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Evaluating near-surface wind speed trends using global reanalysis products

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Recent studies have identified a decline (termed “stilling”) in the observed near-surface (10-m height) wind speed across many mid-latitude terrestrial regions over the last decades, especially in the Northern Hemisphere. Many of the studies looking at wind variability has used in situ observations from terrestrial anemometers, but many instrumental issues affect their homogeneity. Moreover, it is also challenging to detect regional differences, as available wind records are not spatially homogeneous across the globe. For these reasons, global reanalysis products represent a potential tool for assessing global changes in near-surface winds with full spatial resolution, if their ability in realistically reproducing observed near-surface wind changes and in consistently representing spatial patterns of the changes can be demonstrated.

In this study global near-surface wind speed changes have been analyzed using 7 atmospheric reanalyses with the objective to evaluating their ability in reproducing observed wind speed trends and the stilling phenomenon. Specifically, this work investigates multidecadal wind speed variability by using two 20-century reanalyses (i.e. ERA-20C and NOAA-20C) and five satellite-era reanalyses (i.e. CFSR, ERA-Interim, JRA-55, MERRA-2, and NCEP-DOE) for 1900-2010 and 1980-2016, respectively. Consistently check among all reanalysis products has been also carried for the common 1980-2010 time period.

During 1900-2010, 20-century reanalyses display a general wind speed increase, especially over ocean surfaces. For the modern renalyses during 1980-2016, global wind speed trends show positive values over oceans and negative ones across land areas, with marked seasonal differences. For the common 1980-2010 period, similar trends appear over oceans in both modern and 20-century reanalyses, which contrast with the large trend differences found over land. The general agreement between the spatial trend patterns found in the reanalysis products suggests that these products do hold the potential to be useful for near-surface wind studies around the world, although additional analysis involving observations are still needed.