The effects of country-level population policy for enhancing adaptation to climate change.

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The authors should be commended for producing an interesting and engaging manuscript, and particularly their attempts to jointly consider the effects of climatic and socio-economic change on future water resources. However, the work significantly lacks depth at present, especially in terms of addressing uncertainties in the results and presenting analysis of the drivers of change. These points, along with several others, are outlined below. I sincerely hope that the authors take these on board, as I feel that the end product will be a highly sought after and citable paper, of use to both academics, water managers and demographers.

Major corrections:

Introduction:

The introduction does not provide a satisfactory overview of existing studies on global water resources. Rather, a discussion of population projections is provided, which forms too narrow an introduction to the study. A couple of useful references are suggested in due course (and the citations within should be followed-up) in order to provide a more rounded opening to the work.

Methodology:

The methods section is exceptionally brief, especially given the number of research tools and techniques employed. Even after having read the supplementary material, there are many questions which remain unanswered in the manuscript, such as:

- how are the population projections calculated?
- how are the climate projections calculated?
- what are the key similarities and differences between the four climate models used?
- what input data were used to fuel TRIP? This needs explicit consideration.
- how does TRIP actually work? As this is central to your research, a detailed section is required to explain the model assumptions and river routing techniques.
- what are the key similarities and differences between the IPCC socio-economic projections used?
- what are the key similarities and differences between each of the commonly used water stress indicators?

More meticulous description, explanation and justification of the methods and techniques used will help make this manuscript more robust.

Results and Analysis: *Uncertainties*

The results section is also very short (especially once the adjustments to section 3.3. have been made: see later comment). Given the concurrent use of multiple models, datasets and

projections, it is surprising that there is a paucity, in fact absence, of uncertainty analysis in this manuscript. A detailed and rigorous undertaking is required in this regard, in order to establish how 'valid' and 'reliable' these results are. Some suggestions follow.

It may well be the case that with the addition of error bars (or uncertainty envelopes) on each of the projections, that they overlap and are largely indistinguishable from one another – that's fine if this is the case, but it needs to be made explicitly clear in the findings.

The results presented at present imply uniform (un)certainty among various regions of the world. However, it is well known that this is not the case. Taking precipitation alone, there is huge variability in the estimates of future precipitation for certain parts of the world, especially for the wettest areas of course. This needs to be recognised through comparison of input datasets into your model, in order to establish the effect data errors and uncertainties impose on your findings and to understand which regions of the world your findings are most/least robust. Your manuscript will gain significant value through undertaking this improvement.

Results and Analysis: *Regional study*

While it is commendable that an attempt to consider so many variables is made, the global scale nature of the work does not lend itself to unpicking exactly what is going on with each of these key indicators through time. The reader sees the end product (a series of global scale maps and graphs, with some associated description), which causes the underlying patterns, and trends (which drive the 'headline' findings) to go unnoticed.

As a result, while I understand that the intention of the manuscript was for a global scale investigation, my request is that a particular region of the world is selected for a highly detailed case study to supplement this work. For example, an interesting choice could be China or India, where both the population and climate appear to be undergoing considerable change. Output and analysis (including uncertainty indicators) of the key population and climate drivers for the selected region will really aid the explanation of future hydrological change and thus provide a very useful document for informing water and population control managers. Understanding the drivers of socio-economic and climatic change in such regions is highly sought after and will make the manuscript attractive for significant volumes of citations. It seems that at present, the focus of the work has been to generate maps and graphs, without really tapping into what has caused these changes.

Abstract and Conclusions: naturally, once these additions and corrections have been implemented into the main body of the article, the abstract and conclusions should be adjusted accordingly.

<u>Minor corrections:</u>

Page 9241, line 4: This is a fairly biased opening to the article. Not *all* large scale water resource assessments project increasing water stress across the entire globe (e.g. Arnell *et al*., 2011; Murray *et al*., 2012). Please provide a more rounded view.

Arnell, N. W., van Vuuren, D.P. and Isaac, M. 2011, 'The implications of climate policy for the impacts of climate change on global water resources', *Global Environmental Change*, vol. 21, no. 2, p.592-603

Murray, S.J., Foster, P.N. and Prentice, I.C. 2012, 'Future Global Water Resources with respect to Climate Change and Water Withdrawals as estimated by a Dynamic Global Vegetation Model', *Journal of Hydrology*, vol. 448-449, p.14-29

Note: 'Arnell' is spelt incorrectly on many occasions.

Line 15+: It is implied that the approach to modelling population change is novel, due to the country-scale approach. However, the aforementioned citations provide outputs at the country and even grid-cell scale. This needs to be acknowledged.

Page 9242, final lines: The ending to the introduction sounds very strange. For example, what are 'low-regret measures'? Please reword this to be more orthodox-sounding. There are also several other 'unconventional' sentences which require rewording, such as "is well established in literature" (p. 9242, line 25) and "Therefore, adaptation to global climate and population changes is a need of the time" (p. 9241, line 5-6). In addition, I suggest that a native English speaker carefully proof reads and corrects the manuscript, in order to avoid such errors.

Results: how do these water stress results compare to those of other studies? Please provide at the very least a summarising table and a couple of paragraphs to explain any differences.

Section 3.3: This section requires moving to the introduction, as it provides no new results generated from this study. In fact, while important and worthy of retaining in this manuscript, it merely overviews the effects of population policies as documented in the academic literature. This would be better placed in the introduction, to form a foundation for the ensuing research.

Conclusions: please indicate areas where this research can be improved (building on the first paragraph on p.9250 in the form of an evaluation) and avenues for future research exploration on the basis of these findings.