



Return levels of temperature extremes in southern Pakistan

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Southern Pakistan (Sindh) is one of the hottest regions in the world and is highly vulnerable to temperature extremes. In order to improve rural and urban planning, it is useful to gather information about the recurrence of temperature extremes. In this work, return levels of the daily maximum temperature T_{max} are estimated, as well as the daily maximum wet-bulb temperature TW_{max} extremes. We adopt the peaks over threshold (POT) method, which has not yet been used for similar studies in this region. Two main datasets are analyzed: temperatures observed at nine meteorological stations in southern Pakistan from 1980 to 2013, and the ERA-Interim (ECMWF reanalysis) data for the nearest corresponding locations. The analysis provides the 2-, 5-, 10-, 25-, 50-, and 100-year return levels (RLs) of temperature extremes. The 90% quantile is found to be a suitable threshold for all stations. We find that the RLs of the observed T_{max} are above 50°C at northern stations and above 45°C at the southern stations. The RLs of the observed TW_{max} exceed 35°C in the region, which is considered as a limit of survivability. The RLs estimated from the ERA-Interim data are lower by 3 to 5°C than the RLs assessed for the nine meteorological stations. A simple bias correction applied to ERA-Interim data improves the RLs remarkably, yet discrepancies are still present. The results have potential implications for the risk assessment of extreme temperatures in Sindh.

Zahid, M., Blender, R., Lucarini, V., and Bramati, M. C.: Return levels of temperature extremes in southern Pakistan, *Earth Syst. Dynam.*, 8, 1263-1278, <https://doi.org/10.5194/esd-8-1263-2017>, 2017