Models move from brain to rain

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Photo of a monsoon in Mumbai. Credit: Planemad via Wikimedia Commons.

(Phys.org)—One of climate scientists' key ambitions is to predict future climate change more accurately. They create incredibly detailed computer models, but even these cannot calculate all the infinite detail of the real climate.

The inevitable approximations they have to make mean that when it comes to rainfall - one of the most important, yet tricky, aspects of climate - different models seem to say very different things.

But what if, fundamentally, they're not so different?

What if they all agree that a monsoon will become wetter in future years; it's just that they disagree on the time of year that the monsoon will appear and where exactly it tends to pass over?

'Each model is a bit like a photograph of the same object taken from a slightly different angle,' Adam Levy from Oxford University's Department of Physics tells me. 'If you simply overlaid them they wouldn't match up in many places, but if you can adjust for the different perspectives – of monsoons coming a month or two earlier or later or shifting a bit further south or north - many of the differences between models might just melt away.'

Adam is part of an Oxford University team that recently reported in Geophysical Research Letters a new way of applying techniques used to analyse human brains to climate models.

In medical imaging, researchers use mathematical techniques to work out the relationships between anatomical regions of the brain that can look different in different patients – something that needs to be adjusted for so that the images 'fit' and they can spot common symptoms or patterns.

In their new approach the Oxford team applied these techniques to 14 of the latest global climate models, first transforming the historical simulations generated by these models so that they lined up better with observations, and then applying these transforms to the models' predictions to see how this affected their agreement on future rainfall.

To do this, the team have worked in collaboration with medical image analysis researchers in the Oxford Centre for Functional MRI of the Brain (FMRIB).

'Climate models seem to disagree about rainfall quite a lot, which is a huge problem, as changes in rainfall will have bigger human impact than many other aspects of climate change. What we found, though, was that when we transformed the models using our technique, was that we had managed to iron out a substantial part of the disagreement,' Adam explains.

The transformation increased agreement between the models by an average of 15%, although some areas saw more benefits than others. Overall there was increased agreement across 66% of the globe about rainfall patterns. This first test run used an extreme climate scenario in which unabated carbon dioxide emissions have quadrupled atmospheric levels. However, the plan is to apply the technique to more realistic and subtle simulated scenarios.

The team are currently working on dedicated software which takes into account the many ways that climate models differ from brains - for instance in being wrapped around a sphere as opposed to a 3D 'image' of a subject's brain - to create tools tailored to this new application.

'The long-term goal is to be able to make accurate predictions of how climate change will affect average rainfall at a given time, at a given location on the globe,' says Adam.

Such techniques could give us a much clearer picture of what climate models are really saying about how rainfall patterns are likely to change – and this could help to ease the strain on the brains of policy makers trying to plan for our planet's future.

More information: onlinelibrary.wiley.com/doi/10 …

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Provided by Oxford University

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