

Referee Comment

Please add a short explanation on how you derived the plume age that is visualized in Fig. 6 and 7, and firstly mentioned in line 429.

Author's Response

A short explanation on the plume age derivation is provided in the methodology (Sect. 2.4, lines: 230-233). We now refer the reader to this section explicitly in text. Also, we have added a reference to this section when discussing the plume's travel distance following Fig. 7.

Author's Changes in Manuscript

Lines: 428; 472

Referee Comment

In Fig. 7f, the exponential decay fit seems incorrect, because it does not align with the other panels. Please verify and adjust the discussion with respect to MIROC6.1-SPRINTARS accordingly.

Author's Response

The exponential decay is fitted using the same method applied to the observations and other models shown in Fig. 7. We acknowledge the difference between MIROC6.1-SPRINTARS and the other panels in text (lines: 498-499). Our reasoning for the poor fit in MIROC6.1-SPRINTARS is given in the manuscript as a combination of the following:

- Ratios sampled in the younger plume have a smaller total error, and so larger influence on the fitting, as opposed to ratios sampled in the mature plume (lines: 500-502).
- MIROC6.1-SPRINTARS underestimates the ratios in the young plume (30-60 h) (lines: 447-448; 507-508).

Hence, as these underestimated ratios in the young plume have relatively small total errors, the fitting procedure weights them more heavily than mature plume ratios which results in the sharp decay fit seen in Fig. 7f. We conclude the MIROC6.1-SPRINTARS discussion by stating that if the young plume ratios (30-60 h) were better captured by the model, a fit more in keeping with the other models and observations would likely be seen (lines: 506-509). We feel we address this seemingly incorrect fit sufficiently in the manuscript yet have amended the text to improve the clarity of our reasoning.

Author's Changes in Manuscript

Lines: 497-512

Referee Comment

Line 507-508: “The seemingly poor fit of MIROC6.1-SPRINTARS is likely due to the underestimation of the ratios between 24 h and 48 h (see Sect. 5).” The connection between the poor fit and the underestimation within 24-48 h remains unclear, as data is available for plume ages between ~5-210 h. Please clarify!

Author’s Response

See response to previous comment.

Author’s Changes in Manuscript

See changes to previous comment.

Referee Comment

Line 139: Are times in UTC or local time?

Author’s Response

Times are in UTC.

Author’s Changes in Manuscript

Line: 139

Referee Comment

Line 300: There is no “vertical profile” shown, only the plume extent. Please revise.

Author’s Response

References to “vertical profile” have been removed and, where needed, replaced with “vertical extent”.

Author’s Changes in Manuscript

Lines: 301; 309; 331

Referee Comment

Fig. 4: Please remove panel (c) as it is the same as Fig.3(c). Also amend the in-text references. There is no need to show it twice.

Author's Response

Fig. 4c has been removed and the figure caption updated accordingly.

Author's Changes in Manuscript

Figure 4

Lines: 358

Referee Comment

Fig.6: Please add to the caption that the plume age is displayed.

Author's Response

Caption amended. Also, added a similar comment on the plume travel distance to the Fig. 7 caption.

Author's Changes in Manuscript

Lines: 423; 492

Referee Comment

Line 469: Missing "." at the end of the sentence.

Author's Response

Corrected, thank you.

Author's Changes in Manuscript

Line: 468

Referee Comment

Line 498: depicts -> depict

Author's Response

Corrected, thank you.

Author's Changes in Manuscript

Line: 497

Referee Comment

Line 509: capture -> captures

Author's Response

Corrected, thank you.

Author's Changes in Manuscript

Lines: 509-510

Referee Comment

Line 561: to the describe -> to describe

Author's Response

Corrected, thank you.

Author's Changes in Manuscript

Line: 562

Referee Comment

Line 574: help -> helps

Author's Response

Corrected, thank you.

Author's Changes in Manuscript

Line: 575