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A 25-year assessment of Hot and Dry Weather Compound Events in Europe using Earth Observation

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Weather Compound Events (WCE), broadly defined as “the combination of multiple drivers and/or hazards that contributes to societal or environmental risk” [1], contribute to important societal impacts and widespread economical damages. However, the underlying mechanisms and complete storylines of these events are complex and not well understood yet.

In this study, we build an 25-year database of co-occurrent hot and dry compound events (HDCE) including heatwaves, droughts, dust storms and wildfires affecting Europe and the Mediterranean Basin from 2003 to 2020. based on Earth Observation exclusively. Individual natural hazards were systematically identified by a spatial and temporal matching algorithm applied on consistent ESA CCI Earth Observation datasets. The resulting individual natural hazard masks were then overlayed over Europe and permitted to identify regions simultaneously affected by two or more natural hazards on a daily basis. The climatology revealed HDCE hotspots among others in Northern Italy, Balkans and Caucasus regions.

Characteristics of HDCE such as their duration, intensity and spatial extension are stored in the database. HDCE could also be associated with a severity index to aid comparison across events.

Long-term statistics of the generated HDCE have shown a high interannual variability with HDCE being more frequent during the 5 last years rather than two decades ago.

The large-scale preconditions preceding and occurring during HDCE are investigated as well in this study and revealed systematic patterns in the atmospheric dynamics.

[1] Zscheischler, J., Martius, O., Westra, S., Bevacqua, E., Raymond, C., Horton, R.M., van den Hurk, B., AghaKouchak, A., Jézéquel, A., Mahecha, M.D. and Maraun, D., 2020. A typology of compound weather and climate events. *Nature reviews earth & environment*, *1*(7), pp.333-347.