Margins of forecasting the future increase in torrential rains controlling adaptation to climate change

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(Keywords) climate change, torrential rains, flood control projects, increase rate, sensitivity analysis

1. General condition of river development for flooding prevention and climate change

Even the safety level of flood control of the average first-class rivers in Japan has been improved by accumulated river development, it has not yet meet a target level indicated in a river development policy. On the other hand, land use is becoming densely therefore even the same scale of flooding may cause further damages. Furthermore, it is pointed out that torrential rains may increase due to global warming. If torrential rains occur more frequently while river development is making progress, it is easily supposed that the safety level of flood control will not improve as before. Therefore, it is required to think about how to adapt to the situation while forecasting the increase in torrential rains in the future and enforce measures strategically. In that case, there is a *margin* in the forecast predicting a degree of increase in torrential rains, and it is being questioned how to deal with them while looking at the margin (and the larger margins just in case). In the River Department, the divisions relating to flood damages are cooperating with each other for addressing this issue. As a first step, calculations using the latest forecast for climate change were made concerning the degree of increase in torrential rains and the rate of increase in the possibility of flooding arising from it, and the scale of additional efforts for river development in case of setting the equivalent target level to the present level to improve the possibility. At the calculation, we studied how much a future vision could be changed when the rate of increase in torrential rains changes a little, by giving the forecast results of torrential rains some margins

2. Impacts of increase in torrential rains on flood control

We calculated the increase rate of torrential rains showing how much the largest yearly amount of rainfall used for river development will increase in the future [at the end of 21st century] compared to the present, targeting the directly controlled 109 river systems based on the four forecasts[1)] on future climate change. Looking at the average of all river systems, forecast results are ranging from 1.12 to 1.27 on average and a difference (confidence interval 95%) between the maximum and the minimum forecast is ranging from 0.02 to 0.11. Together with such increase in torrential rains, the flow equivalent to the target level will also increase. As the result, we calculated "how many times of increase in the probability of flooding exceeding the river flow equivalent to a target level in the future compared to the present" and "how many times of increase in insufficient cross section of flow in a river course necessary for safety flow down of the water volume equivalent to the target level in the future compared to the present". (See the increase rate of flow, increase rate of probability of flooding, and increase rate of river development efforts in the figure.) [2)] It is found that as for the national average, the torrential rains will increase 1.16 times, the river development efforts 1.88 times, and the probability of floods 2.87 times greater than the present. In other words, it means even if river development meeting the present target flow level is completed, the probability of flooding will increase 2.87 times, and required efforts will be 1.88 times to prevent this. This resulted in that only about 0.16 times of increase in torrential rains leads to multiplying the probability of flooding and efforts for river development and therefore future situation may change drastically even if the increase rate of torrential rains is within the *margin* stated before.

3. Measures supposing the future with *margins*

Thus, future forecasting is not easy. It will be required to expand the practicable measures both in terms of software and hardware free from the limitation of existing measures for flood control by entering on the basin of rivers. Moreover, it is important to appropriately use and combine various measures so that their effects are maximized, and reach the way of strategy planning without having regrets on the assumption the future is uncertain even if prediction is wrong. In the River Department, we are now examining for solving the issues while analyzing flooding risks so that specific damages by flooding for each river system and the effects of measures can be evaluated.

<Reference> 1) MEXT: Innovative Program of Climate Change Projection for the 21st Century "Projection of the change in future weather extreme using super-high-resolution atmospheric models, 2011 Study report, 2012. 2)Mr. Hattori and others: Macro-evaluation of climate change impact on flood control measures in Japan, Advances in river engineering, Vol.18, 2012)

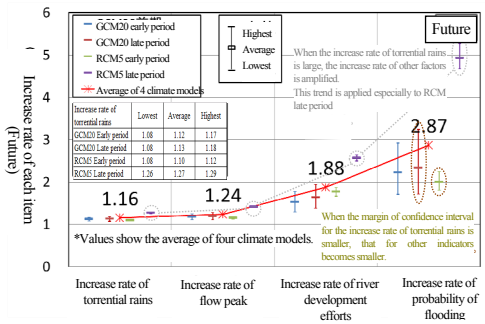

Figure Impacts of torrential rains increase on indicators