Impact of Climate Change on Dam Reservoir Water Quality

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1. Introduction

The fifth report of the U.N. Intergovernmental Panel on Climate Change (IPCC) forecasts that the world's average temperature will rise even if any scenario occurs to greenhouse gas emissions, raising the risk of suffering impact from climate change toward the end of the 21st century. In response to such view, the Central Environment Council documented "Report and future issues on the evaluation of impact of climate change in Japan (opinion offering)" in March 2015. This Report states that no studies have been found that provide specific forecast about the impact on water environment including lakes and dam reservoirs from changes in river flow or increase in frequency or magnitude of extreme events due to changes in precipitation or space-time distribution of rainfall caused by climate change.

Accordingly, this study attempted quantitative evaluation of the impact of climate change on the water quality of the reservoir of the case study dams using the results of calculating the present and future climates based on climate models. In addition, water quality improvement measures were discussed for eliminating present and future changes in water quality.

2. Results of study 1)

For each of the four case study dams, we built the model for water run-off / utilization in the basin of each dam and the water quality model for the dam reservoirs. We estimated the impact of climate change on the water quality and temperature of the dam reservoirs by inputting the results of output from the climate models in terms of the current climate and future climate on six cases of RCP 2.6 to 8.5 through bias correction. The Figure shows some examples of estimation.

Results of estimation were organized by classifying them into water quality change phenomena that may be caused to the dam reservoirs by climate change, i.e., "algal growth", "bottom water quality deterioration", "rise in turbidity", and "rise in water temperature." Although the types of phenomena considered to show major change were different according to each dam, a water quality change event that may indicate so-called degradation trend was seen in all the case study dams. In order to eliminate the difference in water quality changes in current and future climates, we set up measures based on the introduction of the water quality improvement measures that have been conventionally adopted
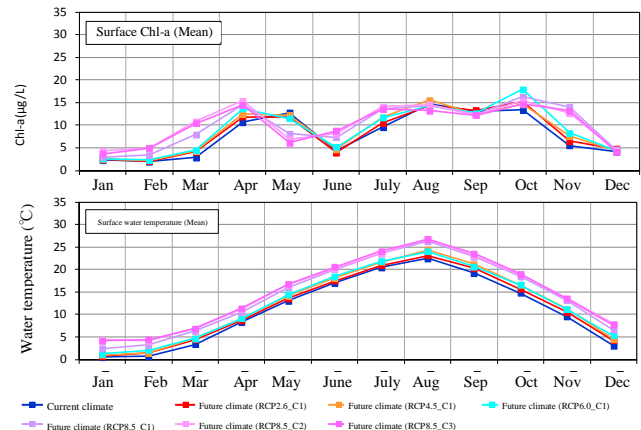

Fig. Example for estimation of impact on water quality / temperature

(including operational change and reinforcement of existing facilities), including selective water withdrawal facilities and aerating circulation facilities and estimated the effect of these measures, and found that they are effective.

3. Conclusion

In the MLIT Climate Change Adaptation Plan formulated by the Ministry of Land, Infrastructure, Transport and Tourism in November 2015, it was determined with regard to the climate change adaptation measures for the water environment of dam reservoirs to continue to implement the measures for water quality conservation including selective water withdrawal facilities and aerating circulation facilities and to consider the review of operation method for water quality conservation facilities according to changes in water quality.

Considering that it functions as climate change adaptation measures to further reinforce management cycle including investigation, consideration of measures, operation, effect verification, etc. concerning water quality conservation in dam reservoirs and apply them without interruption, we would like to advance the review of the measures for water quality conservation in existing dams as well as systematic organization of above-mentioned management cycle.

☞**See the following for details.**

1) Technical Note of NILIM, No. 856 (August 2015)

http://www.nilim.go.jp/lab/bcg/siryou/tnn/tnn0856.htm