Reply to the reviewer's comments on the manuscript "Biogenic isoprene emissions, dry deposition velocity and surface ozone concentration during summer droughts, heatwaves and normal conditions in Southwestern Europe".

Guion et al.

Report #2

The authors would like to thank the reviewers for their careful reading of the paper and for their comments that improved the quality of the manuscript. All comments have been addressed and a point-by-point answer is provided in the following (in blue after the corresponding comment). The line numbers given in response to comments correspond to the latest version submitted. Finally, modifications made in the new manuscript version are highlighted in the track-changes file provided by the authors.

Suggestions for minor revisions:

A. The abstract needs to be rewritten to provide quantitative information on the impacts of drought and heatwaves on biogenic isoprene emissions, dry deposition velocity, and surface ozone air pollution.
Line 6 in the abstract: what is "gaz dry deposition"? Do you mean "gas dry deposition"?

We agree that the abstract can be improved by providing more quantified effects. We have rewritten the summary, in particular the part on cluster analysis.

We thank the reviewer for identifying the writing error. We made sure to replace the word "gaz" with "gas" everywhere.

B. Please label figure panels as a, b, c, ... and explicitly describe each panel in the caption. Figures in the present form (e.g., Figure 2 and 5) are very difficult to follow.

As pointed out by the reviewer, we labeled the panels of the figures and updated the captions.

C. In the present manuscript, discussion on the variability of isoprene emissions, dry deposition, and ozone concentrations are based on episodes (mostly 2012). It would be more meaningful to examine inter-annual variability in 2012 (hot and dry), 2013, and 2014 (relatively cool and wet).

Figure 13 shows that the model has difficulty simulating the observed ozone inter-annual variability, particularly the observed ozone enhancements in the hot and dry summer of 2012. Does the model simulate increases in biogenic isoprene emissions and decreases in ozone deposition velocity in the summer of 2012 compared to 2014? In-depth discussion and analyses are needed for this section.

The analysis of the variation of C_5H_8 emissions, O_3 dry deposition, and O_3 concentrations by clusters of extreme weather events was well done for the summers of 2012, 2013 and 2014. It includes inter-annual variability.

The result section is divided into two parts. Firstly, we performed a sensitivity analysis of simulated biogenic C_5H_8 emissions, O_3 concentration and O_3 dry deposition to drought effects only for summer 2012. Secondly, we performed a cluster analysis of simulated biogenic C_5H_8 emissions, O_3 concentration and O_3 dry deposition over summers 2012-2014, including a comparison to O_3 over the same period. To allow more robust conclusions, we have extended the cluster analysis to the observations of O_3 for summers 2000-2016 and HCHO for summers 2005-2016. We made it clearer in the abstract and introduction of the section 5.2 “Statistical variation during droughts and heatwaves”. Please see Ln. 512 – 515 “Clusters of droughts and heatwaves (isolated or combined) are constructed based on the PLA_{T2m} and PLA_{SD} indicators, allowing to analyze the statistical variation of simulated C_5H_8 emissions, O_3 stomatal conductance and O_3 surface concentration for summers 2012-2014. We performed the same analysis on observations of HCHO total column for summers 2005-2016 and O_3 for summers 2000-2016.”.

Concerning the Figure 13, the number of exceedances is indeed generally smaller in the simulations (compared to the observations). This is due to the overall underestimated daily maximum in CHIMERE presented in the validation. However, some countries such as France or Austria present similar inter-annual patterns (Figure 13). Moreover, the distribution of exceedance days by extreme weather events over Europe is consistent with the observations (Table 4), as stated in Section 3 “Threshold level exceedance of O_3”.