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Physical modeling of the atmospheric boundary layer for wind energy and wind engineering studies[1] GREGORY TAYLOR-POWER, JOHN TURNER, MARTIN WOSNIK, University of New Hampshire — The Flow Physics Facility (FPF) at UNH has test section dimensions W6.0m, H2.7m, L=72m. It can achieve high Reynolds number boundary layers, enabling turbulent boundary layer, wind energy and wind engineering research with exceptional spatial and temporal instrument resolution. We examined the FPFs ability to experimentally simulate different types of the atmospheric boundary layer (ABL): the stable, unstable, and neutral ABL. The neutral ABL is characterized by a zero potential temperature gradient, which is readily achieved in the FPF by operating when air and floor temperatures are close to equal. The stable and unstable ABLs have positive and negative vertical temperature gradients, respectively, which are more difficult to simulate without direct control of air or test section floor temperature. The test section floor is a 10 inch thick concrete cement slab and has significant thermal mass. When combined with the diurnal temperature variation of the ambient air, it is possible to achieve vertical temperature gradients in the test section, and produce weakly stable or weakly unstable boundary layer. Achievable Richardson numbers and Obukhov lengths are estimated. The different boundary layer profiles were measured, and compared to theoretical atmospheric models.

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