Getting your Science in the Unified Model and part of the weather, climate and earth system models

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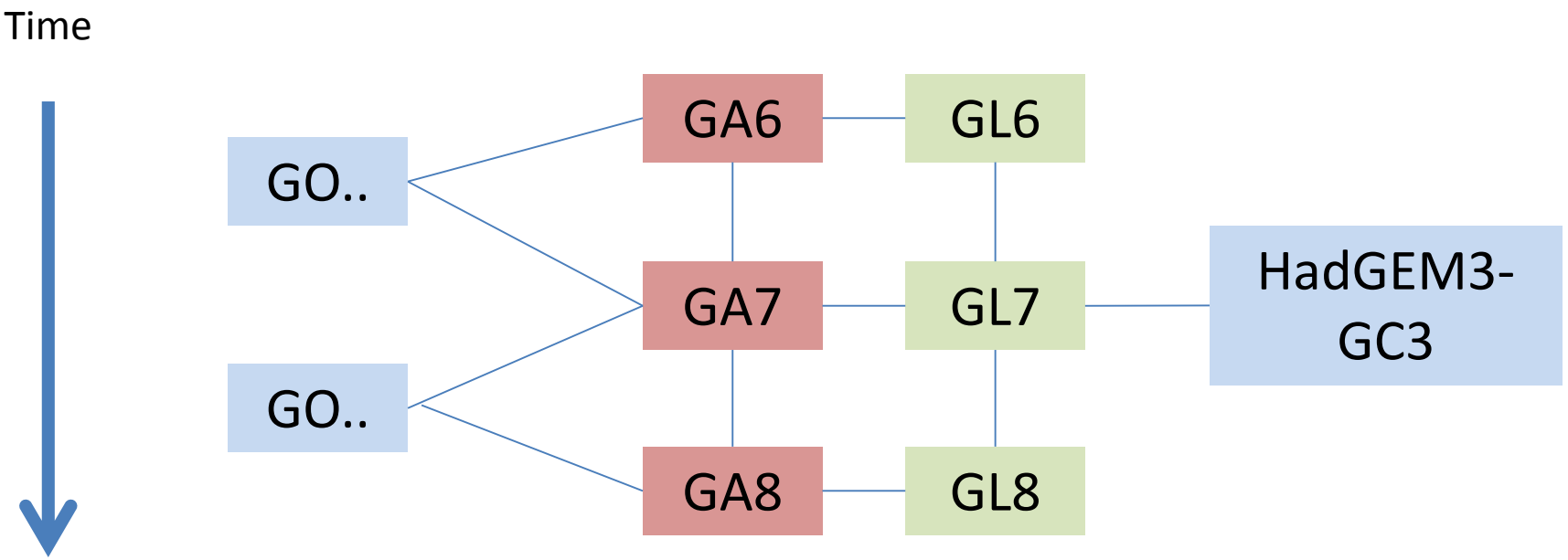
Unified Model (UM)

- Same code base applied to weather, climate and earth system applications.
  - JULES is one component of the UM, alongside NEMO, SOCRATES, UKCA, ...
  - Unified as the same ‘core’ is applied across all spatial and temporal timescales and applications
- Significant Model configurations
  - Weather
  - Climate
  - Earth System

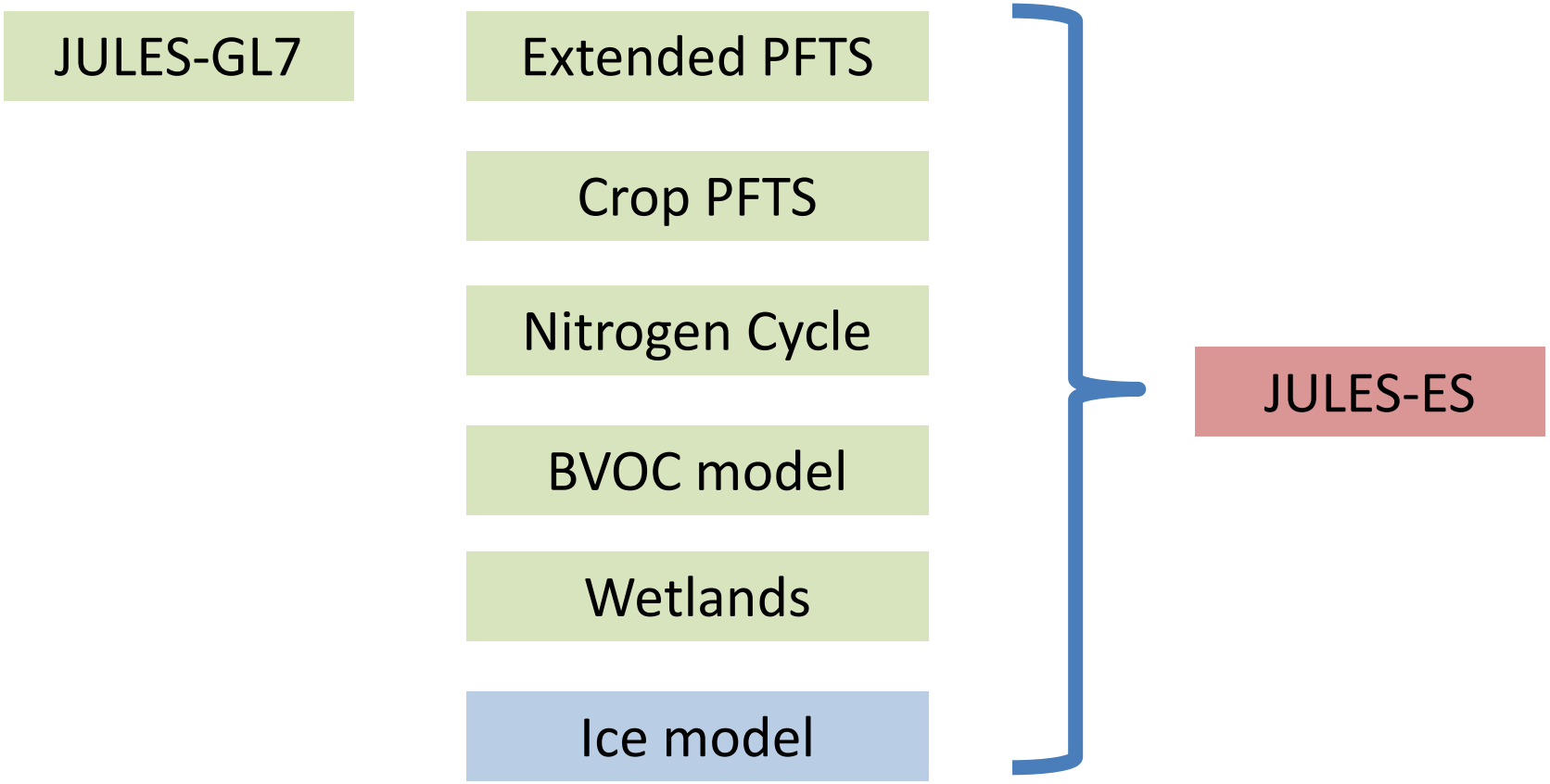
Configurations versus Model release

- Configurations are maintained between model releases and should be reproducible
  - Run same experiment different model should give same answer
- Ideally would talk about model release and configuration together when presenting results.

MO led Science Configurations



JULES-ES


JULES-GL7
Extended PFTS
Crop PFTS
Nitrogen Cycle
BVOC model
Wetlands
Ice model
JULES-ES

Backwards compatibility/reproduceability

- JULES releases are not necessarily entirely backwards compatible
  - New science introduced over a number of releases
    - In general users should wait until a configuration release is available before using it.
  - Bug fixes
    - Often temporary switches are used to fix a bug. Switches set initially to .F., then moved to .T.
- Too many possible switch configurations to test entire resilience

Bit reproducibility

- This is the result that two runs of same science configuration give the same result to the last significant bit
  - Can be applied across model releases
  - Can be applied across processor configurations
- Only for significant science configurations is this enforced.
  - This is the role of rose-stem
- Minor configurations can be updated given agreements with the configuration/module leaders

Code Testing

- Rose-stem is the backbone of our testing system to ensure code resilience
  - Essential to maintain systems integrity
  - Useful to all, that we have a basis from which to work that has passed a number of significant tests.
- Two forms:
  - JULES: Tests core configs and more
    - Add tests to add resilience to your code
  - UM: Weather, Climate, Earth System

Code submission

- Split large developments over release cycles
- Submit ASAP after a release
  - Avoid conflicts with new code on the trunk
  - Take advantage of limited technical support available

Getting code into major configurations

- Get code onto the trunk – technical testing
- Do science testing –
  - **use standard base configuration**
  - demonstrate impact/importance of your change
  - show not overly negative on other components
  - Use evaluation tools
    - ESMValTool – www.esmvaltool.org
    - iLAMB – www.ilamb.org
    - AutoAssess – Met Office tool
- Criteria
  - Demonstrated benefit
  - Conserves water and carbon
  - Globally applicable
  - Appropriate order of complexity

Configurations – see JULES pages

- JULES-C
  - 5 PFT HadGEM2-ES like setup currently wide used
- JULES – GL7
  - Plan JULES config available in the autumn
- JULES – Trait
  - Anna's setup with extended PFTs and trait-based physiology
- JULES-Crop
  - Setup with the prognostic crop model
- JULES-Fire
  - INFERNO fire model
- JULES-ES
  - Currently being tuned – available from the autumn

Define new configurations

- Impacts configuration – Exeter University
- UK high-res configuration – CEH
- …

- Need updated rose-stem tests for scientifically assured quality.
- Minor configurations can be updated during a development phase

Summary

- Configurations
  - Use standard configurations – some basis for scientific quality
- Test code thoroughly and submit to trunk early
- Use rose-stem to protect your code
- Seek advice from the community
- ES – Talk to me
- Physical model – discuss with module leaders as first point of contact