EGU24-13513, updated on 20 May 2024
https://doi.org/10.5194/egusphere-egu24-13513
EGU General Assembly 2024

Impact of summer-persistent ENSO events on the global climate and the occurrence of extreme weather events

Anna Schultze[1], Zhengyao Lu[1], Qiong Zhang[2], Minjie Zheng[3,4], and Thomas Pugh[1]
[1]Lund University, Physical Geography and Ecosystem Science, Lund, Sweden
[2]Stockholm University, Department of Physical Geography and Bolin Centre for Climate Research, Stockholm, Sweden
[3]Lund University, Department of Geology Lund, Sweden,
[4]ETH Zürich, Institute for Atmospheric and Climate Science, Zürich, Switzerland

El Niño Southern Oscillation (ENSO), the most prominent climate variability in the tropical Pacific Ocean, significantly influences global climate and weather patterns, impacting ecosystems and societies worldwide. Our study focuses on the underexplored aspect of summer-persistent ENSO events, their global climatic impacts, and their role in triggering extreme weather occurrence.

ENSO events follow a distinct cycle, with El Niños more tightly bound to this cycle, while some La Niñas tend to fall below the ENSO threshold during the summer and then re-intensify in the following winter, resulting in multi-year La Niña events. However, there have been cases of slower ENSO decay, where sea surface temperature anomalies (SSTA) exceeding the ENSO threshold values into the northern-hemisphere summer, have been observed. The 2018/2019 El Niño, persisting until July, is a recent example, linked to significant events like the severe Australian bushfires in 2020 and the longest heatwave in history in the North Pacific in 2019. The El Niño was followed by a triple-dip La Niña, linked to extreme weather events in Africa, Australia and the United States. This highlights the importance of understanding the summer-persistent ENSO events.

Our study is structured based on three aims: identifying past summer-persistent ENSO events, assessing their impacts on global temperature and precipitation patterns, and examining their linkage to extreme weather events. Utilizing the Oceanic Niño Index calculated from the extended reconstructed sea surface temperature (ERSSTv5), we categorised ENSO events into conventional, summer-persistent, and multi-year summer-persistent types. The latter two were defined by events in which the Oceanic Niño Index exceeded the ENSO threshold until June for one or two consecutives summer seasons, respectively. We identified 12 summer-persistent ENSO events since 1940, separated into four summer-persistent El Niños, five summer-persistent La Niñas, and three multi-year summer-persistent La Niñas. Analyzing ERA5 reanalysis composites of 2-m temperature and precipitation, we compared the climatic impacts of these ENSO variants across winter and summer. This study advances our understanding of the climatic consequences of summer-persistent ENSO events, providing insights crucial for developing mitigation strategies for their impacts on global climate and extreme weather occurrences.