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Stilling and Recovery of the Surface Wind Speed Based on Observation, Reanalysis, and Geostrophic Wind Theory over China from 1960 to 2017

Zhengtai Zhang and Kaicun Wang

Beijing Normal University, College of Global Change and Earth System Science, Beijing, China (zhangzht@mail.bnu.edu.cn)

Surface wind speed (SWS) from meteorological observation, global atmospheric reanalysis, and geostrophic wind speed (GWS) calculated from surface pressure were used to study the stilling and recovery of SWS over China from 1960 to 2017. China experienced anemometer changes and automatic observation transitions in approximately 1969 and 2004, resulting in SWS inhomogeneity. Therefore, we divided the entire period into three sections to study the SWS trend, and found a near zero annual trend in the SWS in China from 1960 to 1969, a significant decrease of $-0.24 \text{ m/s decade}^{-1}$ from 1970 to 2004, and a weak recovery from 2005 to 2017. By defining the 95th and 5th percentiles of monthly mean wind speeds as strong and weak winds, respectively, we found that the SWS decrease was primarily caused by a strong wind decrease of $-8 \text{ \% decade}^{-1}$ from 1960 to 2017, but weak wind showed an insignificant decreasing trend of $-2 \text{ \% decade}^{-1}$. GWS decreased with a significant trend of $-3 \text{ \% decade}^{-1}$ before the 1990s, during the 1990s, GWS increased with a trend of 3 \% decade^{-1} whereas SWS continued to decrease with a trend of $10 \text{ \% decade}^{-1}$. Consistent with SWS, GWS demonstrated a weak increase after the 2000s. After detrended, both of SWS and GWS showed synchronous decadal variability, which is related to the intensity of Aleutian low pressure over the North Pacific. However, current reanalyses cannot reproduce the decadal variability, and can not capture the decreasing trend of SWS either.