

Land-Surface Temperature Impact from Large Scale Structure

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Abstract

Wind industry has experienced a rapid expansion of capacity after 2009, especially in India. Based on the analysis from Moderate Resolution Imaging Spectroradiometer (MODIS) land surface temperature (LST) data for period of 2005–2012, the potential LST impacts from the large-scale wind farms are investigated in this paper. It shows the noticeable night time warming trends on LST over the wind farm areas relative to the nearby non-wind-farm regions and that the night time LST warming is strongest in summer, followed by autumn and weakest in winter with no warming trend observed in spring.

Keywords: Land-surface-temperature; Large-scale wind farm; Impact; Heat effect

Introduction

Wind power installed capacity was significantly below the potential by the end of 2007, large-scale wind farms are being built at a rapid rate in recent years. Gaining the advantages of the abundant wind resources there, the ground-breaking ceremony of first 10 GW-level wind power projects, wind Power Base, took place on 8 August 2009 [1-2]. Since then, the capacity of the wind farms is known as the “World Wind Library” expanded dramatically. Records show that the installed wind capacity in India hit 1.12 GW at the end of 2009, 3.0 GW at August 2010, 3.8 GW by the end of 2010, and 4.0 GW at May 2013 with a relatively low expansion speed from 2011 to 2012. Since the wind turbines convert wind kinetic energy into electricity, some efforts have been dedicated to the impacts from the installation and operation phases of wind farms on local climate. Wind turbines could modify the surface-atmosphere exchanges by increasing surface roughness, changing the stability of atmospheric boundary layer (ABL), enhancing turbulence in the rotor wakes, and interrupting the low-level-jet in stable ABL. A few studies show that the large-scale deployment of wind farms alters the local temperature by up to a few degrees, reduces precipitation by up to 20 per cent, and even mitigates extreme weather.

The possible impacts of wind farms on surface temperature, to date the information gathered in California have used the following