A Methodology to Map Roughness Length and Displacement Height in Complex Terrain

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Abstract

Over the last decades, a great effort has been made to study the effect of the roughness and the height of the obstacles located in the terrain on the wind modeling when a logarithmic profile is used to approach the wind velocities. As a consequence, a wide number of works have been devoted to obtain suitable values of the aerodynamic roughness length (z_0) and the height displacement (d), i.e., the parameters that define those phenomena. In this paper a new methodology for constructing z_0 and d maps is proposed. The first step consists of selecting a land cover database of the studied region and assignning a range of variation of such parameters for each type of land use. The land cover database used in this work is from the project SIOSE (Information System of Land Cover of Spain) [1], based on the CORINE Land Cover European Project [2]. The range of z_0 and d parameters for each surface type is based on the results obtained by diverse authors. Next, we apply a 3D adaptive finite element mass consistent model to construct the wind field, using a subset of forecasting values of wind velocities, arising from HARMONIE mesoscale model, as input data. Another subset of wind data from HARMONIE and some available wind measures from anemometers allow us to evaluate the error of the wind model results in terms of a RMSE fitness function [3]. The minimisation problem of the RMSE is solved by using the Differential Evolution method [4] combined with the L-BFGS-B algorithm [5]. A numerical experiment in La Palma Island is carried out in order to show the performance of the proposed methodology.

References

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