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Applying the v2f and the algebraic structure-based Reynolds stress closures to wind flow over complex terrain[1] JOHN O'SULLIVAN, University of Auckland, RENE PECNIK, GIANLUCA IACCARINO, Stanford University — Increasing worldwide wind energy production means wind farms are being constructed in areas where the terrain is more complex. Two important features of wind flow over complex terrain are flow separation and anisotropic turbulence. The most commonly used simulation approaches for wind flow use the Reynolds averaged Navier-Stokes (RANS) equations with a k-epsilon turbulence closure. This closure has difficulty in estimating separation accurately and cannot represent turbulent anisotropy. In other applications the v2f turbulence closure has shown a good ability to predict flow separation. Similarly the algebraic structure-based model (ASBM) has shown promise in capturing turbulent anisotropy. The flow over a representative hill which includes these features is calculated using the RANS equations with both the v2f and ASBM closures. A novel implementation of the ASBM closure is developed allowing a stable solution to be obtained. The results are compared with experimental data for the same flow and a good agreement is obtained for the separated region and the Reynolds stress components. Wall functions are developed for the v2f closure to enable the simulation of higher Reynolds number flows that include surface roughness. The results are compared with experimental data and accurately capture the separated region.

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