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Project acronym: ENSEMBLES

Project title: ENSEMBLE-based Predictions of Climate Changes and their Impacts

Instrument: Integrated Project

Thematic Priority: Global Change and Ecosystems

M2A.3.4 Interim report on the impact of increased resolution on the mean climate and variability by UREADMM

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Organisation name of lead contractor for this deliverable: UREADMM

Revision [1]

Project co-funded by the European Commission within the Sixth Framework Programme (2002-2006)		
Dissemination Level		
PU	Public	✓
PP	Restricted to other programme participants (including the Commission Services)	
RE	Restricted to a group specified by the consortium (including the Commission Services)	
CO	Confidential, only for members of the Consortium (including the Commission Services)	

WP2A Milestone 2A.3.4: Interim report on the impact of increased resolution on the mean climate and variability by UREADMM (Month 36)

The development and basic evaluation of the UK's new high resolution global coupled model, HiGEM, has been completed. HiGEM is based on the latest climate configuration of the Met Office Unified Model, HadGEM1. In HiGEM, the horizontal resolution has been increased to 1.25º x 0.83º in longitude and latitude for the atmosphere, and 1/3º x 1/3º globally for the ocean. Multi-decadal integrations of HiGEM, and the lower resolution HadGEM, are used to explore the impact of resolution on the fidelity of climate simulations.

Generally SST errors are reduced in HiGEM. Cold SST errors associated with the path of the North Atlantic drift improve, and warm SST errors are reduced in upwelling stratocumulus regions where the simulation of low level cloud is better at higher resolution. The ocean model in HiGEM allows ocean eddies to be partially resolved, which dramatically improves the representation of sea surface height variability. In the Southern Ocean, most of the heat transport in HiGEM is achieved by resolved eddy motions, which replaces the parametrised eddy heat transport in the lower resolution model. HiGEM is also able to more realistically simulate small-scale features in the windstress curl around islands and oceanic SST fronts, which may have implications for oceanic upwelling and ocean biology.

Higher resolution in both the atmosphere and the ocean allows coupling to occur on small spatial scales. In particular the small scale interaction recently seen in satellite imagery between the atmosphere and Tropical Instability Waves in the Tropical Pacific Ocean is realistically captured in HiGEM. Tropical instability waves play a role in improving the simulation of the mean state of the Tropical Pacific which has important implications for climate variability. In particular all aspects of the simulation of ENSO (spatial patterns, the timescales at which ENSO occurs, and global teleconnections) are much improved in HiGEM.