Characteristics of Offshore Winds at Shirahama Oceanographic Observatory

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ABSTRACT

For the purpose of understanding characteristics of offshore winds in coastal waters around Japan for future development of offshore wind energy generation, long-term wind measurements on a research platform of Shirahama Oceanographic Observatory, located 2 km off the closest coastline in Tanabe Bay, Japan, are analyzed. Based on measurements of a propeller anemometer at 23 m height, this paper describes and discusses annual- and monthly-mean wind speeds and directions, frequency distribution of wind speed, wind rose, energy density, atmospheric stability and turbulence intensity at Shirahama. Some new interesting findings are obtained through the analysis and are finally summarized in the conclusions.

KEY WORDS:
Offshore wind; Wind resource assessment; Shirahama; Atmospheric stability; Turbulence intensity; Land-sea breezes; Coastal waters

INTRODUCTION

In Northern Europe, through a preliminary survey prior to constructing an offshore wind farm and its actual operation, characteristics of offshore winds have been well analyzed by using in-situ wind measurement data from a met mast (e.g., Barthelmie et. al, 1996; Coelingh et. al, 1998; Lange et. al, 2004). On the other hand, in Japan, a government-led feasibility study on offshore wind power generation finally started in 2008 (NEDO, 2008), and the country has just taken the first step toward full-fledged installation of offshore wind power generation in the future. For the purpose of acquiring such in-situ data to reveal characteristics of offshore wind around Japan, an intensive observation has been carried out since autumn of 2007 on a research platform at Shirahama, Japan (Ohsawa et. al, 2007). During the intensive observation period, vertical wind profiles up to 140 m above the research platform are measured with a Doppler Sodar. In the paper, to prior to analysis of the Doppler Sodar data available only in such a short period, 14 years of routine measurements for the past 14 years since 1994 are statistically analyzed, and characteristics of the offshore winds at Shirahama are described here in terms of wind climate.

SHIRAHAMA OCEANOGRAPHIC OBSERVATORY

Site Description

The research platform of Shirahama Oceanographic Observatory, owned by Disaster Prevention Research Institute, Kyoto University, is located at the mouth of Tanabe Bay (33°42'23" N, 135°19'58" E) and 2 km away from the closest coastline (Fig. 1). The platform stands on the