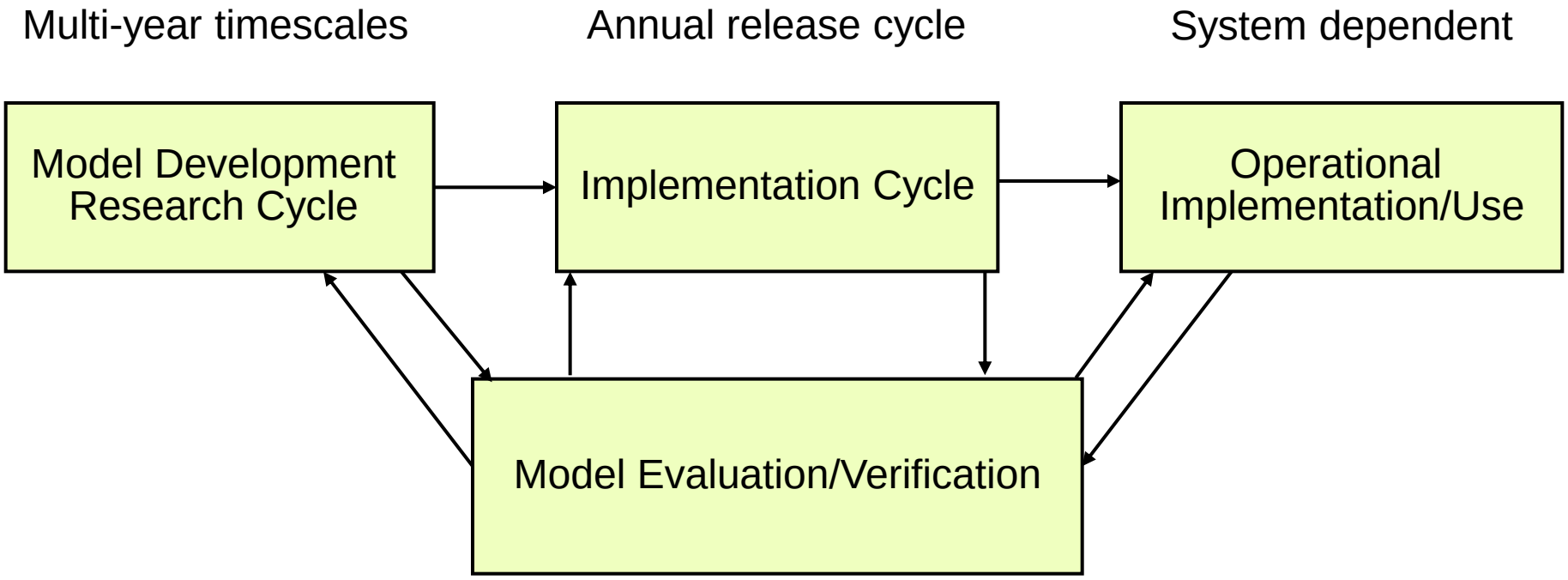
MOGREPS-G short-range EPS

AMIP-like climate simulations



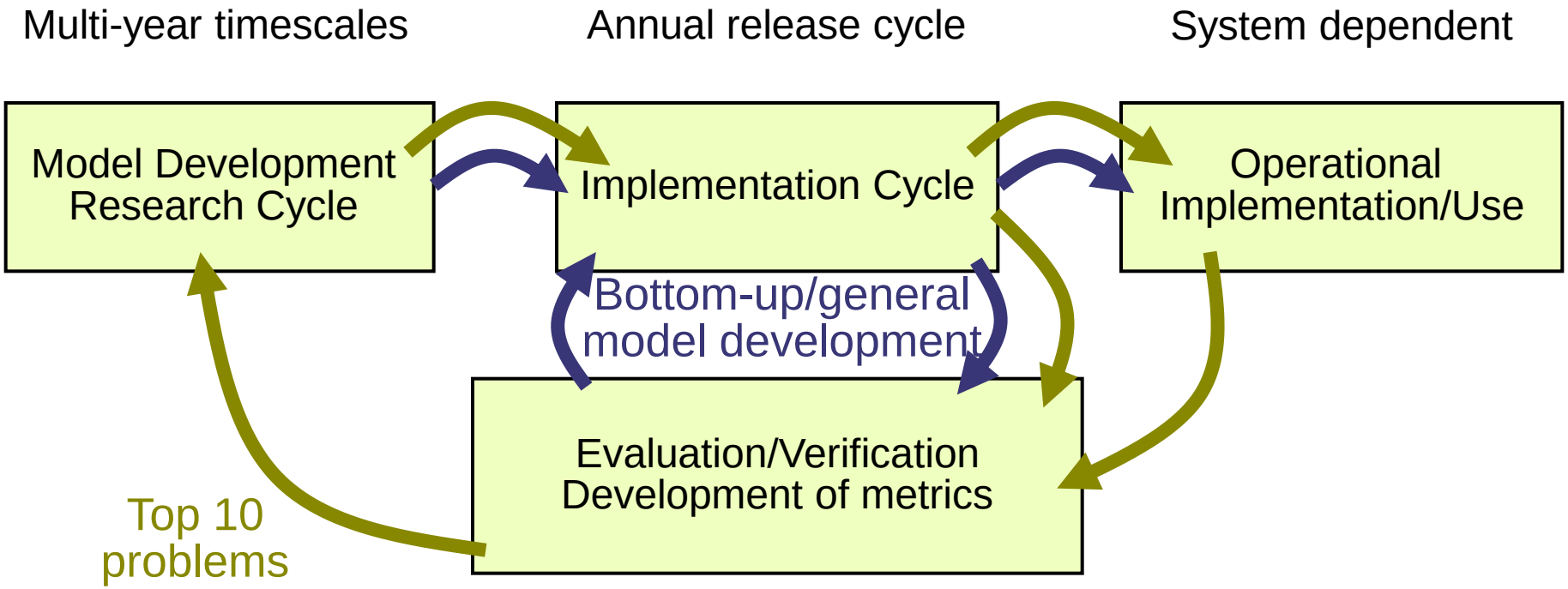
Global model development

Process design



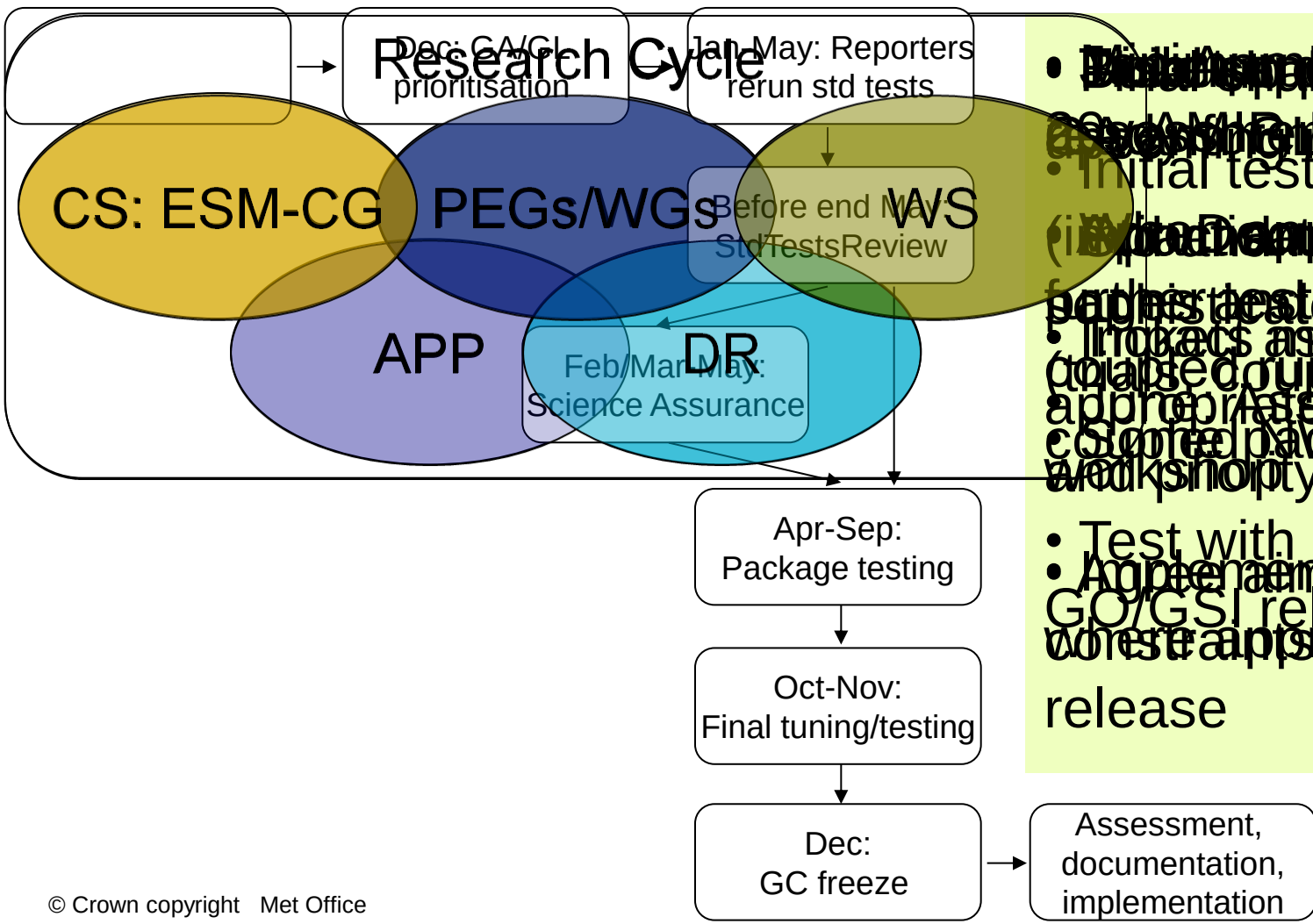
Global model development

Typical workflows



GA development

Template for the implementation cycle



- Initial tests recorded
- Test with candidate GO/GSI releases
- Implementation where appropriate

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Global coupled development

Seaonal-to-climate timescales and global coupled NWP

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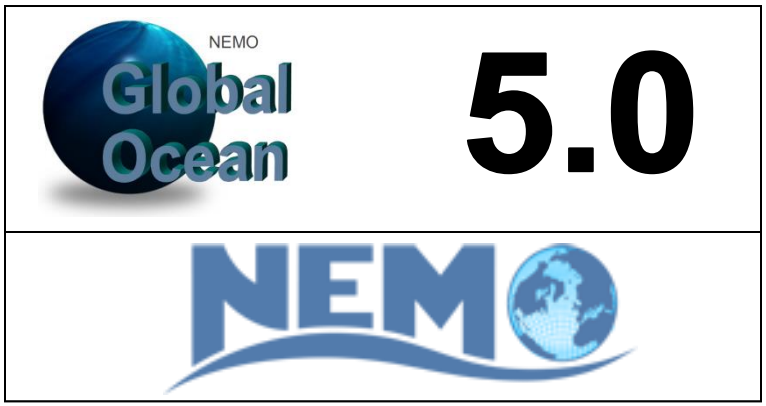
Global Ocean 5.0

NEMO Global Ocean Configuration

https://code.metoffice.gov.uk/trac/GO



ORCA025 (0.25°)

What is Global Ocean/GO5.0?

- Science config. of NEMO ocean model
- Defined grid and set of model settings
- Currently uses only ORCA025 resolution
- Developed through UK Joint Ocean Modelling Programme (JOMP) with MO/NOC/BAS

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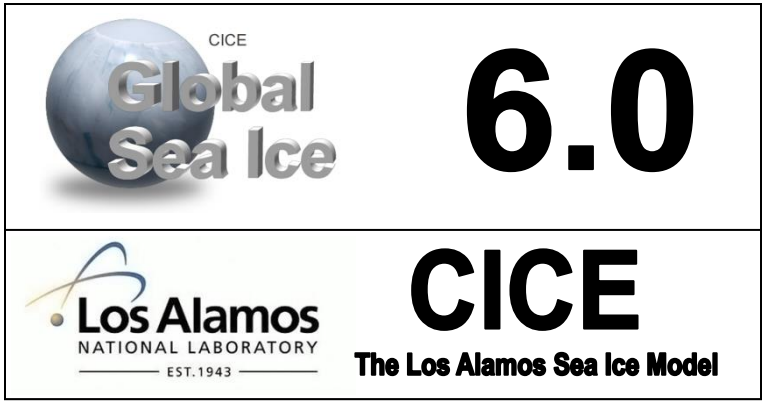
Global Sea Ice 6.0

CICE Global Sea Ice Configuration

https://code.metoffice.gov.uk/trac/GSI



ORCA025 ⟶ ORCA1 (1°)

What is Global Sea Ice/GSI6.0?

- Science config. of CICE sea ice model
- Developed for use with NEMO GO configs
- Has been run at ORCA025 and ORCA1
- Developed through UK Joint Sea Ice Modelling Programme (JSIMP) with MO/CPOM/NOC/BAS

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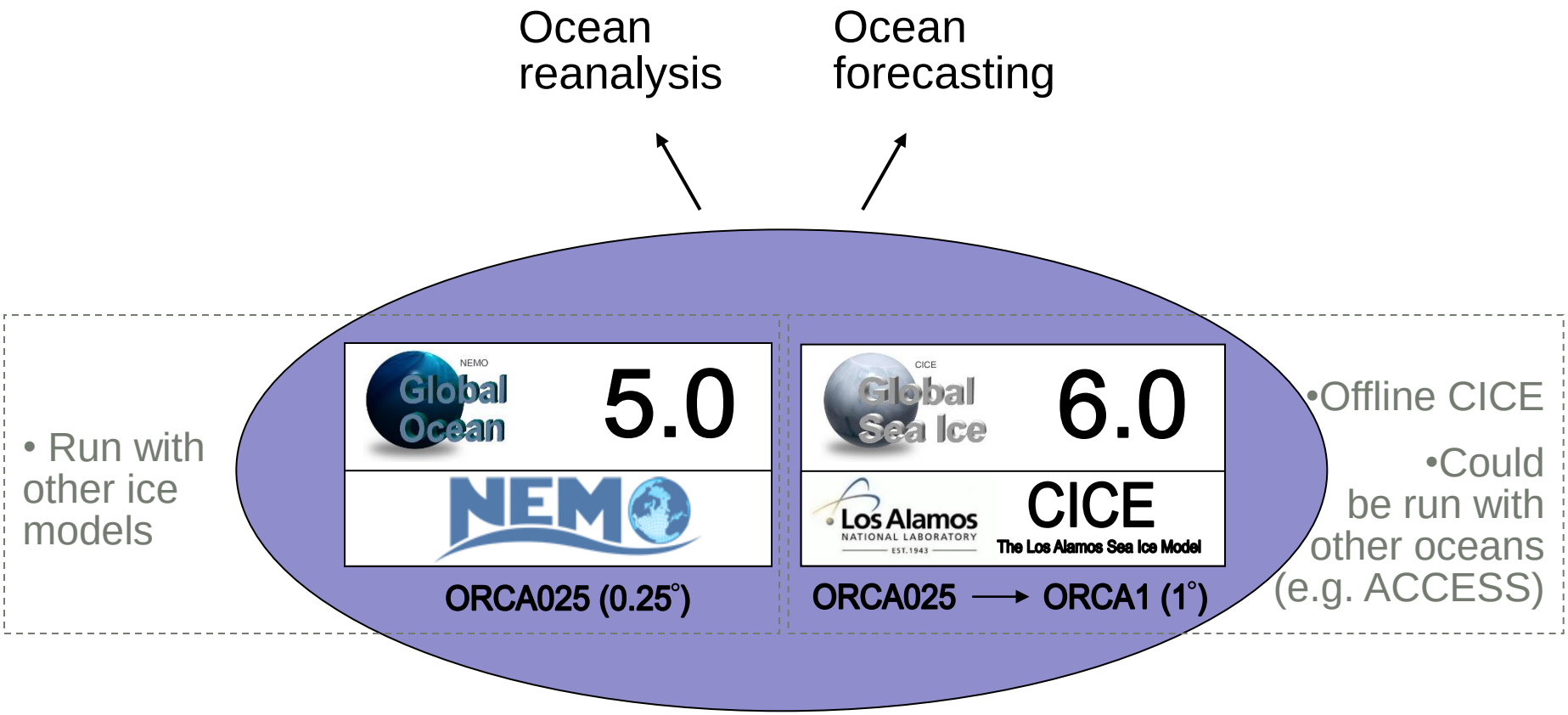
GO5.0/GSI6.0

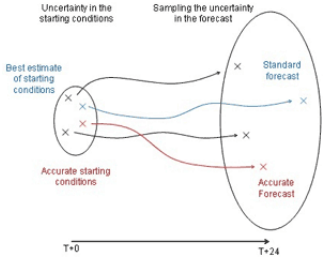
Combined GO/GSI configurations



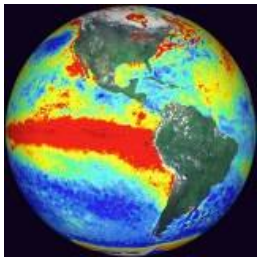
Global Coupled configuration

GC2.0 and its components

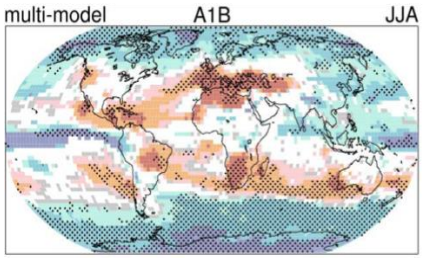
Coupled NWP/assimilation



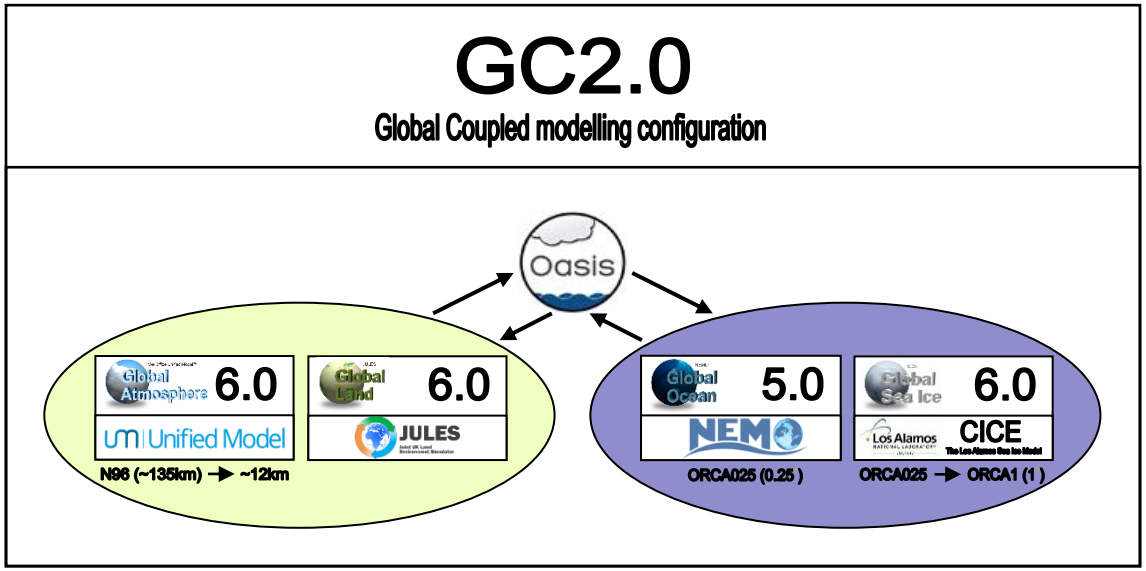
GloSea seamless EPS



Decadal Prediction



Climate Change studies



Global Coupled development across timescales

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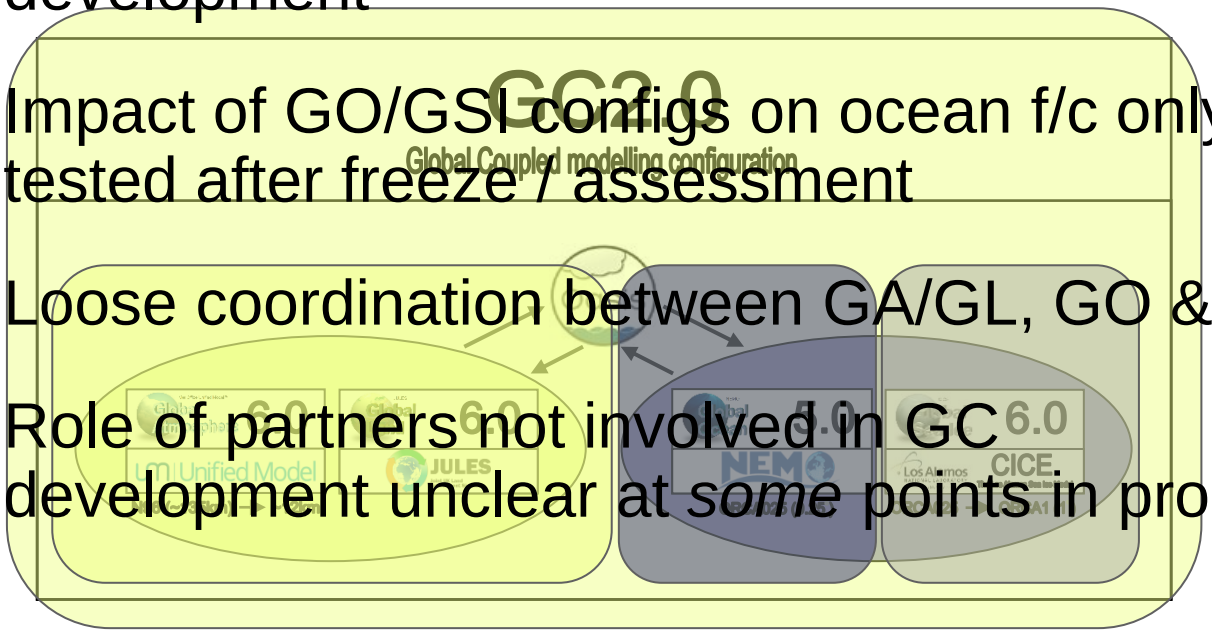
Governance of GC process

Current situation

- GA/GL & GC governed by INTEGRATE project
- GO/GSI governed by JOMP/JSIMP
- Initialised coupled runs not used much in development
- Impact of GO/GSI configs on ocean f/c only tested after freeze / assessment
- Loose coordination between GA/GL, GO & GSI
- Role of partners not involved in GC development unclear at *some* points in process



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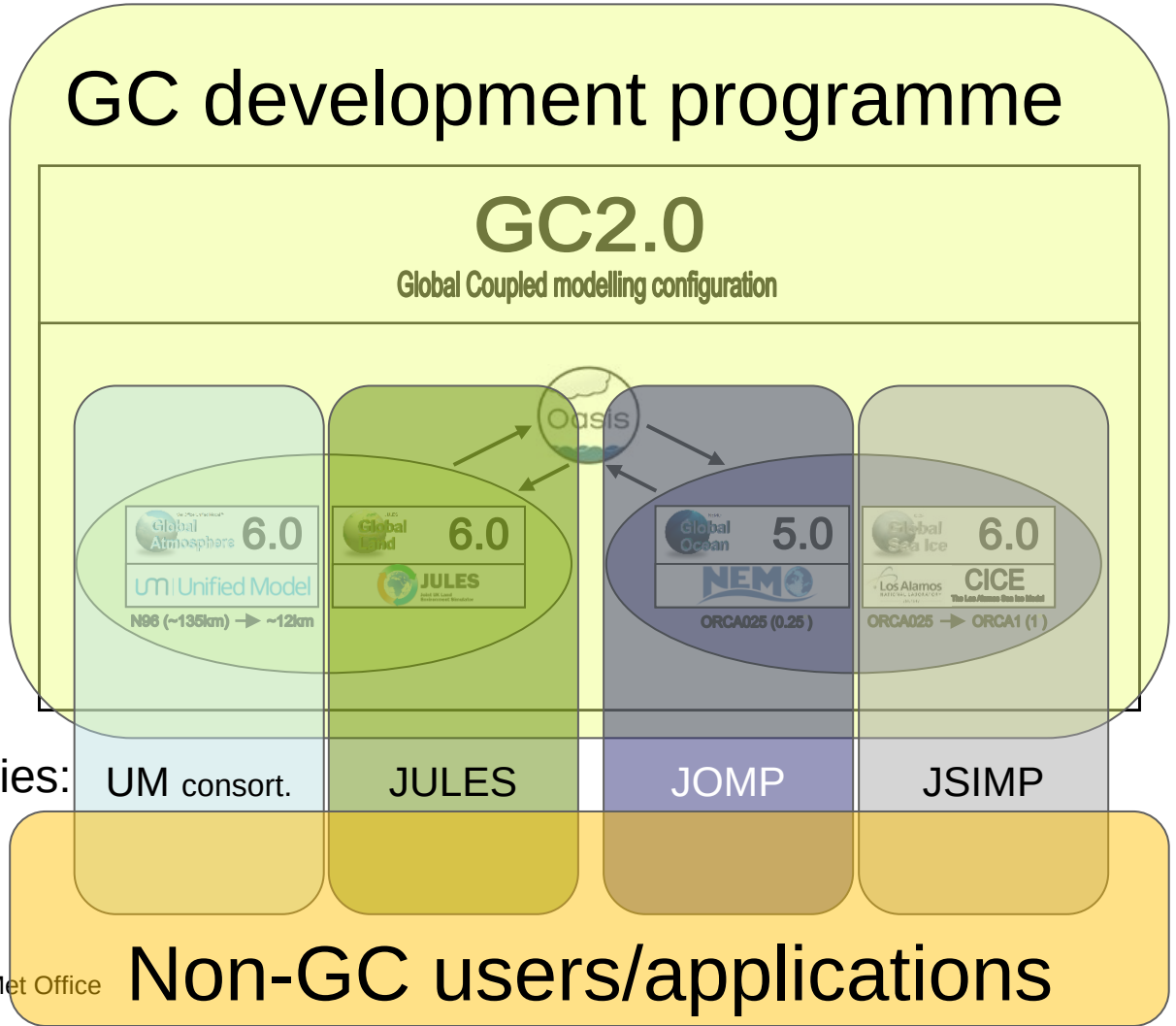
Governance of GC process

Proposed approach



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Summary

- GA/GL development process bedded in and delivering to users
- Current GC development “bolts on” to GA/GL development process
- Future GC development should better coordinate development of component models but allow each to continue to deliver to non-GC users

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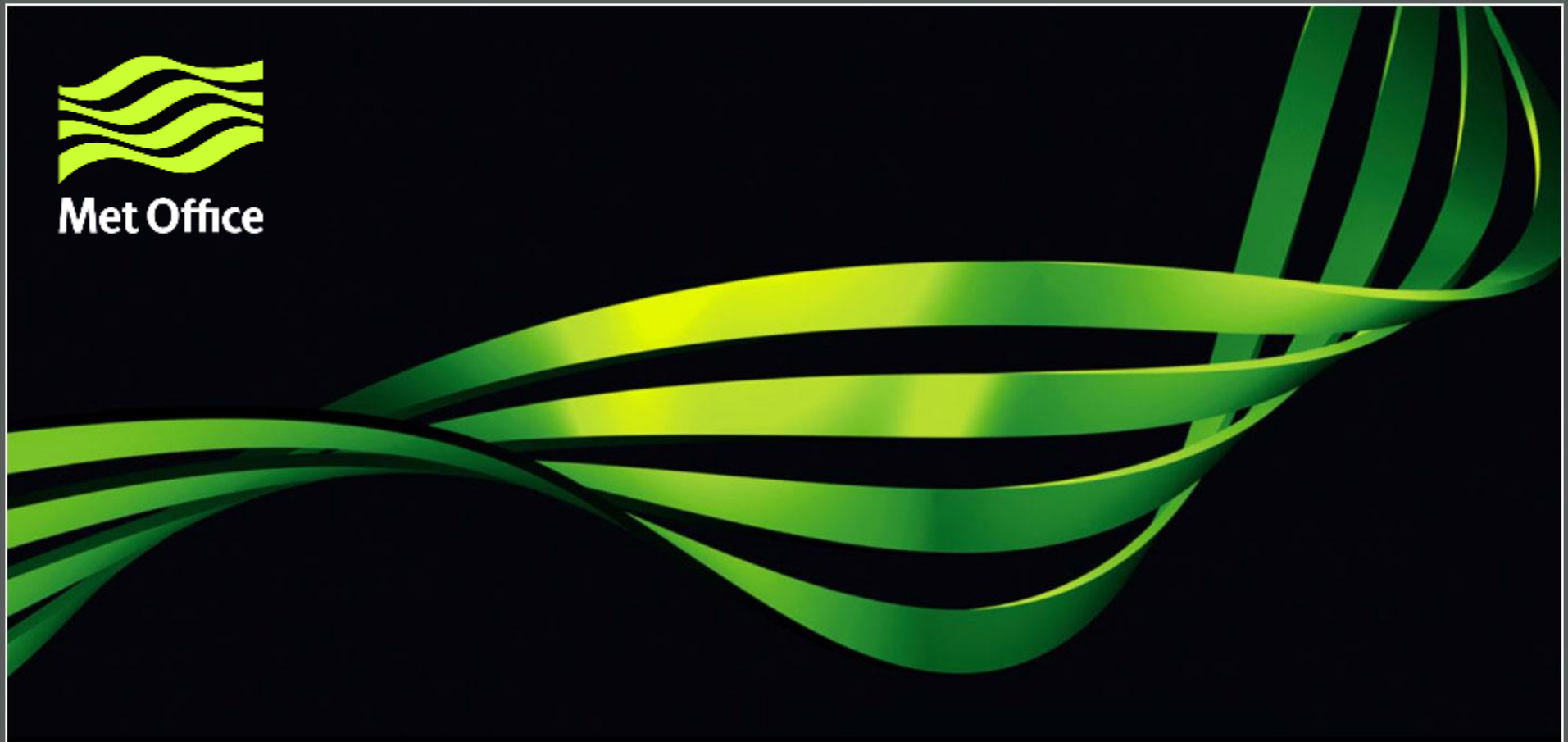

Questions?

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