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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Weather response to management of a large wind turbine array" *by* D. B. Barrie and D. B. Kirk-Davidoff

Anonymous Referee #1

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This paper builds on the work of Kirk-Davidoff and Keith (2008). It takes forward the idea that time-varying synoptic-scale roughness anomalies, introduced by the creation of continent-scale wind farms, may be used for weather modification on the synoptic scale. The representation of wind farms by surface roughness seems reasonable and well researched. Having demonstrated in Kirk-Davidoff and Keith (2008) that a synoptic scale response arises due to surface roughness changes I think that the idea addressed in this paper is of interest. The authors clearly lay out their assumptions, give sufficient detail for their results to be reproduced, and give sufficient evidence to support their conclusions.

However, there are some issues which I would like to see quantitatively addressed in this paper. I feel that once these are addressed they will make the conclusions

sufficiently substantial and considerably more meaningful:

1. How sensitive is the synoptic scale disturbance to the size (and distribution/shape) of the wind farm?

2. Is there a critical size of the wind farm at which the magnitude of the response rises above the level of forecast uncertainty, and how sensitive is this critical size to the initial atmospheric conditions?

3. What is the size of the downstream response to a perturbation by a wind farm on the scale of those planned today? I note that currently planned wind farms are on the order of 100 square miles and would generate about 1GW. The wind farm simulated in this paper would cover 2 million square miles and generate 2.5TW. I think this difference is too large to go without comment.

It would also be informative to see formulae to demonstrate that the size of the simulated surface roughness perturbation is quantitatively reasonable for the quoted energy output of the wind farm.

The paper is well structured and fluent. I notice no typographical errors.

Interactive comment on Atmos. Chem. Phys. Discuss., 9, 2917, 2009.