Study on the accuracy of satellite based precipitation data for near real-time flood forecasting in river basins

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Water related disasters are substantially being increased in the past few decades. The impacts of climate change are already being experienced in many parts of the world. While climate change will affect everyone, it is expected to have a disproportionate effect on those living in poverty in developing countries. Within many developing countries, water related hazards have become frequent due to numerous factors related to climate, topography, socio-economic conditions etc. The most frequent and devastating water related hazard in these regions is flood. In order to control the damage due to floods, a comprehensive flood management system including structural and non-structural measures is necessary. In that sense, flood forecasting and early warning is important. Although there are many hydrologic and climatic models available for easing the flood management activities, the applicability of those models has been diminished due to the lack of ground-based data, particularly the rainfall observations in developing countries. In many situations the available ground-based rainfall observation networks are relatively sparse and some river basins in these countries are totally ungauged. Therefore, basically the satellite-based technologies have the potential to provide improved precipitation estimates for large portions of the world. However the basic question is how accurate are the satellite-based precipitation products for flood forecasting relative to the ground based observations.

In this study, the accuracy of three satellite-based precipitation products; CMORPH by NOAA, 3B42RT by NASA, GSMaP by Osaka Prefecture University are compared with gauged data (hourly) of two river basins (Tone and Yoshino) in Japan with relatively high precipitation gauge density. The predictability of instantaneous heavy rainfall events by the satellite-based precipitation products which is a long-standing need for a wide variety of applications including characterizing local climatologies, providing input to water-resource, and flash-flood analyses is examined. It is noted that all the considered products show poor accuracy during heavy rainfall events. Further the applicability of considered precipitation products for flood forecasting is analyzed using a distributed hydrological model. The model is calibrated using gauged precipitation data and then the satellite based precipitation is input to generate discharge while keeping other model parameters and input are unchanged. Results show the inability of the model to generate the peak flow events accurately using satellite based precipitation though long term average volume may be kept. The output results are compared and possible correction criteria for near real-time satellite based precipitation products is also discussed.