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Verification of the WRF Model for Simulating Heavy Precipitation in North West of Iran

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Northwest of Iran has complex topography and heavy precipitation is one of the major severe weather that causes flash floods over the region. High-resolution numerical modelling technique is required to better predict heavy precipitation events which is important for providing an early warning system to minimize disaster. The Weather Research and Forecasting (WRF) model was used to simulate precipitation for three flooding events in Northwest of Iran. While the choice of microphysics and cumulus schemes can significantly impact the simulation of the model, this study investigated the performance of WRF in forecasting heavy precipitation using various microphysics and cumulus schemes. A total of 20 combination of microphysics and cumulus schemes were used at three resolutions of 45, 15 and 5 Km for 24 hour and model outputs were validated with observations stations data. Four cumulus parameterization schemes, no cumulus parametrization (NCP), Kain-Fristsch (KF), Betts-Miller-Janjic (BMJ), Grell-Devenyi (GD), five microphysics scheme Purdue Lin (LIN), Kessler, Ferrier, WSM3 and WSM5 and Yonsei University (YSU) planetary boundary layer scheme were tested. Verification was evaluated in terms of Probability of detection, BIAS, False alarm ratio, Root-mean-square-error, Treat score and Proportion correction. The results show that the WSM3 microphysics scheme combination with Kain-Fretsch (KF) and Grell-Devenyi (GD) cumulus schemes were the best combination for simulation of heavy rainfall over North West of Iran. The precipitation accuracy was generally observed when the horizontal resolution of the model was increased to 5 Km but there was not obvious difference in simulation heavy precipitation in both 15 and 5 Km resolutions.