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Numerical Wave Modeling and Wave Energy Estimation

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Abstract

In a rapidly evolving operational and research framework concerning the global energy resources, new frontiers have been set for the scientific community working on environmental and renewable energy issues. In particular, new numerical techniques supporting the accurate estimation of renewable energy sources are highly emphasized. In this framework, wave energy – the energy that can be captured from sea waves – provides an alternative option with critical advantages. In the present paper, recent advances and some preliminary results obtained in two European projects will be discussed: Marina Platform and E-wave projects are focusing on the estimation of the wave energy potential in North Atlantic coastline of Europe and in Eastern Mediterranean Sea, respectively. Special emphasis is given to the utilization of numerical atmospheric and wave modeling systems able to accurately monitor the atmospheric and sea conditions in the area of interest. On the other hand, advanced statistical techniques are utilized for the local adaptation of the results and the estimation of the spatial and temporal distribution of the wave energy potential.

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1 Introduction

During the last decade most of the developed European and American countries have set as a primary target the adaptation of novel policies and methodologies that will lead to a substantial increase of the use of renewable resources for energy production. The recent global economic crisis further strengthened this political decision leading to a reduced dependence of oil products. Within this framework, the exploitation of wave energy potential, that is the energy produced by the sea waves, seems to be one of the most promising solutions especially for countries with extended coastline like Greece and Cyprus.

Wave energy has some critical advantages compared to other renewable sources: it is far more stable than wind power and, therefore, it is easier to be merged into the general grid. Moreover, wave power can be produced even in the absence of local winds by exploiting the swell component of the waves while ecological damages or consequences appear negligible. Still, there are issues that should be taken into consideration in order to ensure the successful exploitation of this type of "clean" energy: The wave energy potential in the area of interest should be monitored in a credible way and local activities that could be affected (fisheries, touristic companies, marine structures, wildlife, hazards to navigation) must be taken into account.

In the present work, the main activities and results of two European projects dealing with wave energy potential estimation are presented. The E-wave project, coordinating by the Oceanography Centre of the University of Cyprus and the MARINA project, in which the Atmospheric Modeling and Weather Foreacting Group of the University of Athens is participating, focusing on the development and application of novel methodologies for the accurate estimation of the wave energy potential in the Mediterranean and the North Atlantic coastline of Europe. Towards this target, state of the art numerical atmospheric and wave simulation systems are utilized while novel statistical approaches are developed and exploited in order to support the credible monitoring of the wave energy potential in the areas of interest.

The present work is organized as follows: In Sect. 2 the main directions and components of the above mentioned projects are presented. The models and the techniques employed are discussed in Sect. 3, while some first results that have been reached are outlined in Sect. 4.

2 The Projects

The primary objectives and methodologies of the Marina and E-wave projects are outlined in this section. Special emphasis is given to the components relevant with the wave power estimation.

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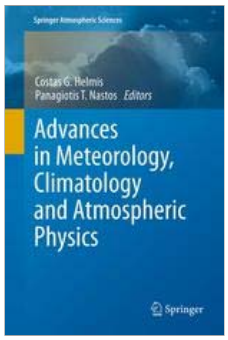

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References (6)

1. Bidlot JR, Janssen P, Abdalla S, Hersbach H (2007) A revised formulation of ocean wave dissipation and its model impact. ECMWF Technical Memorandum 509. ECMWF, Reading, UK, 27pp
2. Eskridge RE, Ku JY, Rao ST, Porter PS, Zurbenko IG (1997) Separating different scales of motion in time series of meteorological variables. Bull Am Meteorol Soc 78(7):1473–1483. doi:10.1175/1520-0477(1997) 078<1473:SDSOMI>2.0.CO;2 CrossRef
3. Jansen PAEM (2000) ECMWF wave modeling and satellite altimeter wave data. In: Halpern D (ed.), Satellites, oceanography and society, Elsevier, New York, pp 35–36
4. Kallos G (1997) The regional weather forecasting system SKIRON. In: Proceedings, symposium on regional weather prediction on parallel computer environments, Athens, Greece, 9pp, 15–17 Oct 1997
5. Rao ST, Zurbenko IG, Neagu R, Porter PS, Ku JY, Henry RF (1997) Space and time scales in ambient ozone data. Bull Am Meteorol Soc 78(10):2153–2166. doi:10.1175/1520-0477(1997) 078<2153:SATSIA>2.0.CO;2 CrossRef
6. WAMDIG, The WAM-Development and Implementation Group: Hasselmann S, Hasselmann K, Bauer E, Bertotti L, Cardone CV, Ewing JA, Greenwood JA, Guillaume A, Janssen PAEM, Komen GJ, Lionello P, Reistad M, Zambresky L (1988) The WAM model - a third generation ocean wave prediction model. J Phys Oceanogr 18(12):1775–1810

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