Extreme rainfall events during and following heatwaves

Christoph Sauter¹, Christopher White¹, Hayley Fowler², and Seth Westra³
¹Department of Civil and Environmental Engineering, University of Strathclyde, Glasgow, United Kingdom of Great Britain and Northern Ireland (christoph.sauter@strath.ac.uk)
²School of Engineering, Newcastle University, Newcastle upon Tyne, United Kingdom of Great Britain and Northern Ireland
³School of Civil, Environmental and Mining Engineering, University of Adelaide, Adelaide, Australia

Heatwaves and extreme rainfall events are natural hazards that can have severe impacts on society. The relationship between temperature and extreme rainfall has received scientific attention with studies focussing on how single daily or sub-daily rainfall extremes are related to day-to-day temperature variability. However, the impact multi-day heatwaves have on sub-daily extreme rainfall events and how extreme rainfall properties change during different stages of a heatwave remains mostly unexplored.

In this study, we analyse sub-daily rainfall records across Australia, a country that experiences severe natural hazards on a frequent basis, and determine their extreme rainfall properties, such as rainfall intensity, duration and frequency during SH-summer heatwaves. These properties are then compared to extreme rainfall properties found outside heatwaves, but during the same time of year, to examine to what extent they differ from normal conditions. We also conduct a spatial analysis to investigate any spatial patterns that arise.

We find that rainfall breaking heatwaves is often more extreme than average rainfall during the same time of year. This is especially prominent on the eastern and south-eastern Australian coast, where frequency and intensity of sub-daily rainfall extremes show an increase during the last day or the day immediately after a heatwave. We also find that although during heatwaves the average rainfall amount and duration decreases, there is an increase in sub-daily rainfall intensity when compared to conditions outside heatwaves. This implies that even though Australian heatwaves are generally characterised by dry conditions, rainfall occurrences within heatwaves are more intense.

Both heatwaves and extreme rainfall events pose great challenges for many sectors such as agriculture, and especially if they occur together. Understanding how and to what degree these events co-occur could help mitigate the impacts caused by them.