EMS Annual Meeting Abstracts
Vol. 15, EMS2018-450, 2018

Atmospheric Conditions at the onset of Extremely Large Wildfires in Mediterranean Europe

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Here we characterize the atmospheric conditions at the beginning of the extremely large fires (ELF, >2,500 ha) that have occurred in the Mediterranean biome of Europe over the past 11 years (2006-2016) by a synoptic scale classification. We seek to provide a starting point on the role of meteorological and climatological conditions in the development of large fires: while the climatological conditions may drive fuel dry down, the meteorological drivers can enhance the magnitude of the wildfire.
Fire information was obtained from the European Forest Fire Information System (EFFIS), which has analysed MODIS daily images at 250 m spatial resolution. During 2006-2016 there were 147 ELF, representing the 2.26 % of the total number of fires (46 in Portugal, 48 in Spain, 3 in France, 16 in Italy and 34 in Greece). ELFs occurred across 108 different days, but typically in August (81 events) and with high inter-annual variation: between 1 and 22 ELFs in a year.
We classified the synoptic environment using the global gridded data from the NCEP/NCAR Reanalysis, which provides 2.5 degrees resolution (available until the present day). This dataset is available at 4 daily steps, and we chose the conditions occurring at 12 UTC, as they are more representative of the atmospheric state at the critical time for wildfire propagation. We were interested in variables that capture the different atmospheric states affecting environmental processes on surface. We thus selected sea level pressure, geopotential at 750 and 500 hPa and temperature and humidity at 850, 750 and 500 hPa.
The synoptic patterns (SP) were obtained by a multivariable analysis based on three steps: Principal Component Analysis, Cluster Analysis and Discriminant Analysis to detect the principal dynamic and thermodynamic atmospheric processes.
The results show a total of five SP. The number of days for each pattern is: SP1-56, SP2-21, SP3-18, SP4-8, SP5-5. In SP1, the Azores anticyclone is deep and its ridge affects the Iberian Peninsula. SP1 is characterized by a warm and dry air mass over all the Mediterranean Sea and small barometric gradient and it leads to ELF in any part of the Mediterranean basin. SP2 shows a low pressure over northern latitudes and an anticyclone over center Europe. A ridge present over Iberian Peninsula is extended to the north. SP2 is associated with ELF in Portugal. In SP3, the anticyclone is located over Great Britain and a low barometric gradient is found in the Mediterranean basin. A high pressure is located in the western Mediterranean in SP4. Low pressure is located in the north-west of Europe. Western winds flow over the Iberian Peninsula. SP5 is similar to SP3 however in this pattern low pressures are deeper in the western part of the Mediterranean basin.