Why is the Wind Speed Decreasing?

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The annual mean wind speed as measured at the Blue Hill Observatory has dropped by more than ten percent over the last thirty years. After remaining in a range of 15-16 mph for much of the last century, the annual average wind speed began a slow decline in the mid-20th century that has steepened significantly since 1980 to a record low value for any year of 12.6 mph in 2008. Figure 1 shows the trend in the annual mean (in black) along with running averages over 10 years (in blue) and 30 years (in red).

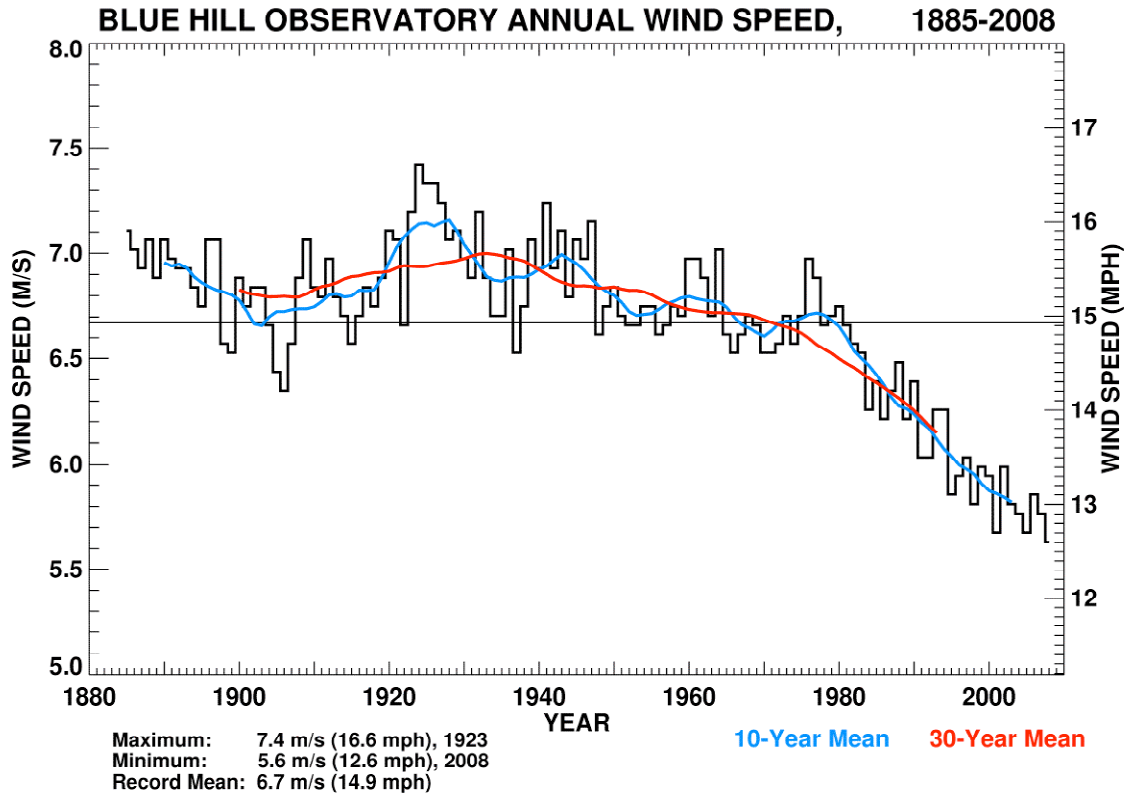

Figure 1. Blue Hill Observatory annual mean wind speed and running means.

Wind speed is measured at Blue Hill with an instrument called a contacting anemometer that dates to the early 1960s. This three-cup instrument is mounted at the top of the highest wind mast on the Observatory roof about 50 feet above ground level, and this height has remained unchanged since 1908. The wind instruments were about ten feet lower prior to 1908. The contacting anemometer is calibrated so that a nearly constant 640 spins of the instrument equal one mile of wind passing the Observatory. Each time that count is reached, an electrical contact sends a signal to the indoor recorder, which makes a mark on a moving chart. The marks are counted for each hour to derive the average hourly speed, that is, the number of miles per hour. To this day, low wind speeds are corrected upward slightly to ensure consistency of the present

wind measurements with the similar preceding instrument. The contacting anemometer is maintained and lubricated meticulously. It remains in excellent condition, and the bearings have insufficient wear to explain a drop in measured wind speed of the observed magnitude.

Then why is the wind speed decreasing? Several processes on local, regional and global scales are likely contributing. Locally, on the summit of Great Blue Hill vegetation has grown nearly continuously during the 20th century after many years of intentional clearing during the 19th century. The growth of trees may be slowing the wind as it passes over the hill, but this gradual growth is inconsistent with the sudden downward turn in the wind speed about 30 years ago. In addition, substantial clearing of vegetation and some trees on the summit to the west (the prevailing wind direction) of the Observatory during the last decade has not affected the drop in wind speed.

Similarly, regional reforestation that has occurred over much of New England and the northern United States in the last 50 or more years may be contributing to slower surface wind speeds. Other locations throughout the country, in particular the East Coast and Mid-west, have also seen lower wind speeds in recent decades (Pryor et al., 2009).

On larger scales, several research studies have shown using both climate model simulations (Yin, 2005) and surface observations (Leibensperger et al., 2008; Wang et al., 2006) that the position of the main storm tracks that cross North America, which are generally associated with the jet stream, have moved northward. This may be impacting the frequency of storms and wind speed at the latitude of Blue Hill. Wind is partly a result of a contrast in temperature such as across a strong cold front or between low and high latitudes. The observed greater warming over the Arctic relative to middle latitudes is reducing this temperature contrast, which may also be a factor in lowering the wind speed. Given the relevance of wind as a possible indicator of global climate change and its importance to efficient wind power generation, the Blue Hill Observatory will continue to monitor the wind carefully and consistently to help unravel the causes of the ongoing decline in wind speed.

References

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