Radiometric Calibration Analysis from OCO-3 and OCO-2 Simultaneous Nadir Overpasses

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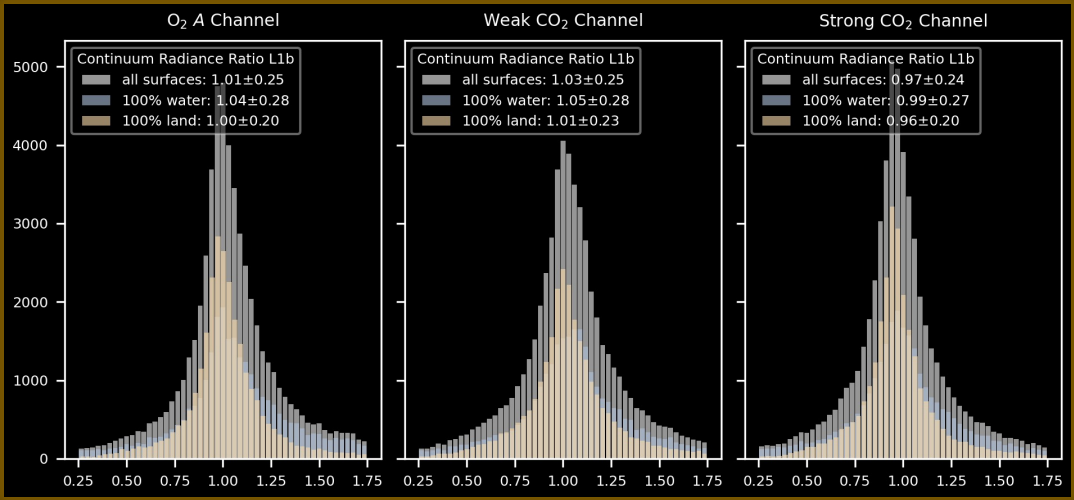
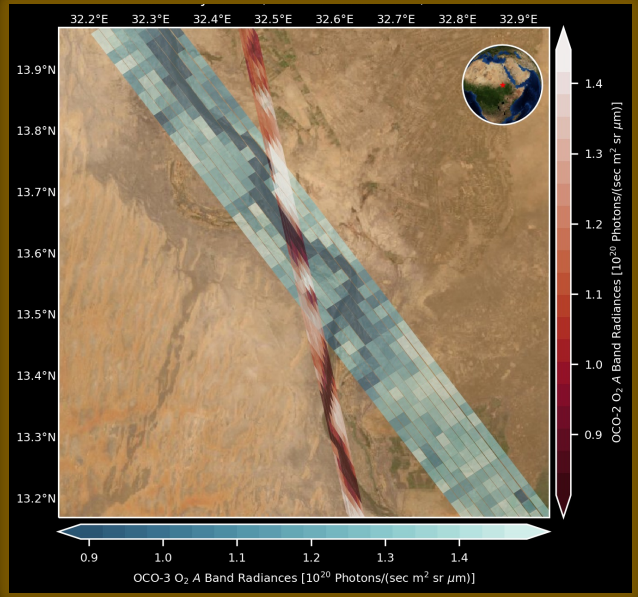
the initial histogram analysis of OCO-3/OCO-2 continuum radiance ratios from simultaneous nadir overpasses (SNOs) indicates consistency of OCO-3 radiometric accuracy in all bands; further analysis will include cloud screening and tighter SNO match criteria





comparison of OCO-3&2 continuum radiances from SNOs helps to establish the radiometric accuracy of the OCO-3 spectrometer

what are simultaneous nadir overpasses (SNOs)?

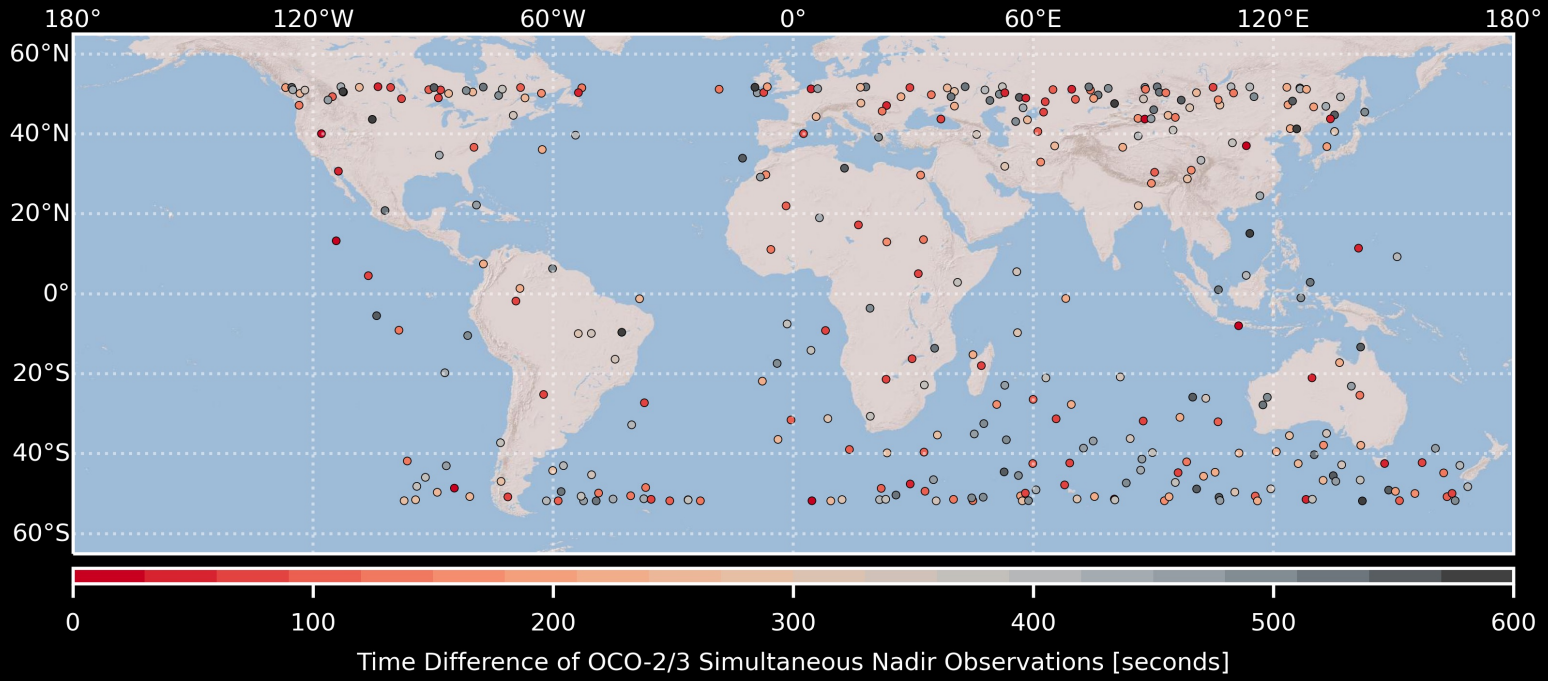
we define an SNO as the occurrence of successful data acquisition by OCO-2 and OCO-3 in nadir-geometry over the same location within 10 minutes of each other, containing footprints from both sensors located within a 2 km radius

why are we interested in SNOs?

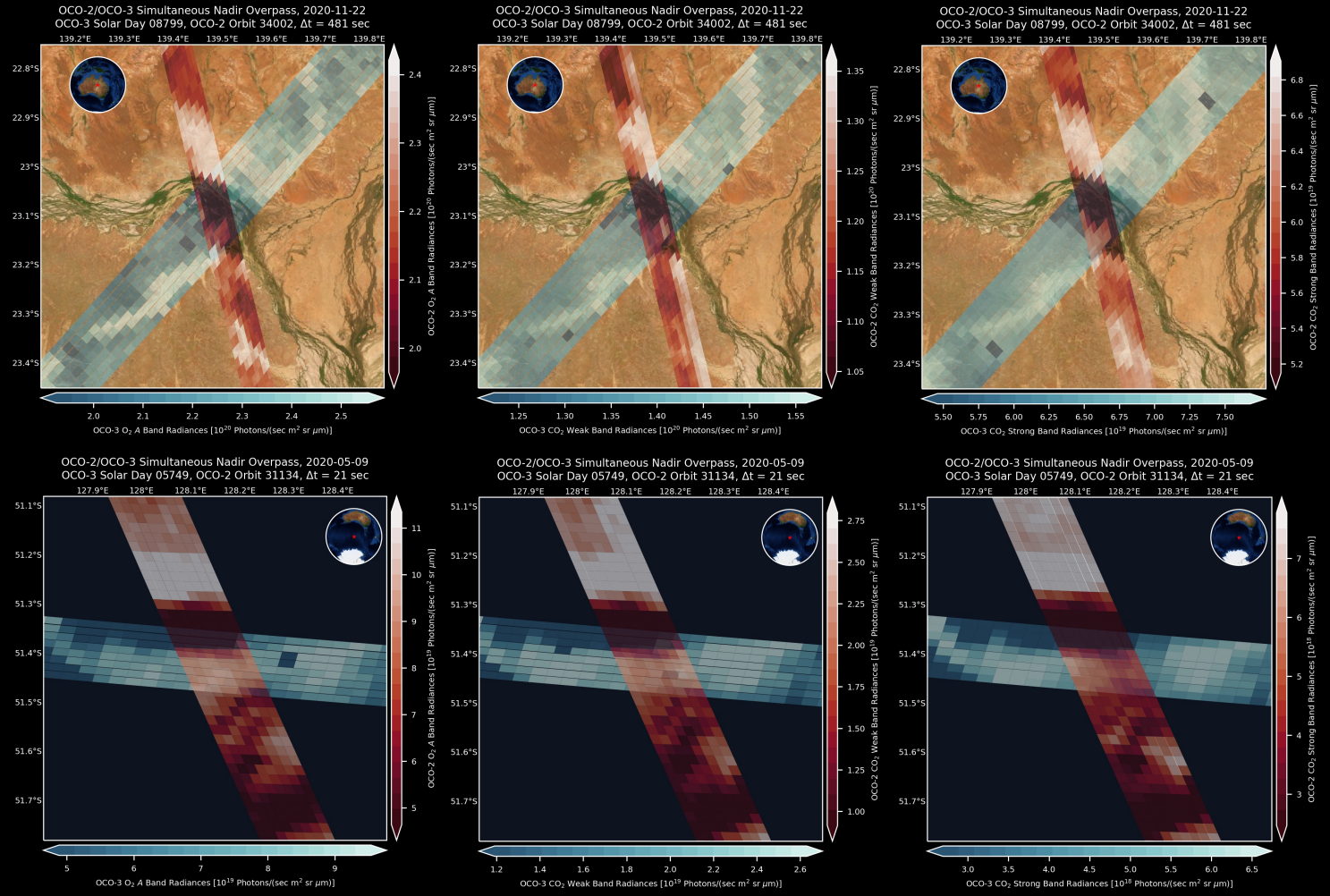
due to ISS constraints, OCO-3 cannot acquire solar irradiance; radiometric calibration has to rely on pre-flight thermal vacuum tests, on-board lamp and in-flight lunar measurements, as well as vicarious and cross-sensor calibration. given the similarities of the two spectrometers, OCO-3/2 SNOs help us to establish radiometric accuracy of the OCO-3 continuum radiances.

how do we identify OCO-3/2 SNOs?

starting from an OrbNav sno query (sips.ssec.wisc.edu/orbnav/#/tools/snotimes) j, the list of potential daytime matches is checked against the available OCO-3/2 data record and reduced to observations made in nadir-geometry (viewing zenith angle ≤2°; this can include OCO-3 SAM and Target mode at nadir). within a ±3° geographic region around the SNO, distances between all OCO-3 and OCO-2 footprint centers are calculated and those within 2 km of each other are marked for further analysis. at present radiances are only screened for viewing zenith angle and measurement quality flag; future comparisons will include screening for cloud and surface properties.

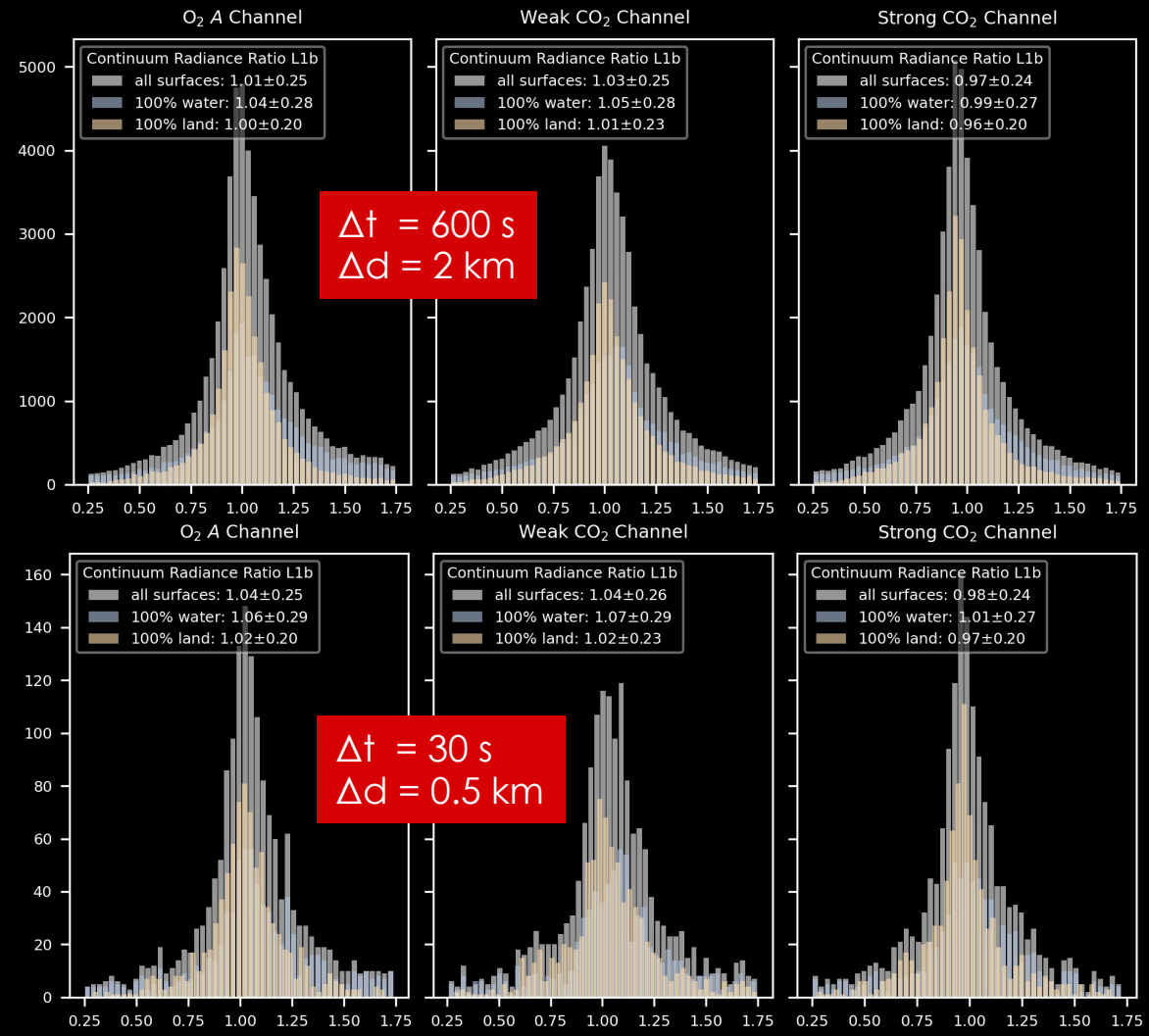


during the available OCO-3 data record, 334 daytime SNOs with OCO-2 have been identified within 10 minutes overpass time and containing valid footprint nadir-geometry data within a 2 km radius. SNOs tend to occur predominantly at the apex of the ISS track, *i.e.*, around 50–52°N/S due to the relative angle of the ground tracks. the global image shows the locations of these SNOs color-coded by the difference in overpass time in seconds.



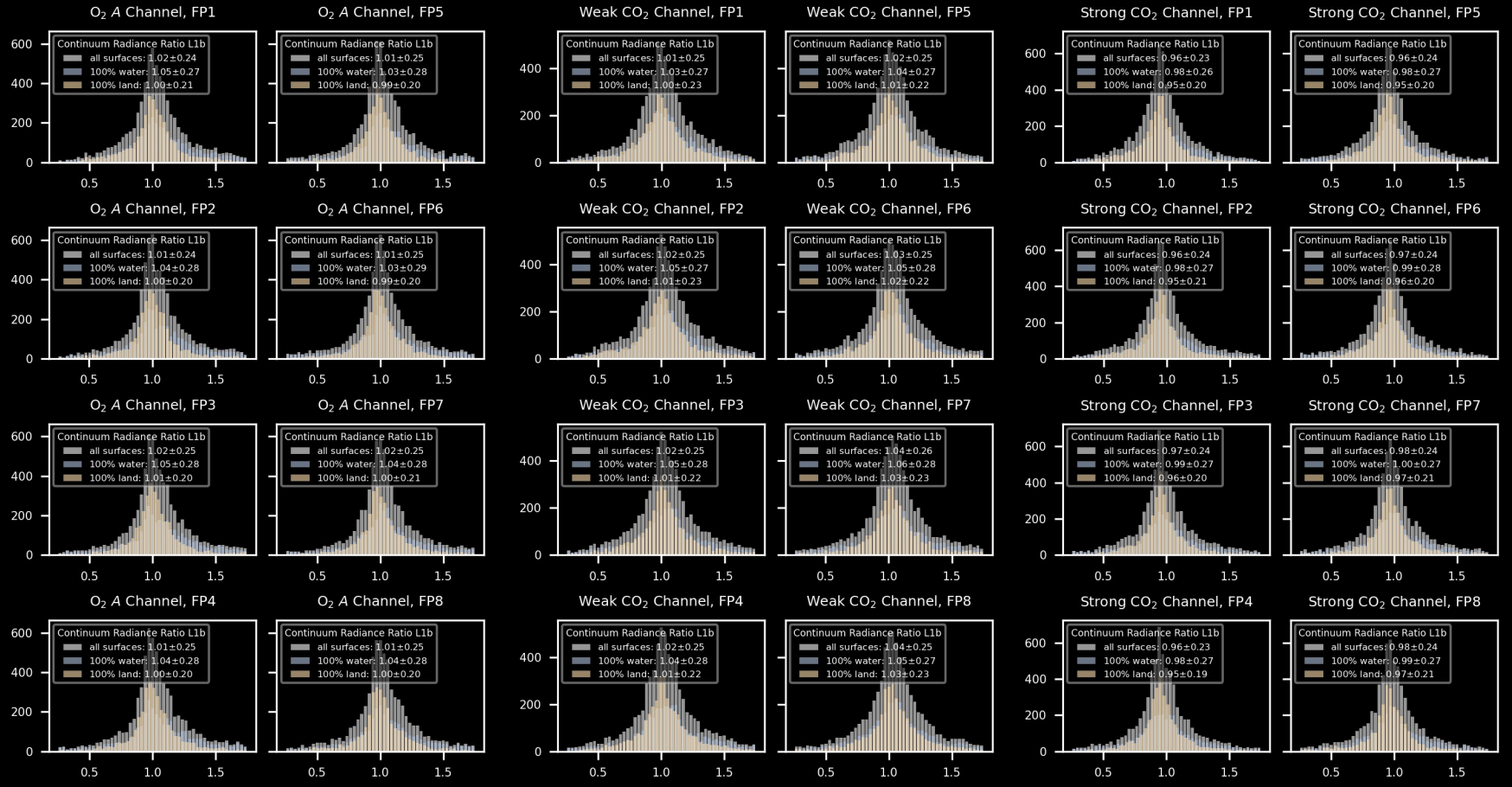
images of OCO-3 and OCO-2 continuum radiances for the three detector channels (from left to right: O_2 A, weak CO_2, strong CO_2) from two SNOs over land and water, illustrating the effects of surface reflectance and clouds.

future continuum radiance analysis will take into account scene reflectivity in the assessment of OCO-3 radiometric accuracy.



preliminary histogram analysis of footprint-matched OCO-3/OCO-2 continuum radiance ratios for SNOs within the indicated (Δt,Δd) time window and footprint-distance; by detector channel, limited to the interval [0.25, 1.75], and separated into land, water, and all surface types (lighter shading indicates land/water overlap). mean and standard deviation of the ratio distribution are given in the legend.

no fundamental bias is detected between OCO-3 and OCO-2 continuum radiances, independent of the constraints of the time window/footprint-distance match criteria.



histogram analysis from the previous slide, broken down by OCO-3 footprint (matched OCO-2 footprint numbers vary). (Δt,Δd) = (600 s, 2 km). no fundamental bias is observed for any of the footprints.