

Authors' Response to Reviews of

BAYESIAN ATMOSPHERIC CORRECTION OVER LAND: SENTINEL-2/MSI AND LANDSAT 8/OLI

Feng Yin, Philip E Lewis, Jose L Gómez-Dans

Geoscientific Model Development, <https://doi.org/10.5194/egusphere-2022-170>

RC: Reviewers' Comment, AR: Authors' Response, Manuscript Text

1. Technical corrections

RC: *The title page of *pdf. manuscript file must include the full institutional addresses of all authors. However, country's and city's names are missing from the affiliation #2. Please add it for the next revision.*

AR: This has been fixed.

RC: *Please ensure that the colour schemes used in your maps and charts allow readers with colour vision deficiencies to correctly interpret your findings. Please check your figures using the Coblis – Color Blindness Simulator (<https://www.color-blindness.com/coblis-color-blindness-simulator/>) and revise the colour schemes accordingly.*

AR: File has been checked and colour-blind-safe versions of some figures have been updated.

RC: *It would be better to clarify the Bayesian fusion of varying sources of information method.*

AR: We have added section 2.7 as a clarification/summary:

1.1. Summary of SIAC approach

In SIAC, the atmospheric composition at 500m is inferred by combining three sources of constraints:

- an *a priori* constraint on land surface reflectance (at 500m) derived from the MODIS MCD43 product.
- an *a priori* constraint on atmospheric composition (AOT and TCWV) derived from CAMS near-real-time predictions.
- an expectation of spatial smoothness (correlation) in atmospheric composition parameters at the 500m scale.

The spatial and spectral mismatch between the original S2/L8 product and MODIS are dealt with by modelling the MODIS *ePSF* (Appendix E) and using spectral mapping based on a hyperspectral data library (Appendix D), respectively. These constraints form the observational cost function \mathcal{J}_{obs} (Eq. 2 in Sect. 2.3) and prior cost function \mathcal{J}_{prior} (Eq. 5 in Sect. 2.4). By minimizing the combined cost value ($\mathcal{J}_{prior} + \mathcal{J}_{obs}$), the uncertainty-quantified estimates of AOT and TCWV at the 500m resolution

are obtained. These estimates are then interpolated to the S2/L8 spatial resolution to parameterise Eq. 8 for the atmospheric correction.