

## CONTENTS

	<b>PAGE</b>
ENGLISH ABSTRACT	ii
THAI ABSTRACT	iii
ACKNOWLEDGEMENTS	iv
CONTENTS	v
LIST OF TABLES	ix
LIST OF FIGURES	xii
LIST OF SYMBOLS	xxiv
LIST OF TECHNICAL TERMS AND ABBREVIATIONS	xxv

### CHAPTER

<b>1. INTRODUCTION</b>	<b>1</b>
1.1 Rationale	1
1.2 Precipitation	2
1.3 Physical Parameterization	2
1.4 Literature Review	3
1.5 Research Objective	5
1.6 Scope of Works	5
<b>2. THEORIES</b>	<b>7</b>
2.1 The Weather Research and Forecasting (WRF) Model	7
2.2 The WRF Modeling System Program Component	8
2.3 Governing Equation of the WRF Model	9
2.3.1 Vertical Coordinate and Variables of the WRF Model	9

## **CONTENTS (Cont.)**

	<b>PAGE</b>
2.3.2 WRF Flux-Form Euler Equations	10
2.3.3 WRF Inclusion of Moisture Equation	11
2.3.4 WRF Map Projections Equation	13
2.3.5 WRF Perturbation Form of the Governing Equation	15
2.3.6 Model Discretization	17
2.4 The Climate of Thailand	18
2.5 The Season of Thailand	18
2.6 Physical Parameterizations of WRF Model	19
2.7 Microphysical Particles and Processes	20
2.7.1 Microphysics Parameterizations	22
2.7.2 Microphysics Parameterizations of WRF Model	24
2.8 Statistical Comparison Methods	25
<b>3. METHODOLOGY</b>	<b>27</b>
3.1 Observation Data	27
3.2 Model Configuration	27
3.3 Domain of Experiments for the Microphysics Parameterization WRF Model	28
3.4 Period of Experiments for the Microphysics Parameterizations WRF Model	31
3.5 Initial Boundary Data for the Microphysics Parameterizations of WRF Model	38
3.6. Experiments for the Microphysics Parameterizations of WRF Model	38

## CONTENTS (Cont.)

		PAGE
<b>4.</b>	<b>RESULT</b>	<b>42</b>
4.1	Re-gridding the Result of Rainfall Pattern from Microphysics Parameterizations WRF Model	42
4.1.1	Re-gridding the Result of Rainfall Pattern on 3 Hourly-Rainfalls During 0000 UTC 28 March 2011 to 0000 UTC 29 March 2011	42
4.1.2	Re-gridding the Result of Rainfall Pattern on 3 Hourly-Rainfalls During 0000 UTC 23 November 2011 to 0000 UTC 24 November 2011	46
4.1.3	Re-gridding the Result of Rainfall Pattern on 3 Hourly-rainfalls During 0000 UTC 23 November 2011 to 0000 UTC 24 November 2011	51
4.2	Comparison of Rainfall Pattern between Microphysics Schemes of WRF Model and TRMM Observation Data on 3 Hourly-Rainfalls During 0000 UTC 28 March 2011 to 0000 UTC 29 March 2011 (Summer Season)	55
4.3	Comparison of Rainfall Pattern between Microphysics Schemes of WRF Model and TRMM Observation Data on 3 Hourly-Rainfalls During 0000 UTC 10 September 2011 to 0000 UTC 11 September 2011 (Rainy Season)	66
4.4	Comparison of Rainfall Pattern between Microphysics Schemes of WRF Model and TRMM Observation Data During 0000 UTC 23 November 2011 to 0000 UTC 24 November 2011(Winter Season)	78
<b>5.</b>	<b>CONCLUSION</b>	<b>91</b>
5.1	Conclusion	91
	<b>REFERENCES</b>	<b>93</b>
	<b>APPENDIX A</b> The Comparison of Spatial Pattern between the Original Results and Re-gridding Results on 28th March 2011 of Exp01, Exp02 and Exp03	<b>95</b>

## CONTENTS (Cont.)

	<b>PAGE</b>
<b>APPENDIX B</b> The Comparison of Spatial Pattern between the Original Results and Re-gridding Results on 10 <sup>th</sup> September 2011 of Exp01, Exp02 and Exp03	<b>105</b>
<b>APPENDIX C</b> The Comparison of Spatial Pattern between the Original Results and Re-gridding Results on 23 <sup>th</sup> November 2011 of Exp01, Exp02 and Exp03	<b>115</b>
<b>APPENDIX D</b> The Comparison of Spatial Pattern between Observation Data of Exp05 and Exp03 on 28 <sup>th</sup> March 2011	<b>125</b>
<b>APPENDIX E</b> The Different of Spatial Pattern between Observation Data of Exp05 and Exp03 on 28 <sup>th</sup> March 2011	<b>132</b>
<b>APPENDIX F</b> The Comparison of Spatial Pattern between Observation Data of Exp03 and Exp05 on 10 <sup>th</sup> September 2011	<b>137</b>
<b>APPENDIX G</b> The Different of Spatial Pattern between Observation Data of Exp03 and Exp05 on 10 <sup>th</sup> September 2011	<b>144</b>
<b>APPENDIX H</b> The Comparison of Spatial Pattern between Observation Data of Exp09 and Exp05 on 23 <sup>th</sup> November 2011	<b>149</b>
<b>APPENDIX I</b> The Different of Spatial Pattern between Observation Data of Exp09 and Exp05 on 23 <sup>th</sup> November 2011	<b>155</b>
<b>BIOGRAPPHY</b>	<b>161</b>