Extreme Value Analysis of Global Temperature Anomalies

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Several studies using differing methodologies have revealed that human-made and natural climate forcing variables as well as ocean atmospheric processes contribute to the temperature variation over time, and that the human-made climate forcing is the main contributor to temperature growth. Examination of global land and sea temperatures anomalies for the period 1880 to 2012, from well-known databases, reveal a structural break in the trend from a gentle to a steeper slope from around the mid 1960s. Here an alternative approach that uses generalised extreme value (GEV) analysis is applied to the global temperature anomaly maxima, taking into account the structural break to evaluate the extent of the impact of these climate forcing variables and ocean atmospheric processes on temperature variation. This study reveals that after the structural break, the combined human-made climate forcing variable makes a greater contribution to temperature growth than before it. However, while this contribution is significant, it is smaller than the contribution over the entire record, arrived at in other studies. This study also reveals that some of the other climate forcing variables make significant contributions to temperature growth over the entire record. It also exploits a useful feature of the GEV model to produce extreme quantiles of the distribution of annual temperature anomaly maxima, and hence make probability statements concerning long-term temperature changes. This is different from the long-term temperature projections that are made in other studies where fairly complex climate models are used.

Keywords: Temperature anomalies; Climate forcing; Time varying mean; Extreme quantiles.