6th European Conference on Computational Mechanics (ECCM 6)
7th European Conference on Computational Fluid Dynamics (ECFD 7)
11-15 June 2018, Glasgow, UK

PARAMETER ESTIMATION IN A DIAGNOSTIC WIND MODEL OVER COMPLEX TERRAIN

G. Montero[1], E. Rodríguez[1], A. Oliver[1] and J. Calvo[2]

[1] SIANI - University of Las Palmas de Gran Canaria, Edificio Polivalente I, Campus Universitario de Tafira, Las Palmas de Gran Canaria, Spain, (gustavo.montero, eduardo.rodriguez, albert.oliver)@ulpgc.es, http://www.dca.iusiani.ulpgc.es/proyecto2015-2017/html/index.html

[2] Agencia Estatal de Meteorología (AEMET), Leonardo Prieto Castro, 8, 28040-Madrid, Spain, j.calvo@aemet.es, www.aemet.es

Keywords: *Parameter Estimation, Wind Modelling, Roughness Parameters, Memetic Algorithms*

The aerodynamic roughness length (z_0) and the displacement height (d) are critical for wind modelling based on the log vertical profile. It is well known that the values of these parameters depend on weather conditions and land coverage. Thus, many authors have studied its relationship, providing typical ranges for each land coverage. In this work, a comprehensive literature review is performed to collect the ranges of z_0 and d for each surface type. In particular, we have focused on the coverages present in the "Information System of Land Cover of Spain" (SIOSE) [1]. Using these ranges, we propose a procedure to construct z_0 and d maps through a downscaling wind model. Results from the HARMONIE-AROME and ECMWF mesoscale numerical weather prediction models are downscaled using a 3D diagnostic wind model with adaptive finite element method [2, 3]. The values of z_0 and d are estimated with a memetic algorithm that combines the Differential Evolution method [4], a rebirth operator and the L-BFGS-B algorithm [5]. So, the root mean square error (RMSE) of the wind model is minimised against the observed wind data. This fast procedure allows updating the roughness parameters for any weather condition. Some numerical experiments are presented to show the performance of this methodology. Although we work with the SIOSE database and the Wind3D model, the method can be used in conjunction with other databases and downscaling models.

REFERENCES

[1] National Technique Team SIOSE, *Documento Técnico SIOSE2005 Versión 2.2*. Technical report, D.G. Instituto Geográfico Nacional, Madrid, 2011.

[2] A. Oliver and E. Rodríguez and J.M. Escobar and G. Montero and M. Hortal and J. Calvo and J.M. Cascón and R. Montenegro, Wind forecasting based on the HARMONIE model and adaptive finite elements. *Pure Appl. Geophys.*, Vol. **172**, pp. 109–120, 2015.

[3] G. Montero and E. Rodríguez and A. Oliver and J. Calvo and J.-M. Escobar and R. Montenegro, Optimisation technique for improving wind downscaling results by estimating roughness parameters. *J. Wind Eng. Ind. Aerod.*, 2018. In press.

[4] R. Storn and K. Price, Differential Evolution – A Simple and Efficient Heuristic for Global Optimization over Continuous Spaces. *J. Glob. Optim.*, Vol. **11**, pp. 341–359, 1997.

[5] R.H. Byrd and P. Lu and J. Nocedal and C. Zhu, A Limited Memory Algorithm for Bound Constrained Optimization. *SIAM J. Sci. Comput.*, Vol. **16**, pp. 1190–1208, 1995.