

Climate Change Impact on Water Resources Management in the Tone River Basin, Japan

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Climate change is expected to strongly affect the hydrologic cycle in coming decades. Long-term changes in water resources depend mainly on the amount of precipitation and evapotranspiration. Many researchers suggest that climate change accelerates water cycles with more precipitation and increased evapotranspiration, limiting freshwater resources less in the next century, but increased precipitation does not necessarily mean sustainable water resources because less frequent but heavier precipitation may lead to extremely dry periods.

Under future climate conditions, the risk of water problems may remain or even increase due to variations in seasonal patterns and increased numbers of extreme events. In areas dominated by snow, seasonal variations in water resources due to climate change become more apparent. A warmer world will mean less snowfall in winter and earlier snow melting in spring, shifting much surface runoff to earlier seasons.

Water supply condition in Japan is not stable even now due to its severe seasonal variation and high population density. So far, this water related problems have been skillfully handled with many reservoirs and multi-purpose dams. Every reservoir has own optimized operation rules to maximize its function under given water problems. However, this current reservoir operation rules may not work properly under the changed hydrologic cycle in the future.

To evaluate current dam reservoir operation rules under the changed climate conditions, one of dam reservoirs in Japan was modeled and simulated. Future climate condition was set by the output of a

very high resolution atmospheric model that was developed by the Japan Meteorological Agency (JMA) and the Meteorological Research Institute (MRI), Japan. The subject area for this study is the Yagisawa Dam basin (167.6km^2), which is located at the upper part of the Tone River. The Tone River is the main water source to the metropolitan Tokyo, Japan, and the upstream of the basin is in snow- dominated regions.

Dam model simulation to reproduce current dam release pattern was able to realize the present outflow pattern in the future. In this case, however, the water level regulations should be revised, and the shortage of the reservoir water in summer season should be carefully considered. More information on dam operations and water demand/ usage from the reservoir should be defined for more reasonable dam modeling. Further researches are under going to develop realistic dam operation models and proposing revised dam operation rules for the proper water resources control in the future.

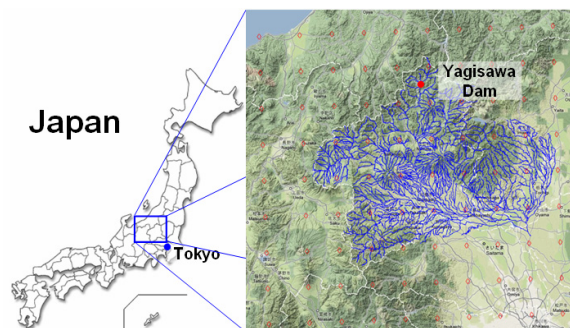


Fig. 1 Location of the upper Tone River basin (outlet: Kurihashi station, $8,772\text{ km}^2$) and the Yagisawa dam basin (167.6 km^2). Red diamond marks (right) are the center of the AGCM20 output grid cells.