Aggressive mitigation policy could halve climate-related impacts on exposure to water scarcity by 2100

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(PhysOrg.com) -- In a paper highlighted in *Nature Climate Change* today, Nigel Arnell, Director of the Walker Institute for Climate System Research at the University of Reading, and colleague Detlef van Vuuren from the Netherlands Environmental Assessment Agency found that stringent measures to reduce greenhouse gas emissions could half the adverse impacts of climate change on water scarcity by 2100, although some models suggest impact reductions as low as 15%. The large range exists because climate models do not agree on exactly how rainfall will change in the future.

This study is the first to consider how climate change impacts on water scarcity are reduced if warming is kept below 2 degrees C, compared with a scenario in which global temperatures increase by 4 degrees C by 2100. International climate negotiations are focused on a target which keeps global temperature rise below 2 degrees.

Professor Arnell said: "Our results show that stringent measures to reduce greenhouse gas emissions help to reduce the adverse effects of climate change on water scarcity, but they by no means remove the impacts altogether. So, adapting to the climate change we can't avoid is as necessary as mitigation measures to reduce greenhouse gas emissions.

"The absolute numbers and locations of people affected vary considerably across the four climate models used in the study."

Even without the effects of climate change, as much as 40% of the world's population will be living under water scarce conditions by 2020. Climate change is expected to influence future water scarcity through regional changes in precipitation and evaporation. Most climate models suggest rainfall is likely to decrease in the subtropics and increase in mid-latitudes and some parts of the tropics, although details vary.

In some water-scarce parts of the world (eg parts of Asia), rainfall is projected to increase under climate change and this could lessen problems of water scarcity (but possibly also bring an increase in flood risk). In these areas, the mitigation scenario could actually reduce the amount of extra water potentially available.

The research, undertaken as a part of the EU-funded ADAM project, compares a 'business as usual' scenario which leads to an increase in global mean temperature of 4 degrees C by the end of the 21st Century with a mitigation scenario which assumes policies to reduce greenhouse gas emissions and leads to a warming of 2 degrees C by 2100. The emission reductions are achieved by using energy more efficiently, increased use of renewable and nuclear power, increased use of carbon capture and storage and reducing other non-CO2 greenhouse gases. As a result, global emissions of greenhouse gases continue to grow until around 2020 and then decrease rapidly to 2100.

The part of the study just published takes the results from four climate models and feeds the results through a hydrological model which simulates river flow. From river flow the authors calculate two indicators of water availability: one which measures amount of water per person and one which measures the ratio of water used to water available. These measures give an indication of exposure to water stress and assume no adaptation.

More information: Arnell, N.W., van Vuuren, Detlef P., Isaac, M.,

The implications of climate policy for the impacts of climate change on global water resources. *Global Environmental Change* doi:1.1016/j.gloevncha.2011.01.015 (2011).