



National Computational Infrastructure

Enabling fantastic science from the Australian research community

What is NCI?

World-class, high-end supercomputer and data services

- NCI is the premier facility in Australia for:
 - High-performance computing
 - Cloud computing
 - National reference data collections
 - Data services
- We support over 5000 Australian researchers
- We enable research that informs policy
- We deliver outcomes with national benefits



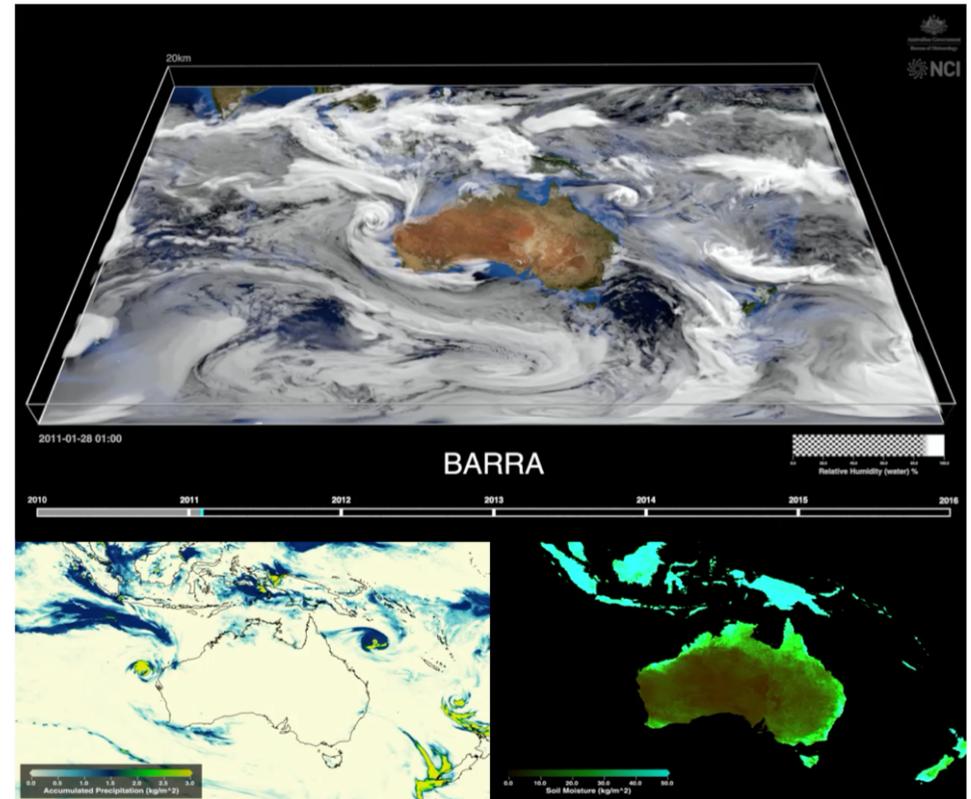
Where are we located?



Why do we need this?

World-class, high-end supercomputer and data services

- Supercomputers are useful when experiments are:
 - **Too small** (nanotechnology)
 - **Too large** (oceans modelling, genomics)
 - **Too short** (fundamental physics)
 - **Too long** (climate science)
 - **Too expensive** (vehicle design)
 - **Too dangerous** (nuclear technology)



How is NCI funded?

World-class, high-end supercomputer and data services

NCI is funded directly by the Australian Government, through the Department of Education, Skills and Employment's National Collaborative Research Infrastructure Strategy (NCRIS).



Australian Government
Department of Education,
Skills and Employment



**Australian
National
University**



Australian Government
Bureau of Meteorology



Australian Government
Australian Research Council

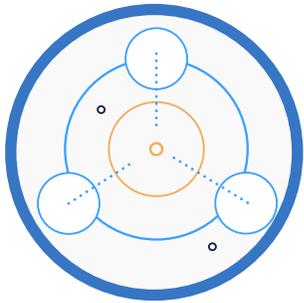


Australian Government
Geoscience Australia

NCI has been largely supported by its Foundation Collaborators since 2007.

Spectrum of Science

FUNDAMENTAL



- Physics
- Chemistry
- Mathematics
- Astronomy

STRATEGIC



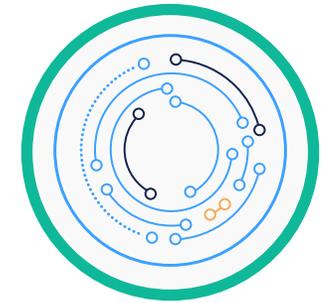
- Environment
- Medical
- Geoscience
- Agriculture
- Materials

APPLIED



- Weather forecasting
- Extreme weather
- Material design
- Disaster management and mitigation

INDUSTRY



- Hydrological modelling
- Medical research institutes



How does NCI enhance Australian research?

What is Gadi?

High-performance computing

- Australia's fastest research supercomputer
 - 9.26 petaflops (over nine quadrillion calculations/second)
 - #24th fastest in the world on debut (currently #27)
 - Over seven times faster than its predecessor
- Gadi is made up of 3024 CPU nodes, and 160 GPU nodes
 - 6048 Intel Cascade Lake CPUs, 180,000+ cores
 - 640 NVIDIA V100 GPUs



Data co-location

And why is it important?

- The Gadi supercomputer is located next to Australia's fastest file systems
- 50+ petabytes is stored and managed on site at NCI
 - 50,000,000 gigabytes, or more than 800 years of Netflix!
- Storage is available to researchers using Gadi via 100 gigabit/second network links
 - 1000 times faster than 'top tier' residential NBN services
- Unique for Australia, this setup enables researchers to perform research that would otherwise be impossible.



Enabling time-critical research to develop COVID-19 treatments

- Gadi supports four Australian research groups investigating COVID-19
- Researchers are simulating protein structures, human cell receptors, future potential pandemics
- NCI was able to provide 40 million compute hours at very short notice

"NCI's new Gadi supercomputer is the only supercomputer in the Southern Hemisphere powerful enough to do these simulations."

- Professor Megan O'Mara, The Australian National University

Supporting climate research nationally and internationally

- NCI is home to CMIP6, a multi-petabyte climate modelling resource used by the Intergovernmental Panel on Climate Change (IPCC)
- CMIP6 informs researchers from more than a dozen different research organisations across Australia
- Some of the data is relevant globally, connecting NCI to the global research community
- NCI is the only facility of its kind in Australia that can support the intensive data analysis and simulation that CMIP6 requires

“CMIP6 is the most comprehensive suite of climate science experiments ever conceived. We hammer the NCI peak-system... Gadi is a credit to Australia.”

- Dr Simon Marsland, CSIRO

Reducing the risk of ship grounding in real time

- Global not-for-profit water and maritime engineering organisation DHI is using NCI to model currents and waves to understand the risks of ships coming aground on the Australian coast
- Ships going aground often cause a lot of damage, have the potential to create oil spills and are expensive to rescue.
- Working with the Australian Maritime Safety Authority (AMSA), DHI is trying to help them understand where the risk of ships going aground is the greatest.
- DHI needs to forecast what waves and currents are doing in the ocean at a continental scale, requiring an enormous amount of compute.



“Working with NCI has allowed us to model longer and wider than we ever have before... DHI are envisioning an even stronger partnership with NCI in the future.”

- Simon Mortesen, DHI Group Executive for Port and Navigation

Protecting lives and property from extreme bushfire

- UNSW researchers used Gadi to discover an unknown mode of fire propagation
- Simulations were derived from existing data (2003 Canberra bushfires), numerical weather prediction models and computational fluid dynamic (CFD) models
- Research into bushfire behaviour may aid communities and firefighters during catastrophic fire conditions
- The research could not have been completed within a reasonable timeframe without the Gadi supercomputer

"The facilities and support at NCI are critically important for the core research of our group."

- Professor Jason Sharples, UNSW Canberra

Reprocessing genomic datasets

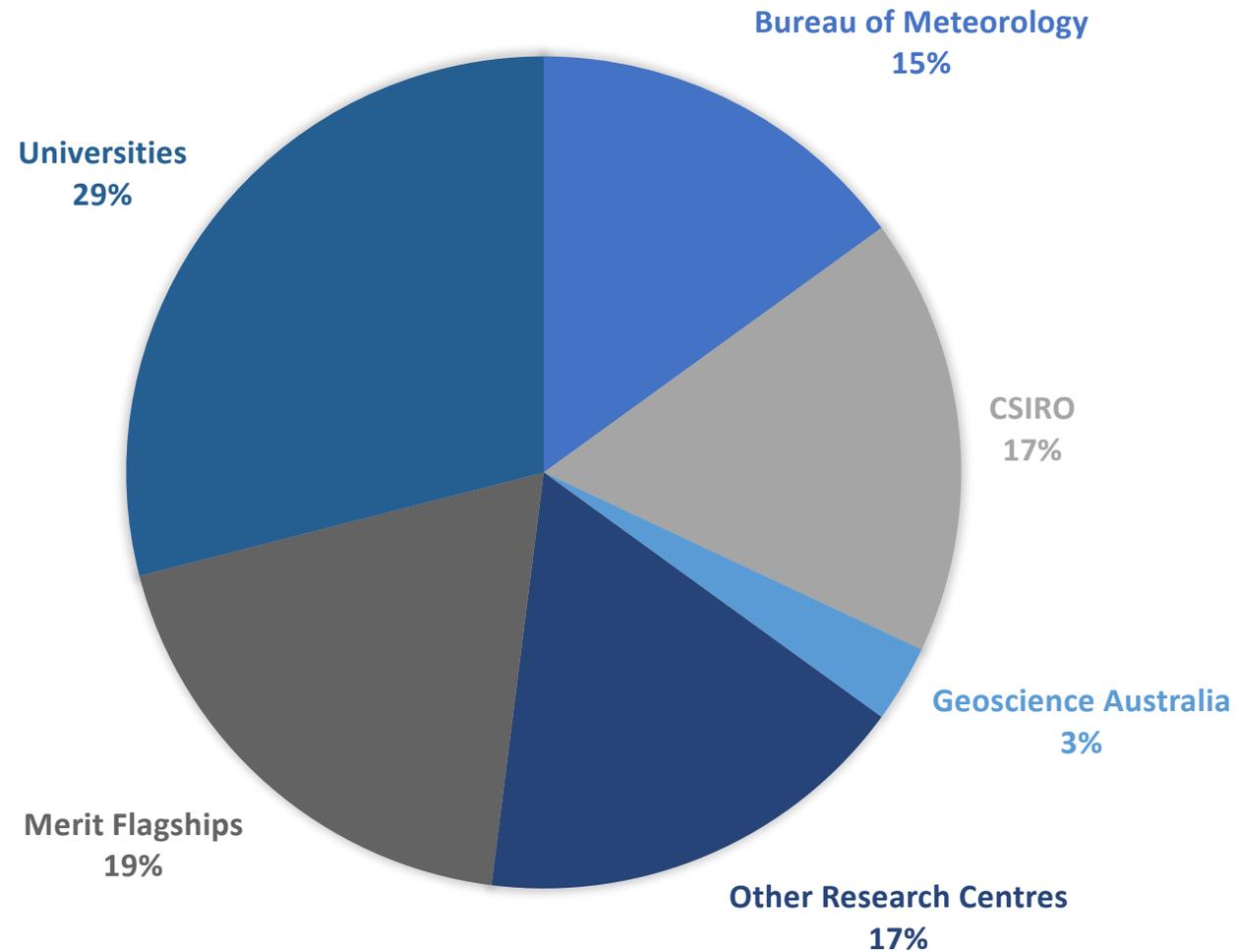
- Garvan Institute of Medical Research uses NCI for reprocessing of human genomes
- 4,000 anonymous genomic samples of healthy seniors are processed and stored at NCI as part of the Medical Genome Reference Bank (MGRB)
- These 4,000 samples can be easily processed at NCI in one batch using HPC
- Reprocessing is needed to further refine the sample and produce a more accurate representation of a healthy human
- The MGRB can be compared against the sequenced genome samples of those seeking treatment



"Aligning that many genomes in one night is a clear demonstration of might of the NCI computational capacity - that couldn't have been done elsewhere in Australia."

- Dr Dan Andrews, Program Manager AGHA

HPC resource usage by organisation



How does NCI support its user community?

- Previous in-person training events are now offered online (Zoom etc)
- Extensive technical documentation available online
- User support services to assist researchers in running and fine-tuning their research
- Enviably 'system uptime', employing industry best practices to maintain system reliability and ensure research takes place 24/7/365
- NCI staff assist users with code optimisation and enhancement to improve and expedite research
- Development of tools, virtual environments and scientific visualisations to further aid researchers



What's to come?

Australian HPC beyond 2021



NCI Contacts



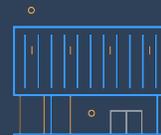
General enquiries: +61 2 6125 9800
Media enquiries: +61 2 6125 4389



Support: help@nci.org.au



Email: nci.communications@anu.edu.au



Address

NCI, ANU Building 143
143 Ward Road
The Australian National University
Canberra ACT 2601

License

