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Large-scale freshwater transport in the Hadley Centre global environmental model HadGEM1

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The global hydrological cycle is one of the key elements of the Earth system. It influences climate through a great variety of processes and plays an important role in the heat budget of our planet, especially through the greenhouse effect of water vapour. Changes in precipitation, evaporation or river runoff may have serious effects for societal activities and a good understanding of the current and future hydrological cycle is necessary for planning purposes. An accurate representation of the global water cycle in climate models is therefore crucial for reliable climate change predictions.

In this work we present results from an investigation on the large-scale aspects of moisture transport in the atmosphere modelled by the new version of the Hadley Centre global environmental model HadGEM1. Global characteristics of water vapour transport are compared with the previous coupled model, HadCM3, and climatologies produced from the ERA-40 reanalysis project.

We estimate integrated surface freshwater forcings $(P - E + R)$ to different ocean basins, based on water vapour transports across boundaries of those basins, taking account of the adjoining land areas which drain into the basins. Using this diagnostic we are able to obtain observational constraints of those forcings from atmospheric reanalysis and evaluate the freshwater forcings in the model. We discuss implications of these results for predictions of the Thermohaline Circulation response to anthropogenic forcing.