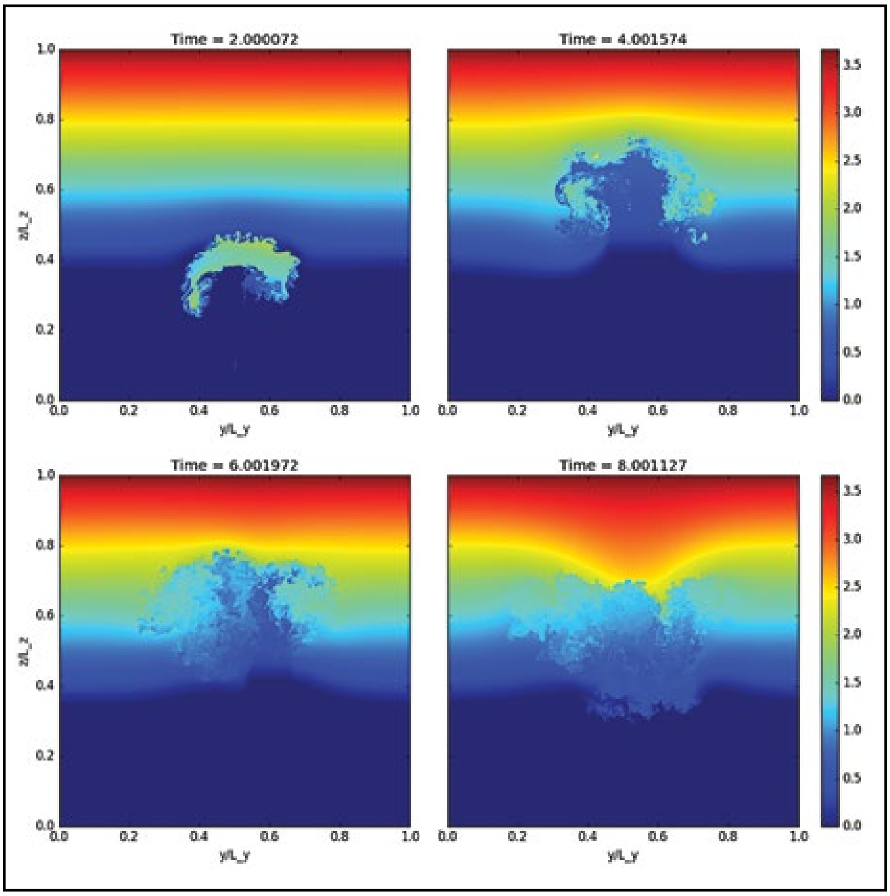
IMPROVING CLOUD MODELLING FOR BETTER WEATHER AND CLIMATE PREDICTION

The turbulent behaviour of clouds is the reason for many of the uncertainties in weather and climate prediction. Researchers at the University of St Andrews and University of Leeds have worked with staff at EPCC to develop software which allows vastly improved computational modelling of clouds.

Current weather and climate models struggle to resolve the complex details of the interactions between clouds and their environment.

A team of researchers from the University of St Andrews and University of Leeds had previously developed a new numerical model, MPIC (Moist Parcel-In-Cell), which deals with the dynamics of clouds. These researchers have now incorporated this code into a community code used by atmospheric scientists around the UK, the MONC (Met Office NERC Cloud) framework.

The resulting new PMPIC (Parallel Moist Parcel-In-Cell) code can now be run on many thousands of processors on supercomputers such as ARCHER. Compared to the original MPIC code, this permits much larger simulations to be carried out, allowing the dynamics of the cloud to be resolved in much greater detail. This is particularly important at the edge of the cloud, where evaporation of cloud droplets and the difference in velocity between the cloud and its environment create turbulence.



Example evolution of the buoyancy in a simulation with 864^3 grid cells

By adopting and building on the existing MONC framework, the researchers aimed to make MPIC easy for the UK weather and climate communities to adopt. The MONC community is the first in the world to benefit from access to an atmospheric model based on this novel methodology.

Improvements made to the MPIC codebase have also led to the code running significantly faster. The new code is widely adaptable and could in future be used to model other aspects of the atmosphere, including atmospheric chemistry and the behaviour of rain and snow. It could also be applied to other fields of research, including ocean modelling, astrophysics, and modelling of gravity currents.

Reference:

This work was carried out in an ARCHER eCSE project
(A fully Lagrangian dynamical core for the Met Office NERC Cloud Model: https://www.archer.ac.uk/community/eCSE/eCSE12-10/eCSE12-10.php).

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About ARCHER

ARCHER is the UK National Supercomputing Service. The service is provided to the UK research community by EPSRC, UoE HPCx Ltd and its subcontractors: EPCC and STFC's Daresbury Laboratory, and by Cray Inc. The Computational Science and Engineering (CSE) partners provide expertise to support the UK research community in the use of ARCHER. The ARCHER CSE partners are EPSRC and EPCC at the University of Edinburgh.

The eCSE Programme

The Embedded CSE (eCSE) programme provides funding to the ARCHER user community to develop software in a sustainable manner to run on ARCHER. Funding enables the employment of a researcher or code developer to work specifically on the relevant software to enable new features or improve the performance of the code.

The Case Study Series

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