Development of real-time forecasting system using hydrological model and data assimilation technique

Recently, flood damage has become serious problem around the world due to the changes in climate condition. Flood forecast system using hydrological model is useful tool to mitigate the flood damage. One of the main topics in our research team is to develop real-time flood forecasting system using distributed/lumped hydrological models and radar rainfall data. In addition, to improve forecasting accuracy, we introduce data assimilation techniques like Kalman Filter and Particle Filter into the forecasting system, and investigate the uncertainties caused by hydrological modeling including parameter setting and by weather/climate forecasting data as an input to the hydrological models.
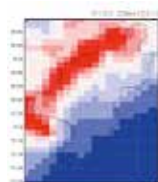

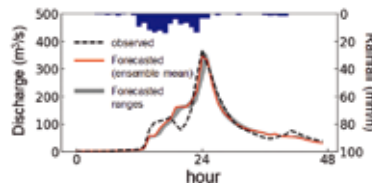Figure 1 Spatial distribution of rainfall based on radar data

Figure 2 Example of real-time flood forecasting.

The impact assessment of climate change on hydrological cycle using hydrological model and climate scenarios. -Uncertainty analysis of impacts of climate change on snow processes-

The impact of climate change on snow water equivalent (SWE) and its uncertainty were investigated in snowy areas in Japan by using a snow process model and climate projections derived from general circulation models (GCMs). In particular, we examined how the uncertainty due to GCMs propagated through the snow model, which contained nonlinear processes defined by thresholds. The uncertainty analysis demonstrated that when the peaks of the distributions of daily mean temperature projected by GCMs cross the key thresholds set in the snow model, the GCM uncertainty, even if tiny, can be amplified by the nonlinear propagation through the snow process model. This amplification results in large uncertainty in projections of CC impact on snow processes.
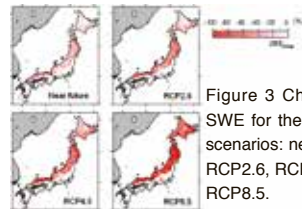

Figure 3 Changes in SWE for the emission scenarios: near future, RCP2.6, RCP4.5, and RCP8.5.
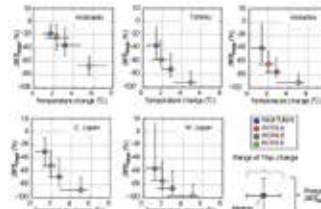

Figure 4 Projection ranges of regionally averaged changes in winter-mean temperature and SWE.

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