Resolution impacts for accuracy of forecasting precipitation using the WRF model Area of Study: KARKHE and KAROON basin

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Abstract

Despite the significant advances in Numerical Weather Prediction (NWP), the prediction of precipitation is still challenging. Considering the importance of accurate prediction of precipitation in hydrological applications and prediction of flood, In this paper, in order to determine WRF resolution impacts for precipitation, model precipitation prediction was evaluated for three domains with resolution of 36, 12 and 4 km in 5 cases of heavy precipitation resulted in flood (more than 50mm at 24 hours) at KARKHE and KAROON basins. At first, atmosphere conditions investigated synoptically at the time of heavy precipitation in the study area by ECMWF data with resolution of 0.75 degrees. In order to study the quality of the model in terms of synoptic, Jet Stream at 200hPa, Relative Humidity and Horizontal Flux Moisture at 700hPa were drawn for three domains with different resolutions and were compared with their respective maps with reanalysis data. Then, WRF model accumulated precipitation output has been compared with accumulated observations for 22 synoptic stations at KAROON basin and 20 stations at KARKHE basin. In order to verify the WRF model output in prediction of precipitation, the statistical index of correlation coefficient was calculated. Also, for a closer look, average and accumulated precipitation maximum was determined for three domains. Results showed that in a synoptic study when heavy precipitation occurs, model prediction is consistent (For example, in terms of the direction of motion of the wind, the maximum, the center of measurement and curvature in the Jet stream of 200 hPa and the relative humidity of 700 hpa) for all three domains with different resolution. Also, comparing precipitation observation and prediction, the 4 km domain is more accurate with higher correlation coefficient. In general, the prediction of precipitation for the WRF model is acceptable In terms of increasing accuracy in predicting rainfall and flood for a domain with a 4 km resolution. So, the model prediction in the third domain with 4-km resolution compared to the second domain with a resolution of 12 km has improved in terms of the average precipitation of 7% and in terms of maximum precipitation of 5%. Also, the percentage of improvement of the third domain of the model compared to the first domain of the model with a resolution of 36 km for the average and maximum precipitation of catchments is 12% and 22%, respectively.

Keywords: WRF Model, Resolution, Correlation Coefficient, Average Precipitation, Maximum Precipitation.