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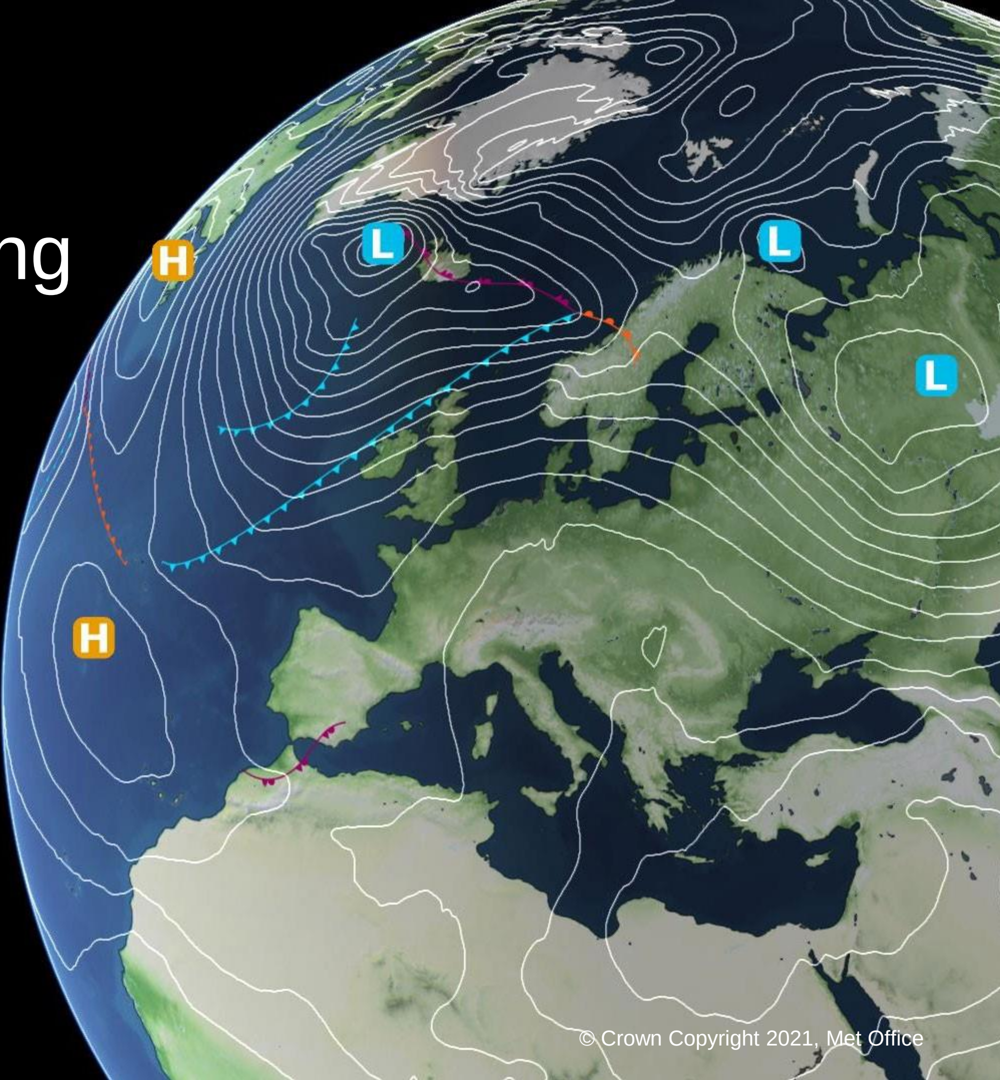
JULES and the Next-Generation Modelling System

or Tstar Track: The Next Generation

or Resistance is fertile

Richard Gilham et al



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- Next-Generation JULES?
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- Conclusions

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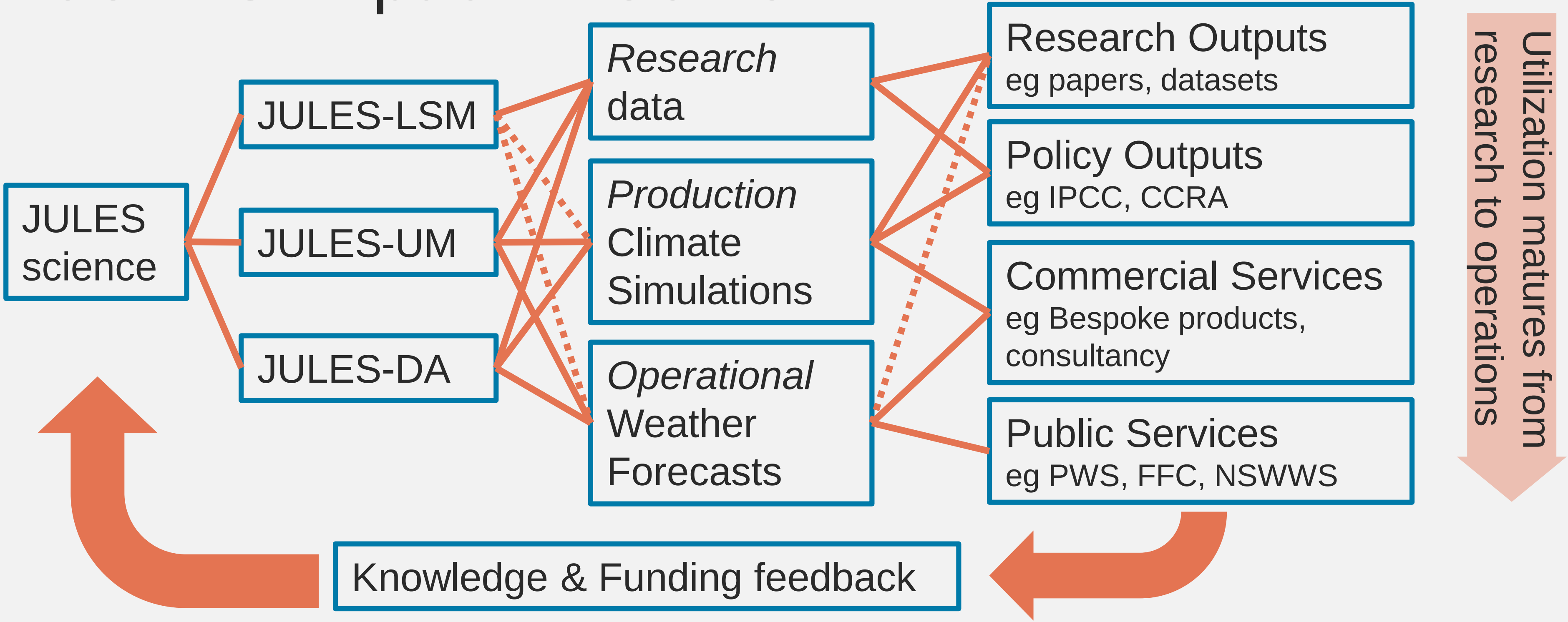
JULES Impact in Context



JULES science

JULES-LSM

JULES-UM

JULES-DA

Research data

Production Climate Simulations

Operational Weather Forecasts

Research Outputs
eg papers, datasets

Policy Outputs
eg IPCC, CCRA

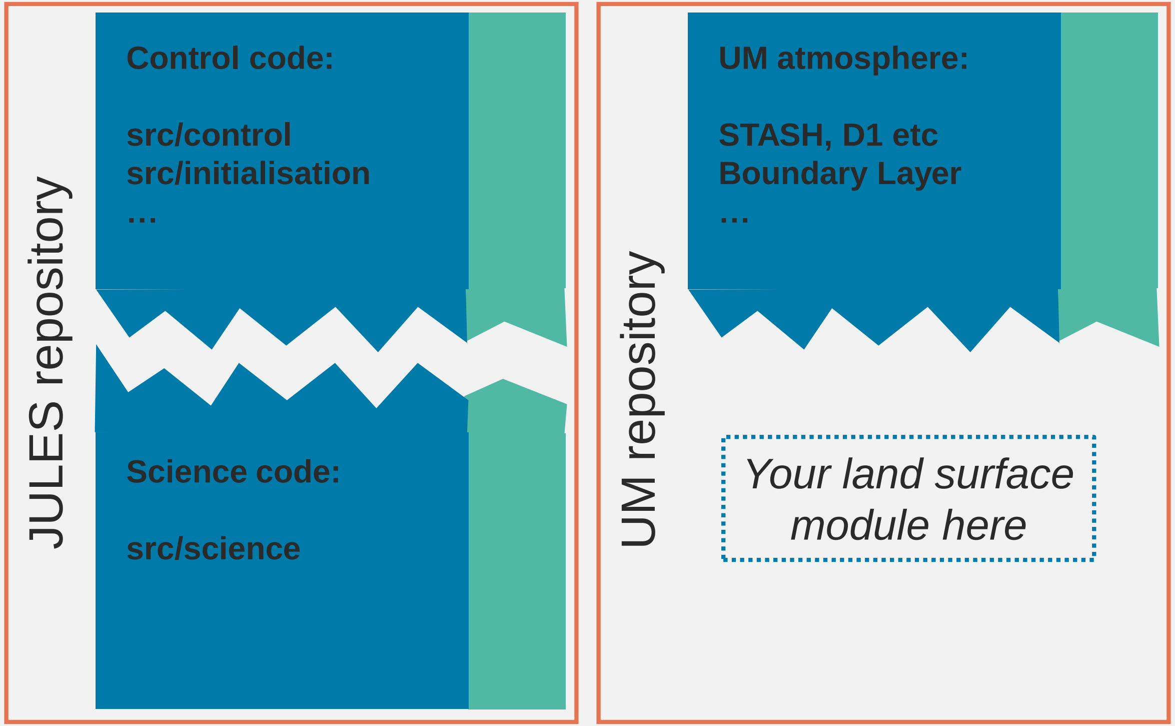
Commercial Services
eg Bespoke products, consultancy

Public Services
eg PWS, FFC, NSWWS

Knowledge & Funding feedback

Utilization matures from research to operations

Parent models & development



JULES repository

Control code:

src/control
src/initialisation
…

Science code:

src/science

UM repository

UM atmosphere:

STASH, D1 etc
Boundary Layer
…

Your land surface module here

JULES science code plugs into multiple parents (Standalone, UM, LIS)

Science code change only available if parents updated

Quality & ‘resistance’

- JULES used by many parent-models
  - UM and LSM use cases add value to each other
- Gives JULES science integrity

- ‘Getting code in’ is not trivial:
  - **Good resistance**- eg scrutiny to maintain quality interoperable science
  - **Bad resistance**- eg working with D1, STASH, access to run UM etc

We don’t like bad resistance

Next Generation Modelling System

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Next Generation Modelling System (NGMS)

- LFRic (after L F Richardson) to replace UM
    - New Gung-Ho dynamical core
    - UM physics (shared source code initially)
    - Lat-lon grid no longer ‘baked-in’
    - Technical infrastructure designed in sympathy with non-CPU supercomputers
- Separation of Concerns
    - Science, technical and parallel code separate
- Requires wind-down of UM
    - Science development
    - Technical development
    - Operational & production retirement
    - Legacy use cases
    - Sunset support

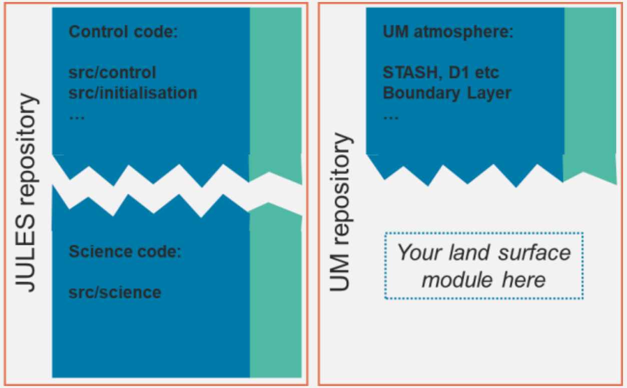
UM-JULES Science Roadmap (redraw into table/timeline)

- Physical model configurations- GC5 (GAL9), RAL3, RAL4
  - Code already on trunk
  - Configuration freeze late 2021
- Earth System configuration- UKESM2
  - Code changes anticipated until early 2024
  - Configuration freeze ?????

- UM/JULES science code is ‘done’ for operational impact routes
- New land surface science development likely realise impact via LFRic
- Finite window for climate production policy impact routes via UM

Parent models (again)

- UM- decreasing importance for impacts
- LFRic- emerging importance for impacts



Opportunity to reduce ‘bad resistance’ for JULES science?

NG-JULES-LSM: Concept

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NG-JULES-LSM? Why?

- LFRic technical infrastructure designed around ‘mini-apps’
- Plausible to replicate existing JULES-LSM functionality/experience
- Unlock new functionality previously too difficult?

Reduce bad resistance?

- ‘Get in’ to the coupled model for ~no extra effort
- Leverage support, documentation and training
- Learn lessons from what didn’t go well before

Changes and continuity

- LSM user/developer experience largely the same
  - Write science code; plumb it in; test etc; do Good Things
  - Science code will not change much
- Surrounding technical software changes
  - Shared support, training & documentation- Better Together

What’s the Plan?

The Plan

- Being explored by a subset of JLMP
- Explore some exemplar use-cases
- Turn implicit requirement to explicit requirements
- Evaluate the LFRic infrastructure against requirements
- Create proof-of-concept NG-JULES-LSM

Would this project to deliver this change likely give the expected benefits?

Assurances

- JULES-LSM releases and support remain as-is until further notice
- Supporting technologies may change but the fundamental scientific process will be preserved
- Lessons learned from the past matter

Conclusions

Conclusions

- LFRic is the long-term future for coupled modelling with JULES science

- New technical infrastructure offers opportunities to reduce ‘bad resistance’ in maximising the impact of JULES science

- Now is the right time to evaluate this opportunity

Thank you

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NG-JULES-LSM 1-slide summary

- JULES Science impact via Standalone and Coupled models
  - Research, Policy, Commercial and Public Service
- Types of Resistance:
  - **Good resistance**- eg scrutiny to maintain high-quality interoperable science > Integrity
  - **Bad resistance**- eg working with D1, STASH, access to run UM etc
- Next Generation Modelling System- NG-JULES-LSM?
  - **Reduce Bad Resistance?**
  - Shared tech infrastructure, support training etc
  - Unlock new science capabilities?
- Proof of concept; testing exemplar use-cases