Assessing the impact of climate change on a global scale

December 16 2013

Thirty research teams in 12 different countries have systematically compared state-of-the-art computer simulations of climate change impact to assess how climate change might influence global drought, water scarcity and river flooding in the future.

What they found was:

- The frequency of drought may increase by more than 20 per cent in some regions.
- Without a reduction in global greenhouse-gas emissions, 40 per cent more people are likely to be at risk of absolute water scarcity.
- Increases in river flooding are expected in more than half of the areas investigated.
- Adverse climate change impacts can combine to create global 'hotspots' of climate change impacts.

Dr Simon Gosling from the School of Geography at The University of Nottingham co-authored four papers in this unique global collaboration. The results are published this week—Monday 16 December 2013—in a special feature of the *Proceedings of the National Academy of Sciences* (*PNAS*).

For the project—'Intersectoral Impact Model Intercomparison Project (ISI-MIP)'—Dr Gosling contributed simulations of global river flows to help understand how climate change might impact on global droughts,

water scarcity and river flooding.

Dr Gosling said: "This research and the feature in *PNAS* highlights what could happen across several sectors if greenhouse gas emissions aren't cut soon. It is complementary evidence to a major report I jointly-led with the Met Office that estimated the potential impacts of unabated climate change for 23 countries. Those reports helped major economies commit to take action on climate change that is demanded by the science, at the 17th UN Climate Change Conference of the Parties (COP17) in Durban."

One of the papers1 reports a likely increase in the global severity of drought by the end of the century, with the frequency of drought increasing by more than 20 per cent in some regions—South America, Caribbean, and Central and Western Europe.

This in turn has an impact on water scarcity. Another paper2 co-authored by Dr Gosling shows that without reductions in global greenhouse-gas emissions, 40 per cent more people are likely to be at risk of absolute water scarcity than would be the case without climate change.

Dr Gosling said: "The global-level results are concerning but they hide important regional variations. For example, while some parts of the globe might see substantial increases in available water, such as southern India, western China and parts of Eastern Africa, other parts of the globe see large decreases in available water, including the Mediterranean, Middle East, the southern USA, and southern China."

Another paper3 in the *PNAS* feature found that while river flooding could decrease by the end of the century across about a third of the globe, increases are expected at more than half of the areas investigated, under a high greenhouse gas emissions scenario.

Dr Gosling said: "More water under climate change is not necessarily always a good thing. While it can indeed help alleviate water scarcity assuming you have the infrastructure to store it and distribute it, there is also a risk that any reductions in water scarcity are tempered by an increase in flood hazard."

The ISI-MIP team describe how adverse climate change impacts like flood hazard, drought, water scarcity, agriculture, ecosystems, and malaria can combine to create global 'hotspots' of climate change impacts4. The study is the first to identify hotspots across these sectors while being based on a comprehensive set of computer simulations both for climate change and for the impacts it is causing. The researchers identified the Amazon region, the Mediterranean and East Africa as regions that might experience severe change in multiple sectors.

The findings of the ISI-MIP are amongst the scientific publications that feed into the Intergovernmental Panel on Climate Change (IPCC) Working Group II report on climate change impacts to be presented in March 2014. The IPCC Working Group I report on physical climate science was published in September 2013.

Dr Gosling's 23-volume report, Climate: observations, projections and impacts5, commissioned by the Department of Energy and Climate Change (DECC), which he jointly led with the UK Met Office, addressed an urgent international need for scientific evidence on the impact of climate change to be presented in a consistent format for different countries, particularly those that lack an adequate research infrastructure, to facilitate valid international comparisons. Since COP17, the research has prompted governments to re-consider their options for adapting to climate change.

He said: "I think the results presented in the *PNAS* special feature have the potential for similar impact".

More information: 1. Prudhomme, C., et al. (2013): Hydrological droughts in the 21st century: hotspots and uncertainties from a global multi-model ensemble experiment. *Proceedings of the National Academy of Sciences* (early online edition)

2. Schewe, J., et al. (2013): Multi-model assessment of water scarcity under climate change. *Proceedings of the National Academy of Sciences* (early online edition) www.pnas.org/cgi/doi/10.1073/pnas.1222460110

3. Dankers, R., et al. (2013): First look at changes in flood hazard in the Inter-Sectoral Impact Model Intercomparison Project ensemble. *Proceedings of the National Academy of Sciences* (early online edition)

4. Piontek, F., et al. (2013): Multisectoral climate impact hotspots in a warming world. *Proceedings of the National Academy of Sciences* (early online edition) [DOI: 10.1073/pnas.1222471110]

5. Met Office (2011) Climate: observations, projections and impacts (23 volumes).

Provided by University of Nottingham