Testing of Non-Hydrostatic Core and Microphysics over the Carpathians

Bushra Khalid

Institute of Geographic Sciences and Natural Resources Research, Chinese Academy of Sciences, Beijing, China

kh_bushra@yahoo.com

ABSTRACT

This study involves the testing of non-hydrostatic core and microphysics over the Carpathians using the fifth-generation regional climate modeling system RegCM5. The domain size 80 x 108 x 18 was selected which include the Carpathians in the two basic regions i.e., Hungary and Slovakia regions. The domain center falls 47.5 N, 17.5 E. The ERA5 dataset was used for precipitation and temperature datasets for the years 1999-2015. The Kain-Fritsch cumulus convective scheme was used to evaluate the non-hydrostatic core and microphysics in the region in the 1st setup whereas it was kept off in the 2nd setup.

Keywords: Carpathian, Kain-Fritsch, convective scheme, model run, RegCM5
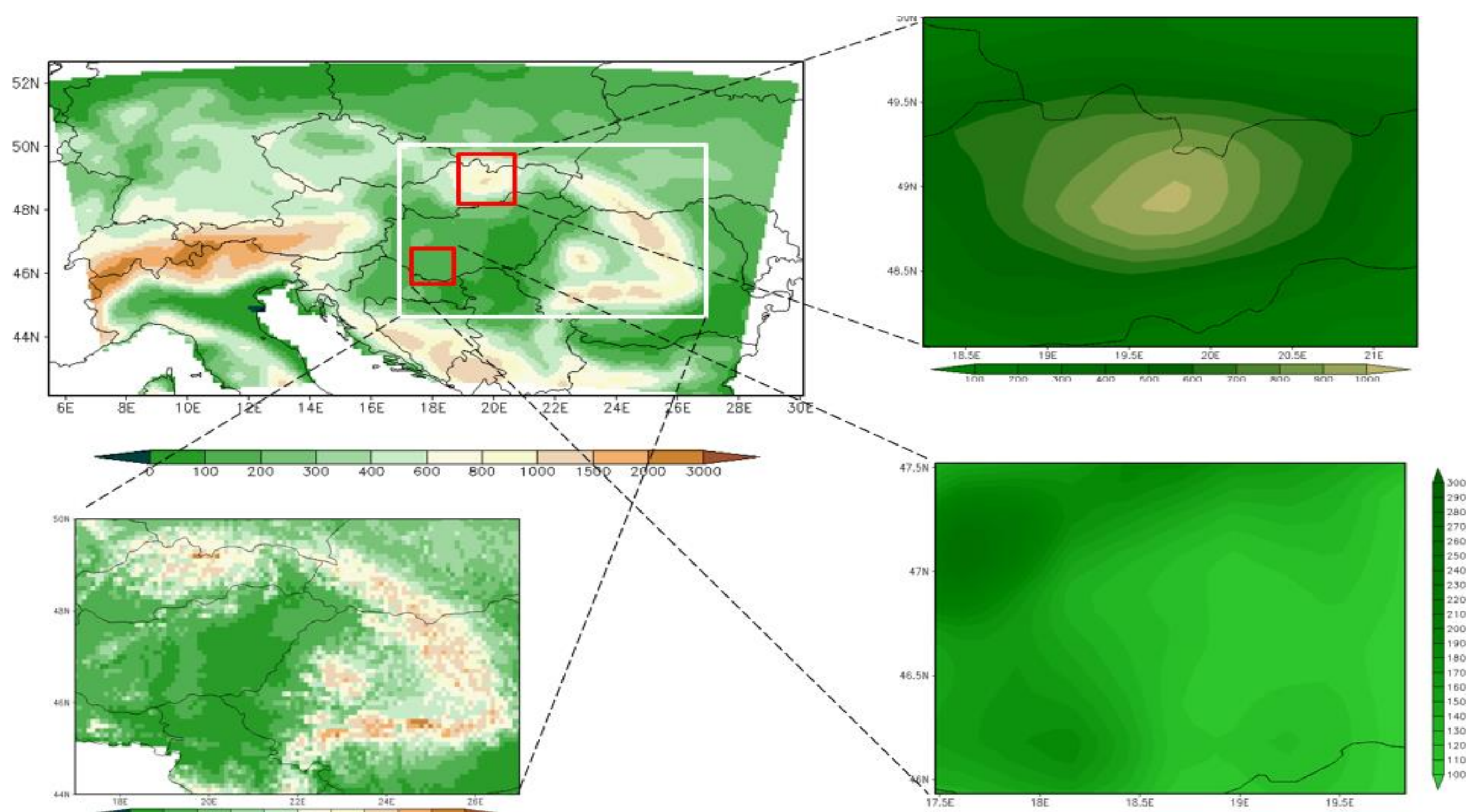
DOMAIN

Fig 1. The domain of the study is covering Hungary-Slovakia region and the Carpathians

OBJECTIVES

This study intends to compare the differences of the performance of model run and observations over the Hungarian-Slovakian region including Carpathians by using Kain-Fritsch scheme in RegCM5. The parameters tested in this study are temperature and precipitation.

EXPERIMENT SETUP

	Setup 1	Setup 2
Dynamical core	Non-Hydrostatic	Non-hydrostatic
Moisture scheme	Microphysics	Microphysics
Cumulus convective scheme	Kain-Fritsch	Off

EIN75 →

Coarse Domain
Resolution 20 km
Domain size 80 x 108 x 18
Domain center 47.5 N, 17.5 E
Time 1999-10-01 to 2000-11-02

Hungary Domain
Resolution 4 km
Domain size 60 x 60 x 18
Domain center 46.7 N, 18.6 E
Time 2000-03-01 to 2000-10-01

Slovakia Domain
Resolution 4 km
Domain size 70 x 70 x 18
Domain center 49.0 N, 19.7 E
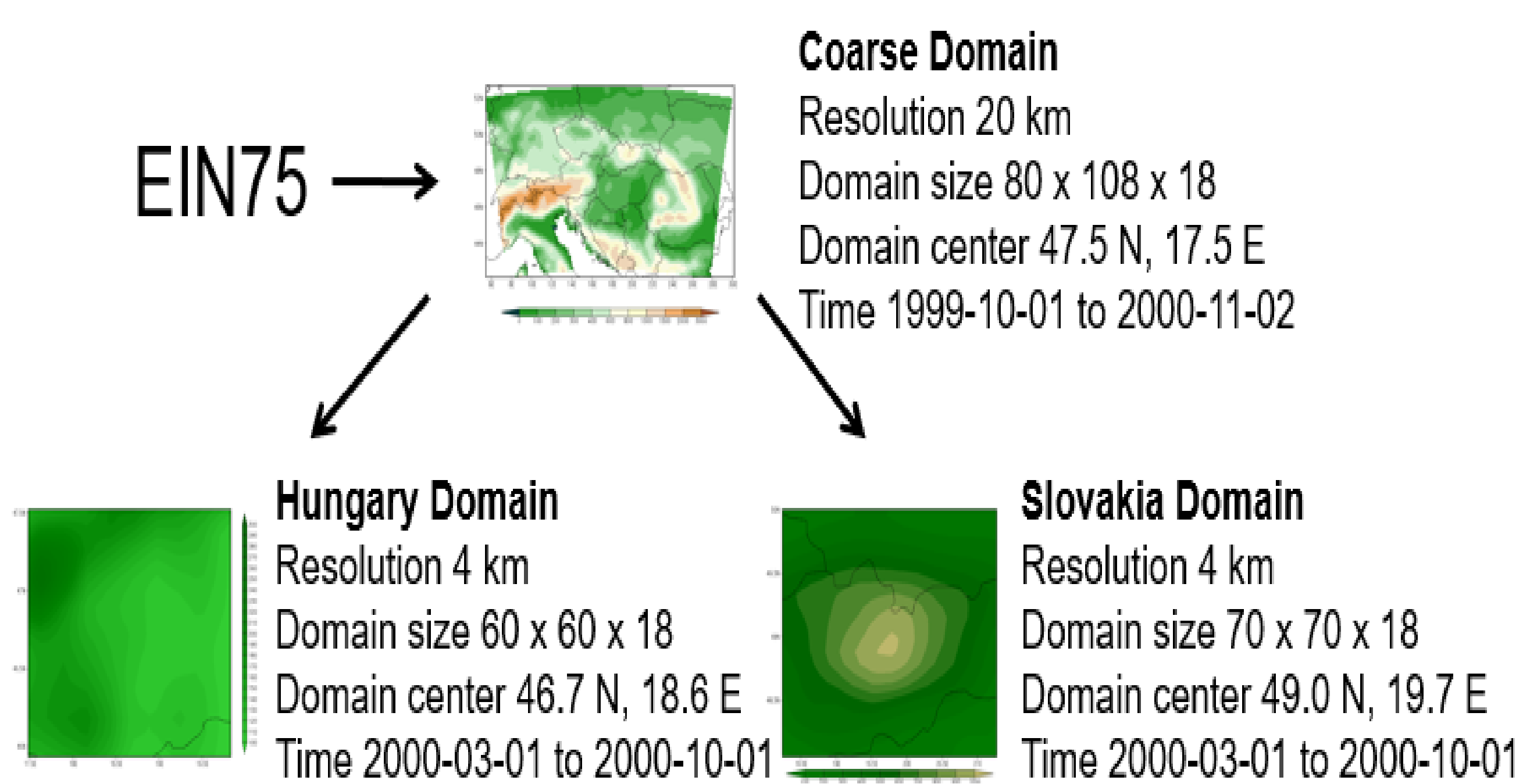Time 2000-03-01 to 2000-10-01

Fig 2. The experimental setup is shown with the specifications of the dataset used in this study

RESULTS & DISCUSSION

The results of both setups were compared to see the differences and performance of the model run. The results of the model were validated against the observation. The model performance was better over the Slovakia region as compared to Hungarian region. The average daily temperature over the region produced results quite closer to that of observation. However, the results for precipitation were underestimated when compared to the observation. Similarly, the Cu-microphysics produced results quite closer to that of observation for daily temperature and precipitation whereas the model run without the convective scheme underestimated the results over the region. The results show that the Kain-Fritsch scheme in RegCM5 performs better over the Carpathian region. The simulations for longer time span may produce improved results for the region.
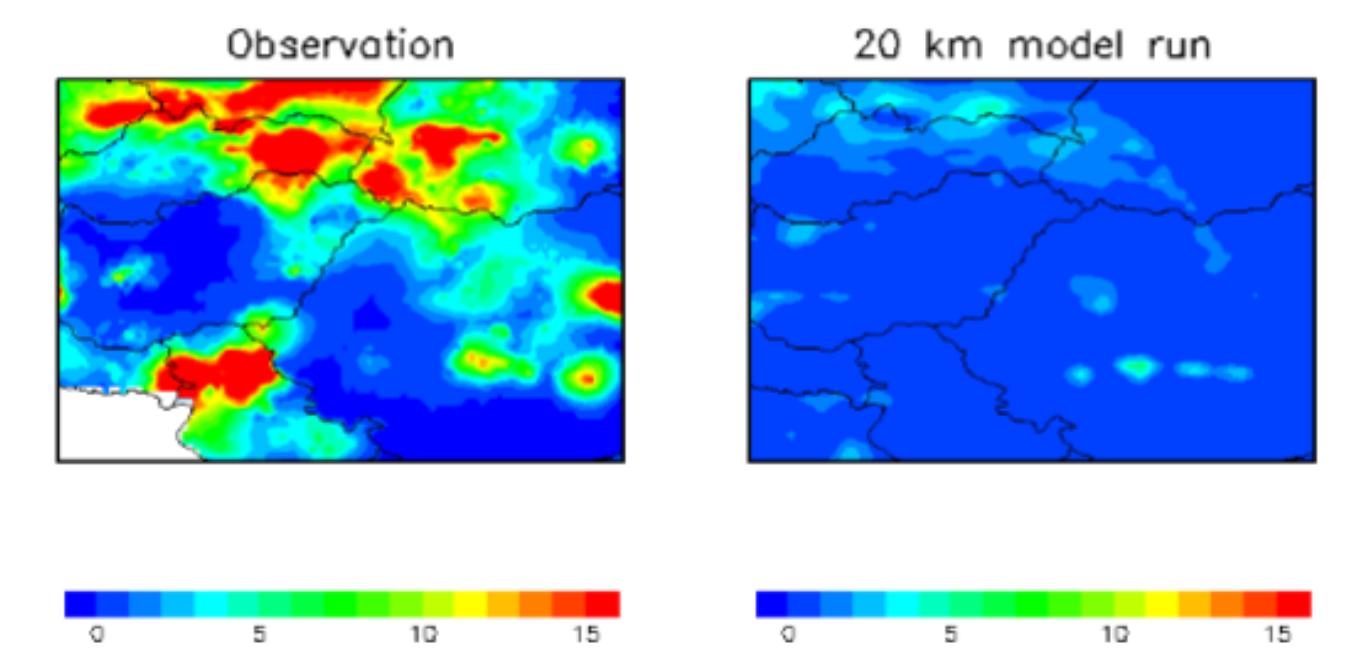
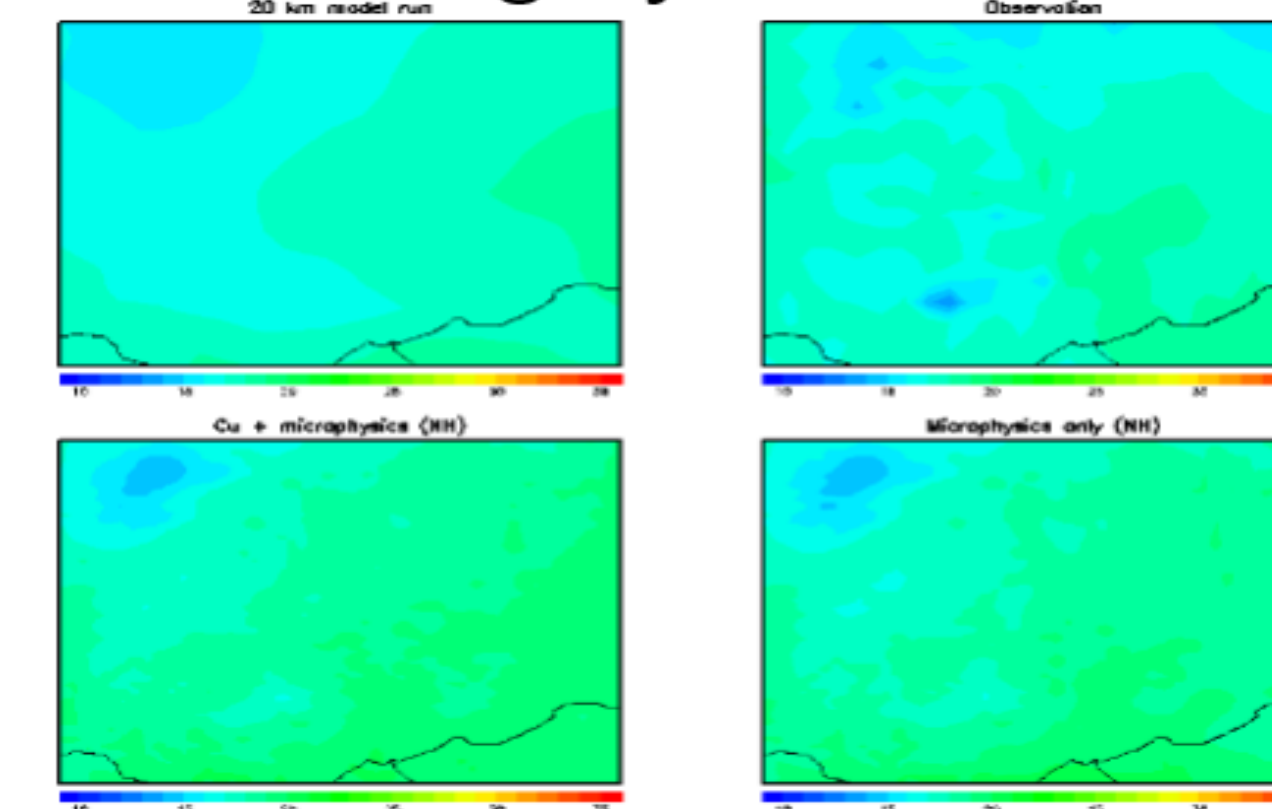### Average Daily Temperature
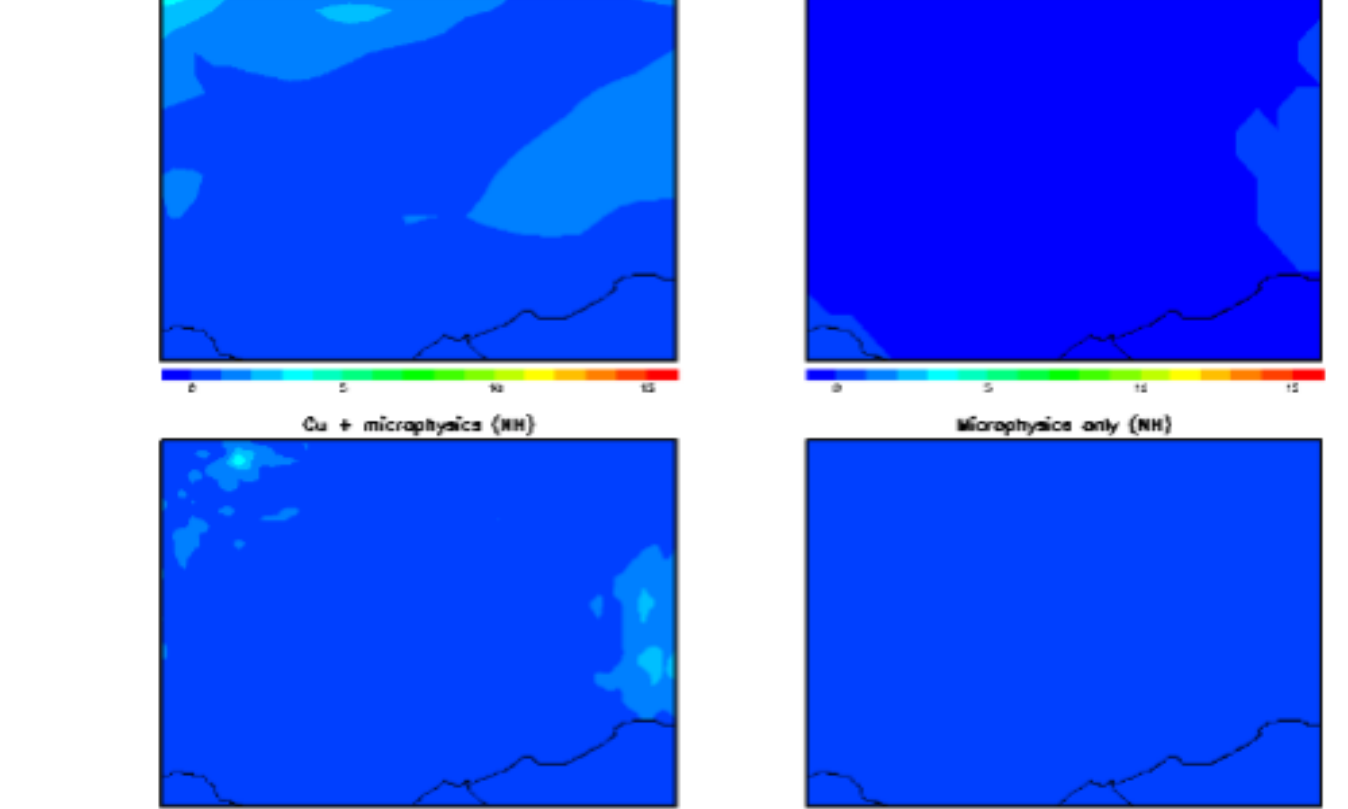10 km observation & 20 km coarse domain
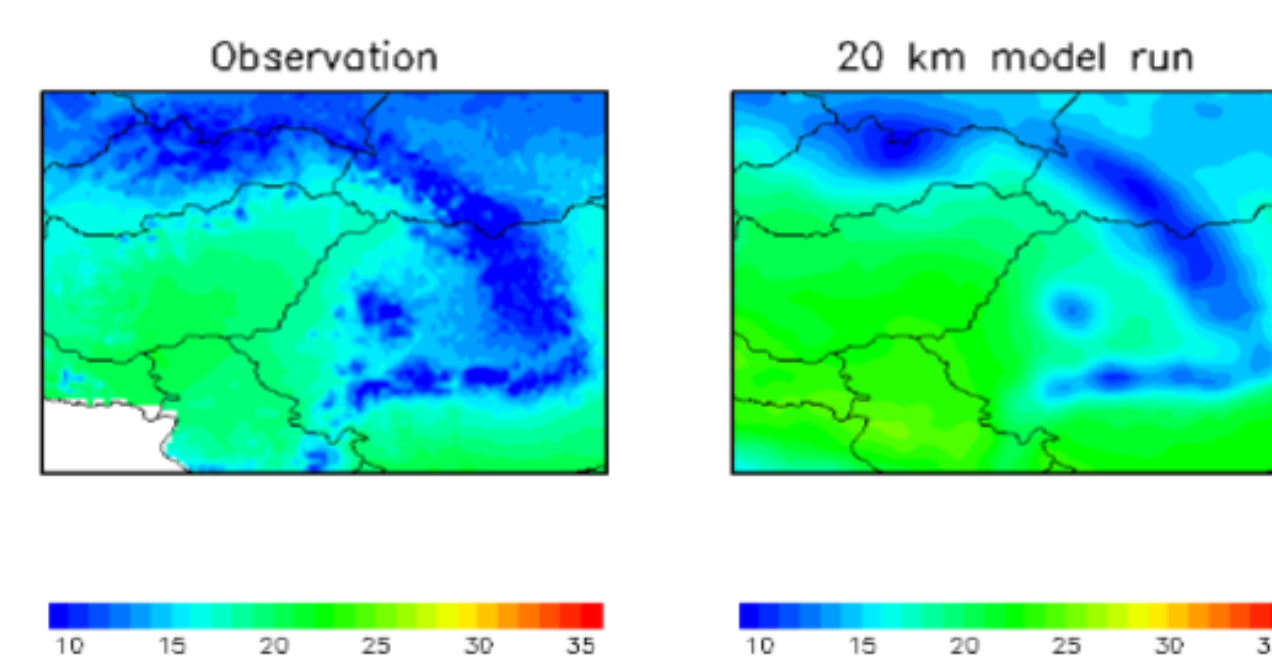
Daily Precipitation
10 km observation & 20 km coarse domain
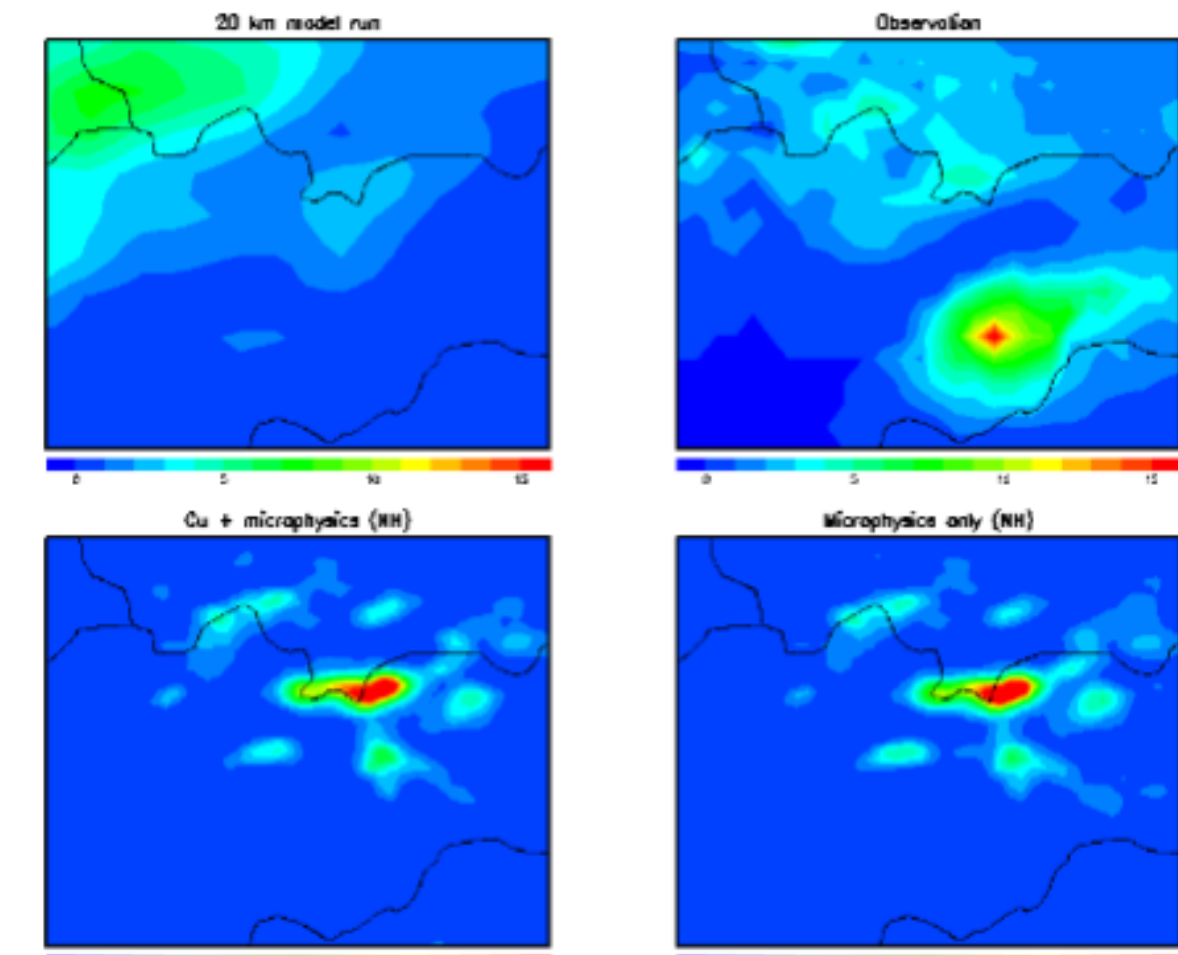

Average Daily Temperature: Hungary Domain

Daily Precipitation: Hungary Domain
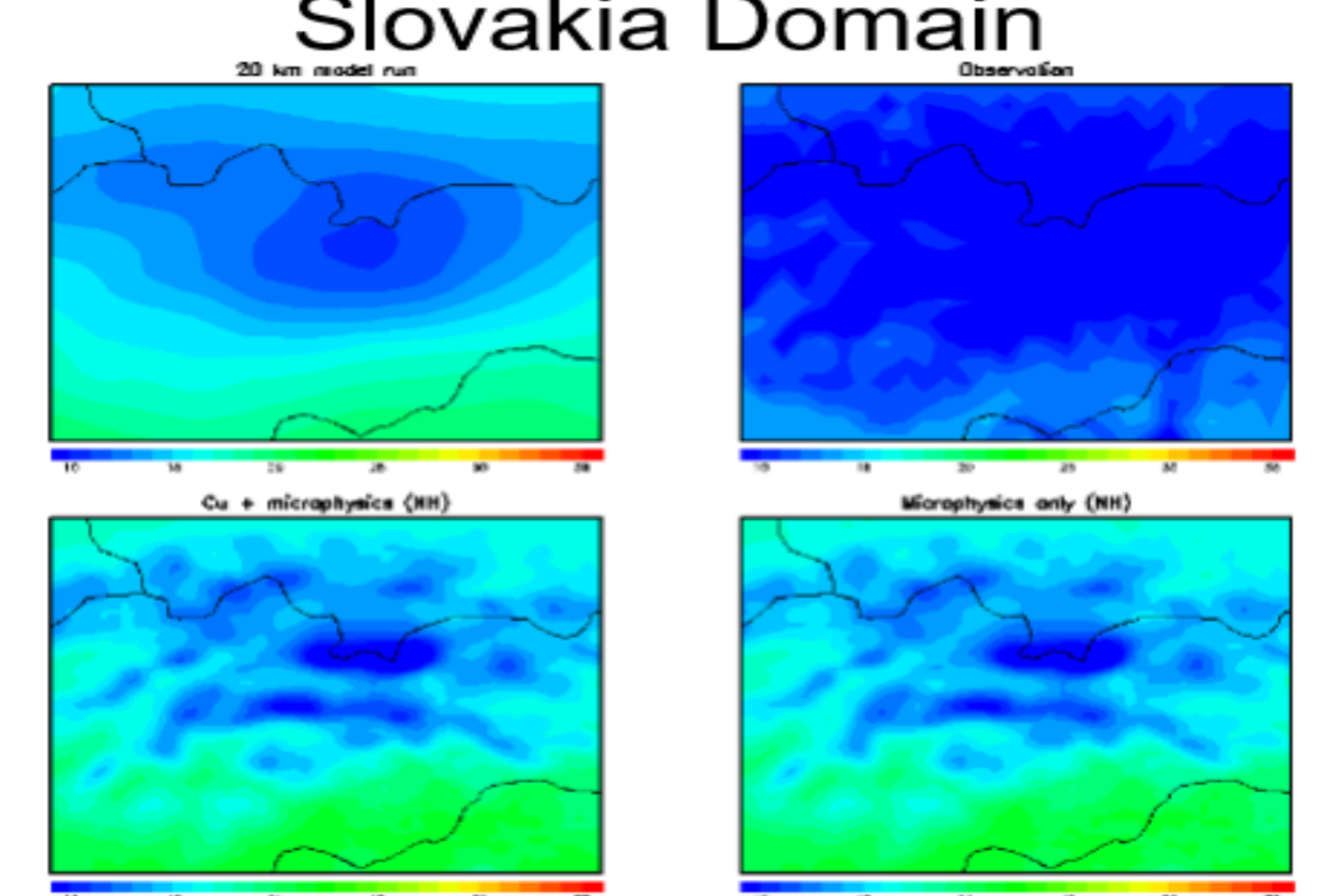

Average Daily Temperature (°C)	Min Temp	Mean Temp	Max Temp	SD
Observation	9.72	21.26	29.19	3.56
20 km Coarse Domain	14.05	24.44	33.42	4.32
4 km Hungary Domain Setup 1	12.80	25.42	34.72	4.29
4 km Hungary Domain Setup 2	13.13	25.31	34.23	4.32

Daily Precipitation: Slovakia Domain

Average Daily Temperature: Slovakia Domain

Average Daily Temperature (°C)	Min Temp	Mean Temp	Max Temp	SD
Observation	-3.26	16.86	28.57	4.24
20 km Coarse Domain	6.73	19.35	31.39	4.94
4 km Slovakia Domain Setup 1	0.47	20.36	34.24	5.16
4 km Slovakia Domain Setup 2	0.72	20.37	33.60	5.18

Fig. 3 The model run in comparison to observations and cu+microphysics and only microphysics

CONCLUSION

•The model performs better with the Hungary domain and results are underestimated for precipitation and overestimated for temperature over the Slovakia domain.

•The model can have better results if model tuning is Cerformed.

•A larger domain for the high resolution simulation can also improve the results.

•The experiments have similar results, therefore longer simulation time is needed in order to draw ultimate conclusions.

ACKNOWLEDGEMENTS