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Assessment of onshore wind energy potential using regional atmospheric modeling system (RAMS) for Thailand

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Abstract

This paper presents an assessment of the onshore wind energy potential in Thailand using the Regional Atmospheric Modeling System (RAMS). A 9 km resolution, 1,150 km by 1,750 km, wind resource map at 120 m elevation above ground level (agl) is produced based on the NCEP reanalysis database for the three year period of 2009-2011. The onshore wind resource map is validated by comparing the modeling results to observed wind data at 100 m agl from the Pollution Control Department (PCD) of Thailand, and at 120 m agl from the National Research Council of Thailand (NRCT). The Mean Square Error (MSE) is computed and is use as the main criterion to evaluate the simulation results. Results showed that, for the study area, the annual mean wind speeds at 120 m agl are in the range of 1.60-5.83 m/s. For its part, the maximum annual mean power density at 120 m agl is approximately 200 W/m² which corresponds to a wind power density of Class 2. Results show that the region has a good wind regime in the mountain areas of western, southern and eastern Thailand. Further assessment is needed to determine if the onshore wind energy resource could be developed and exploited in order to achieve national renewable energy policy targets in Thailand.

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1. Introduction

Largely, because of its environmental benefits, wind energy is being developed worldwide as a reliable energy source. The Global Wind Energy Council (GWEC) reported that the global cumulative installed capacity in 2012 was 238,050 MW [1].

In the development of a wind energy project, high quality wind data is required in order to achieve a proper wind resource assessment campaign. For its part, most of the scientific literature scrutinizes the use of mesoscale modeling to assess wind energy resource, such as the fifth-generation of mesoscale model (MM5), the Mesoscale Compressible Community (MC2) and the Karlsruhe Atmospheric Mesoscale Modeling (KAMM) [2-4].

On the other hand, the Regional Atmospheric Modeling System (RAMS) could also be applied to evaluate atmospheric parameters such as turbulence fluxes over the study area [5]. In one study, RAMS modeling was compared with aircraft, wind profiler, Lidar, tethered balloon and RASS data. It was shown that the RAMS model results were in good agreement with the validation data [6].

In this study, RAMS is used to assess the onshore wind energy resource potential of Thailand at 120 m above ground level with a 9 km resolution.

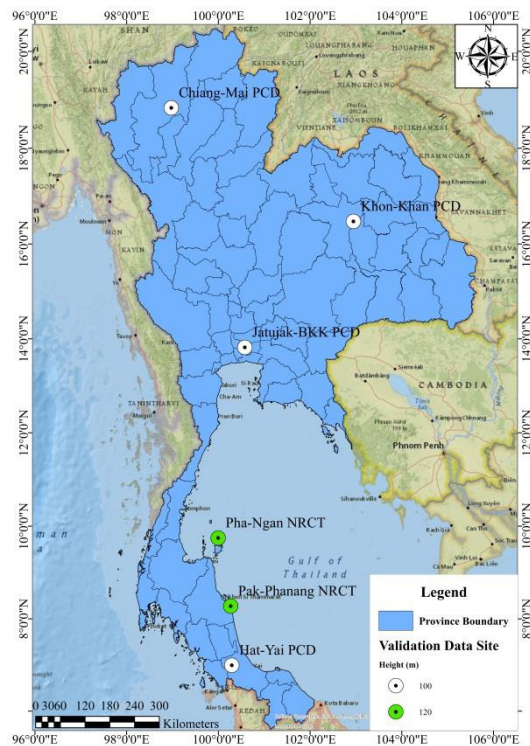


Fig. 1. The study area and locations of met towers of the Pollution Control Department (PCD) and the National Research Council of Thailand (NRCT)

2. Methodology

2.1. Study Area

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