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The sensitivity of ocean-sea ice models to resolution using ACCESS-OM2

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The fidelity of ocean-sea ice models is a strong function of model resolution. Higher resolution models can result in improved representation of mesoscale eddies, more realistic boundary currents, better sea ice climatology and smaller biases from the observed model state. However, higher resolution also comes at computational cost which limits the ability to tune, test and optimise the model state.

In this presentation we will introduce a new version of the ocean-sea ice implementation of the Australian Community Climate and Earth System Simulator, ACCESS-OM2. The model is available at three different resolutions: a coarse resolution (nominally 1°), an eddy-permitting resolution (0.25°) and an eddy-rich resolution (0.1° with 75 vertical levels). The different resolutions have been developed simultaneously, both to allow testing at lower resolution and to permit comparison across resolutions.

We use this model to outline the challenges and benefits associated with enhancing both the horizontal and vertical resolution of this model. At the highest resolution tested here, the model has an improved overturning circulation, particularly in the abyssal ocean, and better representation of regions where fine scales are important such as the Southern Ocean, the Indonesian Throughflow and in the separation of Western Boundary Currents. However, this model is overly sensitive to runaway convection under some forcing scenarios, and degrades subsurface Equatorial currents in some regions. At lower resolutions there are continuing challenges in controlling convective processes and adequately accounting for mesoscale effects. The vertical resolution helps to control both the heat uptake and wind stress forcing at all resolutions.