



Supplement of

Global optimal estimation retrievals of atmospheric carbonyl sulfide over water from IASI measurement spectra for 2018

Michael P. Cartwright et al.

Correspondence to: Michael P. Cartwright (mpc24@leicester.ac.uk)

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Supplement

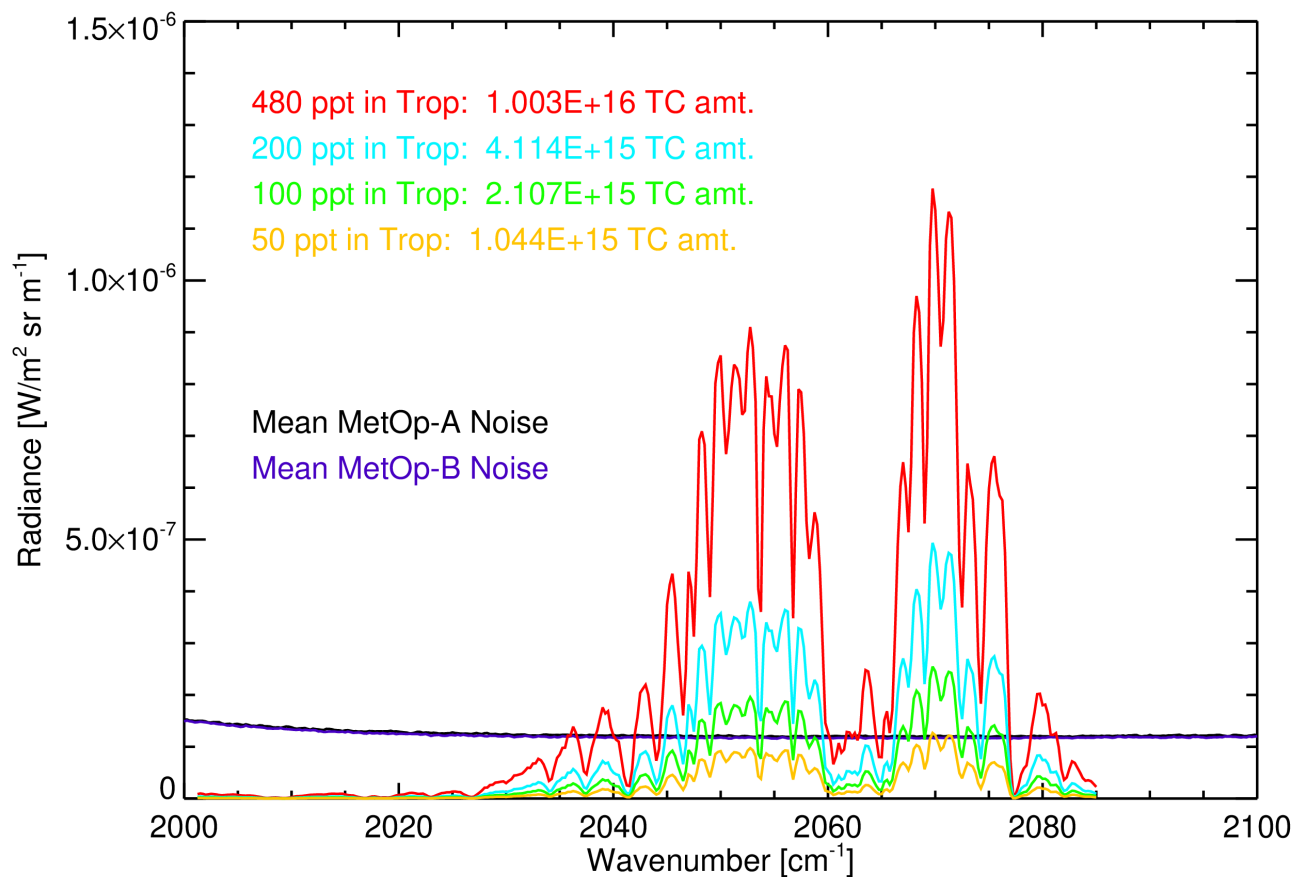


Figure S1. Residual spectra between RFM simulated IASI observations with varying OCS profiles and without OCS all together. MetOp-A and -B instrument noise is shown in black and purple respectively. The spectra show OCS residual signals, representing the detectable signal, compared to instrument noise. Total column amounts are provided for context with comparison to OCS_{SOCE} observations, in units of molecules cm⁻².

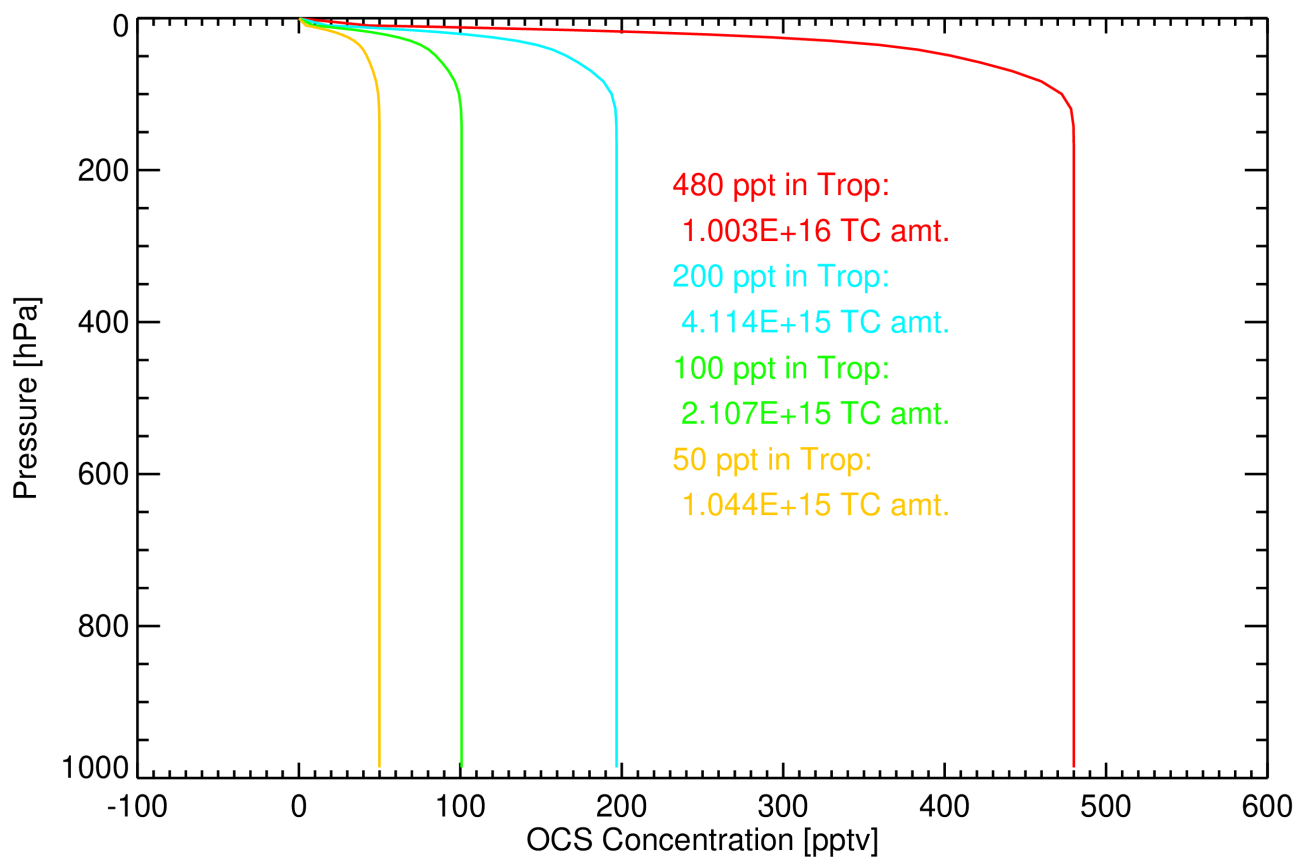


Figure S2. Atmospheric profiles of OCS used in the generation of modelled IASI spectra in Figure S1. Calculated using percentages of the 0-10°S tropic a priori profile used in ULIRS, so to maintain tropopause height. They are characterised by approximate concentration in the troposphere. Percentages used are 100% 480 ppt (red), 41% ~200 ppt (light blue), 21% ~100 ppt (light green), 10.4% ~50 ppt (orange). Total column amounts are provided for context with comparison to OCS_{OCE} observations, in units of molecules cm⁻².

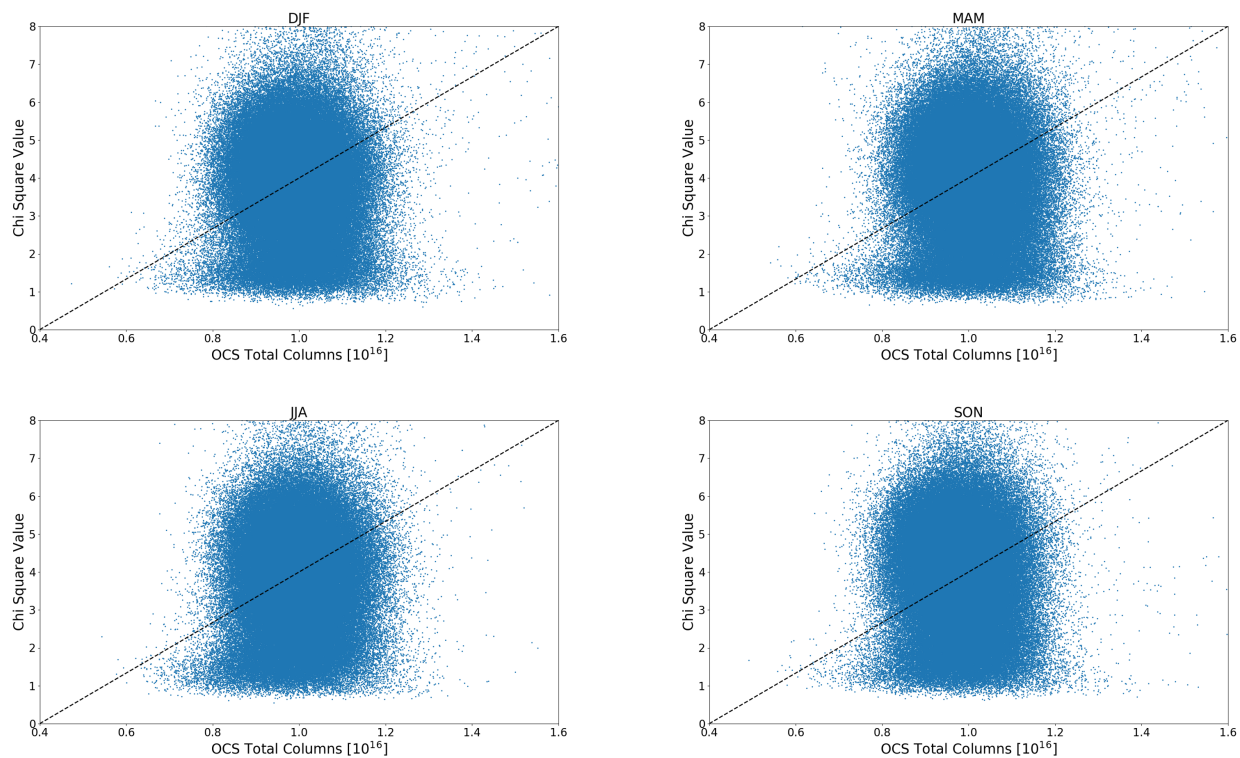


Figure S3. Correlation between OCS total column amounts (molecules cm^{-2}) and χ^2 . A random subset of 200,000 pixels is used from global OCS_{OCe-B} 2018 data.

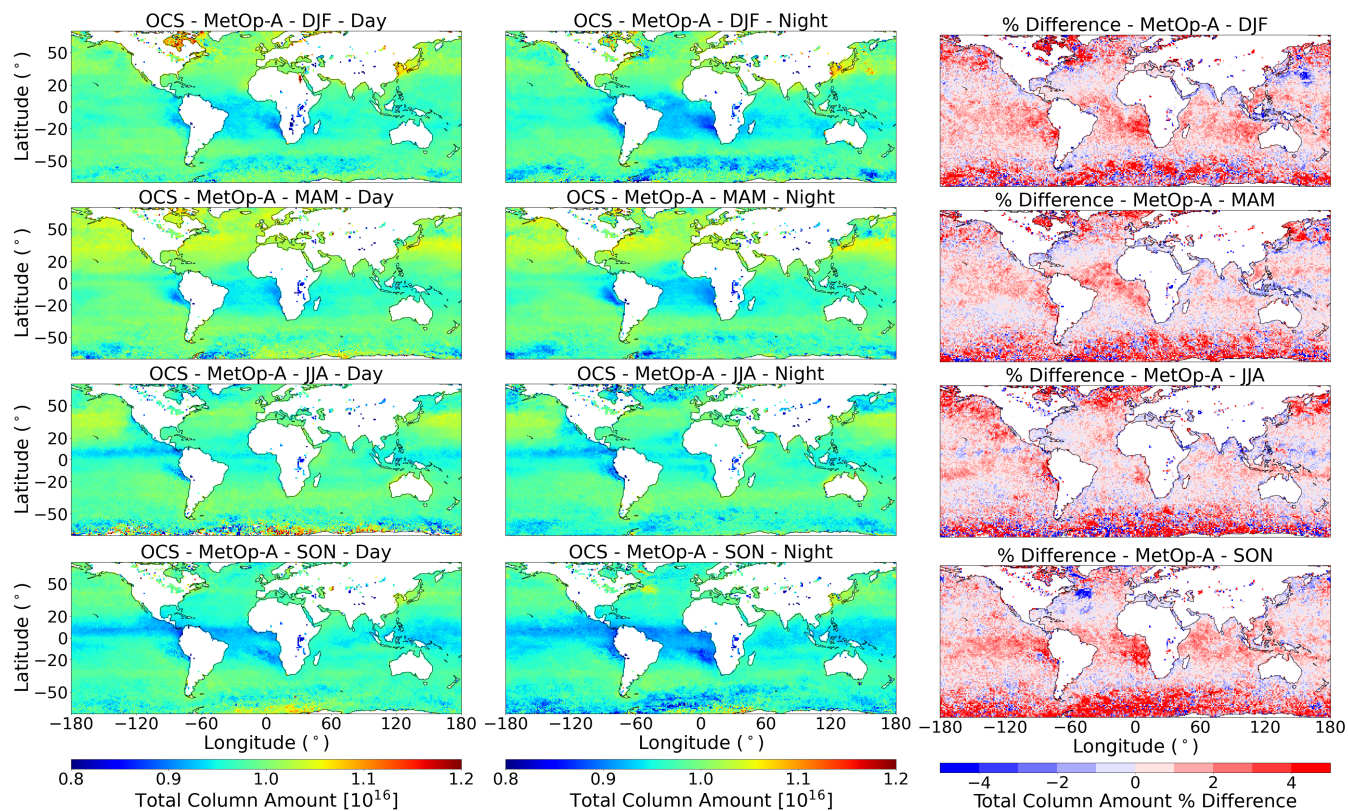


Figure S4. Seasonal estimates of total column OCS mean values in units of molecules cm^{-2} , for 2018, in $1^\circ \times 1^\circ$ bins. Using MetOp-A measurement spectra only. Left: OCS_{OCE-A} daytime estimates, middle: OCS_{OCE-A} nighttime estimates, right: the % difference between day and night.

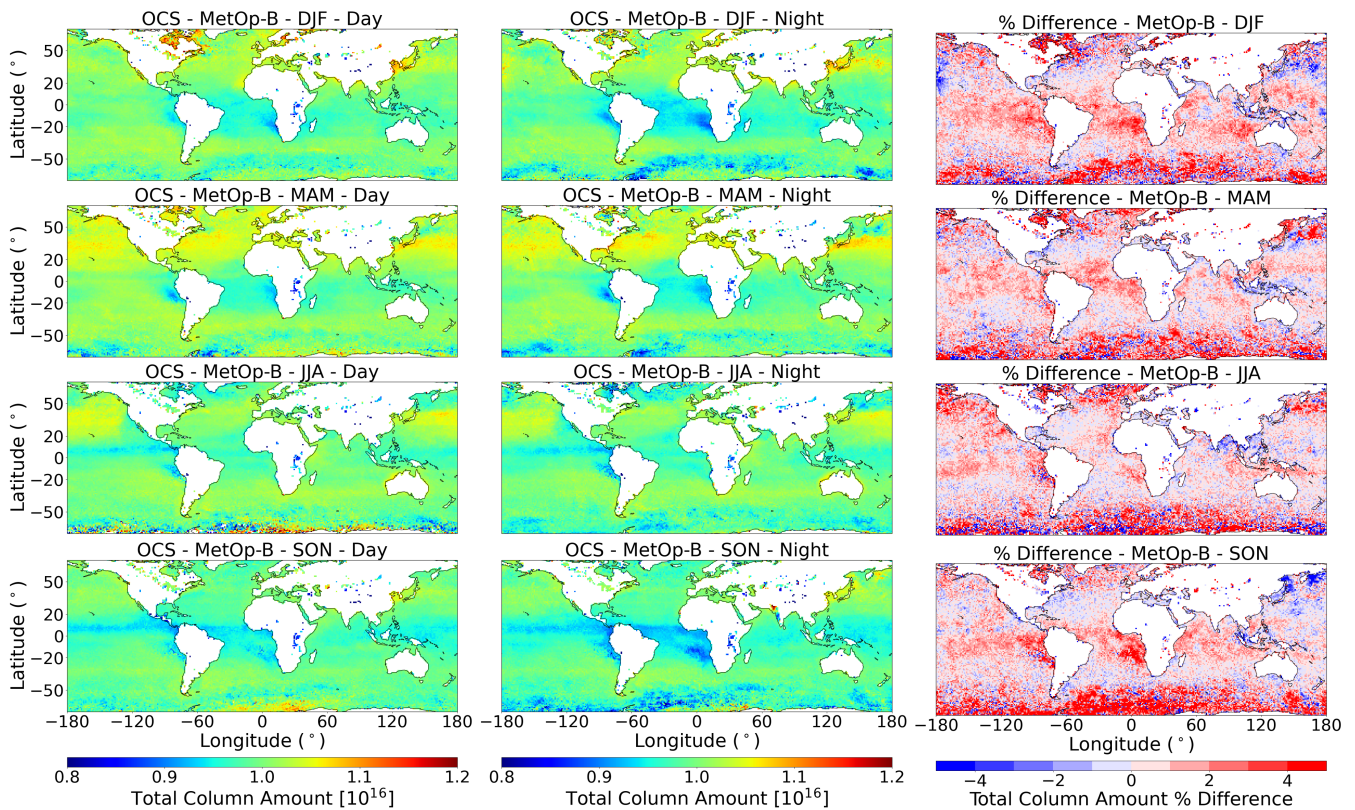


Figure S5. Seasonal estimates of total column OCS mean values in units of molecules cm^{-2} , for 2018, in $1^\circ \times 1^\circ$ bins. Using MetOp-B measurement spectra only. Left: OCS_{OCE-B} daytime estimates, middle: OCS_{OCE-B} nighttime estimates, right: the % difference between day and night.

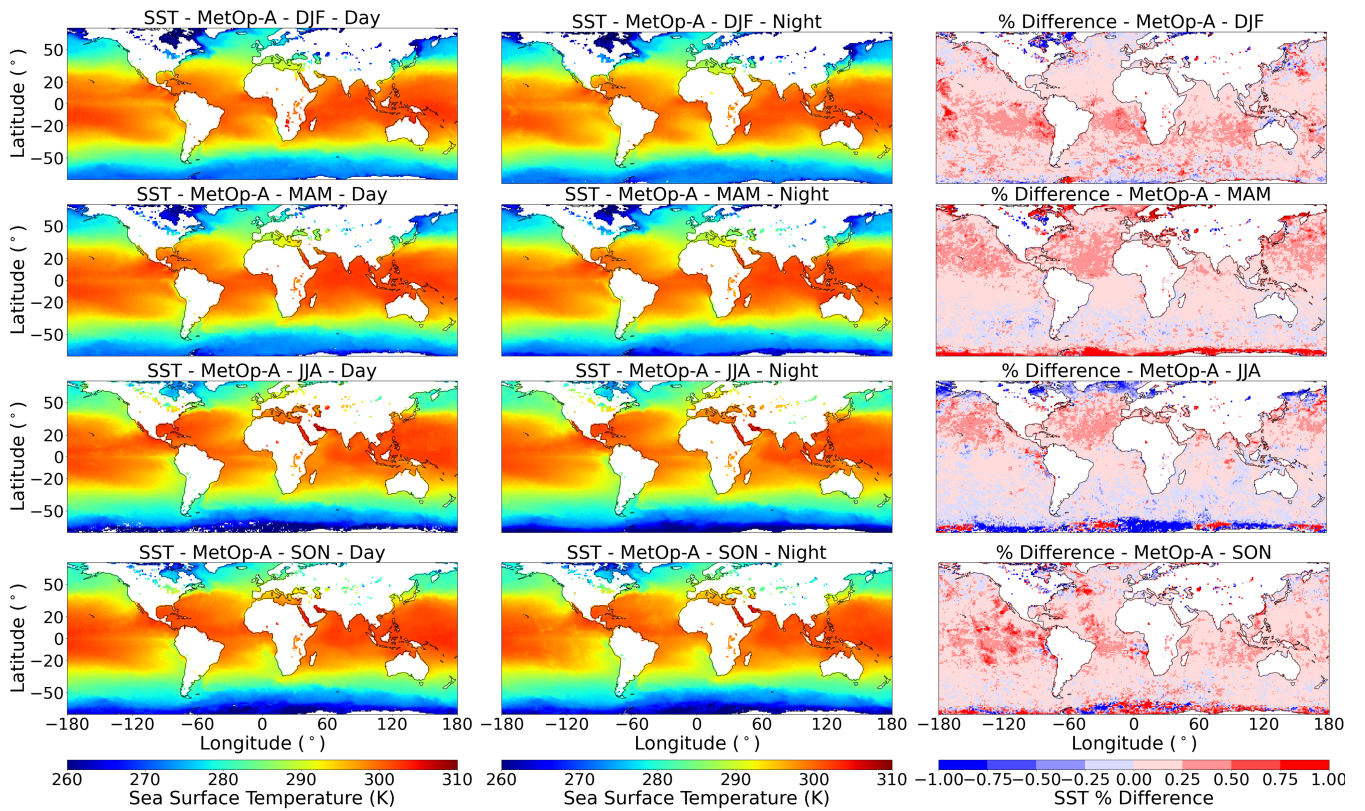


Figure S6. Seasonal estimates of mean retrieved sea surface temperature (SST) values in units of K, for 2018, in $1^\circ \times 1^\circ$ bins. Using MetOp-A measurement spectra only. Left: daytime estimates, middle: nighttime estimates, right: the % difference between day and night.

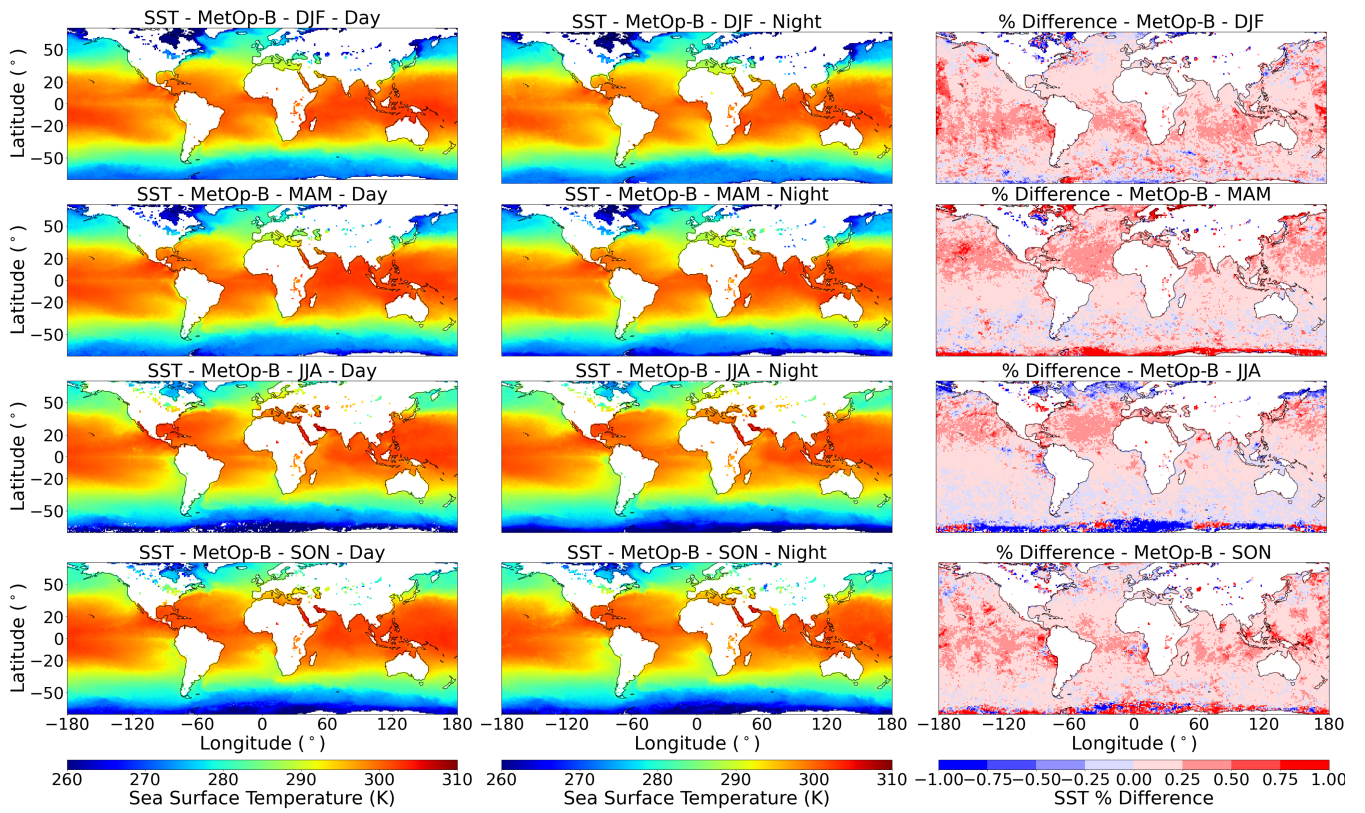


Figure S7. Seasonal estimates of mean retrieved sea surface temperature (SST) values in units of K, for 2018, in $1^\circ \times 1^\circ$ bins. Using MetOp-B measurement spectra only. Left: daytime estimates, middle: nighttime estimates, right: the % difference between day and night.

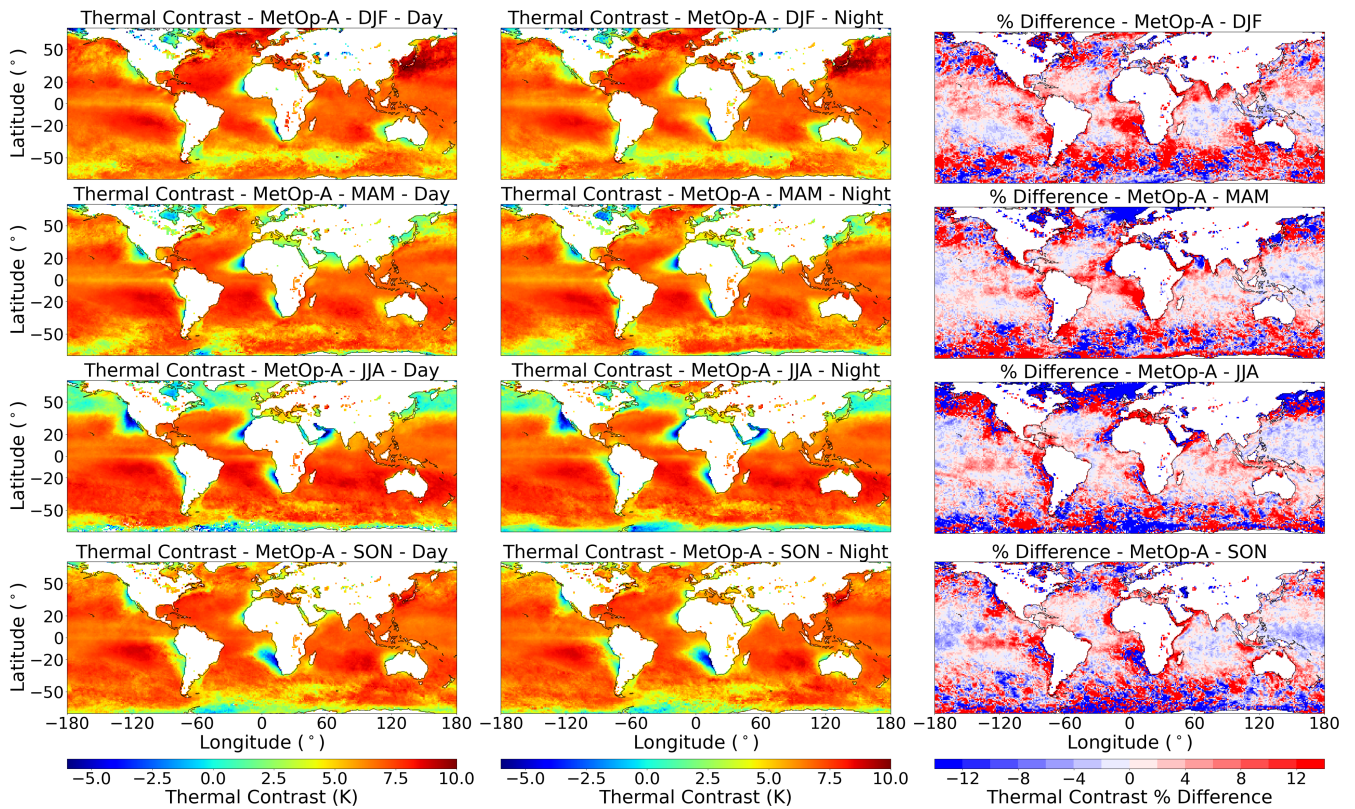


Figure S8. Seasonal estimates of mean retrieved thermal contrast (surface temperature less the first atmospheric layer temperature) values in units of K, for 2018, in $1^\circ \times 1^\circ$ bins. Using MetOp-A measurement spectra only. Left: daytime estimates, middle: nighttime estimates, right: the % difference between day and night.

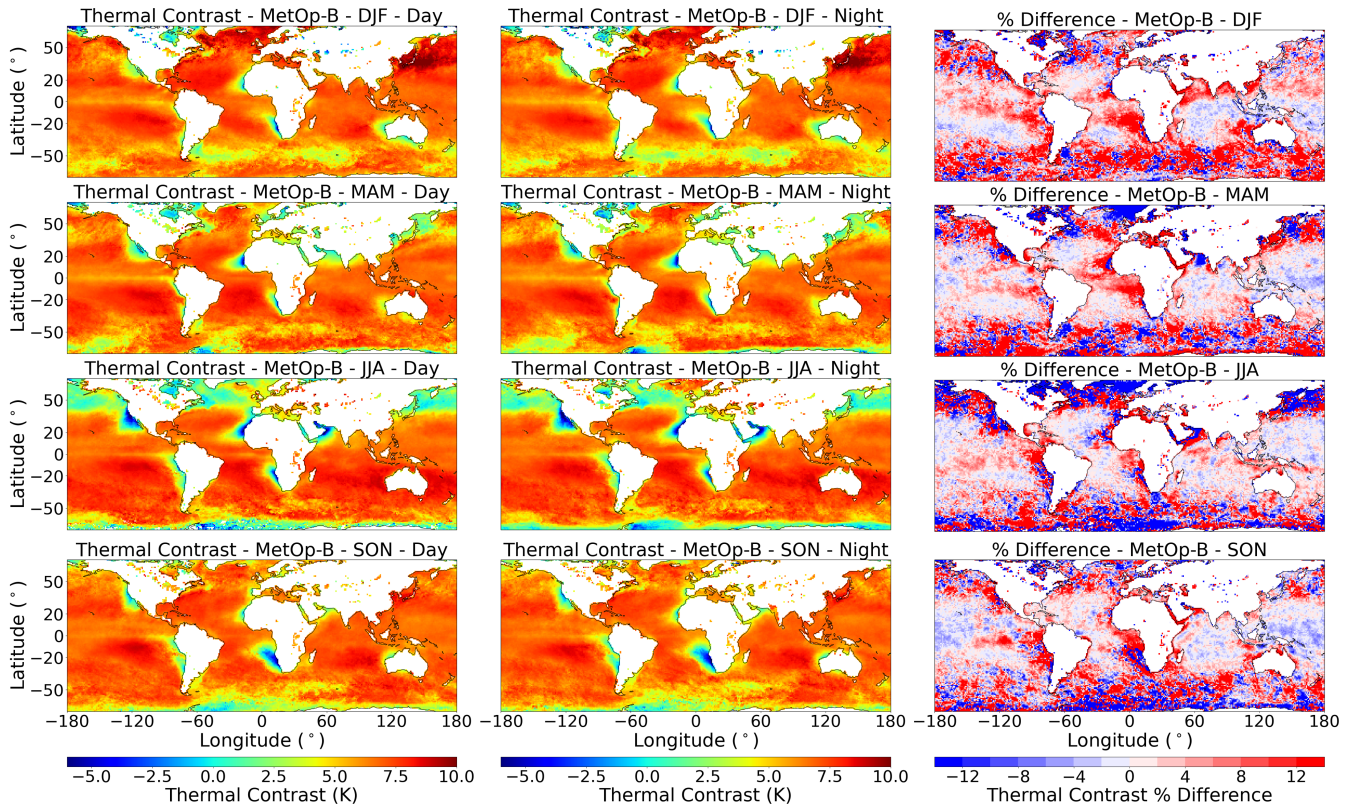


Figure S9. Seasonal estimates of mean retrieved thermal contrast (surface temperature less the first atmospheric layer temperature) values in units of K, for 2018, in $1^\circ \times 1^\circ$ bins. Using MetOp-B measurement spectra only. Left: daytime estimates, middle: nighttime estimates, right: the % difference between day and night.

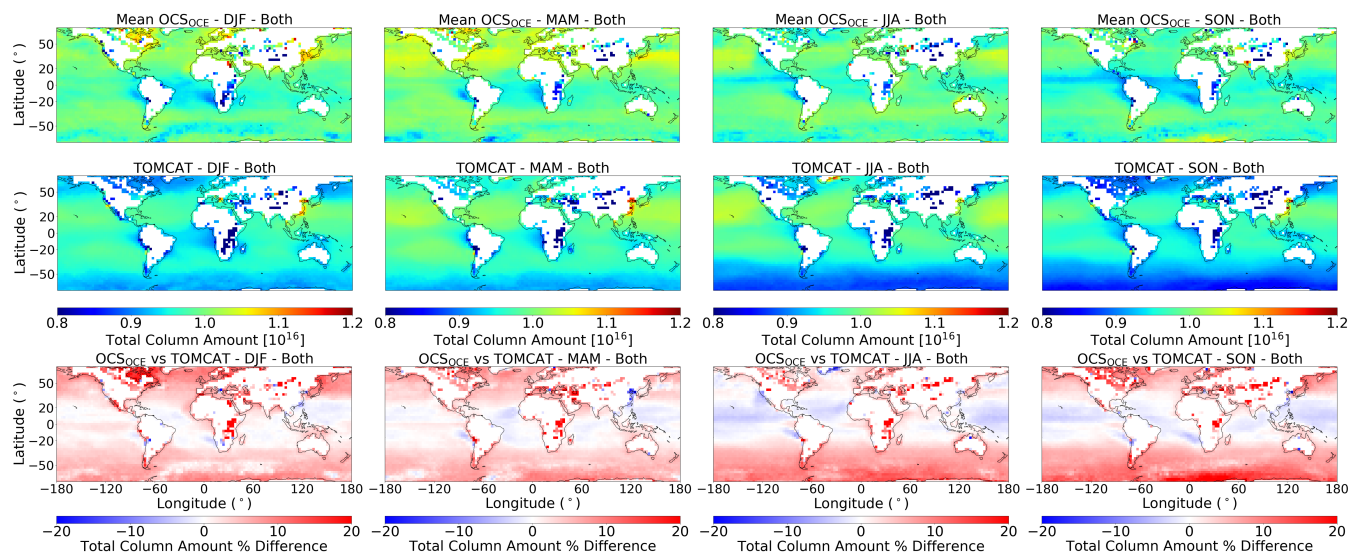


Figure S10. 1st row: seasonal estimates of total column OCS_{OCE} mean values in units of molecules cm⁻², for 2018, in 1°×1° bins. 2nd row: TOMCAT OCS without OCS_{OCE} AK applied and 3rd row: the % difference with OCS_{OCE}.