



Droughts, heatwaves, and wildfires: exploring compound and cascading events of dry hazards at the pan-European scale

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Compound and cascading events of natural hazards usually cause higher damaging-impacts than any of the single hazard event. Despite the significant impacts of compound hazards, many studies have only focused on single hazards. There are some studies dealing with compound dry hazards, however they are mainly focused on the feedback mechanisms between hazards. The location of dry hazards hot-spots, the probability of occurrence of compound hazards, and the propagation of single hazard into compound hazards and cascading events are therefore still not well understood. In this paper we investigate through historical data compound and cascading events of dry hazards, namely drought, heatwave, and wildfire across Europe. We developed a new methodology to explore these events on daily basis. Droughts in soil moisture were analyzed using the threshold approach, which was applied to time series of soil moisture storage that were obtained from the LISFLOOD model forced with weather observations. Heatwaves and wildfires events were analyzed using weather data obtained from the ERA-Interim dataset with a time-span from 1990 to 2016. Our results show that there are discrepancies between hazards identified in our study and hazards occurrence reported by the EM-DAT database. The dry hazard occurrences were largely found in France and north Italy, which means that these locations are identified as the hot-spot of dry hazards. The probability of joint of occurrence of dry hazards in these locations is however relatively low (0.8%). Drought plays a substantial role in determining compound and cascading events of dry hazards, and also controls the number and duration of cascading events. Moreover, drought appears most in the cascading events both as precursor and successor hazard, followed by compound drought and wildfire events. This leads to a combination of drought-drought and wildfires-drought as the most frequent cascading pattern of dry hazards in Europe.