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Natural Hazards and Earth System Sciences
Discussions

Interactive comment on "Precipitation dominates fire occurrence in Greece (1900–2010): its dual role in fuel build-up and dryness" *by* F. Xystrakis et al.

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Dear reviewer #4

Firstly, we would like to thank you for your valuable comments which significantly improve the quality of the manuscript and thus will be taken into consideration in our revised manuscript.

In the following part you may find our reply to your comments.

COMMENT: In the introduction section the weather factors related to burned area are shown, but it should also be included in more detail the influence of moisture condi-

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tions. In this sense, Jurdao et al. 2013 Modelling fire ignition probability from satellite estimates of live fuel Moisture content) and Chuvieco et al.2009 (Prediction of fire occurrence from live fuel moisture content measurements in a Mediterranean ecosystem) are strongly recommended. It could be included in Page 696 line 4

REPLY: This part has been slightly modified in order to show the relation between fuel moisture and weather. Similarly a short part has also been included in the introduction. Yet, an extended description of the influence (mechanisms and effects) of the weather in fuel moisture and respectively in fire ignition and spread escapes the scope of this manuscript. The suggested papers have been considered.

COMMENT: Coherence with the terms "burned or burnt".

REPLY: The term ‘area burnt’ has been replaced with area burned throughout the text

COMMENT: Page 694, line 14, an analysis comparing different fire sizes have not been performed. Therefore, it can not be stated that spring precipitation coincide with large burnt area burned. (In addition, "large burnt area burned" is redundant). In this sense, following other authors studies also focused on mediterranean ecosystems, it would be useful to perform an analyse considereing different fire sizes.

REPLY: We have replaced the phrase ‘[...] years with high spring precipitation coincide with large burnt area burned.’ with the phrase ‘[...] years with high spring precipitation coincide with years with large area burned.’ We believe that we have carefully used the phrases ‘coincide’ and ‘associate’ in order to describe the outputs of the cross-tabulation analysis in the abstract. The large or small annual area burned is indirectly shown by the consideration of the ‘strongly positive’, ‘strongly negative’ of ‘close-to-prediction’ values, as shortly mentioned in the abstract and extensively described in methods part. It is made apparent that a year with strongly positive value of area burned is a year which is characterised by large area burned, or at least, its total area burned stays above the 95% confidence interval of the linear regression model between area burned and time in our time-series. In this sense, and provided the rephrasing of

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the sentence, we believe that the current phrase is sufficient to suitably describe our outputs. Moreover, regarding the additional analyses proposed here, we do not have any data classifying fires to different size classes. Therefore, it is impossible to perform the analyses which, we agree with the reviewer, could reveal more aspects of the fire regime in Greece.

COMMENT: Page 698, 2.2. Section: Define the months included in the fire season precipitation variable. In addition, what about aggregating also the temperature in the fire season? Perhaps it would be useful. Additionally, it seams as in the results section an analyse per season would be shown. However, this is not the case. Therefore, I recommed to define in the methods section, exactly what is going to be analyzed. If winter precipitation or autumn precipitation is not analyzed, perhaps it should not be shown in figure 2 as it does not offer any information related to the aim of the paper.

REPLY: Monthly totals of July, August and September are included in the definition of fire season precipitation. This information is provided in the manuscript in section 2.2 Additionally, we included the reasoning for not showing the outputs of winter and autumn precipitation in the results section (3.2). We believe that intra-annual variation in precipitation is far more important than the respective variation in air-temperature patters. It is generally agreed that, in Mediterranean ecosystems, it is mainly precipitation seasonality and availability that controls primary productivity, phenology and various other aspects of plant physiology (Lázaro et al., 2001) since during the optimum period for plant growth in terms of air temperature, water availability is limited. Moreover, values of the mean maximum, mean minimum, absolute maximum and absolute minimum air temperature are expected to reach their peak during summer (for maximum) and winter (for minimum). The analysis, therefore, of annual values indirectly corresponds to an analysis of their seasonal maximums and lows. This is also obvious from the inspection of the Spearman correlation coefficients between the annual and seasonal values of absolute maximum air temperature (Table 1 in supplementary file). Based on the above, we believe that the inclusion of seasonally aggregated values of air temper-

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ature would only marginally improve the outputs of our analyses and so we decided to focus in precipitation which, right from the beginning, showed a distinct seasonal pattern.

COMMENT: Page 696, line 10: Extreme fire weather? (perhaps, extreme fire season weather? In this case, first define fire season).

REPLY: Here, we adopt the definition form Hély et al. (2001) when using the term 'fire weather'. Yet, we agree that this may be a source of confusion, thus we rephrase in 'Weather is tightly related [. . .]'. Similarly we change the part in page 696 lines 5-6 as follows: '[. . .]it has been demonstrated that extreme weather results in [...]'.

COMMENT: Page 697, line 11: How is it possible to develop a forecasting model if the main explanatory variable is obtained with the mean of the precipitation recorded during the fire season?.

REPLY: Firstly, we have to notice that the term 'forecasting' has been replaced in the text (abstract and discussion) with more suitable words/phrases in order to avoid possible misidentification with the daily/weekly fire danger forecasting. It was a poor word choice. We have to notice that we use the term 'forecasting' in order to describe the ability to develop predictive models like these presented in Koutsias et al. (2013) that could take into consideration predictions of weather conditions (e.g. on the basis of various climate change scenarios) and result in respective predictions of area burnt. We would like to add here, that in the light of these comments, a change in the cited references will take place. The citation 'Moritz et al 2010' will be replaced by 'Moriondo et al. 2006'.

COMMENT: Page 699, line 1: change "are statistically" to "were statistically".

REPLY: It is changed in the revised manuscript (page 699 line 10)

COMMENT: Page 699, line 20: Coherence "log transformation (Page 698, line 22) or ln transformation".

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REPLY: It is ln. It is changed in the revised manuscript into ln.

COMMENT: Page 701, line 8: the assumption of "the majority" is questionable since 53.3% and 57.14% are close to the mean. Perhaps change to "more than the mean".

REPLY: The majority refers to the facts that 'more than the half' of the strongly positive values of area burned coincide with strongly positive values of absolute maximum air temperature. It does not refer to the mean since these are categorical variables (strongly positive, strongly negative, close-to-mean). In the presence of these three classes, the expected percentage under complete randomness should be ca 33.33% for each class. Results of the actual data revealed the percentages 53.3% and 57.14%.

COMMENT: Page 702, lines 6-10, 20-23, 27-29. Normally, in the results section, the results are just describe but their explanation is performed in the discussion section. Perhaps move this explanations to the discussion section.

REPLY: These parts have been transferred to discussion and consecutively the discussion part has been modified.

COMMENT: Page 705, lines 10-13. Could you add an idea on how to do that?

REPLY: Similarly like a previous comment, see also Koutsias et al. (2013) for the development of a regression model relating area burned and various weather parameters taking into account the serial correlation of time-series.

COMMENT: Figure 1: "Area burned -corrected" If it is written in the legend, perhaps it would be useful to explain that in the caption.

REPLY: We have included the explanation in the caption.

COMMENT: After reading the paper I was curious about knowing how the temperature (in the fire season) and the precipitation (in the fire season) are relate to each other. Perhaps this analyses is useful

REPLY: This provides a good starting point in developing a combined model with fire-

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season air temperature and precipitation. It has been shown that area burned in Greece is more tightly related to absolute maximum air temperature (Koutsias et al., 2013), although fire-season precipitation reflects higher correlation coefficients with area burned (Koutsias et al., 2013; Xystrakis and Koutsias, 2013). In the present study we have concluded that years with strongly positive values of area burned coincide with years with strongly negative values of fire-season precipitation and years with strongly positive values of spring precipitation and maximum air temperature. Further research is required in order to conclude over the combined effect of the above parameters, i.e. to study the relation of years of large area burned with years of simultaneous strongly negative fire-season precipitation and strongly negative absolute maximum temperature. The Spearman correlation coefficient between fire-season absolute maximum air temperature and fire-season precipitation is -0.1951 (significant at 0.05 level). The negative sign is rather expected since rainy periods are cooler. The magnitude of the correlation coefficient shows that the correlation is not very strong. The cross tabulation analysis of the two parameters (common period 1900-2008 = 109 years), as it is presented in Table 2 (supplementary file), shows that there is an indication of years of strongly positive precipitation with years of strongly negative air temperature, of strongly positive air temperature with strongly negative precipitation and, surprisingly strongly positive precipitation with strongly positive air temperature. The first two combinations are rather expected, but the third shows that high precipitation totals can also be expected with the form of few, stormy days during a considerably warm summer. Nevertheless, more robust and thorough analyses, which escape the scope of the manuscript and this reply, are required in order to draw safe conclusions.

References cited:

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Please also note the supplement to this comment:
http://www.nat-hazards-earth-syst-sci-discuss.net/1/C1103/2013/nhessd-1-C1103-2013-supplement.pdf

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Interactive comment on Nat. Hazards Earth Syst. Sci. Discuss., 1, 693, 2013.