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NCAS Science Highlight

Improving atmospheric moisture transport over land in global climate models

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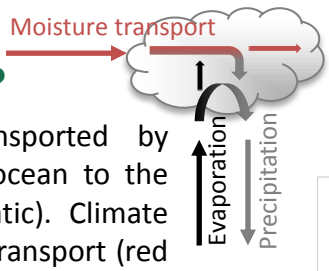

What are the new findings?

Atmospheric moisture is mostly transported by cyclones and weather fronts from the ocean to the land where it precipitates (see schematic). Climate models tend to underestimate moisture transport (red dots on figure) because they do not have the spatial resolution (pixels) required for simulating such fine scale weather events. They exaggerate evaporation (black dots) to compensate for the lack of moisture transport. We found that models need pixels smaller than 50 km to simulate moisture transport over land realistically (black circles get closer to grey bar).

Why are these findings important?

Intergovernmental Panel on Climate Change (IPCC) models span resolutions of 100 to 300 km. Such resolutions are not fine enough for simulating atmospheric moisture transport properly. A finer pixel size can improve models' ability to simulate the frequency and intensity of extreme rainfall events, such as floods over the UK. Finding that we need pixels of 50 km in global climate models is an essential result for determining the pixel size that will be used in the next-generation Earth System models for the IPCC.

How did we discover this?

We used two global atmospheric climate models, HadGEM1-A and HadGEM3-A developed by the UK Met Office, and refined their pixels from 270 to 25 km. We performed several simulations of 25 years to assess the robustness of our results (shown by the error bars in the figure that indicate the spread of the results; the dots indicate their average).

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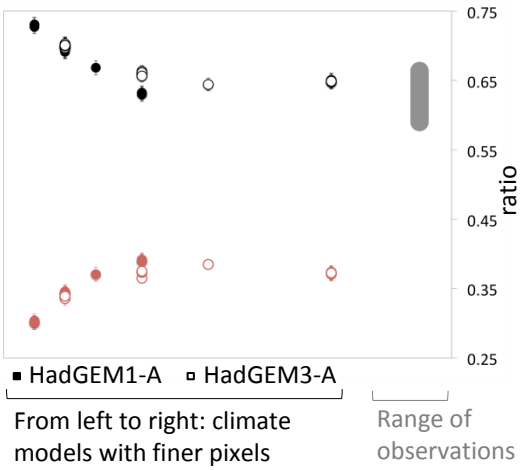
Marie-Estelle Demory is a research scientist at NCAS-Climate. Her research focuses on high-resolution climate modelling and the hydrological cycle



Above: Ratio of evaporation to precipitation (black), ratio of moisture transport to precipitation (red) over land. Models with finer pixels are closer to observations.

Find out more:

- See Marie-Estelle's webpage
- Email m.e.demory@reading.ac.uk
- Take a look at the journal article

Demory, M.-E., et al. (2013) The role of horizontal resolution in simulating drivers of the global hydrological cycle. Climate Dynamics doi: 10.1007/s00382-013-1924-4

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