Available online at www.sciencedirect.com

ScienceDirect

Energy Procedia 125 (2017) 214–220

Energy Procedia

www.elsevier.com/locate/procedia

European Geosciences Union General Assembly 2017, EGU Division Energy, Resources & Environment, ERE

Two years of wind-lidar measurements at an Italian Mediterranean Coastal Site

D. Gullì[a], E. Avolio[a], C. R. Calidonna[a,*], T. Lo Feudo[a] , R. C. Torcasio[a], A. M. Sempreviva[b,a]

a Institute of Atmospheric Sciences and Climate, National Research Council CNR- ISAC, UOS Lamezia Terme, Area Industriale Comp. 15, Lamezia Terme 88046, Italy

b Technical University of Denmark, DTU, Wind Energy Department, 4000 Roskilde, Denmark

Abstract

Reliable measurements of vertical profiles of wind speed and direction are needed for testing models and methodologies of use for wind energy assessment. In particular, modelling complex terrain such as coastal areas is challenging due to the coastal discontinuity that is not accurately resolved in mesoscale numerical model. Here, we present a unique database from a coastal site in South Italy (middle of the Mediterranean area) where vertical profiles of wind speed and direction have been collected during a two-year period from a wind-lidar ZEPHIR-300® at a coastal-suburban area. We show an overview analysis on two-year 10-minute averaged wind profiles.

Peer-review under responsibility of the scientific committee of the European Geosciences Union (EGU) General Assembly 2017 – Division Energy, Resources and the Environment (ERE).

Keywords: wind-lidar; wind energy; breeze; coastal wind condition

1. Introduction

Nowadays wind lidar is accepted as standard in wind energy studies. This technology offers a relatively simple plug and play system as an alternative to standard met-mast installation. As it is a relative new technology, long-term databases are missing especially in complex and coastal areas. In particular, coastal areas introduce the

* Corresponding author. Tel.: +39 0968209150; fax: +39 0968209150.
E-mail address: cr.calidonna@isac.cnr.it

1876-6102
Peer-review under responsibility of the scientific committee of the European Geosciences Union (EGU) General Assembly 2017 – Division Energy, Resources and the Environment (ERE).
10.1016/j.egypro.2017.08.194

challenge of the coastal discontinuity, which is often not accurately resolved in mesoscale numerical models. The actual trend in designing more cost-effective and taller turbine with a longer lifetime requires a deep analysis and understanding of the conditions in which a wind power plant will operate over its lifetime.

Developing wind farm projects requires high quality databases under a wide range of atmospheric conditions or high resolution models that could accurately take into account the effect of the sea-land coastal discontinuity.

Wind-lidars in [1,2] have been shown to be functional for studying the evolution of the vertical wind structure coastal atmospheric boundary layer both on- and offshore. Regarding wind energy studies, in [3,4] detailed statistical analysis of Weibull distribution and parameter detection was conducted comparing/integrating wind measurement and forecasts.

Here, we present a unique database from a coastal site in Italy, in the middle of the Mediterranean area where wind speed and direction vertical profiles have been collected during a two-year period from a Wind-lidar ZEPHIR 300® at a coastal suburban area. In a previous paper one-year period was presented giving first results in wind flow evolution of the area [5]. We show an analysis of 10-minute averaged wind profiles over the whole period.

The paper is organised as follows: after this introduction, Section 2 introduces the experimental site and the data set. Section 3 discusses the data analysis and in the final section results and future works are given.

2. Experimental site and dataset

2.1. Experimental site

The experimental site, the area of the CNR-ISAC section of Lamezia Terme, is located at about 600 m from the coastline in South Italy (Calabria region, Figure 1). Calabria is a mountainous peninsula about 50 km wide and elongated 300 km in the north south direction in the Central Mediterranean. The experimental area is flat and at the end of a west-east oriented valley (the Marcellinara gap) that crosses the peninsula acting as a connecting channel between the Tyrrhenian and Ionian seas and surrounded by mountains up to 1246 m high (Reventino Mount).

This location is a natural laboratory to study land-sea interaction in complex terrain. It is characterized by a synoptic wind mostly from the west and east – west oriented sea/land and mountain/valley breeze systems.

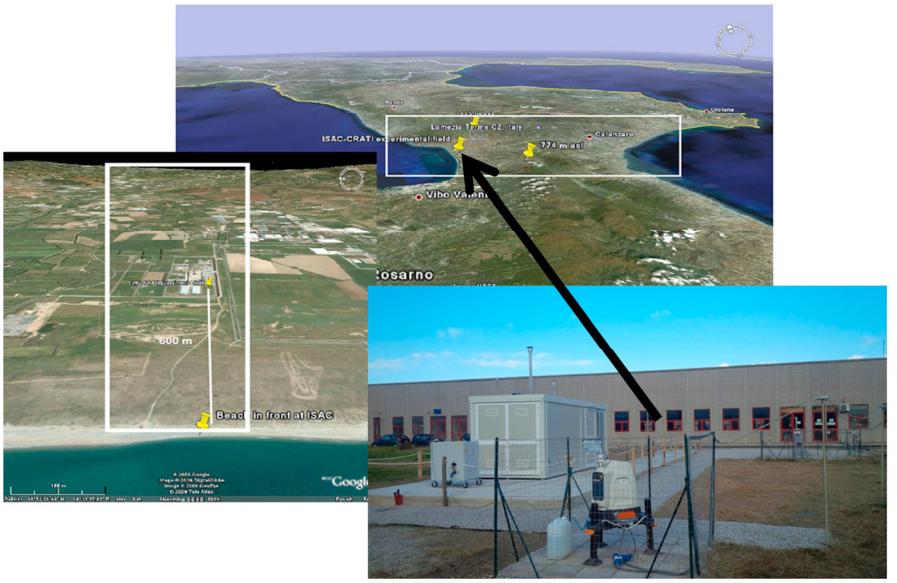

Figure 1 Location and experimental setup of the super site CNR-ISAC GAW-WMO, of Lamezia Terme.