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Candidate	Miss Wikanda Suphasanun
Thesis Advisor	Dr. Dusadee Sukawat
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Abstract

Tropical cyclone with typhoon intensity is seldom formed in the Gulf of Thailand. However, when this occurs the consequence is severe damage due to a very short distance to the coast. In this research, the developments of typhoons GAY (8929) and VAMEI (0126) are simulated in terms of vorticity of the storms. A single level primitive equation model is used for the simulations. Unrealistic weak observed wind speeds of the tropical cyclones are enhanced with an asymmetric wind model before being used as the initial conditions of the primitive equation model. In addition, weak observed northeast monsoon wind speeds at the initial times of simulations are also enhanced. With the enhanced winds of the tropical cyclones and the enhanced monsoon winds, the simulations provide realistic results. The comparison of intensification of typhoons GAY and VAMEI in the Gulf of Thailand with typhoons CHANTHU (0405) and MUIFA (0425) over the Northwest Pacific Ocean shows that northeast monsoon wind plays an important role in the rapid formation of typhoons GAY and VAMEI in the Gulf of Thailand.

Keywords : Tropical Cyclone / Vorticity / Gulf of Thailand

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หลักสูตร	ปรัชญาดุษฎีบัณฑิต
สาขาวิชา	คณิตศาสตร์ประยุกต์
ภาควิชา	คณิตศาสตร์
คณะ	วิทยาศาสตร์
พ.ศ.	2556

บทคัดย่อ

พายุหมุนเขตร้อนที่มีความรุนแรงระดับไต้ฝุ่นไม่ค่อยเกิดขึ้นในอ่าวไทย อย่างไรก็ตามเมื่อเกิดขึ้นผลที่ตามมาคือความเสียหายอย่างมาก เนื่องจากกระยะทางที่สั้นมากจากชายฝั่ง ในงานวิจัยนี้ได้จำลองการพัฒนาของไต้ฝุ่นเกย์ (8929) และว่าเหมย (0126) ในพจน์ของการหมุนวนของพายุโดยใช้แบบจำลองสมการปฐมฐานระดับเดียว ในการจำลองได้ทำการเสริมอัตราเร็วลมตรวจวัดของพายุหมุนเขตร้อนที่อ่อนกว่าความเป็นจริงด้วยแบบจำลองลมอสมมาตรก่อนที่จะใช้เป็นเงื่อนไขเริ่มต้นของแบบจำลองสมการปฐมฐาน ยิ่งไปกว่านั้นยังได้ทำการเสริมอัตราความเร็วลมตรวจวัดของมรสุมตะวันออกเฉียงเหนือ ณ เวลาเริ่มต้นของการจำลองด้วยเช่นกัน การจำลองด้วยลมที่ถูกเสริมของพายุหมุนเขตร้อนและลมมรสุมให้ผลที่สมจริง การเปรียบเทียบการแรงขึ้นของไต้ฝุ่นเกย์และว่าเหมยในอ่าวไทยกับไต้ฝุ่นจันทู (0405) และ หมู๋ฟ้า (0425) เหนือมหาสมุทรแปซิฟิกด้านตะวันตกเฉียงเหนือแสดงว่าลมมรสุมตะวันออกเฉียงเหนือมีบทบาทที่สำคัญในการก่อตัวอย่างรวดเร็วของไต้ฝุ่น เกย์ และว่าเหมย ในอ่าวไทย

คำสำคัญ : พายุหมุนเขตร้อน / การหมุนวน / อ่าวไทย

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LIST OF SYMBOLS

SYMBOL

R	Radius of the storm
$V_h(R)$	Tangential wind speed
b	Shape of the radial profile
p_{center}	Central pressure of the storm
p_{env}	Environmental pressure
R_{max}	Radius of maximum wind
ρ	Air density of fluid
Ω	Angular speed of the earth
f	Coriolis parameter
ϕ	Latitude
$\vec{V}_{asym}(R, \theta)$	Asymmetric wind vector
\vec{V}_{center}	Translation vector of the storm center
\vec{u}_θ	Unitary vector
θ	Angle
u	Wind component along x axis (zonal wind)
v	Wind component along y axis (meridional wind)
w	Vertical wind speed component along z axis
p	Pressure
g	Gravity
h	Depth of the fluid
H	Mean depth
Φ	Geopotential height
C	Circulation
ζ	Vorticity
Δx	Grid intervals along x -axis
Δy	Grid intervals along y -axis
\vec{V}_H	Horizontal wind vector
φ_{Vect}	The wind vector angle
φ_{Met}	The meteorological wind direction angle
φ_{Polar}	The wind vector polar angle in two-dimensions
$\varphi(rad)$	Angular between u and v components in units of radians
$\varphi(deg)$	Angular between u and v components in units of degrees
\vec{V}	Velocity field
\vec{V}_ψ	Non-divergent part
\vec{V}_λ	Divergent part
\vec{V}_H	Non-divergent part of the flow
ψ	Stream function
ζ_{JTC}	Vorticity computed from JTC data
ζ_{Model}	Vorticity from SILEPE model
U_{Enh}	Enhanced wind speeds

u_{Enh}, v_{Enh}	Enhanced northeast monsoon wind components
t	Time
ζ_{GAY}	Vorticity computed from SILEPE model of typhoon Gay
ζ_{VAMEI}	Vorticity computed from SILEPE model of typhoon Vamei
$\zeta_{GAY(JTWC)}$	Vorticity computed from JTWC data of typhoon Gay
$\zeta_{VAMEI(JTWC)}$	Vorticity computed from JTWC data of typhoon Vamei
$\zeta_{CHANTHU(JTWC)}$	Vorticity computed from JTWC data of typhoon Chanthu
$\zeta_{MUIFA(JTWC)}$	Vorticity computed from JTWC data of typhoon Muifa

LIST OF TECHNICAL TERMS AND ABBREVIATIONS

°C	Degree Celsius
hPa	Hestopascal
MM5	Fifth-Generation Penn State/NCAR Mesoscale Model
NCAR	National Center for Atmospheric Research
WRF	Weather Research and Forecasting
RSMC	Regional Specialized Meteorological Center
AWM	Asymmetric wind model
JTWC	Joint Typhoon Warning Center
NOAA	National Oceanic and Atmospheric Administration
NCEP	National Center for Environmental Prediction
SILEPE	Single level primitive equation
UTC	Coordinated Universal Time