Response to the Reviewers

We have received comments from two anonymous Reviewers (AR1, AR2) and Alan Robock, which we thank for their extremely constructive comments. The Reviewers comments have been all taken into account and we have made major revisions in the abstract and additions, which we think have indeed improved the manuscript. Three figures have been changed, namely Figure 4, Figure 6 and Figure 10 and one new figure (Figure 11) has been added. Table 1 has been revised. We hereby reply to all reviewers' comments point by point:

Comments from AR1 (1, 2, 3, 4), AR2 (1) and Alan Robock (1) have been all included in the following fully **revised abstract**, which reads as follows:

"We examine sunsets painted by famous artists as proxy information for the aerosol optical depth after major volcanic eruptions. Images derived from precision colour protocols applied to the paintings were compared to online images, and found that the latter, previously analysed, provide accurate information. Aerosol optical depths (AODs) at 550 nm, corresponding to Northern Hemisphere middle latitudes, calculated by introducing red-to-green (R/G) ratios from a large number of paintings to a radiative transfer model, were significantly correlated with independent proxies from stratospheric AOD and optical extinction data, the dust veil index, and ice core volcanic indices. AODs calculated from paintings were grouped into 50-year intervals from 1500 to 2000. The year of each eruption and the 3 following years were defined as "volcanic". The remaining "non-volcanic" years were used to provide additional evidence of a multidecadal increase in the atmospheric optical depths during the industrial "revolution". The increase of AOD at 550 nm calculated from the paintings grows from 0.15 in the middle 19th century to about 0.20 by the end of the 20th century. To corroborate our findings, an experiment was designed in which a master painter/colourist painted successive sunsets during and after the passage of Saharan aerosols over the island of Hydra in Greece. Independent solar radiometric measurements confirmed that the master colourist's R/G ratios which were used to model his AODs, matched the AOD values measured in situ by co-located sun

photometers during the declining phase of the Saharan aerosol. An independent experiment was performed to understand the difference between R/G ratios calculated from a typical volcanic aerosol and those measured from the mineral aerosol during the Hydra experiment. It was found that the differences in terms of R/G ratios were small, ranging between -2.6% and +1.6%. Also, when analysing different parts of cloudless skies of paintings following major volcanic eruptions, any structural differences seen in the paintings had not altered the results discussed above. However, a detailed study on all possible sources of uncertainties involved (such as the impact of clouds on R/G ratios) still needs to be studied. Because of the large number of paintings studied we tentatively propose the conclusion that regardless of the school, red-to-green ratios from great masters can provide independent proxy AODs that correlate with widely accepted proxies and with independent measurements".

The following specific answers refer to **AR1, Comment #4**

"p. 33147 l. 19-26 I would suggest to downscale this in the abstract- and use the work for a somewhat more 'scientific' sensitivity analysis. The authors use 2 (beautiful!) paintings (see Figure 10) to demonstrate the impact of dust as observed by Maestro Panayiotis Tetsis. The paintings show two sunsets. One painting shows rocks- the size of the sun is different, one painting seems to have some cloud cover, the other not. I suspect that such issues are found in most paintings assessed by the authors. Assuming that the authors only analysed the 'sky' in the paintings, can the authors assess the uncertainty associated with such 'structural' differences in the paintings (e.g. analyse parts of paintings)".

Reply:

For the calculation of the R/G ratios we analysed only the parts of the sky over the field of view of the artist near the horizon trying to avoid clouds. Then, we averaged the measured values. The average values and the standard deviation of R/G ratio for each painting were presented in Appendix B of Zerefos et al. (2007). In that study, we reported that the mean error value was 0.014 due to the variability of R/G ratios within the paintings/images. We also examined how that variability could affect the estimated AOD values for different aerosol conditions and solar zenith angles. The reported uncertainty was less than 0.05 for small optical depths and smaller SZA (70°). That number was comparable to the accuracy of other experiment measurements of AOD. The error however increased with increasing AOD and SZA (85°) and can be as large as 0.18 for AOD larger than 0.5. Instead of repeating the methodology in this paper too, we have tried to estimate uncertainties, particularly the structural of the paintings in the revised manuscript. Please also note that during the Hydra experiment, master colourist Panayiotis Tetsis did not have enough time to complete the rocks, since his priority was the sky and he should start working on the next painting. Please see our response to comment #7.

AR1, Comment #5

"p. 33148 Please explain what is meant with 'created with a colour profile protocol'? I expect this related to the camera sensor and the way the digital picture is stored? A few sentences explaining the issue would be essential."

Reply:

A colour profile protocol is the protocol (set of instructions) used to accurately translate colour through different devices. In our work a colour profile was absolutely necessary so that the scanned paintings retained their original colour information when distributed through digital means. Also by having the colour profile along with calibrated scanners it was possible to compare paintings from other colourists with the minimum possible uncertainty caused by differences in colour translation.

The text has been modified as follows:

"Firstly, by correlating the available R/G ratios from the above-mentioned public websites with the same ratios from their respective high quality colour profile protocols. A colour profile protocol is the protocol (set of instructions) used to accurately translate colour through different devices. In our work a colour profile was absolutely necessary so that the scanned paintings retained their original colour

information when distributed through digital means. Also by having the colour profile along with calibrated scanners it was possible to compare paintings from other colourists without any uncertainty by differences due to colour translation".

AR1, Comment #6

"p. 33150 l.12 In other words: the errors made previously were larger for the 'red' sunsets used to evaluate the impact of volcanoes?"

Reply:

As expected from statistical theory, the standard deviation and the standard errors for the larger R/G ratios are expected to be larger when compared to the corresponding statistics for smaller R/G ratios. We have randomly generated one hundred numbers with values ranging between 1 and 2 and calculated the standard error of them and we did the same with cases with values ranging between 0 and 1. The statistical difference between the errors still has shown that the 'red' R/G ratios were significantly different from the 'less red' ratios. Therefore the statistical effect of the volcanic eruptions is significant. An example of the results obtained from R/G ratios with a high precision protocol and from random numbers is shown below:

Statistics of R/G from paintings (mean value 1.08) and numbers from a random number generator

	Tate+National High resolution (protocol) R/G >1.08	Tate+National High resolution (protocol) R/G <1.08
Average	1.150	1.020
N	139	155
St. deviation	0.069	0.050
St. error	0.006	0.004

Random numbers (RN) from RN generator

	Random numbers between 1 and 2	Random numbers between 0 and 1
Average	1.494	0.493
N	100	100
St. deviation	0.308	0.251
St. error	0.031	0.025

AR1, Comment #7

"p. 33151 as outlined above: I think the authors dismiss too easily the impact of structural differences, and the cancellation of errors is wishful thinking. It would be great to have some attempts to analyse such differences".

Reply:

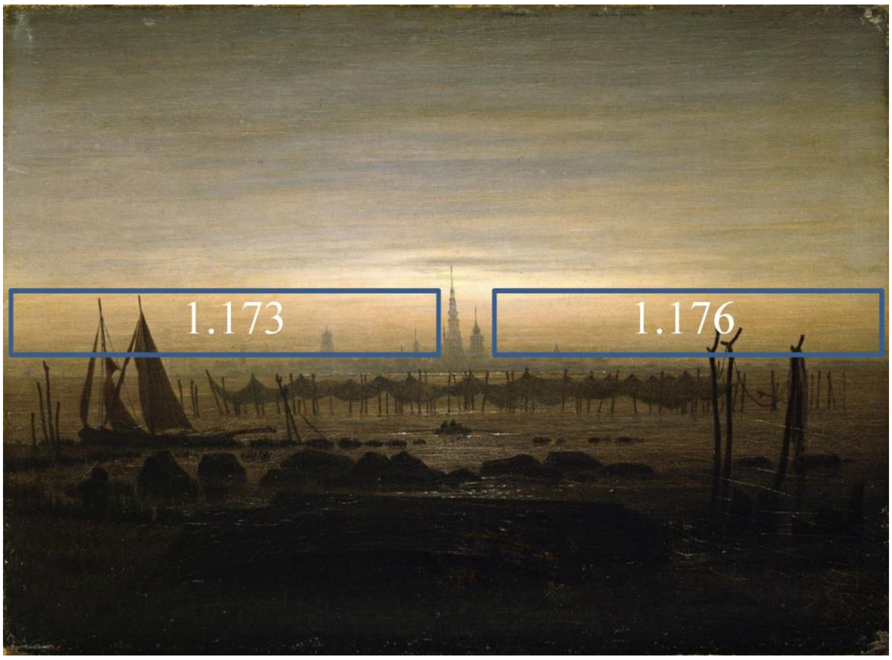
The following text has been added to Section 3:

"This is supported by the signal to noise ratio analysis of the statistical standard errors discussed in the introduction and in Zerefos et al. (2007). In addition, we have searched for a possible impact of structural differences. We provide here examples of paintings with and without structural differences following two major volcanic eruptions namely Tambora (1815) and Krakatau (1883). The calculated R/G ratios in parts of the sky give a similar result in which the differences are small, anyhow smaller than the standard errors we have encountered in this work (see paintings in Appendix C). Therefore, we have to tentatively assume that the impact of structural differences when studying R/G ratios in parts of the sky of the painting are small. We note here that we have made any possible effort to avoid measuring R/G ratios in the presence of clouds. It appears that R/G ratios as measured in this work somehow remind us on the ratios of solar irradiance in different wavelengths which are used in spectrophotometers to measure columnar gases in the atmosphere. In these spectroradiometers the noise introduced by aerosols and other factors related to

scattering and related effects are indeed cancelled out and this is how we obtained the long series of total ozone, total sulphur dioxide, total nitrogen dioxide with remarkably small standard error. We think that the reduction of errors when using R/G ratios provides useful information on the overhead aerosol content which correlates well when averaged with other proxies and/or with real AOD measurements as was the case with the Hydra experiment, discussed in paragraph 5.

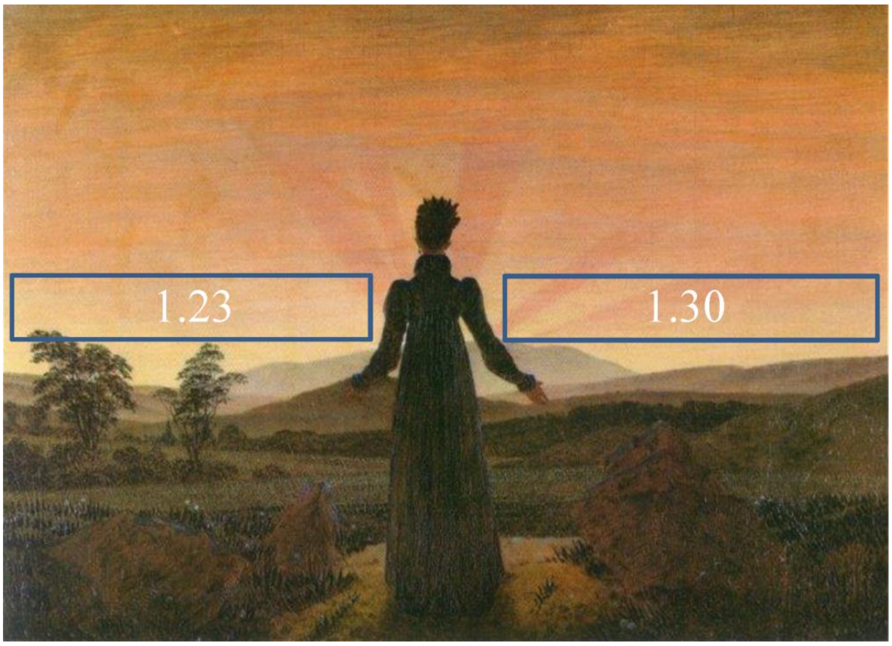
In our study, a detailed quantification of each source of uncertainty was not possible except for the effects of quality in digitization of the paintings, structural differences and the solar zenith angle. Potential sources of uncertainty could be the atmospheric/aerosol related dynamics which affect the magnitude of the impact of each volcano in the area under study (of the painter) as well as the impact of cloudiness on the depicted R/G. Any effects from clouds we think have been avoided by trying to confine our R/G "measurements" to the cloudless parts of the sky in each painting. Following the above discussion and since our goal in this part of the manuscript was focused on the validation of the volcanic eruption effect and not on the actual quantification of the volcanic aerosol in the painting area, we believe that correlation coefficients with the mentioned proxies provide evidence that this goal has been achieved."

Appendix C. R/G ratios with and without structural differences after Tambora (1815) and Krakatau (1883).



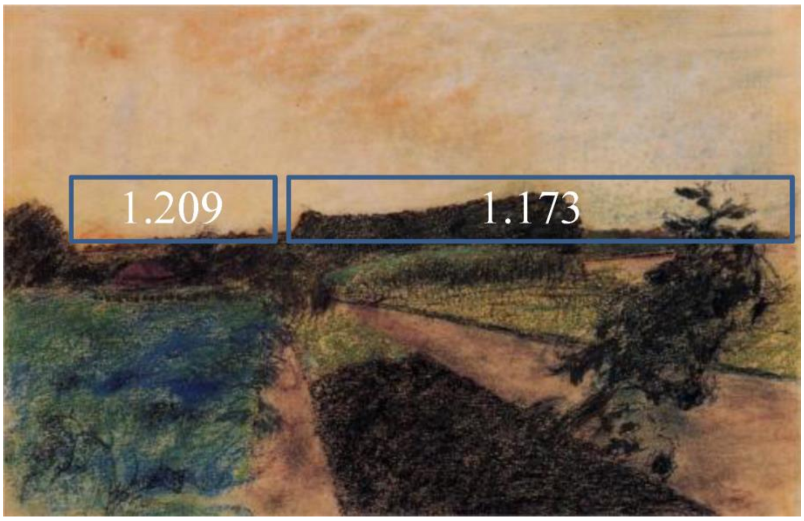
Caspar David Friedrich, Griefswald in the Moonlight, 1817. Corresponding R/G ratios were averaged inside each box.

Karl Friedrich Schinkel, The Banks of the Spree near Stralau, 1817. Corresponding R/G ratios were averaged inside each box.

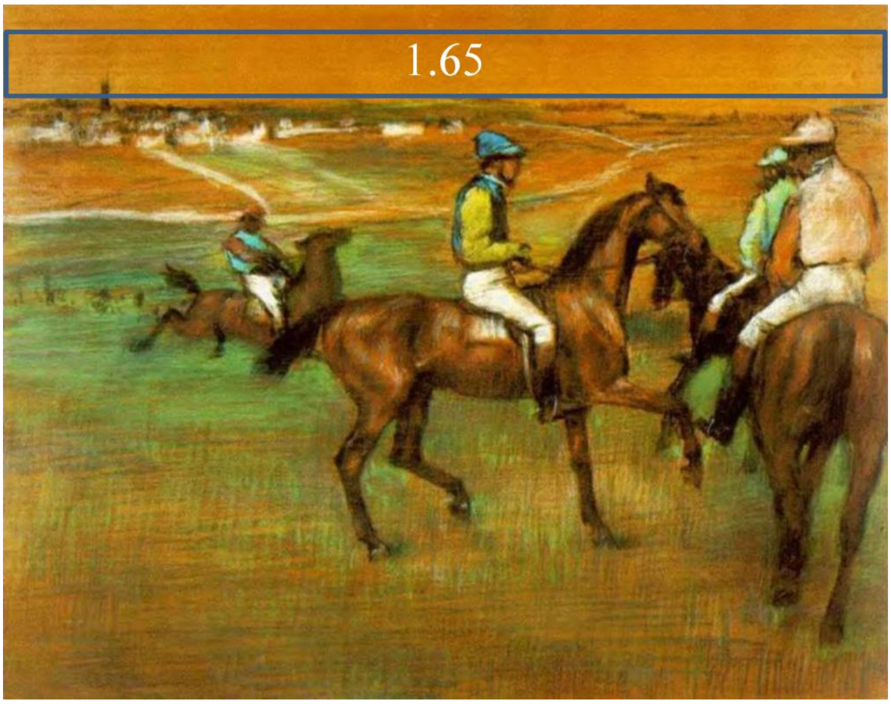


Caspar David Friedrich, Woman in front of the Setting Sun, 1818. Corresponding R/G ratios were averaged inside each box.

Joseph Mallord William Turner, Red sky and crescent moon, c. 1818. Corresponding R/G ratios were averaged inside the box.



Edgar Degas, Landscape on the Orne, c.1884. Corresponding R/G ratios were averaged inside each box.



Edgar Degas, Race Horses, 1885. Corresponding R/G ratios were averaged inside the box.

AR1, Comment #8:

"p. 33152 It would be logical to first describe the experiment as done here, and then the contrasting datasets. Somewhere the information should be given that the data is really about major volcanic eruptions where emissions reach the stratosphere, and remain for several years. This is also important since it means that datasets are probably more globally representative".

Reply:

Section 4 has been revised as follows:

"The earlier estimates of the aerosol optical depth at 550 nm (based on R/G calibrated ratios from paintings) and the radiative transfer model by Mayer and Kylling (2005) and Mayer and Emde (2007), were used to compile an independent time series with AODs during 1500-2000. Additionally, the time series of AODs calculated from paintings has been divided into 50-yr intervals from 1500 to 2000. The year of each eruption and the 3 following years were defined as "volcanic". The remaining "non-volcanic" years were used to calculate the average AOD value pertaining to these years corresponding to Northern Hemisphere mid latitudes. This paper is based on evidence by Western painters and colourists. The type of art is typical to Western European schools so it was inevitable to have more paintings in European countries. Nevertheless, the paper focuses on big volcanic eruptions that have an effect over the entire planet atmosphere, so the evidence could be noticed in most parts of the world. This long term data set of AODs is compared to other independent proxies as shown in Figure 4. Detailed information on those proxies can be found in the primary literature by Lamb (1970, 1977, 1983), Sato et al. (1993), Stothers (1996, 2001), Robertson et al. (2001), Gao et al. (2008) and Crowley and Unterman (2013). Using the data shown in Figure 4 we found that the correlation coefficients between other proxy indices and the estimated AODs from the R/G ratios from paintings are statistically significant (Table 1). Appendix D presents the data used in the calculations shown in Table 1. The reader is also referred to the precision by which the extreme AODs between paintings and proxies during large volcanic eruptions match in most cases. In particular, in 102 cases for which data of both DVI and this study are simultaneously available, DVI spikes are coinciding to AOD spikes

from this study at a percentage of 80% (9 out of 11 cases). As spikes we define the values in both time series that belong in the upper 10% range of values. In addition, this study revealed two high AOD cases that do not match with DVI spikes and it is worth noting that both failing cases succeeded a period of two consecutive years with spikes in both indices.

Total sulphate is the total measured sulphate concentration in ppb in the core, as resulted from deposition either from the stratosphere (volcanic) or the troposphere (anthropogenic and other biogenic sources), as described by Zielinski et al. (1996) and Robertson et al. (2001). The presented values do not refer directly to the atmospheric concentration, but rather to the deposition on ice which however is related to ambient concentrations. The values of calculated index of total sulphate from Greenland ice cores (Zielinski, 1995; Zielinski et al., 1996) and the longer time series of stratospheric AOD (Robertson et al., 2001) were grouped in 50-year time intervals with the same procedure described above for AODs calculated from paintings. The three datasets are presented in Fig. 5. We note here the point raised by Robertson et al. (2001) that the last 150 years increase in total sulphate from ice core was hypothesized to be the result of tropospheric anthropogenic sulphate deposition. The point raised by Robertson et al. that there have been no major volcanic eruptions between 1900 and 1960, needs some clarification. Indeed in the list of major volcanic eruptions in the past 500 years (Appendix B after Ammann and Naveau, 2003; Robock, 2000), we can see that based on VEI two eruptions, Santa Maria (1903) and Katmai (1912) have been classified with VEI 6. However, VEI is known to be not a good index of stratospheric sulphate loading since it measures the explosivity of a volcano and not its stratospheric injection. A good example is the 1980 St. Helen's eruption, with a VEI of 5 but no stratospheric or climatic impact (A. Robock, private communication). Stratospheric injection is important to ensure its global or hemispheric effects. From the above discussion it can be proposed that compared to the pre-industrial period, the industrial period shows higher painting-derived aerosol content, in agreement to what it is expected from literature (e.g., Neftel et al., 1985; Robock and Free, 1995; Robertson et al., 2001; Forster et al., 2007; Wild, 2012)."

AR1, Comment #9:

"p. 33154 l18 Explain why it is possible to compare the impact of mineral aerosol (in lower atmospheric layers, larger) to volcanic aerosol in terms of RGB".

Reply:

The following text has been added at the end of Section 5.2.

"Finally, a comparison between the impact of mineral aerosol (Saharan dust) and the impact of a typical volcanic aerosol in terms of RGB is also attempted. The mineral aerosol during the Hydra experiment at 500nm was measured to vary close to 0.25. Therefore we have made model runs with the volcanic aerosol setting the volcanic AOD case at 500nm equal to 0.25 also. Note here that the mean volcanic AOD (500nm) in our paintings is very close to that number and equals to 0.22. Figure 11 shows the percent difference in R/G ratios between the ones measured at Hydra Sahara dust aerosol profile and a typical modelled volcanic aerosol profile as was used previously in this work. In both cases AOD (500nm) was set to 0.25. The ratios are shown as isopleths in a graph where the position of the sun is fixed at 80^o solar zenith angle. It was quite surprising to see that although both the nature, size and the vertical profiles of the Saharan and the volcanic aerosols differ, their effect on R/G overhead ratios in the sky induce so small a difference ranging from a minimum of -2.6% to a maximum +1.6%, depending on the solar zenith angle and the angle relative to the position of the sun."

AR1, Comment #10:

"p. 33157 Explain the conclusions (abstract) to what extent 'new' information came out of this study, regarding the historic impact of volcanoes in bringing sulphate into the stratosphere? Or is it mainly 'not-contradicting' other datasets."

Reply:

The following text has been added at the end of the conclusions in the revised manuscript:

"The new information in the paper can be summarized as follows:

1. *The comparison of high precision with low precision colour protocol images at independent samples of paintings from the Tate and the National Galleries in London strengthen the tentative results proposed in an earlier paper by Zerefos et al. (2007).*
2. *AODs from a multi-hundred sample of paintings show statistically significant correlations with independent proxies.*
3. *Structural differences in paintings do not seem to alter the above results. The signal to noise ratios following volcanic eruptions are statistically significant.*
4. *When averaged in 50-year intervals, AODs from paintings in non-volcanic years agree with completely independent data sets with the observed increases of the industrial aerosol in the past 150 years.*
5. *R/G ratios calculated from different natural profiles such as from volcanic aerosols and Saharan mineral aerosols show very small differences. This explains how the experiment performed with an internationally known master colourist arrived at similar results with an increase in R/G ratios during the passage of a Sahara dust event.*
6. *Regardless of the school, red-to-green ratios from great masters can provide independent proxy AODs that correlate with widely accepted proxies and with independent measurements.*

The main conclusion of the paper is that nature speaks to the hearts and souls of the artists. When colouring sunsets the R/G ratios perceived by the brain contain important environmental information. It remains to an interdisciplinary community to study further the evidence presented in this research."

AR2, Comment #1:

"p33147 (Abstract) l16-18: Slight clarification needed for this sentence – the AOD value increases from 0.15 to 0.20 – rather than the increase in AOD being 0.15 to 0.20. (I think the increase in AOD is 0.05)."

Reply:

The clarification was addressed in the revised abstract. The text has been modified as follows:

"The increase of AOD at 550 nm calculated from the paintings grows from 0.15 in the middle 19th century to about 0.20 by the end of the 20th century".

AR2, Comment #2:

"p33149 (Section 2) I am unclear exactly how the paintings are sampled to obtain a red-to-green ratio. I guess only parts of the paintings are sampled? (i.e. just the sky, or just parts of the sky?) Or have I got this wrong and the whole painting is sampled? Please could you elaborate on the exact process, perhaps keeping in mind the principle that based on your description of the technique, anyone should be able to repeat your measurements and (hopefully) obtain the same results? Assuming that just parts of the painting are sampled, presumably this corresponds to many (thousands of?) pixels over the whole digital image. Is the R/G value reported just the mean of all these values? I wonder if the full range, or PDF, of values may also be interesting, even if only to add an error estimate on the R/G value?"

Reply:

The method of painting sampling and an analysis of the corresponding uncertainties is fully described in Zerefos et al. (2007). For the calculation of the R/G ratios we analysed only the parts of the sky over the field of view of the artist near the horizon trying to avoid areas covered by clouds. Then, we averaged the measured values. The average values and the standard deviation of R/G ratio for each painting were presented in Appendix B of Zerefos et al. (2007). In that study, we reported that the mean error value was 0.014 due to the variability of R/G ratios within the paintings/images. We also examined how that variability could affect the estimated AOD values for different aerosol conditions and solar zenith angles. The reported uncertainty was less than 0.05 for small optical depths and smaller SZA (70°). That number was comparable to the accuracy of other experiment measurements of AOD. The error however increased with increasing AOD and SZA (85°) and can be as large as 0.18 for AOD larger than 0.5. Instead of repeating the methodology in this paper too, the following sentence was added in the revised manuscript:

"The method of painting sampling and an analysis of the corresponding uncertainties is described in the study by Zerefos et al. (2007)."

AR2, Comment #3:

"p33150 l13 What is C.L.?"

Reply:

It is confidence level and it has been inserted in the revised manuscript.

AR2, Comment #4:

"p33151 l5 Digitization, rather than digitalization? (Maybe they are equivalent…)"

Reply:

Digitization is the correct word, it has been inserted in the revised manuscript.

AR2, Comment #5:

"p33151 (Section 3) What is the geographic spread of the painting locations, and is this important? I am guessing most if not all are from Europe. I appreciate that volcanic aerosol, at least from very large eruptions, is thought to spread globally or at least hemispherically, so maybe sampling only over Europe is not a significant bias. However you are also interpreting your results in terms of changes of tropospheric aerosol related to industrialisation. Are you only really surveying AOD

changes over Europe (or particular parts of Europe) with the data from the paintings?

Related to this point, the origin of the DVI values should be briefly described. Are they based on ice core data, or by other methods? In other words, it should be clarified if the comparison presented in Figure 4 is really comparing similar quantities, or should we perhaps expect (potentially important) differences due to the different methods employed in calculating each proxy? Are the indices (etc.) presented in Figure 4 considered global, or relating to one or other hemisphere?"

Reply:

This paper is based on evidence by mostly Western painters and colourists. The type of art is typical to Western European schools so it was inevitable to have more paintings in European countries. Nevertheless, the paper focuses on large volcanic eruptions that have an effect over the entire planetary atmosphere, so the evidence could be noticed in most parts of the world. In the revised text it is clearly mentioned that the method was used to calculate the average AOD value pertaining to these years corresponding to Northern Hemisphere mid latitudes. The DVI used in this work refers to the northern hemisphere, other are global.

Regarding the DVI, on Lamb's webpage at http://cdiac.ornl.gov/ndps/ndp013.html it is stated that:

"Lamb's Dust Veil Index (DVI) is a numerical index that quantifies the impact of a particular volcanic eruption's release of dust and aerosols over the years following the event, especially the impact on the Earth's energy balance. DVIs have been calculated for eruptions occurring from 1500 through 1983. The methods used to calculate the DVI have been intercalibrated to give a DVI of 1000 for the eruption of Krakatau in 1883. The DVI for any volcanic eruption is based on a review of the observational, empirical, and theoretical studies of the possible impact on climate of volcanic dust veils. The DVI allows one to compare volcanic eruptions by a single numerical index. The data base includes the name of the erupting volcano, year of eruption, volcano latitude and longitude, maximum extent of the dust veil, veil

duration, DVI for the entire globe, DVI for the Northern Hemisphere, and DVI for the Southern Hemisphere."

AR2, Comment #6:

"p33152 l4 at -> from"

Reply:

It was corrected.

AR2, Comment #7:

"p33152 l17 'no major volcanic eruptions between 1900 and 1960' – What about Santa Maria (1903) and Katmai (1912) – both VEI 6 according to your Table A2?"

Reply:

The following revised text has been added in Section 4:

"The point raised by Robertson et al. that there have been no major volcanic eruptions between 1900 and 1960, needs some clarification. Indeed in the list of major volcanic eruptions in the past 500 years (Appendix B after Ammann and Naveau, 2003; Robock, 2000), we can see that based on VEI two eruptions, Santa Maria (1903) and Katmai (1912) have been classified with VEI 6. However, VEI is known to be not a good index of stratospheric sulphate loading since it measures the explosivity of a volcano and not its stratospheric injection. A good example is the 1980 St. Helen's eruption, with a VEI of 5 but no stratospheric or climatic impact (A. Robock, private communication). Stratospheric injection is important to ensure its global or hemispheric effects. From the above discussion it can be proposed that compared to the pre-industrial period, the industrial period shows higher painting-derived aerosol content, in agreement to what it is expected from literature (e.g., Neftel et al., 1985; Robock and Free, 1995; Robertson et al., 2001; Forster et al., 2007; Wild, 2012)."

AR2, Comment #8:

"p33152 l21 (and at least once elsewhere): IPCC recommends reference is made to individual chapters in its reports rather than the whole report, if possible."

Reply:

It is Chapter 2, the following citation was corrected: Forster, P., Ramaswamy, V., Artaxo, P., Berntsen, T., Betts, R., Fahey, D. W., Haywood, J., Lean, J., Lowe, D. C., Myhre, G., Nganga, J., Prinn, R., Raga, G., Schulz M., and Van Dorland, R., 2007: Changes in Atmospheric Constituents and in Radiative Forcing, In: Climate Change 2007: The Physical Science Basis, Contribution of Working Group I to the Fourth Assessment, Report of the Intergovernmental Panel on Climate Change, edited by: Solomon, S., Qin, D., Manning, M., Chen, Z., Marquis, M., Averyt, K. B., Tignor M., and Miller, H. L., Cambridge University Press, Cambridge, UK, New York, NY, USA, 996 pp., 2007.

AR2, Comment #9

"p33154 l6 Suggest delete 'the needs of'."

Reply:

The proposed change has been addressed in the revised manuscript.

AR2, Comment #10:

"p33155 (Section 5.2) Does dust explain all/most of the AOD? Presumably it is relatively straightforward to convert between dust column amount (in g/m2) and AOD. Couldn't you do this to confirm that dust is the aerosol?

Where was the instrument measuring AOD relative to the painter? (Presumably close by)."

Reply:

According to the AERONET values over Athens (the nearest station) the fraction of coarse aerosol particles is around 0.65 in June 19th and 0.4 in June 20th. However, the local pollution at Hydra is considered negligible. So, we can assume that the AOD values observed at Hydra, to their largest part, can be attributed to the presence of Saharan dust aerosol at least for June 19th, where the phenomenon is significant. We have changed Figure 6 to display AOD. The Figure caption has been revised to read:

"Figure 6. Dust optical (AOD) depth at 550 nm and 3000 m wind fields over Greece for the 19 and 20 June 2010, as simulated by the BSC/DREAM model (18:00 UTC). The greater area of Greece is indicated by a red-lined rectangular. The island of Hydra is on the centre of this shape".

AR2, Comment #11:

"p33172 (Figure 6) I suggest zooming in a bit on the area of interest (i.e. the Eastern Mediterranean), and increasing the sensitivity of the colour scale for dust load (currently there is just a green blob over Greece at both times). Also indicate the location of Hydra?"

Reply:

In the revised figures, the greater area of Greece is indicated by a red-lined rectangular where the island of Hydra is in the centre. The movement to the east of the high AOD values is clearly seen both in the maps corroborated by the decline of AODs over Hydra.

Reply to Alan Robock further comments

Comment 2

Reply

Reference to the work of Gao et al. (2008) and Crowley and Unterman (2013) have been added in Figure 4 in the text, Table 1 and the references.

Comment 3

Reply

Figure 6 has been replaced to show isopleths of AOD.

Comments 4 and 5

Reply

Corrected

Comment 6

Reply

Has been taken into account as discussed before in the replies to AR1, Comment #8 and to AR2, Comment #7.