ABSTRACT

Characteristics of tidal energy are noted by the predictability, the reliability and variability. Since tidal current is sensitive to the adjacent geometry, it is necessary for us to know the characteristics of tidal current at the site where the tidal current power generation is planned. We have tidal current data measured by ADCP in the feasibility study on the tidal power generation at Tatsuno-Seto strait in Nagasaki Prefecture for 5 years. We firstly present the characteristics of the tidal current at the site and some useful information for designing the tidal current power generator. In the second part of this study, we present results of the tidal simulation by a coastal ocean model, called as FVCOM, which is opened to the public through internet. Numerical results are discussed in comparison with observation data. Final purpose of the numerical model is to establish the tidal current power map, which will be utilized effectively for selecting the location for tidal current power generation.

KEY WORDS: Renewable energy, tidal current power generation, Tidal simulation, FVCOM, ADCP

INTRODUCTION

It is very urgent to reduce CO$_2$ emission as countermeasures against global warming, but it is not easy to promote international coordination by the political and economic reasons. However, Japan’s Prime Minister Yukio Hatoyama declared at the UN Summit on Climate Change that Japan will reduce CO$_2$ emission by 25 % by 2020 relative to 1990, which is highly appreciated by the international community. For this high goal, Japan should tackle many problems to save and improve the energy conversion efficiency of the existing energy systems of the country as a whole, and try to expand the utilization of renewable energy greatly. One important defect of the renewable energy will be overcome by recent new technology such as the smart grid linked with electric vehicles, which contribute to the electric power stabilization and to the reduction of CO$_2$ like kill two birds by one stone. Among several kinds of ocean energy, tidal and ocean current power utilizes the kinetic energy of the ocean stream. The tidal current is driven by the tidal forces between earth and the planets including moon and Sun, and the velocity and the direction of tidal current is changed in time. The velocity of tidal current is affected by the adjacent geometry, therefore the strong current is appeared at the narrow straits and channels, which is realized by the tidal level difference between the strait. Since the tidal current occurs steadily and periodically that the energy of the tidal current is predictable and reliable. Therefore, the determination of the location and the method of the tidal and ocean current power generation are very important but the information about it is very limited that we should try to establish reliable database about detailed marine information in future. In this report, we present the characteristics of the tidal current data measured by an ADCP (Acoustic Doppler Current Profiler) at Tatsuno-Seto strait (Fig.1) in Nagasaki Prefecture firstly. Secondly, we present results of the tidal simulation by a coastal ocean model, called as FVCOM, which is opened to the public through internet. Numerical results are discussed in comparison with observation data.