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Atmospheric Chemistry and Physics Discussions

Interactive comment on "Meteorological controls on atmospheric particulate pollution during hazard reduction burns" *by* Giovanni Di Virgilio et al.

Anonymous Referee #2

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General comments:

Fires are growing threats to ecosystems and human society in many regions along with climate change. Accordingly, hazard reduction burns (HRBs) or prescribed burns as discussed in this work have gained more attention since they are effective techniques in wildland and forest management for large wildfire prevention. It's important to conduct HRBs skillfully and safely to ensure they are more controllable and less annoying with mitigated negative impacts on air quality and public health. Virgilio et al. in this study used generalized additive mixed models (GAMMs) to examine the meteorological impact on atmospheric particulate pollution during HRBs in Sydney, Australia,

which could benefit HRBs practices in Sydney and other similar regions. The GAMM model generation and selection framework is suitable for this air pollution meteorology study to explicitly take account of collinearity and autocorrelation problems in the predictor and response variables. The manuscript is well-organized and -written, and the conclusion is clear and concise. However, more comprehensive analysis with physical interpretation and implications of modeling results should be added to increase its merits to the fire risk management community. Therefore, I would suggest its publication on the discussion forum of the ACP journal after addressing the specific comments listed below.

Specific comments:

(1) In Table 2 for GAMM model selection, the significant predictor variable groups are quite different among monitoring sites and pollution conditions. I would expect wind direction to be an important factor for local high air pollution during HRBs, but I only found it significant for two sites (Earlwood and Liverpool) rather than the others (Chullora and Richmond). Also the HRBs daily frequency is more significant in the high pollution condition than in the low pollution condition, while HRBs daily burnt area is opposite in general. How to explain these differences and what is the implication for statistical model selection and HRB implementation?

(2) Another question about the relations between meteorological variables and PM2.5 concentrations is the understanding and interpretation of these statistical findings. The authors suggested that "PBLH and total cloud cover were the most consistent predictors of elevated PM2.5 during HRBs" (line 236-237). It is relatively easy to understand the relation between PBLH and PM2.5 concentrations, while it is not that intuitive to interpret the connection between cloud cover and PM2.5. My guess is people tend to conduct less HRBs in cloudy days in case of rain, which might explain the negative influence of cloud cover on predicted PM2.5. The authors should check the original datasets with more detailed explanation of these relations.

(3) I have some concerns with the concentration data used for the trend analysis. It is noted in section 2.2 that the PM2.5 measurement instrument changed since 2012, which might introduce systematic biases in the annual trends in Fig.4. The authors should be cautious about the increasing trends in PM2.5 concentrations after 2011 in Fig.4 and discuss more in the main text about this problem and potential needs for bias correction.

(4) In Fig.11, the fitting seems to be dominated by very few extreme large value samples, especially in the high pollution group. How robust are these relations?

(5) The authors suggested a maximum spatial distance of approximately 300km for the HRB influence on air quality, which is much larger than similar studies of about 100km. Why? What is the temporal scale of HRB influence? How many days after HRBs would the influence on air quality be negligible?

(6) Usually burnt area is one of predominant factors for fire emissions that affect air quality directly. It's a bit surprising that HRB total burnt area per day is not an effective predictor in this study. Though the authors attributed this result to the uncertainty in the burnt area estimation, it's still not very convincing. Probably the authors could examine the correlation between burnt area and fire related tracer species instead of total PM2.5 concentrations to reduce noise in total concentrations contributed by other emission sources.

(7) It's suggested that the authors conduct more comprehensive analysis of air pollution meteorology from other perspectives than individual meteorological variables. For instance, composite analysis on synoptic weather patterns in addition to these variables might be helpful to understand the impact of meteorological conditions on air pollution. The identification of critical weather patterns also benefits the interpretation of statistical relations between meteorological variables and ambient air pollution.

Technical corrections:

(1) The locations of monitoring stations such as Earlwood and Chullora are different in Fig.1 and Fig.2. Please double check the location for each site in these figures.

(2) The subplot titles and axis labels are too small in Figs.4, 6-11. The legends are also missing in these figures.

(3) Please clarify the calendar months for each season in the Southern Hemisphere in line 139-140 or show the seasons in Australia in Fig.5(a) for clear interpretation.

(4) Please indicate the resampling number of the bootstrap method in line 224.

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