A new approach to homogenize daily peak wind gusts: an application to the Australian series

Cesar Azorin-Molina (1), Jose A. Guijarro (2), Tim R. McVicar (3,4), Blair Trewin (5), and Andrew J. Frost (6)

(1) University of Gothenburg, Department of Earth Sciences - Regional Climate Group, Gothenburg, Sweden (cesar.azorin-molina@gu.se), (2) State Meteorological Agency (AEMET), Balearic Islands Office, Palma de Mallorca, Spain (jguijarrop@aemet.es), (3) CSIRO Land and Water, Canberra, ACT, Australia (Tim.Mcvicar@csiro.au), (4) Australian Research Council Centre of Excellence for Climate System Science, Sydney, Australia , (5) National Climate Centre, Australian Bureau of Meteorology, Melbourne, Australia (blair.trewin@bom.gov.au), (6) Australian Bureau of Meteorology, Sydney, Australia (andrew.frost@bom.gov.au)

Daily Peak Wind Gusts (DPWG) time-series are valuable data for the evaluation of wind related hazard risk to different socioeconomic and environmental sectors. Yet wind time-series are prone to be affected by inhomogeneities temporally and spatially that may mislead the studies of their variability and trends. The aim of this study is to present a new strategy in the homogenization of a challenging climate extreme such as the DPWG using 548 time-series across Australia for 1941-2016. Due to the low correlation coefficients between the series, especially in the first decades when the station density was very low, the performance of mean wind speed data from the NCEP/NCAR reanalysis as reference was tested. This initial attempt found that reanalysis data did not improve the low correlation coefficients between the observed series as represent mean wind speed instead of gust winds. The scientific innovation building on our previous homogenization studies implements the use of 353 breakpoints (small proportion supported by metadata) detected at monthly basis to split the daily gust series, which are then homogenized without needing the monthly corrections, and filled out to yield data series completeness. This automatic homogenization of DPWG is developed in a new version 3.0 of the R package Climatol. The major advantages of this homogenization strategy are its ability (i) to automatically homogenize a large number of DPWG series, including short-term ones and without needing metadata; and (ii) to use the closest reference series even not sharing a common period with candidate series or presenting missing data. The approach represents a new advance to ensure the homogeneity of climate records, in which DPWG series have been poorly treated by the homogenization community, and offering a homogenized DPWG dataset to assess and attribute for the first time long-term variability of extreme winds across Australia for future studies.