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High water-stressed population estimated by world water resources assessment including human activities under SRES scenarios

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In an argument of the reduction and the adaptation for the climate change, the evaluation of the influence by the climate change is important. When we argue in adaptation plan from a damage scale and balance with the cost, it is particularly important. Parry et al (2001) evaluated the risks in shortage of water, malaria, food, the risk of the coast flood by temperature function and clarified the level of critical climate change. According to their evaluation, the population to be affected by the shortage of water suddenly increases in the range where temperature increases from 1.5 to 2.0 degree in 2080s. They showed how much we need to reduce emissions in order to draw-down significantly the number at risk. This evaluation of critical climate change threats and targets of water shortage did not include the water withdrawal divided by water availability. Shen et al (2008a) estimated the water withdrawal of projection of future world water resources according to socio-economic driving factors predicted for scenarios A1b, A2, B1, and B2 of the Special Report on Emission Scenarios (SRES). However, these results were in function of not temperature but time. The assessment of the highly water-stressed population considered the socioeconomic development is necessary for a function of the temperature. Because of it is easy to understand to need to reduce emission. We present a multi-GCM analysis of the global and regional populations lived in highly water-stressed basin for a function of the temperature using the socioeconomic data and the outputs of GCMs.

In scenario A2, the population increases gradually with warming. On the other hand, the future projection population in scenario A1b and B1 increase gradually until the temperature anomaly exceeds around from +1 to +1.5 degree. After that the population is almost constant.

From Shen et al (2008b), we evaluated the HWSP and its ratio in the world with temperature function for scenarios A1B, A2, and B1 by the index of W/Q. In global, the HWSP in scenario A2 increased rapidly when the anomaly of temperature is exceeding to about +1.5 degree. In the case of the scenario A1b, the gradient of increase of HWSP was less than that in the case of the scenario A2. When the value of temperature anomaly was exceeding to about + 1.5 degree, the gradient of increase of HWSP became loose. On the other hand, the HWSP in the scenario B1 decreased when the temperature anomaly was exceeding to about +1.2 degree. According to the estimation of the HWSP when the effect of climate change was ignored (that is, runoff was not changed), the HWSP was almost same (not shown). This result implied that it is strongly contributed by not the climate change but the socio-economical factors (ex; an irrigated area, increase of industrial water use, increase of population itself).

In Parry et al (2001), the renewed high stressed population by coastal flooding, hunger, malaria, and water shortage were estimated. The risks of hunger and coastal flooding increase gradually with the warming. Risk of malaria widely increases. Meanwhile, the risk of water shortage rapidly increases after the temperature anomaly exceeds around +2.0 degree. From this result, they insist that the "dangerous level" for sustainable development is +2.0 degree and the target emission level is 550 ppmv. However, they did not consider the quantity of water intake. We estimated the HWSP considering the quantity of water withdrawal and its projection in future. From our result, the "dangerous level" is disagreed. We can insist that the climate change is not so effective within the water withdrawal. If anything, the socio-economic elements, for instance the variation of irrigation areas, industrial water withdrawal, and population itself, contribute to the HWSP.

The HWSP and its ratio in each country should be necessary for not only scientific issue but also political issue.