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Effect of the Ekman Layer on the Effective Roughness Length of Large Scale Wind Farms JAY PRAKASH GOIT, JORIS CODDÉ, HANS ROBEERS, JOHAN MEYERS, Katholieke Universiteit Leuven — Large scale wind farms induce additional surface drag increasing the effective surface roughness ($z_{0,hi}$) experienced by upper atmospheric boundary layer (ABL). In a previous study, Calaf *et al.* [1] obtain $z_{0,hi}$ for wind farms when they are situated within the inner layer of the boundary layer, such that outer-layer dynamics, e.g., the effect of Coriolis forces induced by the Earth's rotation, may be neglected. However, for shallow ABLs where the wind-farm is not entirely situated in the inner layer, the effect of Coriolis forces may become important. In the present work, Large Eddy Simulations (LES) are used to addresses the effect of Coriolis forces on the evaluation of $z_{0,hi}$ for a very large wind farm. Results are compared with existing models for $z_{0,hi}$ [1, 2]. We find that the models for $z_{0,hi}$ agree well with the roughness obtained from the LES when wind turbines are well inside the inner region of the ABL. However, when the turbine height is more than 20% of the ABL, the model's predicted roughness height gets less accurate. This difference can be attributed to the influence of Coriolis Forces .

[1] Calaf M. *et al.* Phys Fluids, **22**, 015110, 2010.
[2] Frandsen S. *et al.* Wind Energy, **9**, 39-53, 2006.

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