Review of EGUSPHERE-2026-2098 « Volcanic sulfur dioxide total columns and layer height from the IASI and TROPOMI Layer Height products: preprocessing and “assimilation on a 0.1° regional domain of MOCAGE”

The article describes two case studies where the assimilation of TROPOMI and IASI SO2 products into MOCAGE are carried out, together with the use of layer height information. The manuscripts is well written, but the section about the methodology is not all clear to me, and in particular the key information on how the layer height products are actually used, which is problematic. Other important specifics are also missing. The evaluation of the two case studies is quite well carried out, but could be extended for the aerosol side for the Reykjanes case by including backscatter/extinction profiles products. The manuscript is promising and overall well written, but can be substantially improved by addressing these comments.

Line 21 : typo “obsevations”

Line 36-42 : TROPOMI layer height is actually used in the operational IFS-COMPO version used for global CAMS (ie beyond tests for the June 2019 Raikoke eruption).

Line 37 : please define the acronym for IFS

Line 64-70 : Could you please provide an estimate of the amount of SO2 released by this eruption? (it is surely available from the usual volcanic eruptions databases, such as Carn et al, or from the reference cited).

Line 72-76 : same comment, please provide the reader with an estimate of the amount of SO2 released.

Line 83 : “Due to the wavelengths, there are no observations during night” – please rephrase and clarify.

Line 109-110 : An accuracy of 2km for the SO2 layer height is problematic for low level eruptions, no?

Line 172 : “the September 2024 version of MOCAGE” – is there a more precise denomination, with a version number?

Line 194 : Not directly relevant to the discussion, but why are you using MACCCity emissions when much more recent emission datasets (CAMS_GLOB, MOSAIC) are publicly available from the same group?

Lines 205-208 : This paragraph should be reviewed for English standard – a few works are clearly “gallicisms”.

Line 215-225 : Please provide (also with plots) the actual values of B that are used for the assimilation of IASI/TROPOMI SO2 not just the theoretical framework. If not done already, please do the same for the R values.

Lines 215-225 : How is TROPOMI SO2 layer height used in this framework? I am not sure that I understand correctly – is it assimilated (ie the first guess layer height – how is it computed? Is modified by DA? How are "increments" of layer height applied to simulated SO2 concentrations?). Or is used in a different way? In IFS-COMPO, the layer height is used to modify the B matrix – is something similar done here? Please clarify.

Line 217: "Only results for a 0.15° horizontal length scale are shown" : why is that? And what was the impact of the correlation length in B? That is something that should be discussed and is of interest to the reader.

Line 230 : "set to 0.5" – any justification for this? Other values have been tried?

Paragraph 5.2 : It is not clear to me how the layer height from TROPOMI or IASI information is used here. Also, what happens is the two contradict – as is the case for Reykjanes?

Line 298 : the section about the preprocessing of LH is very interesting. The impact seems to be significant, but it is not quite properly evaluated – would it be possible here to include a comparison against independent estimates of SO2 layer height, such as those provided by IASI (other products are also likely available). It is mentioned that "the resulting plume altitudes are consistent with IASI observations" : please include and show them. Has there been a study on more than one plume to show that the preprocessing is improving the retrieved LH?

Section 7.1 title : sulfate aerosols are barely discussed (one line), so please remove "sulfate" from title.

Figure 7 : please explicit what are the shaded areas for the retrieval rows (availability of data I suppose)

Figure 9 : I am not sure what is the added value of Figure 9 as compared to Figure 7, which already includes independent data (OMPS).

Figure 10 could be discussed right after Figure 7 as it includes the same information (independent such as OMPS, and not for the others). Actually I think sections 7.1 and 7.2 could be merged based on Figs 7, 8 and 10.

The section about the threshold skill scores is very interesting to read.

Lines 565 and following : for sulfate aerosols, it would be good to include a comparison of simulated backscatter or extinction profiles to observations either from the e-profile network, or from Earthcare/ATLID (data should be available for these dates). Here, a difference is noted but we have no information whether this is a positive or negative change.