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Wind-farms in shallow conventionally neutral boundary layers: effects of transition and gravity waves on energy budget[1] JOHAN MEYERS, DRIES ALLAERTS, KU Leuven, Mechanical Engineering, Celestijnenlaan 300A, B3001 Leuven — Conventionally neutral boundary layers (CNBL) often arise in offshore conditions. In these situations the neutral boundary layer is capped by a strong inversion layer and a stably stratified free atmosphere aloft. We use large-eddy simulations to investigate the interaction between a CNBL and a large wind farm. Following the approach of Allaerts & Meyers (2015) [1], a set of equilibrium CNBLs are produced in a precursor simulation, with a height of approx. 300, 500, and 1000m, respectively. These are used at the inlet of a large wind-farm with a fetch of 15 km, and 20 rows of turbines. We find that above the farm, an internal boundary layer (IBL) develops. For the two lower CNBL cases, the IBL growth is stopped by the overlying capping inversion. Moreover, the upward displacement of the CNBL excites gravity waves in the inversion layer and the free atmosphere above. For the lower CNBL cases, these waves induce significant pressure gradients in the farm. A detailed energy budget analysis of the CNBL is further presented. [1] Allaerts Dries, Meyers Johan (2015). Large eddy simulation of a large wind-turbine array in a conventionally neutral atmospheric boundary layer. Physics of Fluids 27 (6), art.nr. 065108

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