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Assessment of High-resolution Ensemble NWP Rainfall for Flood Forecast of Relative Large River Basin in Japan

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Traditionally, Quantitative Precipitation Forecast (QPF) can be obtained through the use of extrapolation of movement pattern of rainfall distribution from a sequence of radar image or through the use of solving numerically the equations of Numerical Weather Prediction (NWP) model (Nakakita et al., 1996). However, radar forecasting techniques using extrapolation of movement pattern do not consider such as growth and decay of precipitation. On the other hand, NWP models use current weather conditions as input to atmospheric models to predict the evolution of weather systems. These models represent the atmosphere as a dynamic fluid and solve for its behavior through the use of mechanics and thermodynamics. However, Forecasting is difficult because the atmosphere is a nonlinear, chaotic system. A slight change in the initial and boundary conditions could result in unpredictable results. In order to overcome these limitations, ensemble outputs of NWP models have been generated since the early 1990s and probabilistic weather forecasts have been used to express forecast uncertainty. It is believed that NWP ensemble prediction systems exhibit greater forecast skill than single NWP model control run.

The objective of this study is to assess the application of the high-resolution ensemble NWP model data for the purpose of ensemble flood forecast of relative large river basin in Japan with an extended lead time, and to examine the uncertainties of the ensemble flood forecasts based on input of the ensemble NWP rainfall for hydrological application. In dealing with the ensemble flow forecast, it used the ensemble rainfall information of high-resolution NWP model (Figure 1) from Meteorological Research Institute. This ensemble NWP data is special case for extreme event with an extended lead time (30hrs).

It can be concluded from the study that ensemble NWP rainfall produced more good results compared with deterministic forecast in terms of QPF. Ensemble hydrological forecasting driven by ensemble rainfall forecasts also could produce comparable results in comparison of observed data, although peak discharge value was underestimated (Figure 2). Later, Ensemble NWP rainfall data could be applied the hydrological application such as real-time flood forecasting and Dam operation.

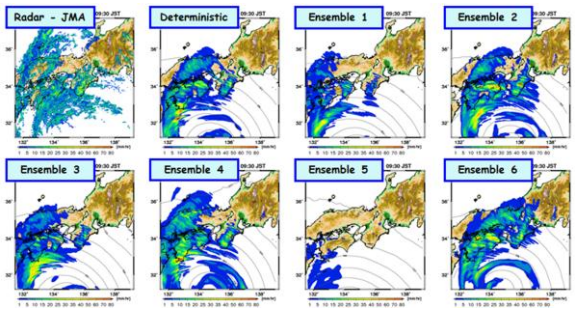

Figure 1. Observed radar rainfall and results of ensemble rainfall forecast (09:30 JST 3 September 2011)

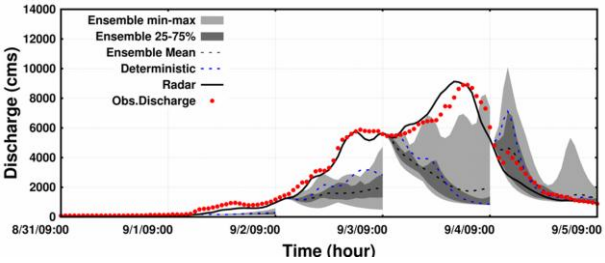

Figure 2. Ensemble hydrological forecasting in Futatsuno dam basin driven by ensemble NWP rainfall during Typhoon ‘Talas’