Abstract Submitted
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Effect of topography on wind turbine power and load fluctuations[1] CHRISTIAN SANTONI, UMBERTO CIRI, STEFANO LEONARDI, Univ of Texas, Dallas — Onshore wind turbines produce more than $17GW$ in the US, which constitutes 4.4% of all the energy produced. Sites selection is mostly determined by the atmospheric conditions and the topographical characteristics of the region. While the effect of the atmospheric boundary layer had been widely studied, less attention has been given to the effect of the topography on the wind turbine aerodynamics. To address how the topography affects the flow, Large Eddy Simulations of the flow over a wind turbine placed over wavy wall are performed. The wavelength of the wavy terrain, λ, is $1.7D$ where D is the turbine rotor diameter. Two different values of the height of the wavy wall, $a/D = 0.05$ and $a/D = 0.10$ have been considered. In addition, two positions of the turbine with respect to the wavy wall had been studied, on the crest and trough of the wavy wall and compared with a wind turbine over a flat wall. For the turbine located at the crest, the pressure gradient due to the wavy wall caused a recirculation behind the wind tower $2.5D$ larger than that of the smooth wall. When placed at the trough of the wavy terrain, the favorable pressure gradient increases the wake velocity near the wall and promotes entrainment into the turbine wake.

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