D05

Ensemble Flood Forecasting using Transposition of NWP Rainfall Fields considering Orographic Rainfall

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1. Introduction

Flood forecasting is an important technique to reduce damages from flood disasters. As the accuracy of weather forecasts has improved with advances in NWP techniques with increasing computing power, it is now possible to generate high-resolution rainfall forecasts at the catchment scale and to integrate quantitative precipitation forecasting (QPF) into flood forecasting systems with extended lead time. At the same time, one of the rising scientific research themes in the flood forecasting area is the development of ensemble prediction systems (EPS). However, in many cases, the potential of forecasting with EPS is described alongside cautious approaches regarding a considerable variability and uncertainty especially in an operational flood forecasting. First, the time/space scale of the hydrological model is still much finer than that of the meteorological model. Second, NWP models have challenges with misplacement of the forecasting rainband, which means that the intensity and shape of the forecasted storm cell may be correct but the location of the storm cell is wrong.

2. Purpose and Methodology

Given the current issue with ensemble forecasting methods, the aim of this research is to address uncertainties in ensemble hydrological forecasting driven by high-resolution ensemble NWP rainfall, and to explore an accuracy improvement of the flood forecasting using transposition of ensemble NWP rainfall fields considering orographic rainfall.

For these objectives, ensemble NWP rainfalls are separated into orographic and non-orographic rain fields by solving physically-based equations, including additional atmospheric variables, such as vertical wind velocity. And then, the non-orographic rainfall fields are examined by transposition method to correct the misplaced spatial position. Lastly, Ensemble NWP rainfall fields are calculated by combining the transposition results of non-orographic rain fields with the orographic rainfall fields (Figure 1). We also apply into rising limb and peak discharge periods to confirm an accuracy improvement of flood forecasting skill (Figure 2).

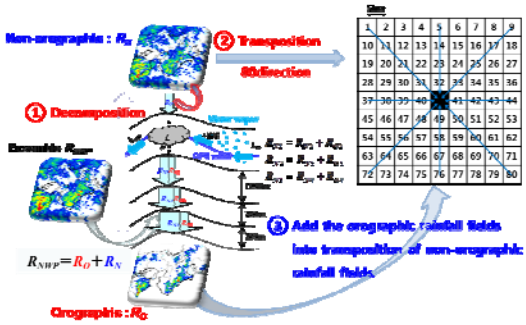

Figure 1. The procedure of transposition method with consideration of orographic rainfall

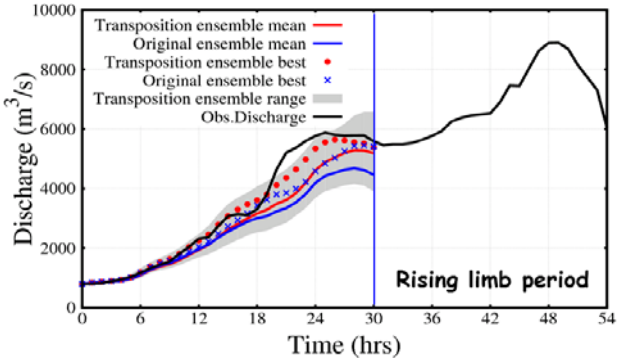

Figure 2. 30h ensemble flood forecasting using the transposition of ensemble rainfall fields in rising limb period over the Futatsuno dam catchment