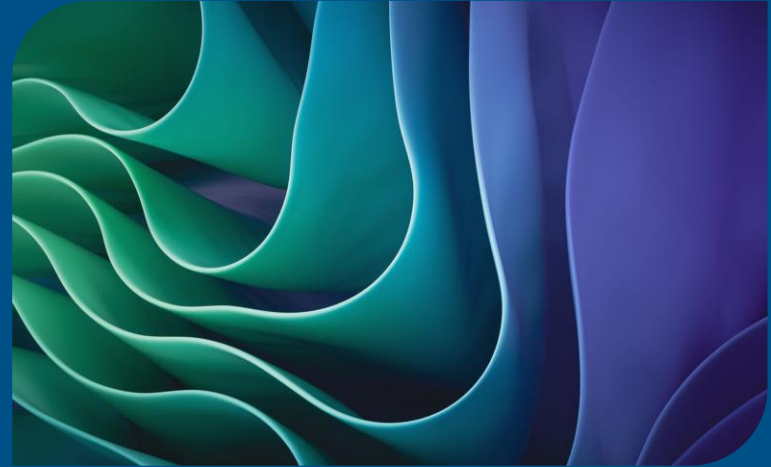


# Why Australasian Research Needs Supercomputing

eResearch Australasia 2025  
Plenary Panel: 23 October 2025



## Panelists:

- Hayley Teasdale, Australian Academy of Science
- Andy Hogg, ACCESS-NRI
- Tim Rawling, AuScope
- Georgina Rae, REANNZ





# Australian Academy of Science

# Future computing needs of the science sector

Dr Hayley Teasdale, Head Science Policy and Advice

# Role of the Academy

- As an independent convenor and a trusted advisor
- Includes strategic planning for science and science disciplines e.g. decadal plans
- Includes connecting Australia to international science, through the international science council, learned academies around the world and diplomatic networks
- Provide policy advice on a range of issues, including research infrastructure
  - Can be public and ‘uninvited’ like submissions and advocacy
  - Often directly requested and behind the scenes



Australian Academy of Science



# Australia's super computer

Australian Academy of Science ✓

Share



# Future computing needs of the science sector roundtable

- Assess the computing needs across the science sector now and into the near- and medium-term future
- Looking towards providing a coordinated voice on computing needs for science
- Combined computing expertise with representatives from different disciplines of science

# What we heard in the roundtable

- There is a lack of understanding outside the research community (and sometimes within) of the importance of research HPC
- Australia lacks both short- and long-term plans for how to maintain existing HPC and plan for the next generation, as well as lacks strategy for handling large scale data (petascale and beyond)
- Tier 1 research HPC are increasingly turning to institutional partners to fund not only operational costs, but also capital works

# Outputs

The output of the roundtable will be a series of short briefs summarising the conclusions of the roundtable

- Brief 1 has now been published – a snapshot of the current situation
- Brief 2 will provide Australian science case studies for exascale (complete but not published)
- Brief 3 will explore use cases for different computing offerings

# Aims of the outputs

- Provide a starting point for engagement across government, including by positioning computing as a sovereign capability
- Make the case for a national strategy for HPCD for research – not just to guide government investment but also industry
- Create a ‘science case’ for exascale by articulating what Australian researchers could achieve with access to these capabilities
- Articulate use cases for how different computing services will support researchers with a ‘near future’ framing (NCRIS facilities, commercial services, cloud, quantum, defence etc.)

# AI & science discussion paper series

- Looks at the preparedness of different areas of the science system in Australia
- Touches lightly on uptake of AI in science disciplines, rather focuses on methods and practice of science, roles of institutions, skills and workforce, governance, infrastructure and research collaboration
- Looks at how Australia is preparing for a future with AI assistants and AI science teams etc
- Complete and ready for publication. No recommendations or asks – starting a national discussion

# Why investment in Australia's supercomputing should matter to every Australian

- Ahead of the 2025 federal election, the Australian Academy of Science is proposed an investment of \$200 million per year over 10 years to urgently modernise Australia's high-performance computing and data infrastructure – our supercomputers – which are reaching their end of life and cannot meet the growing demands of science, defence, industry and society.
- This formed the basis of our pre-budget submission
- Accompanied by case studies that highlighted the importance of supercomputing to different categories of voters
- We are also proposing this is the first step in building AI capability

# Australian Science, Australia's Future

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- Does the science we have match the science we need?
- Mapping science capability against national ambitions articulated by the intergenerational report
- Make strategic recommendations to build science capability
- Strong underpinning theme around computing, data and AI infrastructure



# Strategic Examination of R&D

The strategic examination will find ways to:

- get more value from investment in research across universities, industry and government
- harness and grow business investment in R&D
- leverage our scientific strengths to help address national priorities and foster new industries.

- **Invest in next-generation high-performance compute and data to enhance Australia's digital innovation and AI capabilities**




# Next steps

- A 10-year strategy and investment in high-performance computing and data
- Final outcomes of reviews and strategies
- Bringing together users and providers across sectors
- Release of AI papers and next HPC briefs

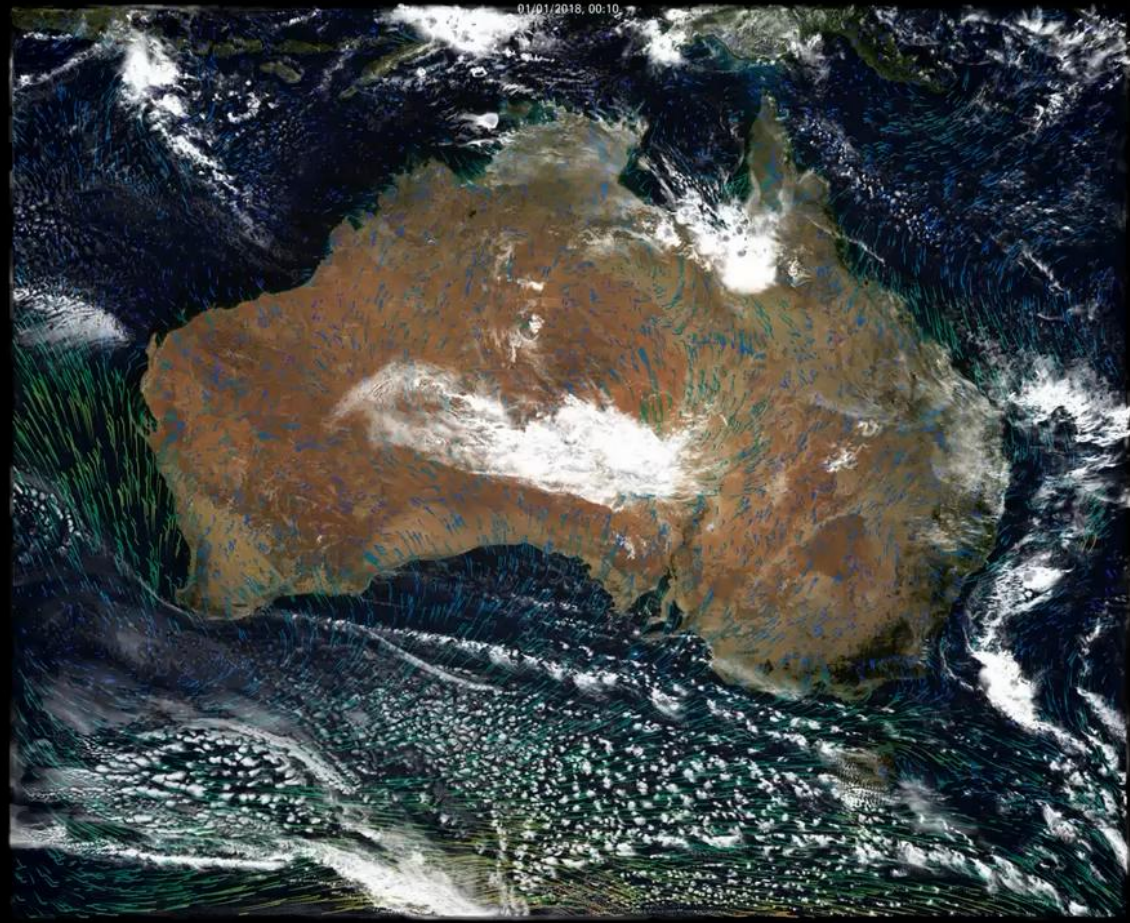
# Why Australia needs Supercomputing for Climate Modelling

Andy Hogg – ACCESS-NRI

## Summary:

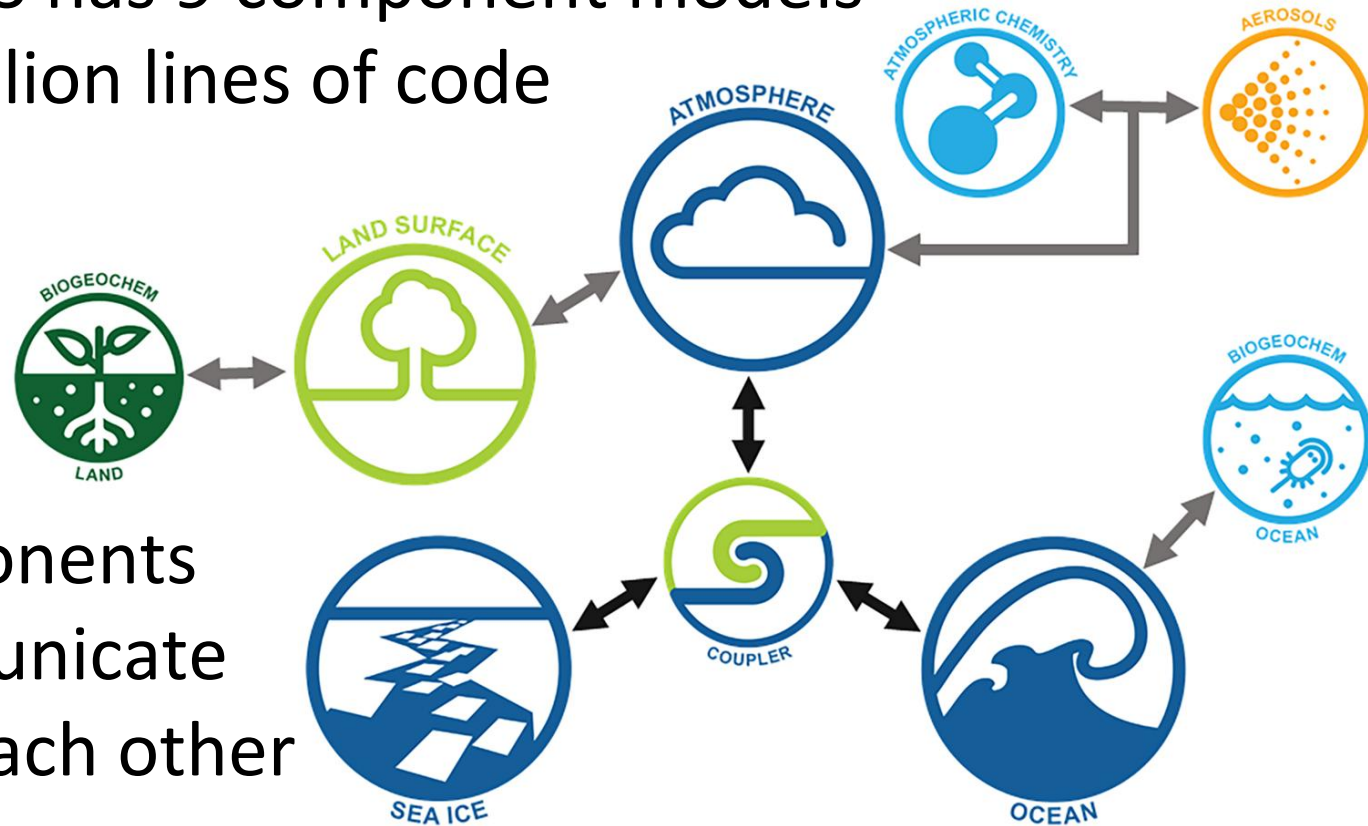
-  Because climate models include complex interactions of many components
-  Because climate models need to represent a wide range of spatiotemporal scales
-  Because climate modellers need a shared platform for collaboration

# What is a Climate (Earth System) Model?



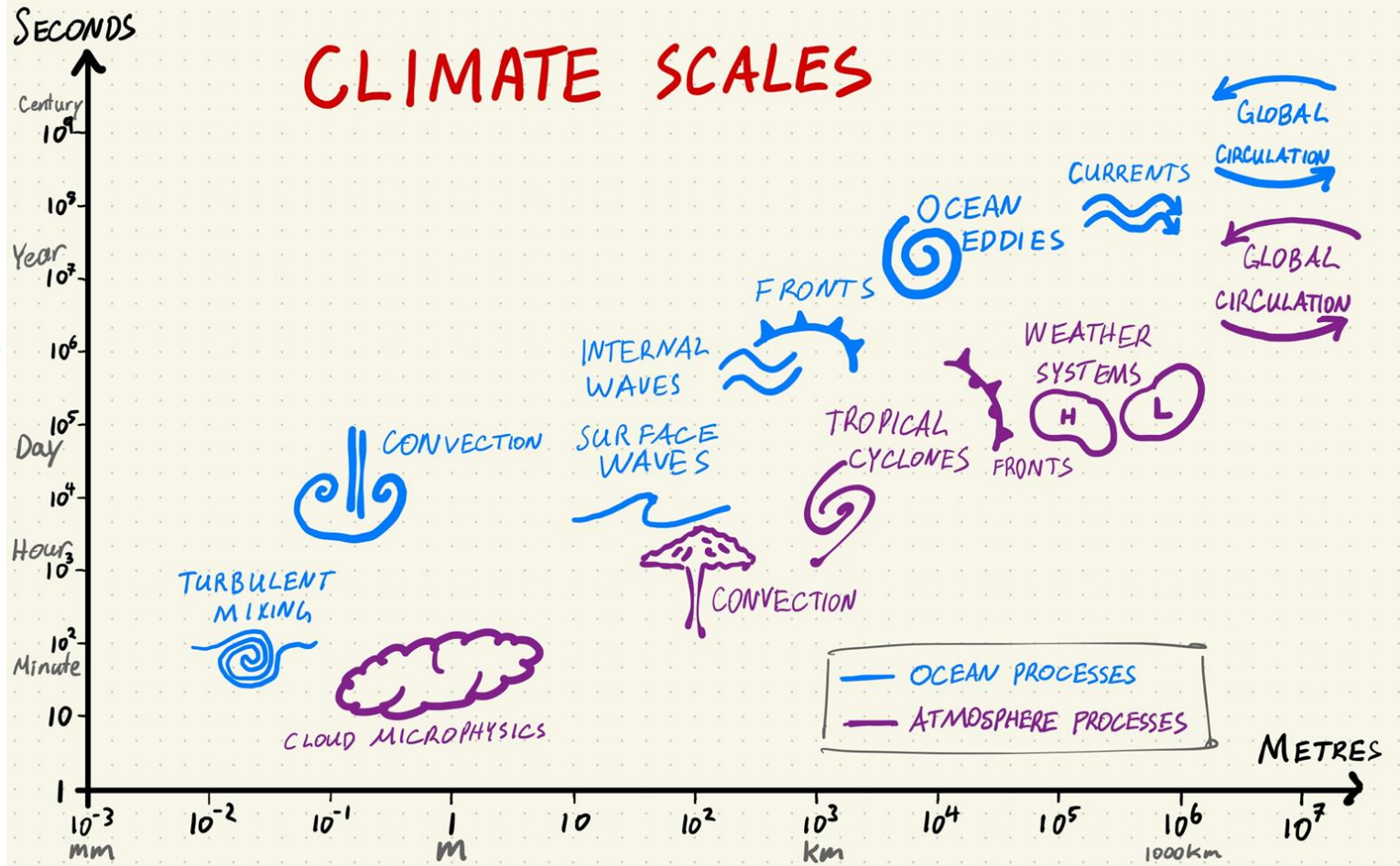
# 1. The Climate System is complex

- ACCESS has 9 component models
- 4.3 million lines of code

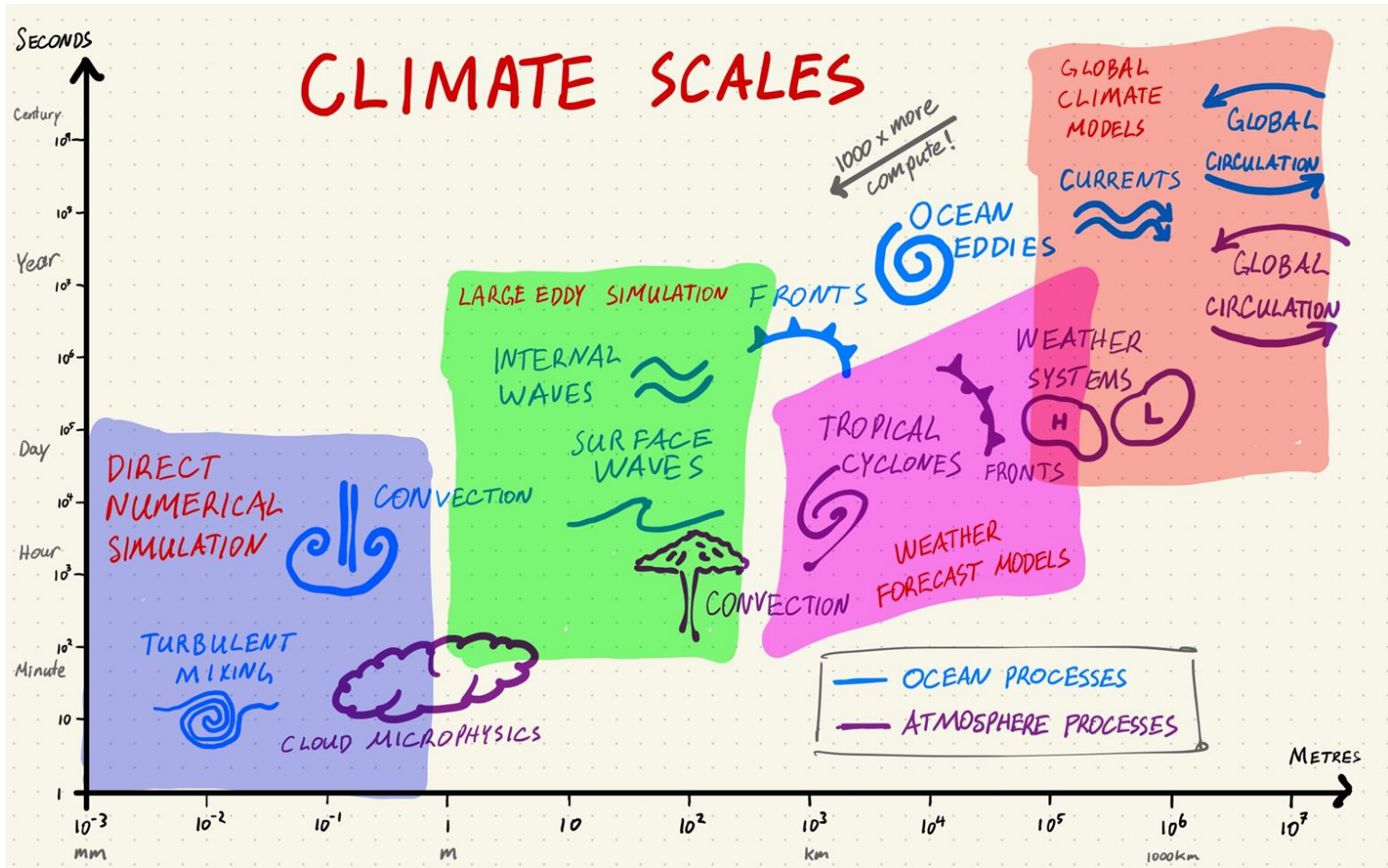


- Components communicate with each other

# 2. Climate spans a range of scales



# 2. Climate Models span several scales...



### 3. Climate Researchers like to Collaborate






- Climate research is interdisciplinary & multi-institutional
- HPC Platforms enable:
  - Common access to input & output data
  - Shared model builds & optimisation
  - Shared problem-solving
  - Community-building

# Why Australia needs Supercomputing for Climate Modelling

Andy Hogg – ACCESS-NRI

## Summary:

-  Because climate models include complex interactions of many components
-  Because climate models need to represent a wide range of spatiotemporal scales
-  Because climate modellers need a shared platform for collaboration

# Why we need HPC for geoscience in Australia

**Dr Tim Rawling**

ORCID: 0000-0002-8841-4384



# Australia's Integrated Geoscience Research Infrastructure



Earth Modelling Software



Data Delivery Platforms



Research Infrastructure Experts



Board & Management



FAIR Data



Drones, Data & Software



Collaborators

Earth Imaging & Monitoring Equipment (Ocean Floor)



Mobile Analytical Laboratory



High Precision Analytical Laboratories



Drill Core Analysis



Education & Outreach



Positioning Telescopes



Earth Imaging & Monitoring Equipment

Mineral Resource



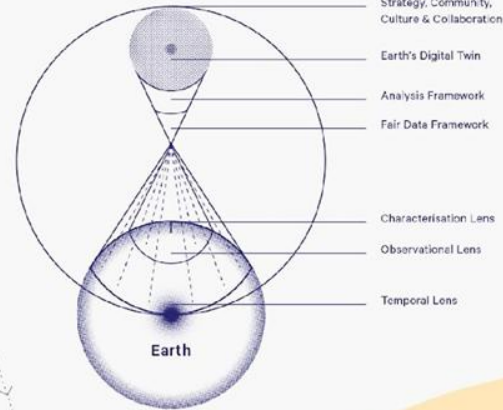
Geohazards (Earthquake)

Mineral Resource

Groundwater Resource

Energy Resource

## Downward-Looking Telescope



## Key AuScope Locations & Sustainable Development Goals (SDGs)



SDG 6 — Clean Water & Sanitation



SDG 7 — Affordable & Clean Energy



SDG 8 — Decent Work & Economic Growth



SDG 13 — Climate Action



SDG 9 — Industry, Innovation & Infrastructure



SDG 15 — Life on Land



AuScope acknowledges Aboriginal and Torres Strait Islander people as Traditional Custodians and the first geoscientists of the Australian continent where our scientific community and infrastructure are located. We pay our respects to their Elders past and present. | © AuScope Limited 2022. | Note: This schematic is not to scale.

auscope.org.au

# National Geophysics Deployments



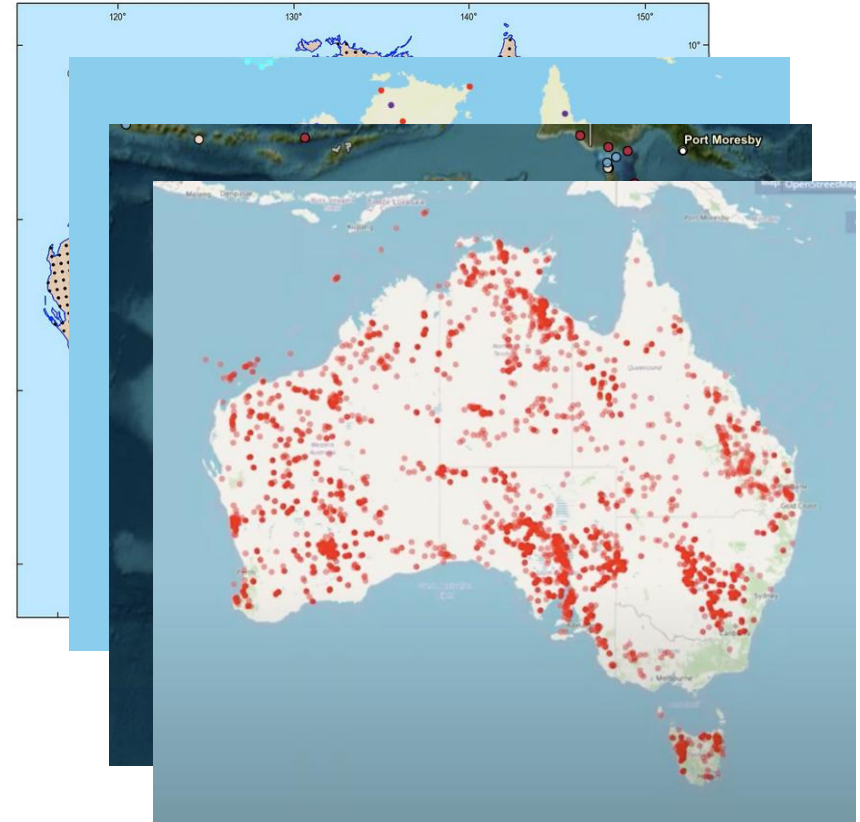
Magnetotellurics

Passive seismic

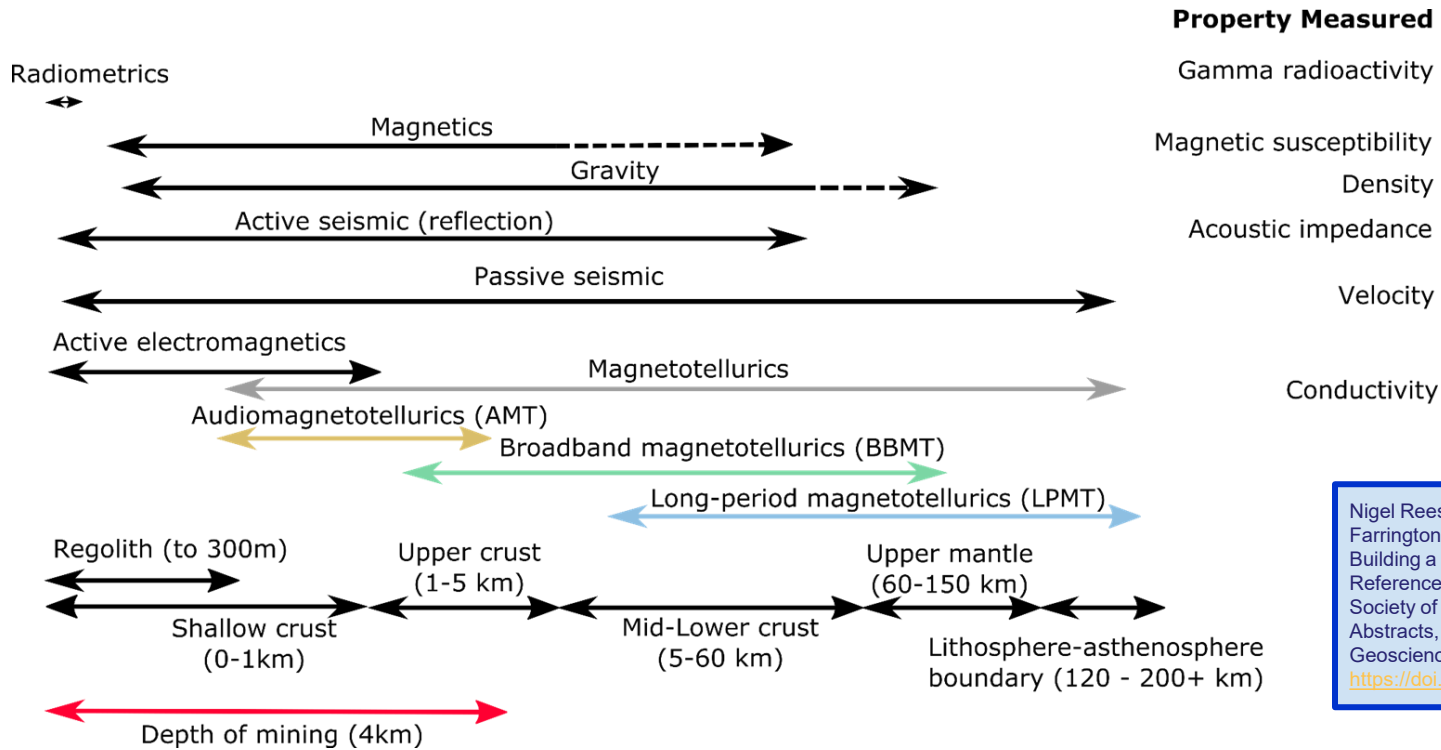
GNSS and VLBI network

Hyperspectral drillcore  
data - NVCL

- Variable data complexity
- Variable data volumes
- Variable processing overhead
- National data computationally expensive



# Multiphysics Analysis at all crustal levels



Nigel Rees, Lesley Wyborn, Ben Evans, Rebecca Farrington, Tim Rawling, Rui Yang, & Yue Sun. (2023). Building a National High-Resolution Geophysics Reference Collection for 2030 Computation. Australian Society of Exploration Geophysicists Extended Abstracts, Volume 2023, 4th Australasian Exploration Geoscience Conference, Brisbane, 2023. <https://doi.org/10.5281/zenodo.7980192>

Types of geophysical data collected in Australia, the physical property measured and the depth of the crust that is sampled: also shown is the depth of current mining. Figure modified from original of Richard Chopping (GSWA).

# Geophysics 2030+

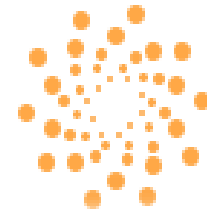
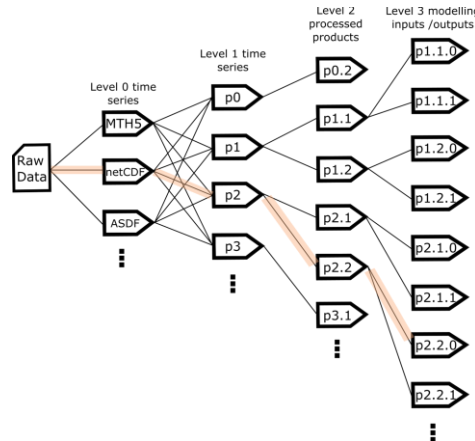
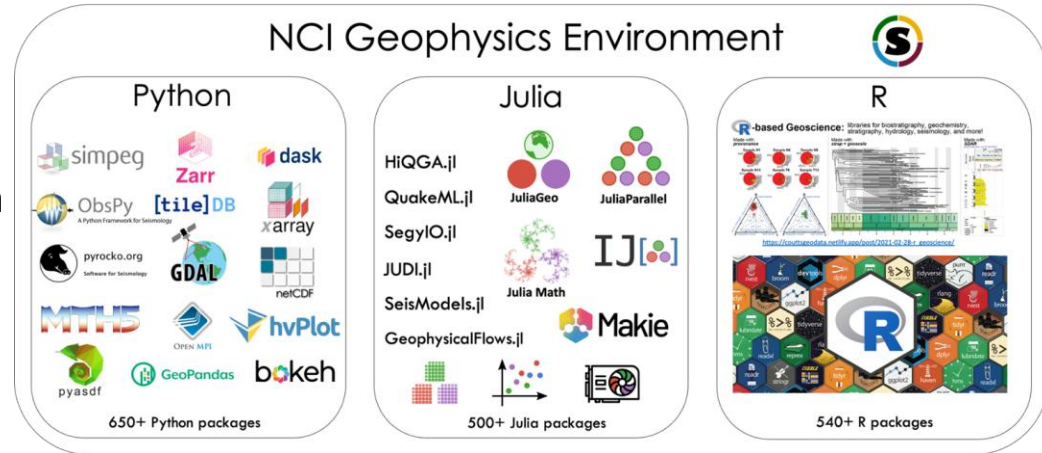
Started as an R&D project funded through a collaboration with NCI, TERN and ARDC

- National-scale high-resolution geophysics datasets suitable for programmatic access in HPC environments;

- Rapid data processing for scalable, data-intensive computation, including AI/ML and data assimilation.

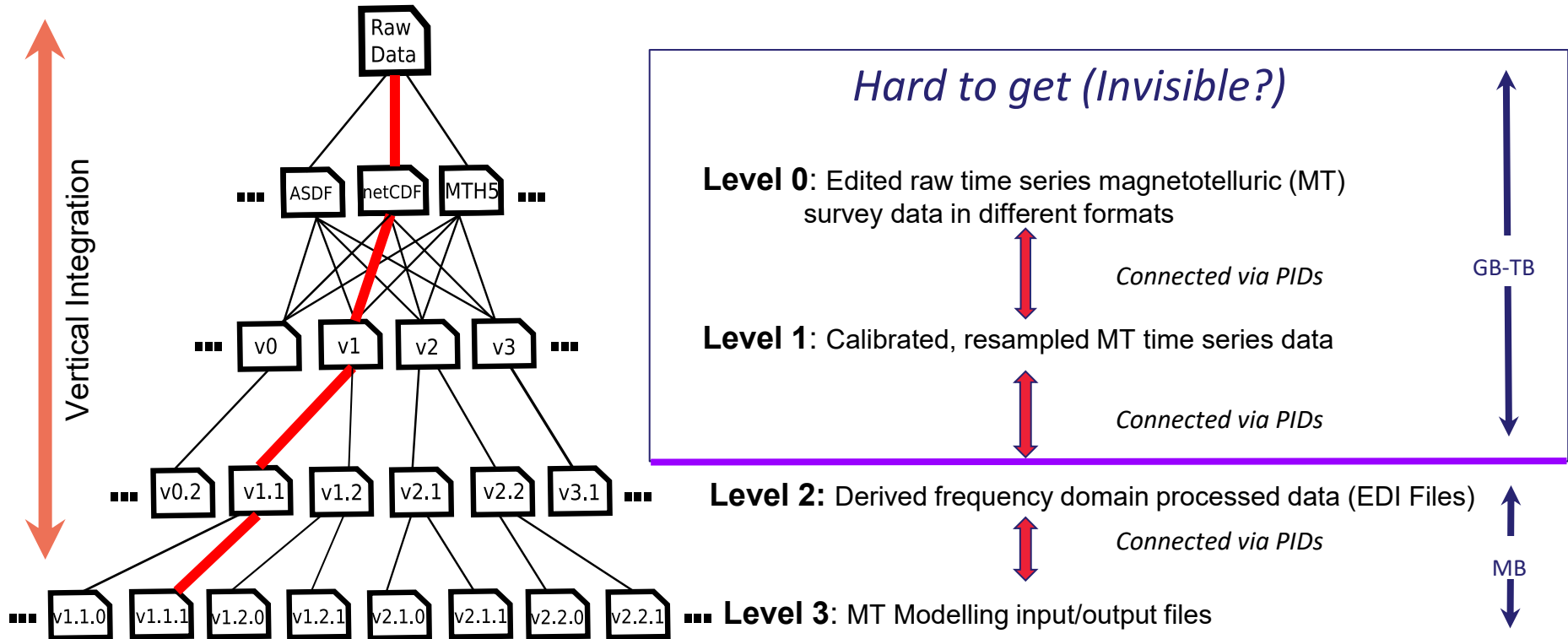
Positioning Australian geophysical data collections to be capable of taking advantage of next-generation technologies and computational infrastructures by 2030.

[auscope.org.au](https://auscope.org.au) | @auscope



**NCI**  
AUSTRALIA

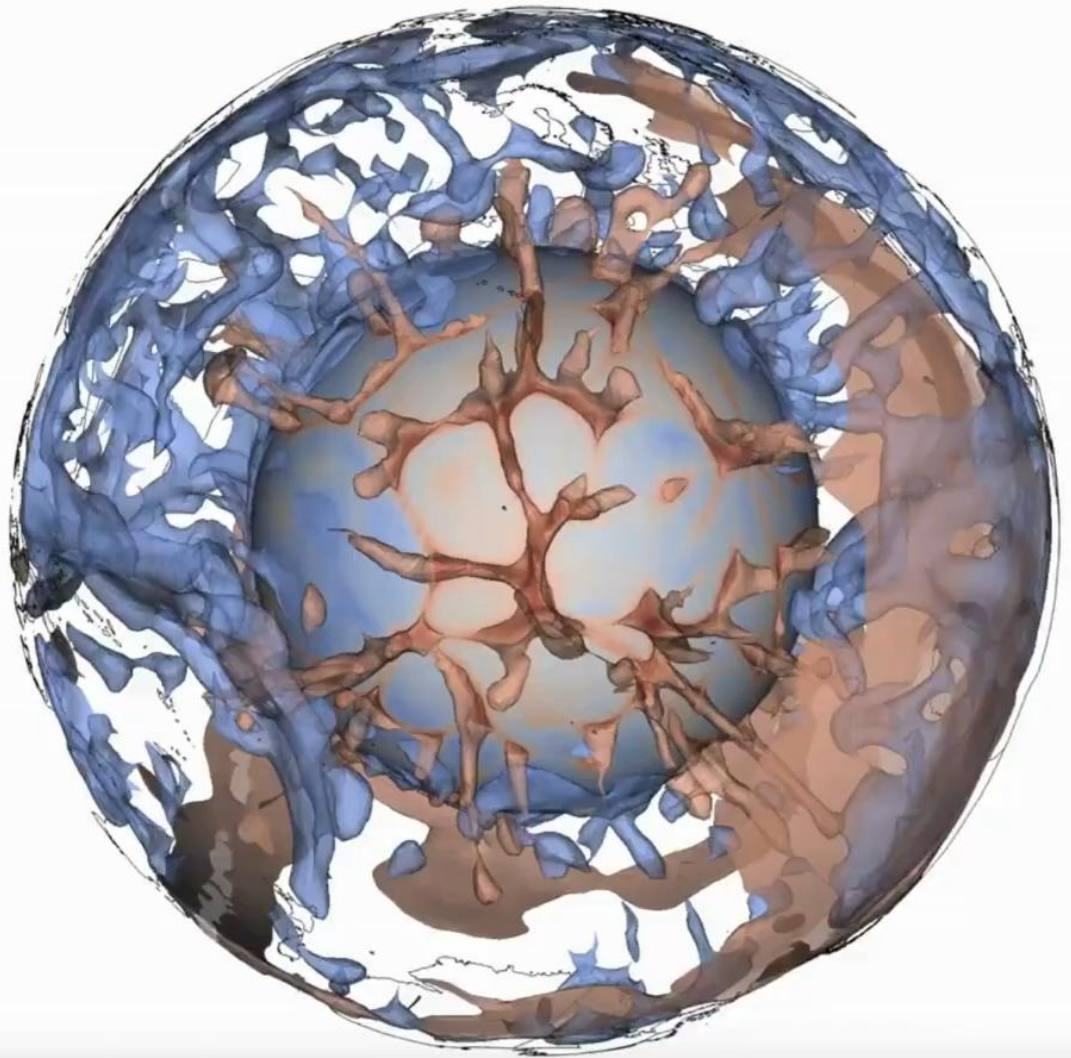
<https://thredds.nci.org.au/>



## Geodynamic process modelling with G-Adopt

Present-day thermal structure  
predicted from a global mantle  
convection simulation in G-ADOPT.  
Professor Rhodri Davies - ANU

- Modelling isostatic response  
to ice sheet retreat
- Integration with AccessNRI
- CoastRI modelling



# Summary

- **HPC is central to everything we do in geoscience.** From high-resolution geophysical inversions to coupled geodynamic and surface-process simulations, the ability to compute at scale underpins almost every modern advance in the field.
- In an era of increasing demand to formally connect data and models, HPC is becoming even more critical. The **integration of large observational datasets with physics-based models** requires scalable, parallel infrastructure and workflow automation to ensure that insights can be reproduced and extended.
- AI is rapidly changing the landscape, and there is an expanding need for GPU-based architectures. However, **CPU systems remain vital.** It takes significant time and effort to port scientific codes to GPUs, and we do not want to leave important research communities or use cases without suitable CPU-based HPC platforms.
- Australia's and the world's **most pressing challenges** - from resource security to climate resilience - can only be tackled by formally **linking models and data**, and that synthesis depends fundamentally on HPC capability and continuity.

23 October 2025


# Why does NZ need Supercomputing?

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Georgina Rae  
eResearch Australasia 2025

REANZ

kākāpō chick photo by Dianne Mason, 2009 [CC2.0](#)



# Acknowledgement of Country

I acknowledge the Turrbal and Jagera peoples, the Traditional Custodians of the land on which we meet today. I pay my respects to Elders past, present, and emerging.

“eResearch is a prerequisite capability for a world-class Research, Science and Innovation sector”

MBIE's eResearch Report, 2023

REANZ



**Infrastructure and  
Related Services to  
Support New Zealand's  
eResearch Future**

<https://www.mbie.govt.nz/dmsdocument/25829-infrastructure-and-related-services-to-support-new-zealands-eresearch-future>

“No single Research Infrastructure can provide all the tools required to tackle today’s complex, interdisciplinary challenges”

OECD Research Infrastructure Policy Paper, 2025

We need an *ecosystem* of infrastructures/services/expertise

REANVZ



[https://www.oecd.org/en/publications/fostering-research-infrastructure-ecosystems-for-addressing-complex-scientific-and-societal-challenges\\_34797721-en.html](https://www.oecd.org/en/publications/fostering-research-infrastructure-ecosystems-for-addressing-complex-scientific-and-societal-challenges_34797721-en.html)

“Extensive use of NZ HPC resources helped QuakeCoRE to produce world-class research output, which made our research internationally visible”



REAN NZ



Sung Eun Bae, QuakeCoRE Research Software Engineer



QuakeCoRE

NZ Centre for Earthquake Resilience  
*Te Hiranga Rū*

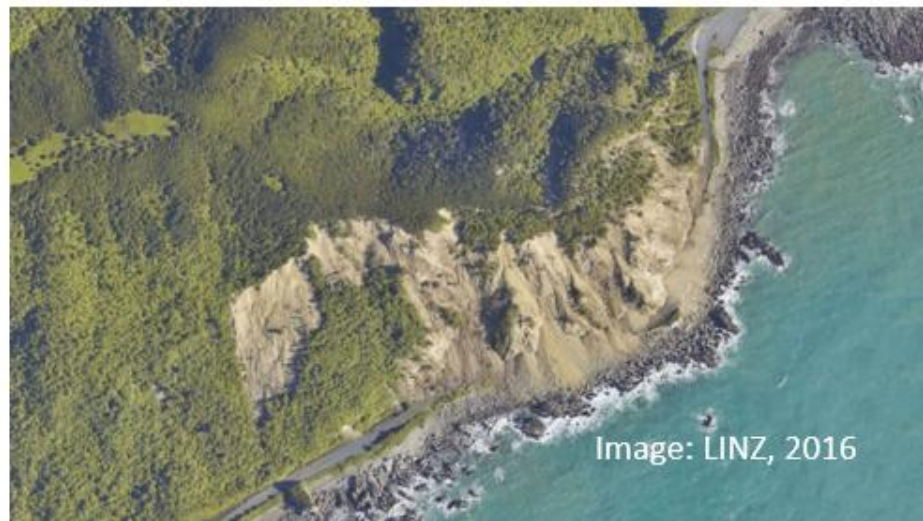
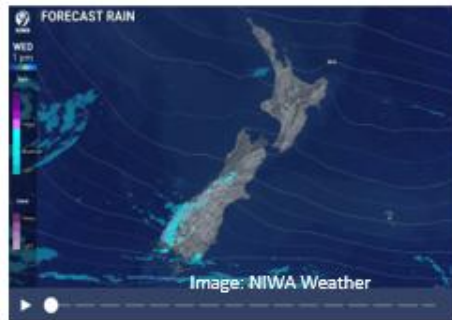


Image: LINZ, 2016



Critical local capability and focus



# Māori Data Sovereignty

“He taonga te data  
i tangohia mai i te  
tangata, i te mea ora”

Moe Milne, Ngāti Hine

# Māori Data Sovereignty in action – Mana Motuhake

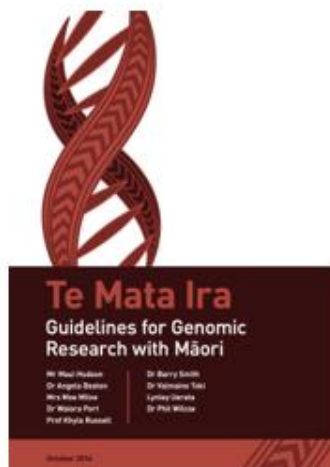


<https://www.temanararaunga.maori.nz/>



**CARE Principles  
for Indigenous  
Data Governance**

<https://www.gida-global.org/care>

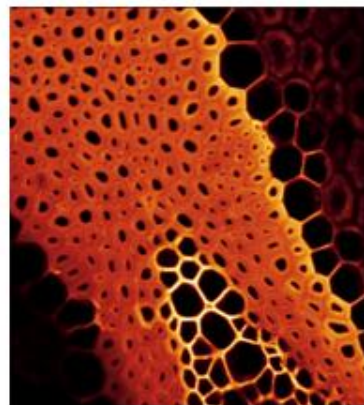


<https://www.genomics-aotearoa.org.nz/sites/default/files/2019-03/Te-Mata-Ira-Genome-Research-Guidelines.pdf>

RAUIKA MĀNGAI



<https://ourlandandwater.r.nz/outputs/a-wai-262-best-practice-guide-for-science-partnerships-with-kaitiaki-for-research-involving-taonga/>



Te Nihonga Kaitiaki  
Guidelines for Genomic  
Research on Taonga Species



<https://www.genomics-aotearoa.org.nz/resources/guidelines-maori-genomics-research>



<https://www.kahuiraraunga.io/maoridatagovernance>

# Why does NZ need Supercomputing?

- Pre-requisite for world-class research
- Ecosystem of resources
- Locally focused outcomes
- Māori Data Sovereignty

