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Estimation of climate change impact on dead fuel moisture at local scale by using weather generators

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The moisture content of dead fuel is an important variable in fire ignition and fire propagation. Moisture exchange in dead materials is controlled by physical processes, and is clearly dependent on atmospheric changes. According to projections of future climate in Southern Europe, changes in temperature, precipitation and extreme events are expected. More prolonged drought seasons could influence fuel moisture content and, consequently, the number of days characterized by high ignition danger in Mediterranean ecosystems.

The low resolution of the climate data provided by the general circulation models (GCMs) represents a limitation for evaluating climate change impacts at local scale. For this reason, the climate research community has called to develop appropriate downscaling techniques. One of the downscaling approaches, which transform the raw outputs from the climate models (GCMs or RCMs) into data with more realistic structure, is based on linking a stochastic weather generator with the climate model outputs. Weather generators linked to climate change scenarios can therefore be used to create synthetic weather series (air temperature and relative humidity, wind speed and precipitation) representing present and future climates at local scale.

The main aims of this work are to identify useful tools to determine potential impacts of expected climate change on dead fuel status in Mediterranean shrubland and, in particular, to estimate the effect of climate changes on the number of days characterized by critical values of dead fuel moisture.

Measurements of dead fuel moisture content (FMC) in Mediterranean shrubland were performed by using humidity sensors in North Western Sardinia (Italy) for six years. Meteorological variables were also recorded. Data were used to determine the accuracy of the Canadian Fine Fuels Moisture Code (FFM code) in modelling moisture dynamics of dead fuel in Mediterranean vegetation. Critical threshold values of FFM code for Mediterranean climate were identified by percentile analysis, and new fuel moisture code classes were also defined.

A stochastic weather generator (M&Rfi), linked to climate change scenarios derived from 17 available General Circulation Models (GCMs), was used to produce synthetic weather series, representing present and future climates, for four selected sites located in North Western Sardinia, Italy. The number of days with critical FFM code values for present and future climate were calculated and the potential impact of future climate change was analysed.