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THE PERFORMANCE OF MICROPHYSICS SCHEME IN WRF MODEL FOR SIMULATING EXTREME RAINFALL EVENTS

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ABSTRACT: In this research, microphysics scheme is one main important scheme to simulate high-resolution rainfall and extreme rainfall event. It has impacted increase natural or relating to aerosols in the atmosphere. It can modify climate in the atmosphere because it can change precipitation efficiency. This research, two microphysics schemes (Lin scheme and WSM6 scheme) in the Weather Research and Forecasting (WRF) model were used to simulate three extreme rainfall events over Thailand with three nested domains. The innermost domain was 4 km × 4 km and covered Thailand area. The results of extreme rainfall events given by the simulations from two microphysics schemes can be compared with the trend of rainfall spatial distribution from the TRMM data. The spatial pattern results of extreme rainfall events given by the two microphysics schemes. It can capture the trend of extreme spatial rainfall distribution with TRMM data. The statistical comparison was supported by the spatial pattern. It was shown the value less than 0 almost three cases that mean the results from the simulation were underestimate than TRMM data. However, the statistical comparison was shown a good trend from two microphysics scheme. In general, the trend of rainfall from two microphysics schemes of the WRF model good approximately extreme rainfall three cases with TRMM data over Thailand.

Keywords: WRF model, TRMM data, Lin scheme and WSM6 scheme

1. INTRODUCTION

The Weather Research and Forecasting (WRF) model is famous for the dynamical atmospheric model, this model is a good model to estimate climate atmospheric value, especially high-resolution rainfall simulation. One scheme is used in calculating rainfall in the high-resolution model, which is microphysics scheme. The WRF model has many microphysics scheme options including a single moment, that is calculated only for the particle mixing ratios or specific humidity. But double-moment is calculated both of the particle mixing ratio and the particle number concentration [1]. The bulk microphysics occurs for the micro-scale and includes the specific humidity of seven different forms of water: water vapor, cloud water, cloud ice, snow, rain, graupel and hail involving cloud and precipitation processes. The processes of microphysics scheme are as follows: cloud droplets, raindrops, ice-crystals, aggregates of ice crystals, snowflakes, rimed ice particles, graupel particles, and hailstones. The certain processes of microphysics scheme are condensation, accretion, evaporation, ice and snow aggregation, accretion by frozen particles, vapor deposition, melting, and freezing [2].

In each microphysics schemes in WRF model is different calculation processes of rainfall high-resolution area case. However, the microphysics scheme has the impact of increase natural or relating to aerosols in the atmosphere. It can modify climate in the atmosphere because it can change precipitation efficiency [2]. So microphysics scheme is the main factor in calculating extreme rainfall in the high-resolution model.

Many types of research were used WRF model to simulate rainfall over their country. Chotamonsak, C. et al., (2012) [3] used two nested domain with the inner domain of 20 km in the WRF model for the downscale region over Thailand, pointing on simulated precipitation using different convective parameterization schemes. They used 4 convective cumulus parameterization schemes Betts-Miller-Janjic scheme (BMJ) Grell-Devenyi scheme (GD) improved Grell-Devenyi scheme (G3D) and Kain-Fritsch scheme (KF) with and without nudging applied to the outermost nest. The results are compared with station dataset and gridded dataset. The results of this study were very well in BMJ scheme is cumulus parameterization scheme with nudging yields over Thailand. Kirtsaeng, S. et al., (2010) [4] used three nested domain with the inner domain of 5 km by Weather Research and Forecasting (WRF) model (version 3.0.1) for simulation of weather phenomenon, in the heavy rainfall over Mumbai, India on July 26, 2005. They used the Kian-Fritsch scheme (KF), Betts-Miller-Janjic scheme (BMJ) and Grell-Devenyi ensemble scheme (GD) are cumulus parameterization schemes. The results of precipitation simulation were compared with rainfall observation data from Tropical-Rainfall Measuring Mission (TRMM). The result of this case was very well in Betts-Miller-Janjic scheme (BMJ) is cumulus parameterization scheme for July 25, 2005, around Mumbai. Vaid, B.H., (2012) [5] checked the ability of the WRF version3 model with three nested domain with the inner domain of 3 km to predict the heavy rainfall over Singapore on 16 June 2010. The result of the model has a maximum precipitation approximate of 5 cm (about 500 mm) over the change airport that result is shown very close to observation.

Since a study about microphysics didn't receive a lot of attention studies emphasizing on microphysics parameterization and isn't completed to examine heavy rainfall case on all seasonal over Thailand. Following, Lim, J.O.J and Hong, S.Y. (2005) [6] are founded the ice process in microphysics schemes that has effected in high resolution to simulate heavy rainfall events over Korea. Therefore microphysics parameterization is important for rainfall simulation for the high-resolution scale. There are many studies using the microphysics schemes in WRF model simulation heavy rainfall event over Thailand. Kaewmesri et al. (2017) [7] were simulated the heavy rainfall over southern Thailand. The simulation period was focused on November 2011. The results can captured heavy rainfall in heavy rainfall case study. In this study was investigated two microphysics schemes (Lin scheme and WSM6 scheme) that have full forms of water, that is contained with water vapor, cloud water, cloud ice, snow, rain, graupel and hail to simulate three heavy rainfall events over Thailand.

The aim of this research was simulated three extreme rainfall events over Thailand with different two kind microphysics scheme (Lin scheme and WSM6 scheme) by using WRF model version 3.4. The others physics options that were used in this research; BMJ scheme for cumulus scheme, Dudhia scheme for shortwave radiation, RRTM for long-wave radiation, YSU scheme for PBL and Noah scheme for the land-surface. The results of rainfall simulation will compare TRMM surface rainfall data from.

2. METHODOLOGY

2.1 The model description

The Weather Research and Forecasting (WRF) model is improved and developed by the National Center for Atmospheric Research (NCAR). This model is a one of Numerical Weather Prediction that based on non-hydrostatic and Euler equations (Ooyama 1990 [8]). The momentum equations (1) – (3) are written as:

$$\frac{\partial U}{\partial t} = m\left[\frac{\partial(Uu)}{\partial x} + \frac{\partial(Vu)}{\partial y}\right] + \frac{\partial(\Omega u)}{\partial \eta} + \mu_d \alpha \frac{\partial p}{\partial x} + \left(\frac{\alpha}{\alpha_d}\right)\frac{\partial p}{\partial \eta}\frac{\partial \phi}{\partial x} - F_U, \tag{1}$$

$$\frac{\partial V}{\partial t} = m\left[\frac{\partial(Uv)}{\partial x} + \frac{\partial(Vv)}{\partial y}\right] + \frac{\partial(\Omega v)}{\partial \eta} + \mu_d \alpha \frac{\partial p}{\partial y} + \left(\frac{\alpha}{\alpha_d}\right)\frac{\partial p}{\partial \eta}\frac{\partial \phi}{\partial y} - F_V, \tag{2}$$

$$\frac{\partial W}{\partial t} = m\left[\frac{\partial(Uw)}{\partial x} + \frac{\partial(Vw)}{\partial y}\right] + \frac{\partial(\Omega w)}{\partial \eta} - \frac{g}{m}\left[\left(\frac{\alpha}{\alpha_d}\right)\frac{\partial p}{\partial \eta} - \mu_d\right] - F_W, \tag{3}$$

The mass conservation equation (4)

$$\frac{\partial \mu_d}{\partial t} = m^2\left[\frac{\partial U}{\partial x} + \frac{\partial V}{\partial y}\right] + m\frac{\partial \Omega}{\partial \eta}, \tag{4}$$

The geopotential equation (5)

$$\frac{\partial \phi}{\partial t} = \frac{1}{\mu_d}\left[m^2\left[U\frac{\partial \phi}{\partial x} + V\frac{\partial \phi}{\partial y}\right] + m\frac{\partial \Omega\phi}{\partial \eta} - mgW\right], \tag{5}$$

The conservation equations for the potential temperature and scalars (6) – (7)

$$\frac{\partial \Theta}{\partial t} = \frac{\partial \Theta}{\partial t} + m^2\left[\frac{\partial(U\theta)}{\partial x} + \frac{\partial(V\theta)}{\partial y}\right] + m\frac{\partial(\Omega w)}{\partial \eta} - F_\Theta, \tag{6}$$

$$\frac{\partial Q_m}{\partial t} = m^2\left[\frac{\partial(Q_m)}{\partial x} + \frac{\partial(Q_m)}{\partial y}\right] + m\frac{\partial(\Omega Q_m)}{\partial \eta} - F_{Q_m}, \tag{7}$$

The equation of state (8)

$$p = p_0\left(\frac{R_d \theta}{p_0 \alpha}\right)^\gamma, \tag{8}$$

where $\vec{V} = \mu\vec{v} = (U, V, W)$, $\Omega = \mu_d\dot{\eta}$, $\Theta = \mu_d\theta$ and $v = (u, v, w)$ the covariant velocities in the two horizontal and vertical directions, respectively, while $\omega = \dot{\eta}$ is the contravariant 'vertical' velocity, θ is the potential temperature. Also appearing in the governing equations of the ARW are the non-conserved variables, $\phi = gz$ is the geopotential, p is pressure, m is map scale factor, $\gamma = c_p/c_v = 1.4$ is the ratio of the heat capacities for dry air, R_d is the gas constant for dry air, p_0 is a reference pressure (typically 10^5 Pascal), $\alpha = 1/\rho$ is the inverse density, $\alpha_d = 1/\rho_d$ is the inverse density of the dry air and The Left-Hand-Side (RHS) terms F_U, F_V, F_W and F_Θ represent forcing terms arising from model physics, turbulent mixing, spherical projections, and the earth's rotation. The WRF equations are formulated using a terrain-following hydrostatic-pressure vertical coordinate denote by η and defined by, while $\mu = p_{hs} - p_{ht}$ the mass per unit area with the column in the model domain, p_h is the hydrostatic pressure, p_{ht} is the hydrostatic pressure at the top of the model, p_{hs} is the hydrostatic pressure at the model surface [9]-[10].

The time-split integration use a Runge-Kutta 3 order scheme, integrates a set of ordinary differential equations using a predictor-corrector formulation. Defining the prognostic variables in the WRF solver as $\Phi = (U, V, W, \Theta, \phi, \mu, Q_m)$ and the model equations as the Runge-Kutta 3 order integration takes the form of 3 order to advance a solution to:

$$\Phi^{*} = \Phi^{t} + \frac{\Delta t}{3} R\left(\Phi^{t}\right), \tag{9}$$

$$\Phi^{**} = \Phi^{t} + \frac{\Delta t}{2} R\left(\Phi^{*}\right), \tag{10}$$

$$\Phi^{t+\Delta t} = \Phi^{t} + \Delta t R\left(\Phi^{**}\right), \tag{11}$$

where is the time step for the low-frequency modes (the model time step)? In equations (9) – (11), superscripts denote time levels. This scheme is not a true Runge-Kutta scheme per se because, while it is third-order accurate for linear equations, it is only second-order accurate for nonlinear equations. With respect to the WRF equations, the time derivatives are the partial time derivatives (the leftmost terms) in equations (1) – (8) and are the remaining terms in equations (1) – (8).

2.2 Initial and boundary condition and data observations

The initial and boundary conditions were used in the 1.0 x 1.0 degree gridded NCEP FNL (Final) Operational Global Analysis. FNL product is from the Global Data Assimilation System (GDAS), which continuously collects observational data from the Global Telecommunications System (GTS), and other sources, for many analyses. The FNLs are made with the same model which NCEP uses in the Global Forecast System (GFS), but the FNLs are prepared about an hour or so after the GFS is initialized. The FNLs are delayed, so that more observational data can be used and The period of data preparing during 1800 UTC 30 July 1999 to present and analyses are available on the surfaced, at 26 mandatory (and other pressure) levels from 1000 millibars to 10 millibars. The spatial coverage from latitude is 180 degrees east to 180 degrees west and longitude is 90 degrees north to 90 degrees south [5].

Furthermore, the Tropical Rainfall Measuring Mission (TRMM) rainfall remote sensing data. Rainfall is very variable in space and time. Accurate rainfall measurement in the tropics has long been and remains a difficult task. Before the existence of satellite remote sensing, there was very little rainfall measurement data over the open oceans and undeveloped countries [5]. TRMM observation data is satellite dataset, where is from a joint mission between NASA and the Japan Aerospace Exploration Agency (JAXA). This study used TRMM 3 hourly observation data version 7. The data can measure the vertical structure of rainfall over ocean and land. The horizontal resolution is 0.25 degree and period of data is during 0000 UTC 1 January 1998 to present. The spatial of TRMM 3 hourly observation cover area is between latitude 180 degree east to 180 degrees west and longitude 50 degrees north to 50 degrees south [12]. TRMM observation data are good estimates for surface observed rainfall. So TRMM observation data are used as a comparison to WRF model output and many research were used TRMM observation data comparison with WRF model output [4-5, 13]

2.3 Experiment description

This research is depended on extreme rainfall observations from the TRMM data. The TRMM data is recorded by satellite and useful for estimating the surface rainfall. This research was chosen by maximum area average accumulate rainfall value during 2000 to 2012. In this case, the highest maximum area average accumulates rainfall value is 2,288.46 mm/year in 2011 as shown in Fig 1.

The selected month of extreme rainfall in summer season simulation from TRMM data is March 2011. Because it has the highest maximum area average accumulate rainfall value in summer season 2011 and the maximum area average accumulate rainfall value is 203.45 mm/month (Fig 2) and month of extreme rainfall rainy season simulation from TRMM data is September 2011. It has the highest maximum Area average accumulate rainfall value in rainy season 2011 and it is 367.08 mm/month. (Fig 2). In the selected month of the winter season of simulation from TRMM data is November 2011. Because it has the highest maximum Area average accumulate rainfall value in the winter season of 2011 and its value is 100.76 mm/month (Fig 2).

The date of summer season simulation from TRMM data and selected date simulation by chosen maximum area average accumulate rainfall value of TRMM data. In the summer season, as shown in Figure 3. The date of the summer season of simulation from TRMM data is March 28, 2011. Hence it has the highest maximum area average values is 20.60 mm/day. The date of the rainy season of simulation from TRMM data is September 10, 2011. Hence it has the highest maximum area average values is 20.60 mm/day. The date of the rainy season of simulation from TRMM data is September 10, 2011. Because it has the highest maximum area average accumulate rainfall value in the rainy season of 2011 and the maximum area average accumulate rainfall value is 27.50 mm/day (Figure 4). In winter season simulation from TRMM data and selected date simulation by chosen maximum area average accumulate rainfall value of TRMM data in the winter season, as shown in Figure 5. The date of the winter season of simulation from TRMM data is November 23, 2011 (10.62 mm/day).

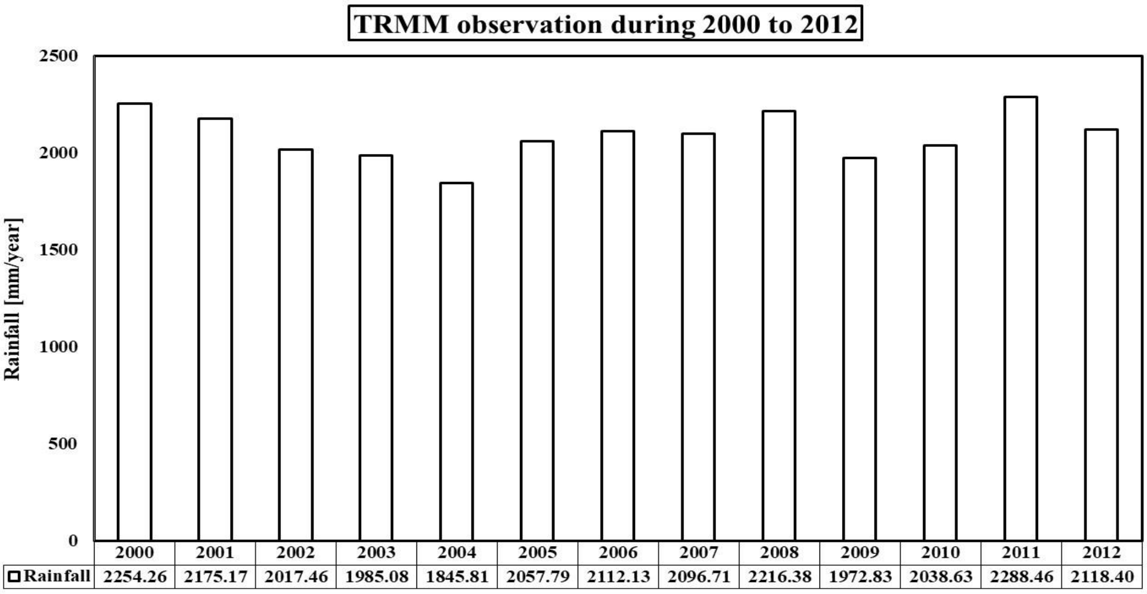

Fig. 1 Area average accumulate rainfall value of TRMM observation data from 2000 to 2012.

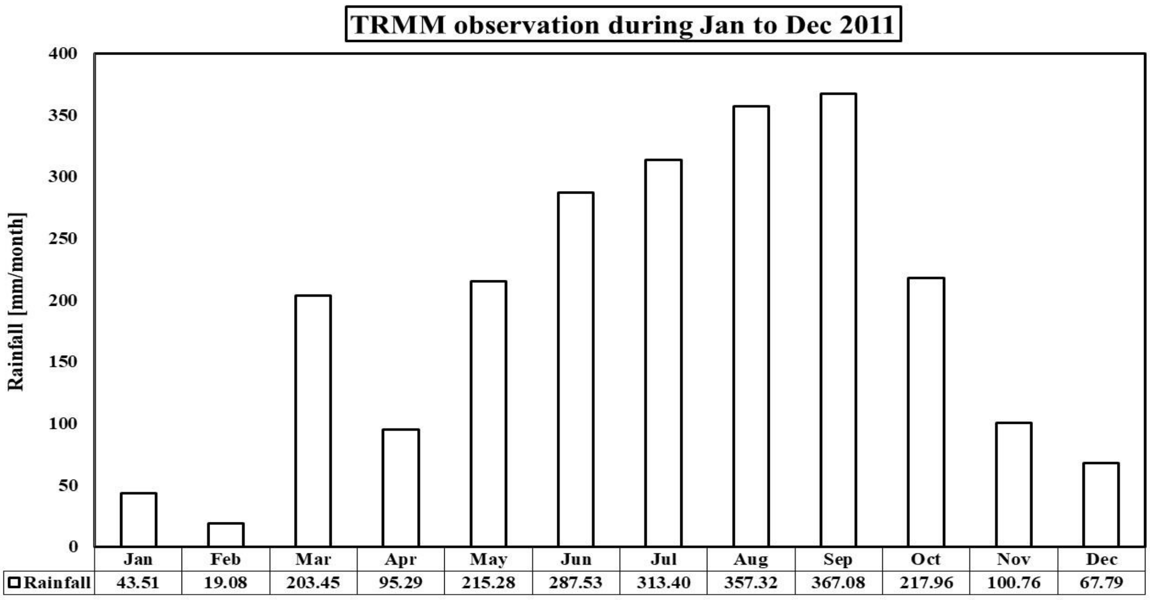

Fig. 2 Area average accumulate rainfall value of TRMM observation data from January to December 2011

2.4 Domain description

The domain of experiments is the finest domain of three simulation domains (Figure 6) were 36×36 km2 (domain1), 12×12 km2 (domain2), 4×4 km2 (domain3) as shown in Fig 6. The domains are run the simulation by two-way nested domain. The domain 1 has 412×392 grids point covering India, Tibet, Philippines, and some part of Australia, that begins at latitude -20.8265 degrees north to 42.5789 degrees north and longitude 66.9183 degrees east to 133.567 degrees east, the domain 2 has 703×728 grids point covering India, Tibet, Philippines, and some part of Australia, that begin at covering at latitude -8.40932 degrees north to 30.888 degrees north cover the Indian Ocean, South China sea, Indonesia and the domain 3 has 667×971 grids point covering India, Tibet, Philippines, and some part of Australia, that begin at covering at latitude 4.4198 degrees north to 21.8973 degrees north and longitude 95.5056 degrees east to 107.506 degrees east, respectively (set the ratio of 1:3).

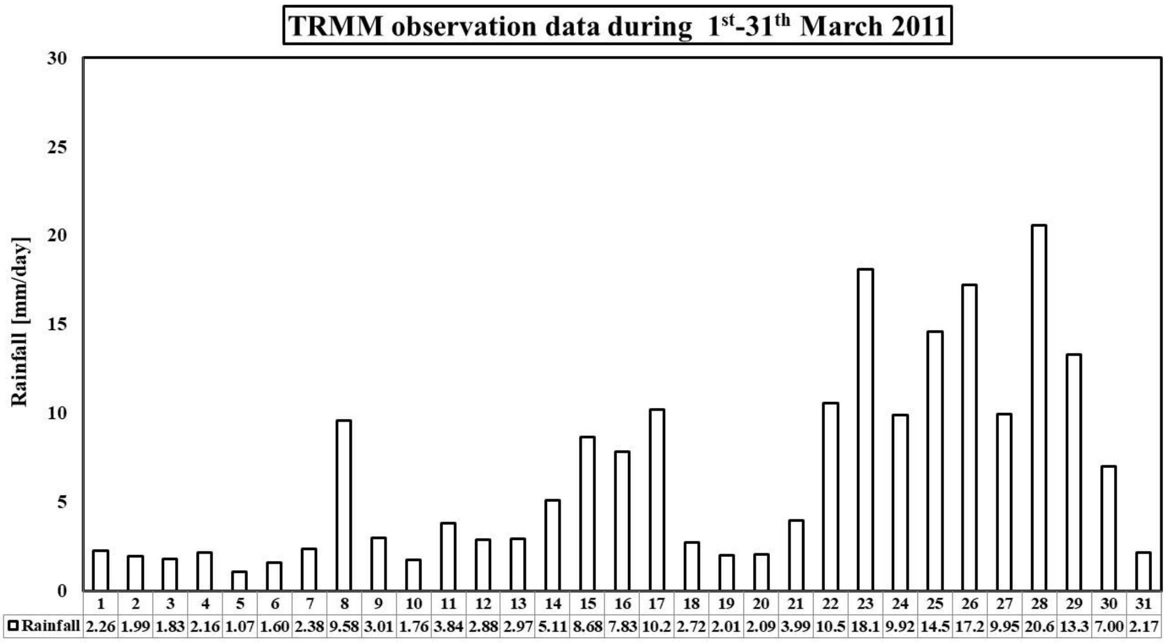

Fig. 3 Area average accumulate rainfall value of TRMM observation data during 1st - 31st March 2011

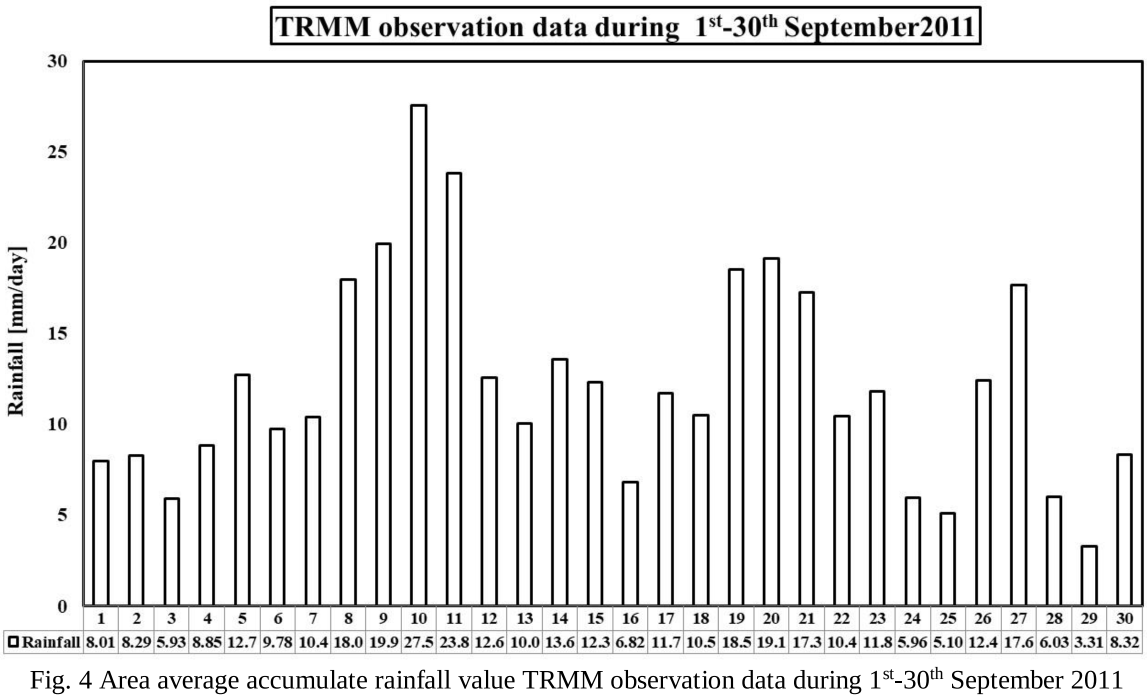

Fig. 4 Area average accumulate rainfall value TRMM observation data during 1st-30th September 2011

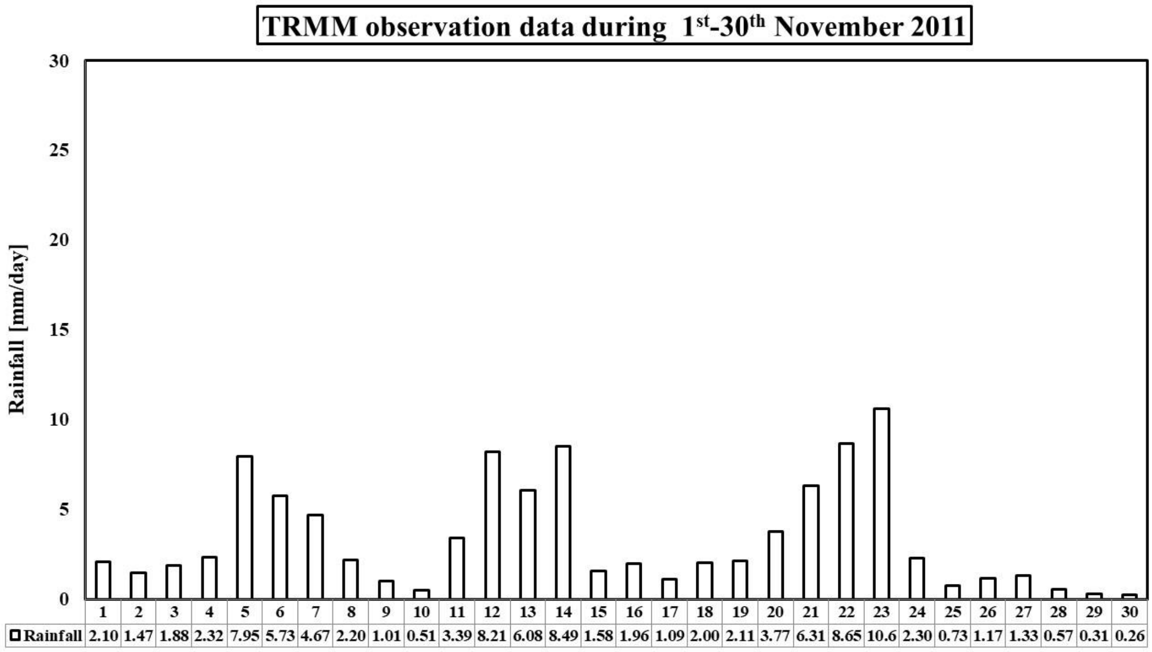

Fig. 5 Area average accumulate rainfall TRMM observation data during 1st-30th September 2011

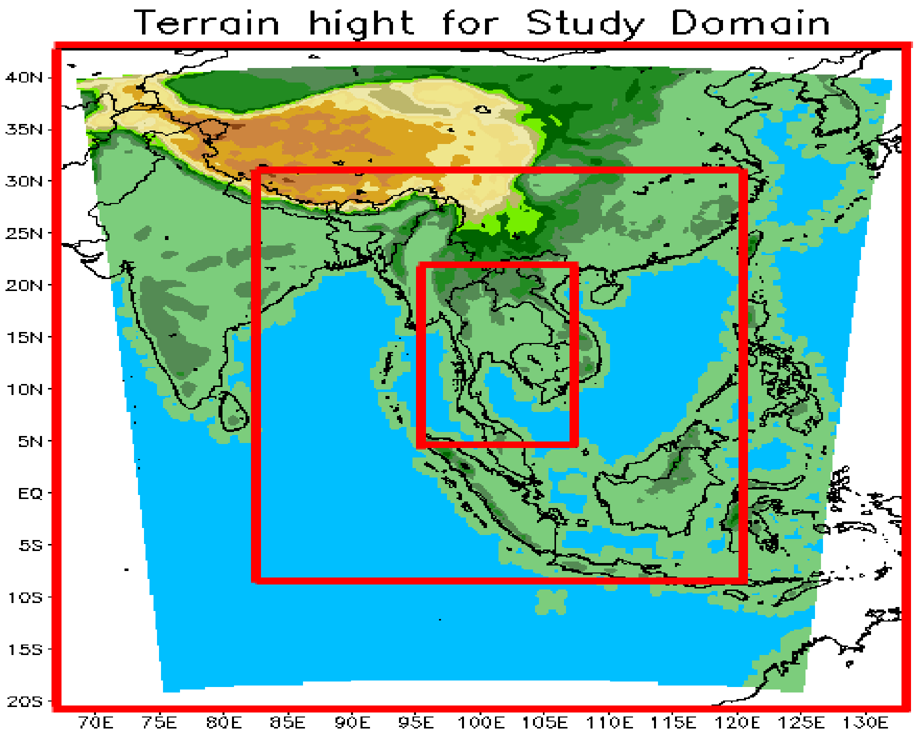

Fig 6. WRF model three nested domain in this study.

In this study, a summary three case of period experiment the first case is 3 hourly-rainfall during 00 UTC March 28, 2011 to 00 UTC March 29, 2011 (heavy rainfall in summer season), the second case is 3 hourly-rainfall during 00 UTC September 10, 2011 to 00 UTC September 11, 2011 (heavy rainfall in rainy season) and the last case is 3 hourly-rainfall during 00 UTC November 23, 2011 to 00 UTC November 24, 2011 (heavy rainfall in winter season) with the physics parameterizations of WRF model and 3 hours spinup is 21 UTC March 27, 2011, 21 UTC September 9, 2011, and 21 UTC November 22, 2011, respectively as shown in Table 1.

Table 1 Experiments for the Microphysics Parameterizations WRF model

Case	Period	Mp	Cu	Short-wave	Long-wave	PBL
Case 1	3 hourly-rainfall during 00 UTC March 28, 2011, to 00 UTC March 29, 2011 (3 hours spinup is 21 UTC 27 March 2011)	Lin WSM6	BMJ Only D1, D2	Dudhia	RRTM	Yonsei
Case 2	3 hourly-rainfall during 00 UTC September 10, 2011, to 00 UTC September 11, 2011 (3 hours spinup is 21 UTC 09 September 2011)	Lin WSM6	BMJ Only D1, D2	Dudhia	RRTM	Yonsei
Case 3	3 hourly-rainfall during 00 UTC November 23, 2011, to 00 UTC November 24, 2011 (3 hours spinup is 21 UTC 22 November 2011)	Lin WSM6	BMJ Only D1, D2	Dudhia	RRTM	Yonsei

**D1 is Domain1, D2 is Domain2

2.5 Statistical Comparison Methods

Once the WRF model grid point values were interpolated to each surface observation location in the horizontal and vertical direction, the data were compared by simulation accuracy. The accuracy of each simulation was calculated using Mean Error (ME), and Mean Absolute Error (MAE). This technique can be done for any scalar quantity.

The ME allows both positive and negative errors to be used in the average. As a result, mean error is also known as bias. If mean error = 0, there is no bias, if mean error > 0, simulation, on average, are too high and if mean error < 0, simulation, on average, are too low (Wilkins, 2011). The mean error is defined by the following equation:

$$ME = \frac{1}{n}\sum_{i=1}^{n}(x_i - y_i),$$

where is Mean Error, x is defined as the simulation value, is the observation value, y is defined as the number of pairs of observations and simulation values.

Each forecast-observation pair gives an error value. This measure sums the absolute values of these errors and divides by the number of forecasts to give an average error. $MAE = 0$ for a perfect forecast (Wilkins, 2011). The mean absolute error is defined by the following equation:

$$MAE = \frac{1}{n}\sum_{i=1}^{n}|x_i - y_i|,$$

where MAE is Mean Absolute Error, x is defined as the simulation value, y is the observation value, n is defined as the number of pairs of observations and simulation values.

3. RESULTS AND DISCUSSION

3.1 Extreme rainfall on March 28, 2011

Fig 7 shows the accumulate rainfall from TRMM data, Lin scheme, and WSM6 scheme on March 28, 2011. The TRMM data show rainfall distribution over Thailand in Fig. 7(a). It shows extreme rainfall area over lower southern Thailand that more than 160 mm/day, especially over Phangnga province, Surat Thani province, Nakhon Sri Thammarat province, Phathalung province and Krabi province. But the Lin scheme and WSM6 scheme were overestimated rainfall than TRMM data. It shows extreme rainfall over lower southern Thailand similarly TRMM data. The extreme rainfall distribution of them shown around Chumphon province, Surat Thani province, Nakhon Sri Thammarat province, Phangnga province, Phuket province and Krabi province. However, the Lin scheme and WSM6 scheme can capture the trend of extreme rainfall over southern Thailand as same as TRMM data.

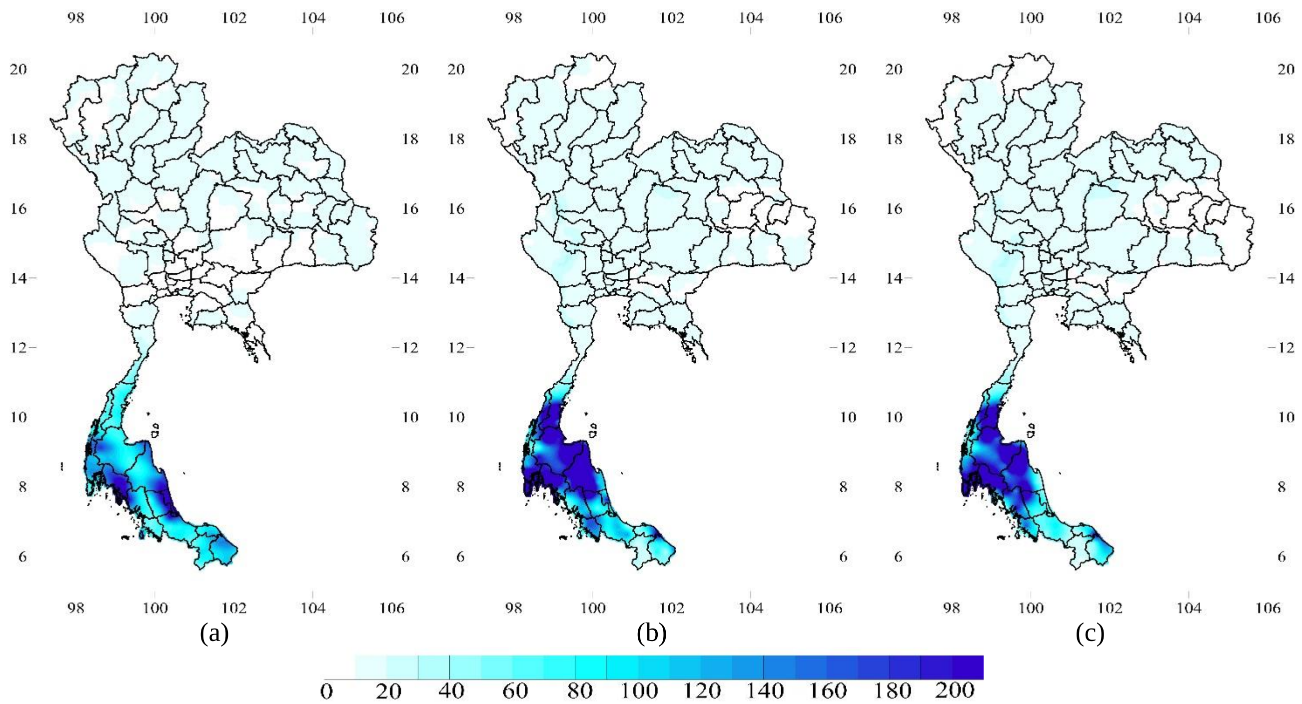

Fig 7. Spatial rainfall pattern accumulate rainfall (mm/day) on March 28, 2011: a) TRMM, b) Lin scheme and WSM6 scheme.

3.2 Extreme rainfall on September 10, 2011

Fig 8 shows the accumulate rainfall from TRMM data, Lin scheme and WSM6 scheme on September 10, 2011. The TRMM data show rainfall distribution over Thailand in Fig. 8(a). It showed rainfall distribution over center, northern, northeastern, western and southern Thailand (in the rage of 40 mm/day to 100 mm/day). Furthermore, TRMM can capture the extreme rainfall (about 100 mm/day to 120 mm/day) over Surat Thani province, Trang province, Phangnga province in southern and extreme rainfall over coast east Thailand. Lin scheme (Fig. 8(b)) and WSM6 scheme (Fig. 8(c)) can capture the rainfall distribution center, northern, northeastern, western and southern Thailand (in the rage of 40 mm/day to 100 mm/day) similarly TRMM data. Furthermore, they can capture extreme rainfall area over coast east Thailand, just like the TRMM. But, they can't capture the extreme rainfall over Surat Thani province, Trang province and Phangnga province, as same as the TRMM data.

3.3 Extreme rainfall on November 23, 2011

Fig 9 shows the accumulate rainfall from TRMM data, Lin scheme and WSM6 scheme on November 23, 2011. The TRMM data show rainfall distribution over Thailand in Fig. 9(a). It shows extreme rainfall area over Chumphon province, Ranong province, Songkhla province, Phathalung province, Pattani province and Narathiwat province (more than 160 mm/day). On the other hand, the Lin scheme (Fig. 9(b)) and WSM6 (Fig. 9(c)) shown extreme rainfall over lower southern Thailand similarly TRMM data, especially over Yala province and Narathiwat province. But they can't capture extreme rainfall over Chumphon province and Ranong province.

3.4 Statistical Analysis.

The results of the two microphysics scheme can indicate trend rainfall distribution pattern as same as TRMM data over Thailand. In this research, to quantify the ability of two microphysics scheme to produce rainfall over Thailand by using Mean Error (ME) and Mean Absolute Error (MAE) that are presented in Table 2. In extreme rainfall on March 28, 2011, the ME of two microphysics scheme were showed value in 12 UTC and 24 UTC. Both schemes were less than 0 (Lin scheme (-1.91), WSM6 scheme (-2.69) in 12 UTC and Lin scheme (-1.49), WSM6 scheme (-6.49)). On September 10, 2011, and November 23, 2011, showed the result of ME less than 0 in both of 12 UTC and 24 UTC similarly March 28, 2011. This research can conclude that the two microphysics scheme were given a lower ME value than 0 in all three case. There were the results of two microphysics scheme to lower simulation than TRMM data. In case of MAE , the results of two microphysics scheme were shown nearly value almost three cases. On March 28, 2011, the MAE from WSM6 scheme was show a good *MAE* value than Lin scheme in 12 UTC. But in 24 UTC the Lin scheme was shown the good *MAE* than the WSM6 scheme. On September 10, 2011, the results of WSM6 were shown the good *MAE* than Lin scheme in 12 UTC and 24 UTC. On the other hand, On November 23, 2011, the Lin scheme was shown good *MAE* than WSM6 scheme. However, the *MAE* statistical comparison was shown a good trend from Lin scheme and WSM6 scheme in this research.

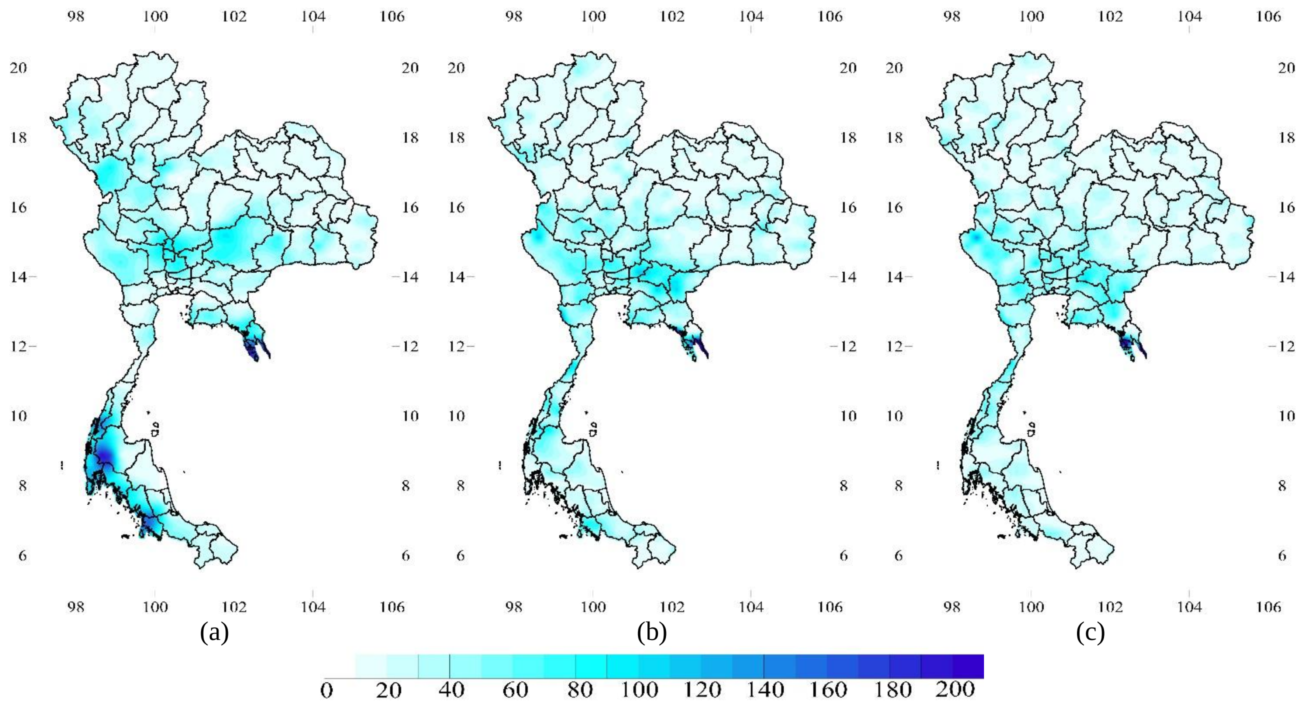

Fig 8. Spatial rainfall pattern accumulate rainfall (mm/day) on September 10, 2011: a) TRMM, b) Lin scheme and WSM6 scheme.

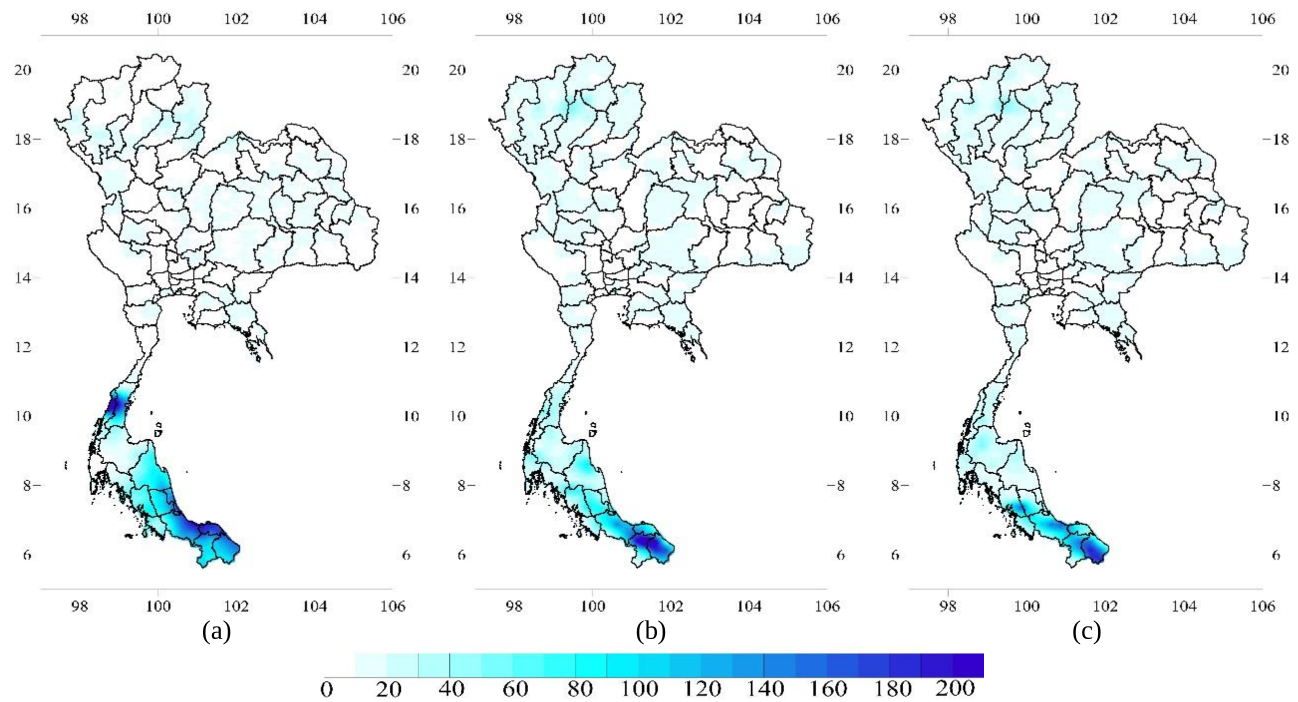

Fig 9. Spatial rainfall pattern accumulates rainfall (mm/day) November 23, 2011: a) TRMM, b) Lin scheme and WSM6 scheme.

Table 2. Mean Error (*ME*) and Mean Absolute Error (*MAE*) values on three case simulation

		ME		*MAE*	
		Lin scheme	**WSM6 scheme**	**Lin scheme**	**WSM6 scheme**
Case 1 (28 March 2011)	12 UTC	**-1.91**	**-2.69**	**11.37**	**11.15**
	24 UTC	**-1.49**	**-6.49**	**19.56**	**19.58**
Case 2 (10 September 2011)	12 UTC	**-3.32**	**-4.40**	**15.20**	**14.82**
	24 UTC	**-1.19**	**-8.19**	**26.44**	**26.38**
Case 3 (23 November 2011)	12 UTC	**-3.52**	**-3.71**	**5.86**	**6.05**
	24 UTC	**-5.36**	**-6.41**	**9.61**	**10.14**

4. CONCLUSION

In this research, a summary of three cases extreme rainfall of period experiment on March 28, 2011, September 10, 2011, and November 23, 2011, with the two microphysics scheme of WRF model. In conclusion, two different microphysics schemes (including the Lin scheme and WSM6 scheme), showed results that can be compared with the trend of rainfall spatial distribution in the TRMM data. On March 28, 2011 case. The Lin scheme and WSM6 scheme presented overestimate extreme rainfall than TRMM data on Chumphon province, Surat Thani province, Nakhon Sri Thammarat province, Phangnga province, Phuket province and Krabi province. On September 10, 2011 case. The Lin scheme and WSM6 scheme can capture extreme rainfall area over coast east Thailand, similarly the TRMM. In the last case, on November 23, 2011 case. The Lin scheme and WSM6 scheme can capture extreme rainfall area over lower southern Thailand, similarly the TRMM data. Which corresponds with the statistical results, the results were shown TRMM data that overestimated than two microphysics schemes as shown in Table 2. The statistical comparison was shown a good trend from Lin scheme and WSM6 scheme in this research. In general, the trend of rainfall from Lin and WSM6 microphysics scheme of the WRF model good approximately three cases extreme rainfall comparing with TRMM data over Thailand.

5. ACKNOWLEDGMENTS

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