Impact Of Cloud Microphysics Parameterization On Simulating The Extreme Rainfall Conditions Over Central Himalaya Using WRF Modeling System

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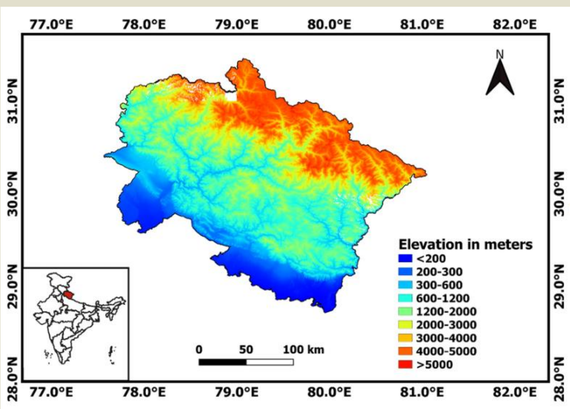
Introduction

According to a study (Nandargi et al., 2016) of over 100 years of extreme rainfall events and severe rainstorms in Uttarakhand, October has the highest frequency of extreme 1-day rainfall (≥100 mm), with higher altitude stations also experiencing extreme rainfall. According to research on extreme rainstorms in the Northwest Himalayas from 1875-2010 (Nandargi, S. & Dhar, 2012), one of the five most severe storms happened in October, while the other four occurred in the second half of September in the region. This study investigated the microphysical processes of extreme rainfall for the verification of the WRF model simulation and a statistical analysis of observed data using MRR was carried out for the extreme rainfall event of 17-19th October 2021 over Almora, Uttarakhand, India.

Study Area and Methodology



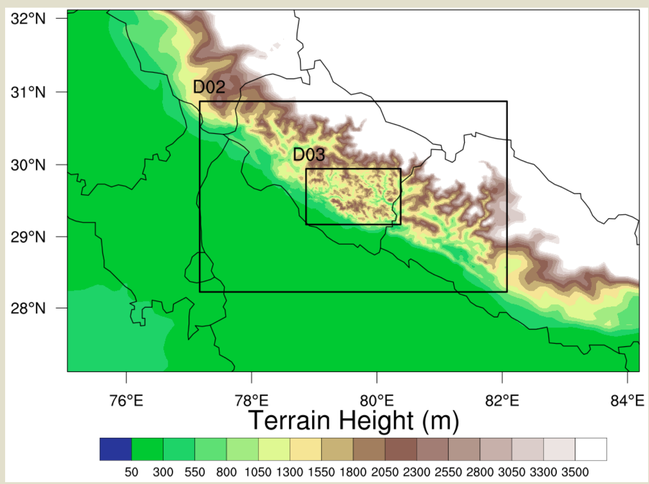


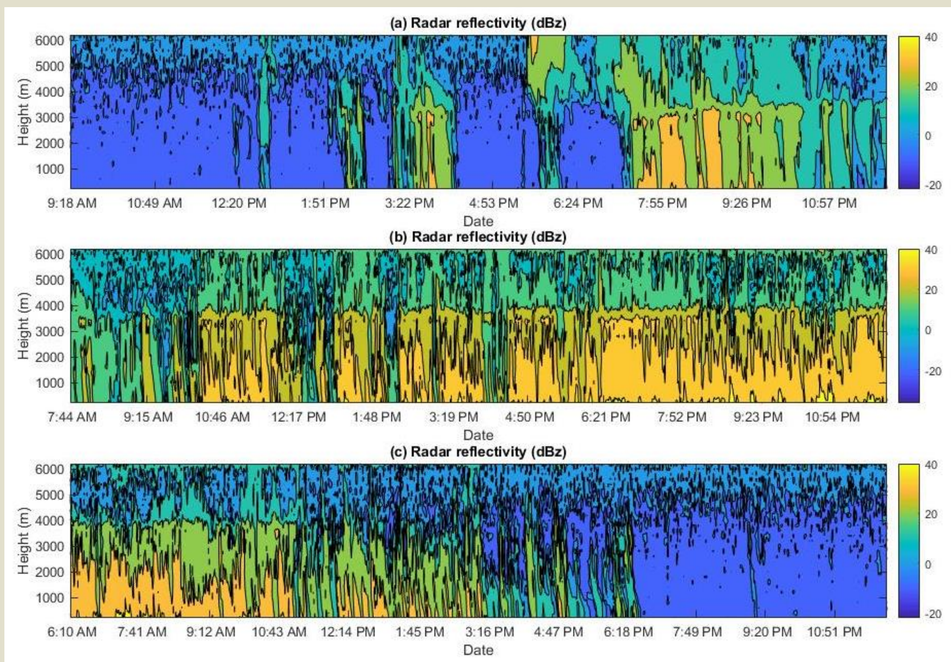
Table-1: Domain configuration used in WRF Model

Model description	Detail
WRF-ARW	Version-4.3.1
No of domain	3
Centre of simulation	29.639 N,79.624 E
Spatial resolution	9, 3, 1 km
Time Step	24 sec
Initial and boundary condition	Final analysis data (FNL) from NCEP, USA
Model initiation date	15/10/2021 00:00 to 21/10/2021 00:00 UTC
Projection	Mercator

Table-2: Microphysics schemes used in WRF Model

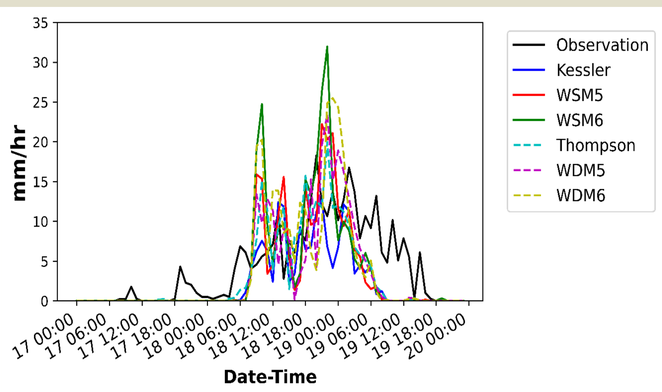
Microphysics Scheme	Physics code
Kessler scheme	1
WRF Single-moment 5-class (WSM5)	4
WRF Single-moment 6-class (WSM6)	6
Thompson	8
WRF Double-moment 5-class (WDM5)	14
WRF Double-moment 6-class (WDM6)	16

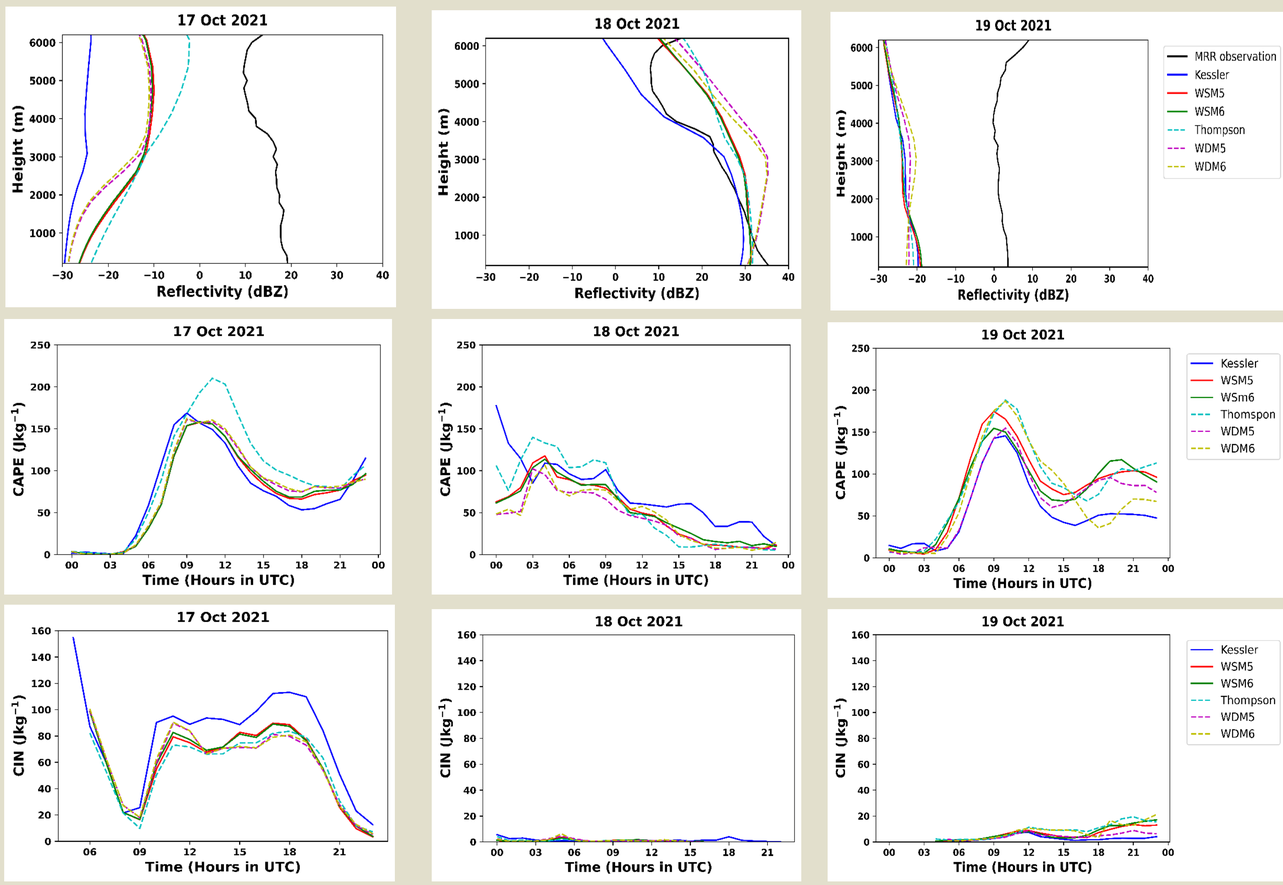
Observation Data Analysis



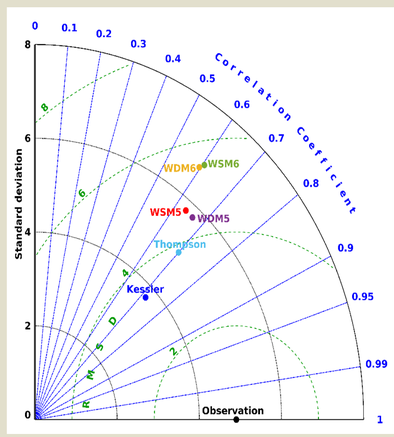
Results and Conclusion

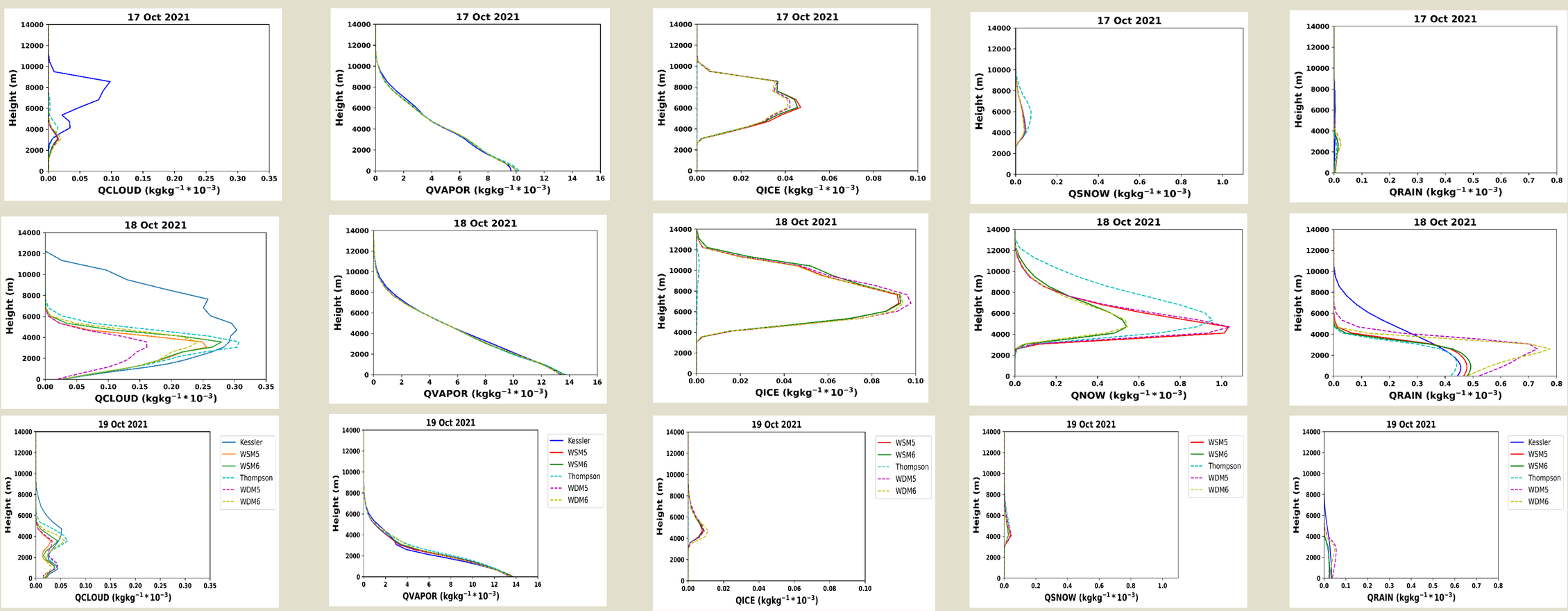
Comparison of Model-Simulated hourly rainfall with observation data (rain-gauge working at GBP-NIHE, Kosi-Katarmal, Almora) on different days 17-19 October 2021





Statistical comparison of six WRF Simulations of cloud microphysics with respect to the observed data in terms of Root Mean Square Error, Correlation Coefficient, and Standard Deviation





References

- Nandargi, S., Gaur, A., & Mulye, S. S. (2016). Hydrological analysis of extreme rainfall events and severe rainstorms over Uttarakhand, India. Hydrological Sciences Journal, 61(12), 2145-2163.
- Nandargi, S., & Dhar, O. N. (2012). Extreme rainstorm events over the northwest Himalayas during 1875–2010. Journal of Hydrometeorology, 13(4), 1383-1388.

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