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**INVESTIGATION OF ENERGY RESOURCE IN THE ANDAMAN SEA
BY USING A NUMERICAL MODEL**

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**A THESIS SUBMITTED IN PARTIAL FULFILLMENT
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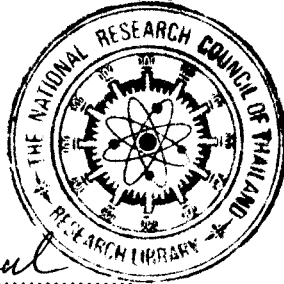
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งานวิจัยนี้มีจุดมุ่งหมายเพื่อสำรวจแหล่งพลังงานในทะเลอันดามันโดยใช้แบบจำลอง SWAN ผลที่ใช้ในการวิเคราะห์แหล่งพลังงาน ได้แก่ ความสูงคลื่นนัยสำคัญ การกำเนิดพลังงานทั้งหมด และการส่งถ่ายพลังงาน ผลลัพธ์ที่ได้แสดงว่า แหล่งพลังงานคลื่นในทะเลอันดามันมีค่าสูงที่สุดในช่วงกลางปี และต่ำที่สุดในช่วงฤดูร้อน การกำเนิดพลังงานทั้งหมดจะมีค่าสูงที่สุดในช่วงกลางปีซึ่งมีค่าน้อยมากเมื่อเทียบกับการกำเนิดพลังงานในทะเลอันดามัน แหล่งพลังงานคลื่นในทะเลอันดามันจะมีรูปแบบการเกิดที่เหมือนกันในทุกๆปี ในส่วนของการส่งถ่ายพลังงานนั้น พลังงานจะถูกส่งถ่ายไปทางซ้ายของทิศทาง x ในช่วงต้นปี และจะถูกส่งถ่ายไปทางขวาของทิศทาง x สำหรับช่วงเวลาที่เหลือ สำหรับการส่งถ่ายพลังงานในทิศทาง y พลังงานจะถูกส่งถ่ายไปด้านล่างในช่วงครึ่งปีแรก และจะถูกส่งถ่ายไปด้านบนในช่วงเวลาที่เหลือ ในการพิจารณาความน่าเชื่อถือของแบบจำลอง จะทำการเปรียบเทียบข้อมูลความสูงคลื่นนัยสำคัญกับค่าที่ได้จากการสำรวจโดย ECMWF แบบจำลอง SWAN ให้ผลลัพธ์ที่สอดคล้องกับค่าที่ได้จากการสำรวจ ถึงแม้ว่าจะให้ค่าการประมาณที่ต่ำกว่า โดยภาพรวมจึงสามารถยอมรับผลจากแบบจำลอง SWAN ได้

คำสำคัญ : แบบจำลอง SWAN / แหล่งพลังงาน / วิธีผลต่างอันดับ / ทะเลอันดามัน

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Abstract

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This research aims to investigate the energy resource in the Andaman Sea by using the SWAN model. The results used for analyzing energy resource are the significant wave height, total energy generation and energy transport. The results show that the wave energy resources in the Andaman Sea have the highest value in the midyear and lowest in summer. The total energy generation has the highest value in the midyear, which is insignificant value for energy generation in the Andaman Sea. The wave energy resources in the Andaman Sea have the same pattern in every years. In the part of energy transport the energy is transported to the left side of x -direction for the beginning of the year and to the right side of x -direction for the rest of the year. In y -direction, the energy is transported to the bottom for the first half of the year and to the top for the rest of the year. In order to validate the model, the results of significant wave height are compared with the observations from ECMWF. The SWAN model gives the results corresponding to the observations, although it gives underestimate results. The overall image of the SWAN model is regarded as acceptable.

Keywords : SWAN model/ Energy Resource/ Finite Difference Method/
Andaman Sea

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List of Symbols

Symbol

η	sea surface elevation
σ	relative radian or circular frequency
E	energy density spectrum
E_{tot}	total energy
d	water depth
g	acceleration of gravity
N	action density
S_{tot}	sources and sinks
$\frac{d}{dt}$	total derivative along a spatial path of energy propagation
c_x	propagation velocity of wave energy in x -space
c_y	propagation velocity of wave energy in y -space
c_σ	propagation velocity in spectral σ -space
c_θ	propagation velocity in spectral θ -space
Δt	time step
Δx	mesh size in x -direction
Δy	mesh size in y -direction
$\Delta \sigma$	direction resolution
$\Delta \theta$	relative frequency resolution
D_{ss}	the diffusion applied in the propagation direction
D_{nn}	the diffusion normal to the propagation direction

Symbol

H_s	significant wave height
P_x	energy transport in x -direction
P_y	energy transport in y -direction
r	correlation coefficient
\vec{k}	wave number vector
ρ_w	water density
S_{in}	wave growth by the wind
S_{nl4}	nonlinear transfer of wave energy through four-wave interaction
$S_{ds,w}$	wave decay due to whitecapping
$S_{ds,b}$	wave decay due to bottom friction
$S_{ds,br}$	wave decay due to depth-induced wave breaking

Lists of Technical Terms and Abbreviations

BSBT	Backward Space, Backward Time
SORDUP	Second Order Upwind
GSE	Garden-Sprinkler Effect
DIA	Discrete Interaction Approximation
SIP	Strongly Implicit Procedure
SWAN	Simulating Wave Nearshore
ECMWF	The European Centre for Medium-Range Weather Forecasts
1D	One dimensional
2D	Two dimensional
RMSD	Root Mean Square Deviation