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Characterising the coherent structures in large eddy simulations of extended windfarms[1] MENGQI ZHANG, RICHARD STEVENS, University of Twente, UNIVERSITY OF TWENTE TEAM — The present work studies the large coherent structures in large eddy simulations of extended windfarms using proper orthogonal decomposition (POD) method. In order to evaluate the effect of wind turbines on the coherent structures, we simulate, in addition to a reference case of a neutral atmospheric boundary layer, periodic and developing windfarms with aligned and staggered wind turbines. The simulations are run for a long time, so as to generate a sufficient database for POD analysis. Both the coherent structures of the velocity field and the kinetic energy flux are investigated. In all the cases, elongated streamwise counter rotating roll structures, covering 1 or 2 turbines in spanwise direction, are identified to be the dominant mode in the POD results. Another pattern, varying in streamwise direction, also appears in all the cases. Besides, by applying a Fourier Transform to the physical database, we also studied the coherent structures at a certain frequency. Preliminary results show that for the most energetic frequency in the windfarms, the real part and imaginary part of the coherent structures are streamwise-varying and the amplitude manifests consistently a streamwise streak structure.

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