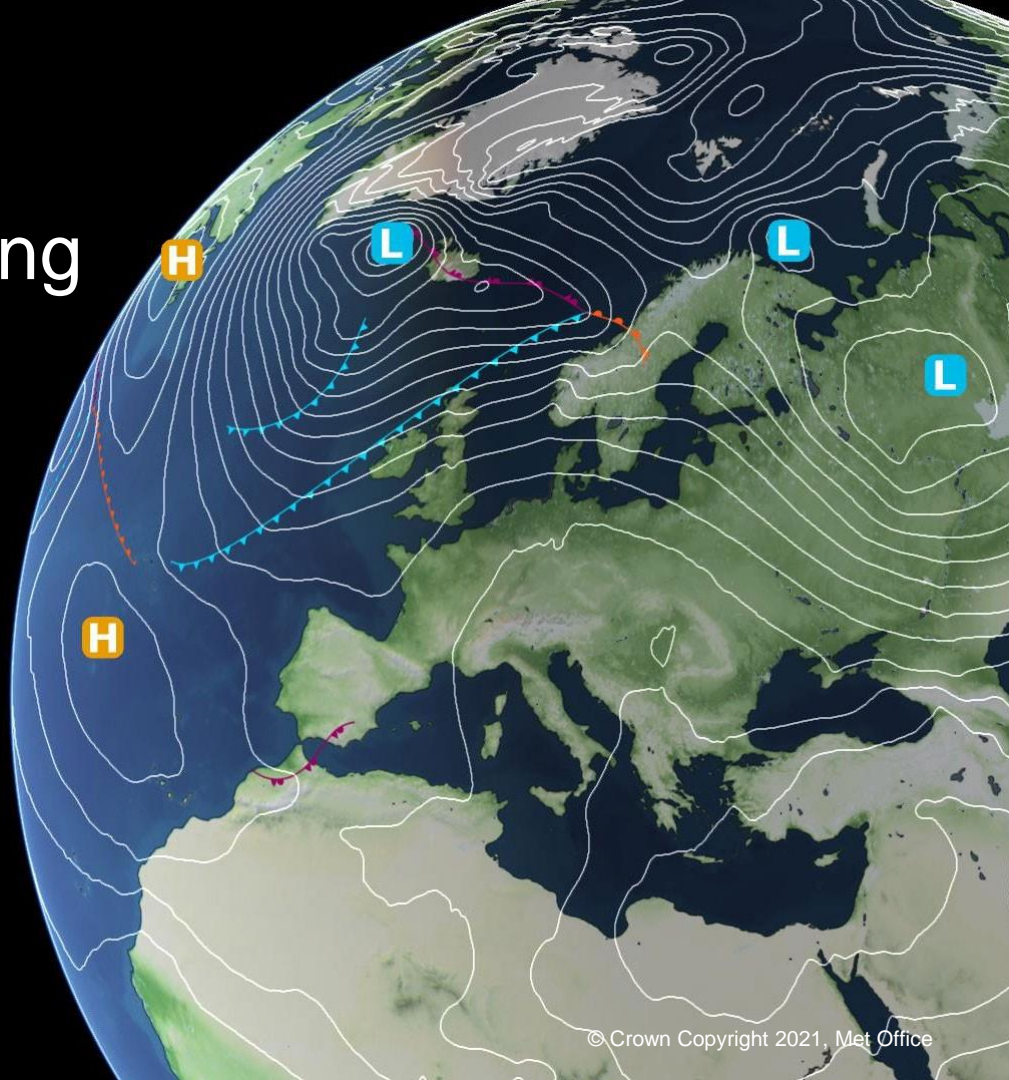


# JULES and the Next-Generation Modelling System

*or Tstar Track: The Next Generation  
or Resistance is fertile*

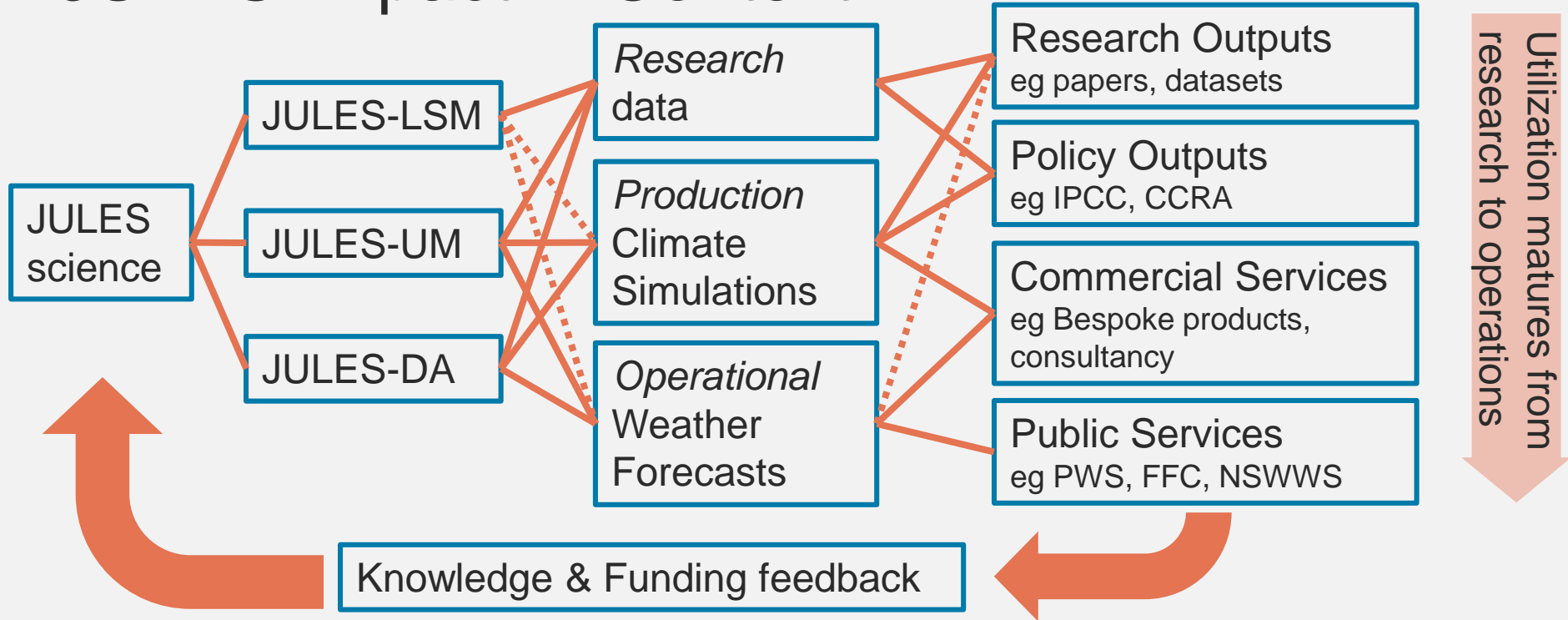
Richard Gilham et al



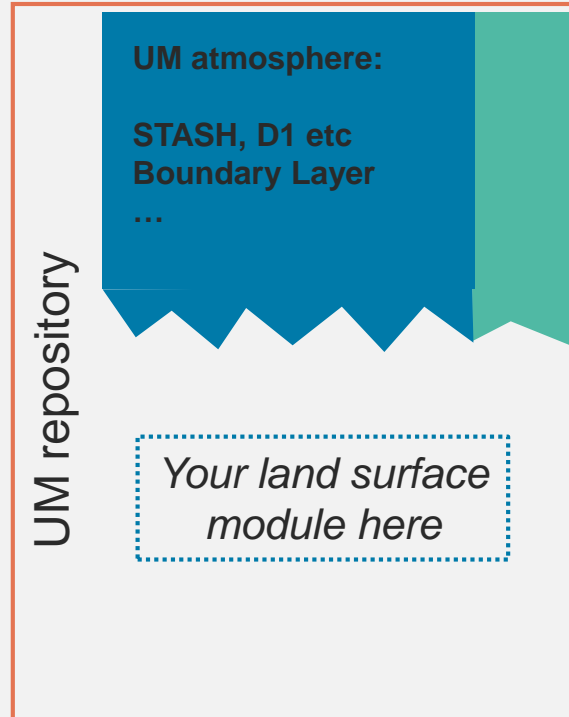
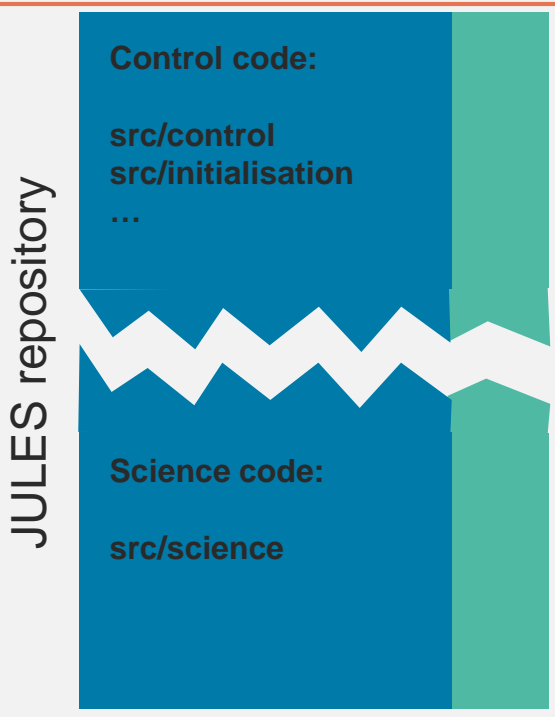
# Contents

- Background
- Next-Generation Modelling System
- Next-Generation JULES?
- What's the plan?
- Conclusions

# JULES Impact in Context



# Parent models & development



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

Science code change only available if parents updated

# Quality & 'resistance'

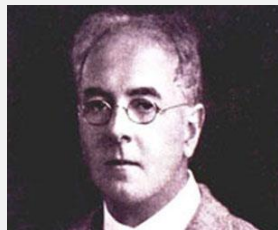
- JULES used by many parent-models
  - UM and LSM use cases add value to each other
- Gives JULES science integrity
- 'Getting code in' is not trivial:
  - **Good resistance**- eg scrutiny to maintain quality interoperable science
  - **Bad resistance**- eg working with D1, STASH, access to run UM etc

We don't like bad resistance

# Next Generation Modelling System

# 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



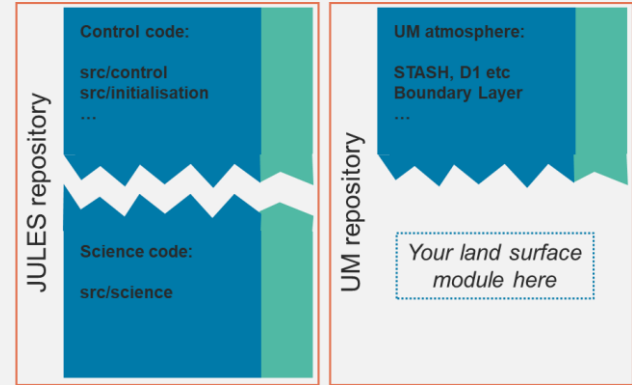
# UM-JULES Science Roadmap (redraw into table/timeline)

- 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

# 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

[richard.gilham@metoffice.gov.uk](mailto:richard.gilham@metoffice.gov.uk)

# 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