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Assessing the sensitivity to horizontal resolution and to the representation of convection of Unified Model simulations of the Indian Monsoon.

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At the UK Met Office the Unified Model is used operationally for both global and limited area numerical weather prediction. The current global model has a horizontal resolution of 25 km whilst the finest resolution limited area model for the UK region, known as the UKV, has a grid length of 1.5 km. In the former, atmospheric convection is parametrized whilst in the latter it is represented explicitly.

In this study the above two model configurations have been used to simulate a 3 week period of the 2011 Indian Monsoon. Both configurations have been run in limited area mode at a range of horizontal resolutions, with all simulations spanning the same 4500 km x 4500 km domain. The UKV-like explicit-convection configuration was run at resolutions ranging from 1.5 km up to 12 km, whilst the global-like parametrized-convection configuration was run at resolutions ranging from 120 km down to 4 km. Thus these simulations explore the sensitivity to horizontal resolution of both the explicit and parametrized convection configurations. Furthermore, for horizontal resolutions of 4 km, 8 km and 12 km both parametrized and explicit convection simulations have been performed which enables the sensitivity to the representation of convection to be assessed independent of the horizontal resolution.

In this presentation these simulations are compared to each other and to observations in order to assess their respective skill simulating the Indian Monsoon. The results presented focus on the analysis of the surface rainfall which is assessed in terms of both the spatial distribution and the diurnal cycle. As part of this analysis the degree to which the desirable result, that increased resolution (which enables the representation of convection to be explicit) leads to reduced errors, is discussed. Furthermore, the degree to which the errors in the coarser resolution simulations are attributable to the convection parametrization, rather than the coarser resolution itself, is assessed. Finally, by comparing diagnostics such as parametrized heating profiles in the explicit and parametrized convection models, potential ways of improving the convection parametrization are proposed.