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Modelling windfarm wakes in operational forecasting model HARMONIE-AROME

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Wind power production in the European Union (EU) is steadily increasing, specifically on the North-Sea. Wind farms are growing both in number and size, while weather models evolve to higher resolutions. This means that the effect of wind farms can no longer be ignored by weather prediction models. Wind farms essentially decelerate the wind (blockage and wake effects) and increase turbulence, indirectly influencing temperature and humidity. In this study, we have included the widely used Fitch et al. (2012) windfarm parameterisation in the operational mesoscale model HARMONIE-AROME. Using our method, we are able to include individual turbines both on- and offshore. The model is evaluated using various datasets, e.g. production data from Elia (Belgium), floating lidar measurements at Borssele Wind Farm, and anemometer measurements from the FINO-towers. The inclusion of the windfarm parameterisation improves the wind forecast near wind farms, also improving the estimate in power production. In addition, we are able to model the effects of wind farms on the boundary-layer temperature and humidity.

Fitch, A. C., Olson, J. B., Lundquist, J. K., Dudhia, J., Gupta, A. K., Michalakes, J., & Barstad, I. (2012). Local and mesoscale impacts of wind farms as parameterized in a mesoscale NWP model. *Monthly Weather Review*, 140(9), 3017–3038.