‘Development of an image processing method for wake meandering…’

by M. Krutova et al.

This is an interesting paper which deals with the difficult problem of reliably identifying wind turbine wakes within a generally turbulent flow field. The paper focuses on methods which use thresholding techniques applied to the image processing of Lidar data. A standard technique for identifying a wake from a set of scanned Lidar data of the velocity field, the Gaussian Wake Deficit method, uses a fixed threshold (usually 95%) of average free stream wind speed to fit a Gaussian cross-wake profile. Because of background turbulence and other noise in the signal this procedure has drawbacks causing errors. The present paper describes an alternative threshold-based method, a development of Adaptive Thresholding Segmentation (ATS) which has been used for other image processing problems such as identification of (sea) waves. In this method first and second derivatives of the cumulative PDF data is used to provide automatic threshold detection. Wake centre-lines are also determined. The new technique is applied first to numerically simulated turbulent flow fields containing turbine wakes generated by LES CFD, and then to Lidar data from the FINO1 tower covering three turbine wakes in the Alpha Venturus offshore windfarm. The wind-speed image data is processed using both the ATS method and the Wake Deficit method. Comparison of the results shows that the two methods are approximately equally successful and comparable in accuracy of detecting wake boundaries and centre-lines in the near wake regions behind rotors, but that in the far wake where accurate detection becomes more difficult the ATS method is significantly more reliable than the wake deficit method. The paper describes the process well and gives a good discussion of the difficulties and errors in the procedure. The code for the process is also available.

This a very useful paper and is suitable for publication in the Journal.