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Building Nationally-Focussed, Globally Federated, High Performance Earth Science Platforms to Solve Next Generation Social and Economic Issues.

Lesley Wyborn (1), Ben Evans (1), Clinton Foster (2), Timothy Pugh (3), and Alfred Uhlherr (4)

(1) National Computational Infrastructure, Australian National University, Canberra, Australia, (2) Office of the Chief Scientist, Geoscience Australia, Canberra, Australia, (3) Bureau of Meteorology, Melbourne, Australia, (4) CSIRO, Melbourne, Australia

Digital geoscience data and information are integral to informing decisions on the social, economic and environmental management of natural resources. Traditionally, such decisions were focused on regional or national viewpoints only, but it is increasingly being recognised that global perspectives are required to meet new challenges such as predicting impacts of climate change; sustainably exploiting scarce water, mineral and energy resources; and protecting our communities through better prediction of the behaviour of natural hazards.

In recent years, technical advances in scientific instruments have resulted in a surge in data volumes, with data now being collected at unprecedented rates and at ever increasing resolutions. The size of many earth science data sets now exceed the computational capacity of many government and academic organisations to locally store and dynamically access the data sets; to internally process and analyse them to high resolutions; and then to deliver them online to clients, partners and stakeholders.

Fortunately, at the same time, computational capacities have commensurately increased (both cloud and HPC): these can now provide the capability to effectively access the ever-growing data assets within realistic time frames. However, to achieve this, data and computing need to be co-located: bandwidth limits the capacity to move the large data sets; the data transfers are too slow; and latencies to access them are too high.

These scenarios are driving the move towards more centralised High Performance (HP) Infrastructures. The rapidly increasing scale of data, the growing complexity of software and hardware environments, combined with the energy costs of running such infrastructures is creating a compelling economic argument for just having one or two major national (or continental) HP facilities that can be federated internationally to enable earth and environmental issues to be tackled at global scales. But at the same time, if properly constructed, these infrastructures can also service very small-scale research projects.

The National Computational Infrastructure (NCI) at the Australian National University (ANU) has built such an HP infrastructure as part of the Australian Government's National Collaborative Research Infrastructure Strategy. NCI operates as a formal partnership between the ANU and the three major Australian National Government Scientific Agencies: the Commonwealth Scientific and Industrial Research Organisation (CSIRO), the Bureau of Meteorology and Geoscience Australia. The government partners agreed to explore the new opportunities offered within the partnership with NCI, rather than each running their own separate agenda independently. The data from these national agencies, as well as from collaborating overseas organisations (e.g., NASA, NOAA, USGS, CMIP, etc.) are either replicated to, or produced at, NCI.

By co-locating and harmonising these vast data collections within the integrated HP computing environments at NCI, new opportunities have arisen for Data-intensive Interdisciplinary Science at scales and resolutions not hitherto possible. The new NCI infrastructure has also enabled the blending of research by the university sector with the more operational business of government science agencies, with the fundamental shift being that researchers from both sectors work and collaborate within a federated data and computational environment that contains both national and international data collections.