Supplement of The Space CARBon Observatory (SCARBO) concept: Assessment of XCO₂ and XCH₄ retrieval performance

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1. Overview

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This supplement provides additional information on the 23 selected FOV pixels (Fig. S1), the atmospheric model used for all simulations (Fig. S2), combination of Fig. 8 and Fig.9 (Fig. S3 and Fig. S4), parameterization results for X_{CH_4} (Fig. S5 and Fig. S18) and finally parameterization performance (Fig S6 – S17).

2. Contents of this file

Figures S1 - S16



15 Figure S1. Locations of the 23 selected pixels. Their L2 results are used to interpolate L2 results to the whole FOV.



Figure S2. Mid-latitudes temperate average TIGR atmospheric model model used in this work: temperature (left), H_2O mixing-ratio (middle) and O_3 mixing-ratio (right).



Figure S3. Combination of Fig. 9 and Fig. 10 for X_{CO_2} . The no-SPEX results appear in black.



Figure S4. Combination of Fig. 9 and Fig. 10 for X_{CH_4} . The no-SPEX results appear in black.



Figure S5. Same as Fig.11 but for X_{CH_4} .



30 Figure S6. Parameterized X_{CO_2} systematic (left) and random (right) errors compared to exact retrieved L2 errors for the no-SEPX design scenario. The colour scale depicts the θ_T transversal angle.



Figure S7. Parameterization approximation errors of X_{CO_2} systematic (top) and random (bottom) errors in the no-SPEX design scenario case. Results are plotted as a function of the situation number: the five top panels detail the ALB, SZA, CLH, COD and FOD values defining all the 324 situations.



Figure S8. Parameterized (black) and exact (coloured) NanoCarb X_{CO_2} AK layer values for the no-SPEX design scenario (AKs are 40 averaged over the 23 selected fov pixels used to interpolate L2 results to the whole fov before they are parameterized)



Figure S9. Parameterized X_{CO_2} systematic (left) and random (right) errors compared to exact retrieved L2 errors for the with-SEPX design scenario. The colour scale depicts the θ_T transversal angle.



Figure S10. Parameterization approximation errors of X_{CO_2} systematic (top) and random (bottom) errors in the with-SPEX design scenario case. Results are plotted as a function of the situation number: the five top panels detail the ALB, SZA, CLH, COD and FOD values defining all the 324 situations.



Figure S11. Parameterized (black) and exact (coloured) NanoCarb X_{CO_2} AK layer values for the with-SPEX design scenario (AKs are averaged over the 23 selected for pixels used to interpolate L2 results to the whole for before they are parameterized)



Figure S12. Parameterized X_{CH_4} systematic (left) and random (right) errors compared to exact retrieved L2 errors for the no-SEPX design scenario. The colour scale depicts the θ_T transversal angle.



Figure S13. Parameterization approximation errors of X_{CH_4} systematic (top) and random (bottom) errors in the no-SPEX design scenario case. Results are plotted as a function of the situation number: the five top panels detail the ALB, SZA, CLH, COD and FOD values defining all the 324 situations.



Figure S14. Parameterized (black) and exact (coloured) NanoCarb X_{CH_4} AK layer values for the no-SPEX design scenario (AKs are averaged over the 23 selected for pixels used to interpolate L2 results to the whole for before they are parameterized)



Figure S15. Parameterized X_{CH_4} systematic (left) and random (right) errors compared to exact retrieved L2 errors for the with-SEPX design scenario. The colour scale depicts the θ_T transversal angle.



Figure S16. Parameterization approximation errors of X_{CH_4} systematic (top) and random (bottom) errors in the with-SPEX design scenario case. Results are plotted as a function of the situation number: the five top panels detail the ALB, SZA, CLH, COD and FOD values defining all the 324 situations.



Figure S17. Parameterized (black) and exact (coloured) NanoCarb X_{CH_4} AK layer values for the with-SPEX design scenario (AKs are averaged over the 23 selected for pixels used to interpolate L2 results to the whole for before they are parameterized)





Figure S18. Same as Fig.13 but for X_{CH_4} .