



Preliminary evaluation of a new developed regional coupled atmosphere-ocean model system for Irish Waters

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In recent years, uncertainties in climate model projections have become of great interest because a wide range of future projection have become available from a combination of various emission scenarios and different climate models. The quality of the future projections of climate change depend critically on the ability of the Global and Regional Climate Models to reproduce the present-day climate. Due to the coarse resolution of global models, high-resolution regional studies are essential for impact studies and adaptation strategies in Ireland. Particularly, the representation of extreme events requires us to use high-resolution Regional Climate Models (RCMs). Moreover, the interaction between the atmosphere and ocean has to be included in RCMs in a more sophisticated way; this is especially important for accurately reproducing the climate over Ireland, which is surrounded by the Atlantic Ocean and Irish Sea.

The RCA_NEMO model, an interactive flux coupled regional atmosphere-ocean model was developed in this study. This model, which combines two well-known components, the Rossby Center regional climate model (RCA) and the ocean model NEMO, together with the OASIS3 coupler, is fully parallel and can introduce the interaction between the atmosphere and ocean into climate simulations in a sophisticated manner.

The model has been demonstrated to run long simulations (1960-1990) without flux correction. The monthly mean value between 1961 and 1990 is fully evaluated against analysis/observations. Mean sea level pressure, which is strongly associated with cyclone activity, has been reproduced well by both models, except in April. The atmosphere-only run has a weaker pressure gradient over Ireland. Comparing the output with the UKCIP observational data, the coupled model more accurately represents the climate of Ireland. Not only are the basic characteristics reproduced by the coupled run; the wet bias in the midlands and the dry bias in the southwest of Ireland are also decreased in the coupled run. Although there is no simple relationship between the monthly mean precipitation and extreme events, the heavy precipitation events over land has been improved by the coupled model, too. The coupled model has different performance at different times of the year. The 2 metre temperature has been slightly overestimated by the coupled model in wet months (January and October). However, the 2 metre temperature has been improved in the dry season (April and July).

In conclusion, the coupled RCA_NEMO model is an effective way to accurately reproduce the current climate of Ireland. Further improvements will be developed in the next stage of this research, and will be used to investigate climate change in Ireland under a range of different climate scenarios.