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

Time

GO.. → GA6
GO.. → GA7
GO.. → GA8
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 widely 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