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Projections of near-surface winds under climate change scenarios for use in the wind energy industry

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Changes in near–surface winds due to global climate change may have profound geophysical and societal impacts. However, as we demonstrate coupled Atmosphere-Ocean Global Climate Models (AOGCM) are unable to replicate historically observed magnitude and spatial variability of wind speeds. For example, the observed mean wind speed at Copenhagen, Denmark in 1982-2000 is 5.9 m s^{-1}, but grid-cell average mean wind speeds for this location from 10 state-of-the-art AOGCM range from 2.3 to 6.3 m s^{-1}. Hence we have developed a downscaling technique capable of generating probability distributions of wind speeds, and apply it here to sites in northern Europe for historical periods (1961-1990 and 1982-2000) and two future periods (2046-2065, 2081-2100). This downscaling approach can reproduce the historical observations and is robust to stochastic effects in the AOGCM derived predictors. The climate change signal in mean and 90^{th} percentile wind speeds is of the order of +/-15% and is currently comparable to the variability due to differences in AOGCM simulations of the downscaling predictors.