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Natural Hazards and Earth System Sciences
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Discussions

Interactive comment on "The efficiency of the WRF model for simulating typhoons" *by* T. Haghroosta et al.

T. Haghroosta et al.

haghroosta@hotmail.com

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Dear Referee #1,

We would like to express our gratitude to you for the insightful comments, which we have answered point-by-point. We think that these comments contributed to improve the quality of our manuscript. All the suggested corrections will be included into the final manuscript version.

Comment 1:

In introduction, the authors introduced about MM5 model and abruptly adverted to WRF model. There are lots of similar studies conducted using WRF model, which should be

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sufficiently reviewed in this article.

Response:

The paper has mentioned some studies related to its aims, but regarding to the comment, following studies will be added to the last version of the paper: Ardie et al. (2012) performed four types of cumulus parameterization schemes in the WRF model for simulating three events of intense precipitation over the southern peninsular Malaysia in the winter monsoon of 2006-2007. The results were compared with the 3-hourly satellite data using a confirmation method named the acuity–fidelity. The four different schemes were the new Kain–Fritsch (KF2), the BMJ, the Grell–Devenyi ensemble (GD) and the older Kain–Fritsch (KF1). While the BMJ scheme indicated good achievement in the second and third events, it showed high errors in the first event. The GD, KF2, and KF1 schemes executed weakly, and the BMJ and GD schemes simulated higher values for rainfall. In general, they stated that although the BMJ scheme had good results, its feeble performance for the first event suggested that appropriateness of the cumulus parameterization scheme might be case dependent.

Li (2013) studied the effect of different cumulus schemes in simulating typhoon track and intensity. The simulation of 20 typhoon cases from 2003 to 2008 represented that cumulus schemes were really effective on the typhoon track and intensity. It was found that KF scheme obtained the most severe typhoon, while GD and BMJ schemes simulated weaker typhoons. Those differences were due to variation in precipitation computations. Different cumulus schemes caused dissimilar typhoon tracks in the case of large-scale circulations simulating. The results also indicated that different atmosphere vertical heating created different typhoon intensity. Those variations led to different convections that create several LHF and cumulus precipitation. The KF scheme simulated the most severe vertical convection, higher cumulus precipitation, and superior intensity, while the GD and BMJ schemes generated more feeble convection, low cumulus precipitation and less intensity

Comment 2:

There is no statement that which version of WRF model is used in this study.

Response:

The WRF (version 3.3.1) was utilized in this study.

Comment 3:

In page 290, Wang et al. (2010) is not included in the reference list.

Response:

Done.

Comment 4:

In page 291, full name of CFSR is omitted in the content.

Response:

Done. It was just mentioned in the abstract.

Comment 5:

In Table 1, each scheme has corresponding reference paper, which should be citied in this paper.

Response:

All corresponding references (as follows) will be added under the Table 1 in the last version of this paper.

WRF single Moment 3-class (Hong et al., 2004); Eta (Rogers et al., 2001); New Thompson (Thompson et al., 2008); Stony Brook University (Lin and Colle, 2011); Lin et al (1983); RRTM and RRTMG (Mlawer et al., 1997); GFDL (Rahmstorf, 1993); New Goddard (Tao et al., 2008); Goddard (Tao and Simpson, 1993); Dudhia (Dudhia, 1989);

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MM5 (Menendez et al., 2011); Pleim Xiu (Gilliam and Pleim, 2010); TEMF (Wang et al., 2010); Noah, 5-layer thermal diffusion, RUC (Wang et al., 2010); Yonsei University (Hong et al., 2006); Mellor Yamada Janjic (Janjic, 1994); ACM2 (Pleim, 2007); Kain Fritsch (Kain, 2004); Betts Miller Janjic (Betts and Miller, 1986; Janjic, 1994); New Simplified Arakawa-Schubert (Han and Pan, 2011); Tiedtke (Tiedtke, 1989; Zhang et al., 2011)

Complementary explanations as follow can be added to the paper to clarify and illustrate the value of findings:

The spotlight of simulation 6 was the amount of temperature and moisture in the different atmospheric layers that were connected (Liu et al., 1997).This combination could predict SST satisfactorily comparing to the other groups in this paper.

The simulation number 5 could estimate both SHF and precipitation rate better than the other sets. This combination has considered convection, mass flux, and cloud effects. Furthermore, Li (2013) demonstrated that the KF cumulus parameterization could create the most severe vertical convection.

On the other hand, the simulation number 1 has focused on the different water phases in clouds. Phase changing in the different layers can affect the amount of LHF (Zhu and Zhang, 2006).

Simulation number 4 for wind speed prediction is focusing on mixed phase and multi-band efficiency along with the temperature and the turbulent kinetic energy played a significant role in forecasting wind speed. According to Draxl et al. (2010), turbulent kinetic energy can perform well in predicting wind speed.

With these changes all following references will be added to the last version of the paper:

Ardie, W. A., Sow, K. S., T Tangang, F., Hussin, A. G., Mahmud, M. & Juneng, L. 2012. The performance of different cumulus parameterization schemes in simulating

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the 2006/2007 southern peninsular Malaysia heavy rainfall episodes. Journal of Earth System Science, 121, 317-327.

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Gilliam, R. C. & Pleim, J. E. 2010. Performance assessment of new land surface and planetary boundary layer physics in the WRF-ARW. Journal of Applied Meteorology and Climatology, 49, 760-774.

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Hong, S.-Y., Dudhia, J. & Chen, S.-H. 2004. A revised approach to ice microphysical processes for the bulk parameterization of clouds and precipitation. Monthly Weather Review, 132, 103-120.

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Menéndez, M., Tomás, A., Camus, P., Garcia-Diez, M., Fita, L., Fernandez, J., Méndez, F. & Losada, I. A methodology to evaluate regional-scale offshore wind energy resources. Oceans, 2011 IEEE, 2011 Spain. IEEE, 1-8.

Mlawer, E. J., Taubman, S. J., Brown, P. D., Iacono, M. J. & Clough, S. A. 1997. Radiative transfer for inhomogeneous atmospheres: RRTM, a validated correlated-k model for the longwave. Journal of Geophysical Research, 102, 16663-16682.

Pleim, J. E. 2007. A combined local and nonlocal closure model for the atmospheric boundary layer. Part I: Model description and testing. Journal of Applied Meteorology and Climatology, 46, 1383-1395.

Rahmstorf, S. 1993. A fast and complete convection scheme for ocean models. Ocean Modelling, 101, 9-11.

Rogers, E., Black, T., Ferrier, B., Lin, Y., Parrish, D. & Dimego, G. 2001. Changes to the NCEP Meso Eta Analysis and Forecast System: Increase in resolution, new cloud microphysics, modified precipitation assimilation, modified 3DVAR analysis. NWS Tech-

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nical Procedures Bulletin, 488, 1-15.

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Wang, W., Bruyere, C., Duda, M., Dudhia, J., Gill, D., Lin, H., Michalakes, J., Rizvi, S., Zhang, X. & Beezley, J. 2010. ARW modeling system user's guide. Mesoscale & Miscroscale Meteorology Division (version 3). Boulder,USA: National Center for Atmospheric Research.

Wang, W., Xie, P., Yoo, S.H., Xue, Y., Kumar, A., Wu, X. 2011. An assessment of the surface climate in the NCEP climate forecast system reanalysis. Climate Dynamic, 37,1601–1620.

Zhang, C., Wang, Y. & Hamilton, K. 2011. Improved Representation of Boundary Layer Clouds over the Southeast Pacific in ARW-WRF Using a Modified Tiedtke Cumulus Parameterization Scheme. Monthly Weather Review, 139, 3489-3513.

Zhu, T. & Zhang, D.-L. 2006. Numerical simulation of Hurricane Bonnie (1998). Part II: Sensitivity to varying cloud microphysical processes. Journal of the Atmospheric Sciences, 63, 109-126.

Please also note the supplement to this comment:

http://www.nat-hazards-earth-syst-sci-discuss.net/2/C1634/2014/nhessd-2-C1634-2014-supplement.pdf

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 2, 287, 2014.