Geophysical Research Abstracts
Vol. 19, EGU2017-9496, 2017
EGU General Assembly 2017


# Sahelian springtime heat waves and their evolution over the past 60 years

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The Sahel is a semi-arid region which experiences very high temperature both during day- and night-times: monthly-mean temperatures in Spring typically oscillate between 30 and 40°C. At the same time a strong climatic warming has been observed over the past 60 years in this region: it reaches +1,5°C over April-May. Thus heat waves in this region have severe impacts on health, ecosystem, agriculture and more broadly economical activities, which will probably worsen in the context of climate change. However, heat waves in the Sahel remain poorly studied. The present work documents Sahelian heat waves and assesses their evolution across the last 60 years.

Properties of heat waves are sensitive to the way they are detected. Here, we use a methodology based on anomalies that allows to filter the seasonal, inter-annual and climatic evolutions, using a percentile-type threshold. It is applied separately to daily maximum and minimum temperatures and leads to two types of heat waves: day- and night-time ones. This separation matters because physical processes linked to minimum and maximum temperatures can be quite distinct.

The changes in both types of heat wave were studied over the period 1950-2012 using the Berkeley Earth Surface Temperature gridded product: several heat wave characteristics were investigated, including morphological ones such as the length and the spatial extent of the event, the heat wave intensity and the associated warming trends. We found no significant trends in the frequency, duration and spatial extent of both types of heat waves, while on the other hand their maximum and minimum temperatures displayed significant positive trends. They were mainly explained by the regional warming. By contrast, with a standard climatic heat index using percentile-threshold on raw temperatures, both day- and night-time heat wave frequencies were increasing, and while the day-time heat waves were getting longer and larger, the night-time heat waves were getting hotter. The explanations for the differences between the heat indexes will be discussed.

The ability of the three reanalyses ERA-Interim, NCEP2 and MERRA to reproduce Sahelian heat wave properties and their associated trends was further assessed on the period 1979-2010. At this shorter scale, we did not find any significant heat wave trend. Furthermore, reanalyses strongly differed in the representation of the heat wave inter-annual variability. These results raise concern about the utilization of meteorological reanalyses for the study of heat wave trends in West Africa.