Developing next generation ocean modelling techniques

Hartree Centre
Science & Technology Facilities Council

The STFC Hartree Centre's supercomputing capabilities and expertise are helping the GOcean project investigate next generation ocean modelling software.

Challenge

The ever-increasing computational power of the supercomputing landscape means that effective use of next generation computer architectures for ocean modelling is critical if the UK is to maintain its world-leading position in ocean science.

Existing ocean models must adapt to run efficiently on new supercomputers to remain relevant, and those which adapt fastest will have a substantial competitive advantage. Adapting existing models, such as NEMO (the ocean model used widely in Europe, including the UK Met Office), however, is time-consuming and resource intensive. The extensive modification of such a code could potentially amount to rewriting it. Furthermore, modifying a code to run efficiently on one supercomputer does not mean it will run efficiently on another, so it may require another major rewrite when a new supercomputer becomes available.

Solution

GOcean is a collaborative project between STFC and the NERC National Oceanography Centre. The project meets the challenge of adapting ocean models to run efficiently on new supercomputers by separating the model code into layers, with each layer having a different responsibility. This separation, originally developed in the GungHo climate and weather modelling project, allows science developers to concentrate on coding the science and computer scientists to concentrate on improving the performance of the code. This means both parties can work simultaneously without either affecting the other, since each is working on a different layer.

Benefits

Representative ocean benchmark codes have been developed and tested. Results show that, by changing only the performance layer of the code, the benchmarks can run efficiently on new architectures available at the Hartree Centre, thereby allowing such codes to be more quickly adapted. Further tests will evaluate the energy efficiency of these codes.

This approach therefore opens up the possibility of running ocean models on future machines faster, more energy efficiently and at higher resolution, potentially leading to greater accuracy in ocean prediction.

"As part of our Energy Efficient Computing Programme, the GOcean project demonstrates how software optimisation can positively impact on energy efficiency, portability and sustainability. Code modernisation that encompasses portability and energy efficiency as well as outright speed is essential to the future of large scale complex simulation ."

– **Neil Morgan, Energy Efficient Computing Programme, Hartree Centre**

Work with us

We collaborate with industrial clients and research partners on projects that create insights and value using high performance computing, big data analytics, simulation and modelling.

By combining our world-class facilities with access to our specialists and computational scientists, we can enable your organisation to produce better outcomes, products and services more quickly and cost-effectively than through conventional R&D workflows.

With our partners we are developing the next generation of supercomputing architectures and software, combining existing best practice with innovation to deliver faster, cooler and more sustainable solutions capable of meeting the challenges of data intensive computing.

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