We are thankful to the reviewer for her/his help in improving the quality of the manuscript. Our detailed responses to the comments are given below in italic

This manuscript describes a modeling study for aerosol radiative impact on photo-chemical pollutants near Moscow, Russia. This second version changed slightly from its first version, e.g. Figure 6's model extinction changed its wavelength from 400 nm to 500 nm. However, it still has very limited model-observation comparison. Other than the single comparison with CALIOP, all the manuscript describes the model-only result, which is hard to justify. Even that comparison, which is at night, has major issue since your discussion is about photochemical impact, which occurs during daytime, right?

In addition to the model comparison with NO_2 and O_3 observations, the evaluation of model results has been now improved by additional statistical comparisons for some PM10 components: ammonium, nitrates and sulphates (see last response below) . Moreover, thanks to both reviewers' remarks, the aerosol radiative feedbacks on photochemistry have been now discussed in a more comprehensive way in the revised manuscript.

Although this study is about the aerosol radiative impact from wildfire plume, it has very limited discussion the exact wildfire impact. How many aerosol impacts come from wildfire plume, and how many come from anthropogenic emission as Moscow is a megacity. The aerosol radiative impacts discuss throughout this paper could be partlly due to anthropogenic influence. There is no discussion about the impact on wildfire event versus non-event.

We agree with the reviewer that the specific impact of wildfires on photochemistry has not been quantified. The aim of this study is to investigate the influence of aerosols on photochemistry during an extreme event (in terms of aerosol concentration), without differentiating particle's origin.
However, the study of Chubarova et al. 2012 clearly shows that, during this specific wildfire episode, the aerosol optical thickness over the Moscow region is more than three times larger than the one observed during typical August conditions over the period 2001-2010. This suggests that, even if anthropogenic aerosols are present over the studied region, the contribution of smoke aerosols during this specific event is very large.
This point has been clarified in the Introduction of the revised manuscript by adding the reference to the work of Chubarova et al 2012 :

« We focus on a major fire event that occurred in Russia during August 2010 as its episode was characterized by important concentrations of primary and secondary aerosols and large concentrations of ozone, especially over this specific region (Zvyagintsev et al. 2010, Konovalov et al. 2011, Popovicheva et al. 2014). Also, the study of Chubarova et al. 2012 clearly shows that, during this specific wildfire episode, the aerosol optical thickness over the Moscow region was more than three times larger than the one observed during typical August conditions over the period 2001-2010. This suggests that, even if anthropogenic aerosols are present over the studied region, the contribution of smoke aerosols during this specific event is very large. Then, this case study represents an excellent opportunity to discuss how aerosol solar extinction, especially biomass burning particles, can affect photochemistry. »

- Chubarova N., Y. Nezval, I. Sviridenkov, A. Smirnov and I. Slutsker: Smoke aerosol and its radiative effects during extreme fire event over Central Russia in summer 2010, Atmos. Meas. Tech., 5, 557-568, 2012.

Page 11, line 4: “the important concentrations of scattering aerosols”. In my knowledge, the major distinguished characteristic of biomass burning plume from anthropogenic aerosol is about its black carbon, or absorptive aerosol. Do you have any measurement near Moscow supporting your point ?

We agree with the reviewer that large values of SSA for biomass burning aerosols are not typical. However, as indicated in the Section 2.1.2, large values of SSA has been measured by AERONET over Moscow during the biomass burning event (0.95-0.96 in the visible/near infrared) and have been well simulated by CHIMERE (0.97 in the visible/near infrared). Such elevated SSA values are also supported by the study of Chubarova et al. 2012 highlighting the dominance of scattering species during this specific event.

This point has been clarified by adding the reference to Chubarova et al. 2012 in the section 2.1.2 of the revised manuscript :

« Such low aerosol absorption properties are supported by the study of Chubarova et al. 2012 highlighting elevated SSA values during this specific event. »

- N. Chubarova, Ye. Nezval, I. Sviridenkov, A. Smirnov, and I. Slutsker, Smoke aerosol and its radiative effects during extreme fire event over Central Russia in summer 2010, Atmos. Meas. Tech., 5, 557-568, 2012.

The major discussion is about the change of photolysis rate and its further impact on photochemical activities. However, there is no photolysis comparison with any observations, but just the model-only result? It is hard to verify whether the model gave the right result. The second version did not change it

We agree with the reviewer that it would be very interesting to make such comparisons. However, no photolysis frequencies measurements are available to us for this specific event. However, recently Palancar et al. 2013 realized a intercomparison exercise between the TUV model and UV actinic flux measurements over Mexico during the MILAGRO campaign. They highlighted the good performance of the model in reproducing observations both at the surface and in the lower troposphere over this highly polluted area. Hence, even though no comparison of photolysis simulations with measurements are made during this specific wildfire episode, the TUV validation study of Palancar et el. 2013 gives confidence in our estimation of photolysis rates perturbations by aerosols.
This point has been clarified in the section 2.2 of the revised manuscript by adding the reference to the work of Palancar et al. 2013 :

« Recently, Palancar et al. 2013 realized a intercomparison exercise between the TUV model and UV actinic flux measurements over Mexico during the MILAGRO campaign. They highlighted the good performance of the model in reproducing observations both at the surface and in the lower troposphere over this highly polluted area. This validation study gives confidence in our estimation of photolysis rates perturbations by aerosols during the 2010 Russian wildfires presented hereinafter. »

- Palancar G. G., B. L. Lefer, S. R. Hall, W. J. Shaw, C. A. Corr, S. C. Herndon, J. R. Slusser and S. Madronich, Effect of aerosols and NO_2 concentration on ultraviolet actinic flux near Mexico City during MILAGRO: measurements and model calculations, Atmos. Chem. Phys., 13, 1011–1022, 2013

In addition, to further investigate the performance of the model taking into account the aerosol radiative feedbacks, additional statistical comparisons have been included in the Section 3.2 of the revised manuscript for three inorganic aerosol species : ammonium, nitrates and sulphates :

	NH_4^+				NO_3^-				SO_4^{2-}			
	Mod.	*Obs.*	*Corr.*	*RMSE*	*Mod.*	*Obs.*	*Corr.*	*RMSE*	*Mod.*	*Obs.*	*Corr.*	*RMSE*
with	*1.09*	*0.86*	*0.48*	*1.03*	*0.14*	*0.12*	*0.20*	*0.15*	*2.24*	*0.48*	*0.23*	*1.80*
without	*1.16*	*0.86*	*0.42*	*1.04*	*0.19*	*0.12*	*0.26*	*0.23*	*2.33*	*0.48*	*0.45*	*1.88*

Statistical comparisons between the near-surface concentrations of NH_4^+, NO_3^- and SO_4^{2-} simulated with and without aerosol radiative feedbacks and measured at Moscow by an air quality station. Mod. and Obs. are the period-averaged modelled and observed concentration. Corr. and RMSE are the temporal correlation and the root mean square error.

As for NO_2 and O_3, including the optical effect of aerosols in the photolysis calculations slightly improves the formation of secondary inorganic species in the CHIMERE model with a RMSE systematically reduced. The overestimation of sulphates levels is decreased and the simulated concentrations of ammonium and nitrates get close to the observed one. This result suggests that taking into account the aerosol solar extinction in the photolysis calculation gives an added value in the capacity of the model to reproduce the photochemistry under polluted environments.