Geophysical Research Abstracts
Vol. 21, EGU2019-7668, 2019
EGU General Assembly 2019
© Author(s) 2019. CC Attribution 4.0 license.

The increasing impacts of sub-tropical ridges in Mediterranean climate areas

Pedro M Sousa (1), Ricardo M Trigo (1), David Barriopedro (2), Ricardo García-Herrera (2,3), and Alexandre M Ramos (1)

(1) Instituto Dom Luiz (IDL), Faculdade de Ciências, Universidade de Lisboa, 1749-016 Lisboa, Portugal, (2) Instituto de Geociencias (IGEO), CSIC-UCM, Madrid, Spain, (3) Departamento de Física de la Tierra y Astrofísica, Facultad de Ciencias Físicas, Universidad Complutense de Madrid, Spain

Atmospheric blocking and other disruptions of the usual westerly flow are an important component of the intra-seasonal and inter-annual variability in mid-latitudes. A comprehensive assessment of high-latitude blocks and sub-tropical ridges (which do not require wave-breaking occurrence) shows that their surface impacts (temperature and precipitation) are generally of opposite signal. In particular, extreme drought episodes and heat events in southern Europe and Mediterranean-like climatic areas should not be attributed to blockings, but rather to sub-tropical ridges, as the latter almost completely wipe out precipitation and result in well above-average temperatures in these areas (Sousa et al., 2018). In this sense, a better understanding and an objective classification of sub-tropical ridges phenomenology is needed, particularly under the context of global warming, and on the hot-topic of the Hadley Cell expansion, where some contradictory results have emerged in recent years.

Here we present a new algorithm designed for the detection of sub-tropical ridges. Taking advantage of this new product, we analyzed the occurrence of intense and/or persistent sub-tropical ridges in several drought and extreme heat episodes such as: the 2003 European heatwave; the 2004-2005 Iberian drought; the late 2017 wildfires season in California; the 2015-2017 “Day-Zero” drought in Cape Town. Our results show how sub-tropical intrusions were involved in these unprecedented events with significant socio-economic impacts, being the persistence and intensity of such atmospheric patterns particularly notable in western margins of continental areas (e.g. Iberia, California, South Africa).

Finally, and within the context of a warming planet and the disparate rates estimated for tropical expansion (Staten et al., 2018), we have analyzed regional changes in the latitudinal extension and intensity of sub-tropical ridges. By applying the new detection scheme to the NCEP reanalysis our results suggest a clear intensification of ridges affecting areas with Mediterranean climates and its association with the observed increase in the magnitude of extreme heat and drought events in those regions. Despite the intensification of subtropical ridges, our results suggest no robust changes in its latitudinal extension at the northern hemispheric scale (when compared to internal variability). On the other hand, a more generalized poleward shift appears to be present in the southern hemisphere.

Sousa et al., 2018, Climate Dynamics, DOI:10.1007/s00382-017-3620-2
Staten et al., 2018, Nature Climate Change, DOI:10.1038/s41558-018-0246-2

This work was supported by project IMDROFLOOD – Improving Drought and Flood Early Warning, Forecasting and Mitigation using real-time hydroclimatic indicators (WaterJPI/0004/2014) funded by FCT.