SIZE-OF-SOURCE EFFECT AND DISTANCE EFFECT ESTIMATION OF THREE TRANSFER RADIOMETERS FOR PREFLIGHT CROSS-CALIBRATION EXPERIMENT

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The Greenhouse Gases Observing Satellite (GOSAT) of Japan Aerospace Exploration Agency (JAXA) and Orbiting Carbon Observatory (OCO) of Jet Propulsion Laboratory (JPL) are scheduled to be launched in 2009 for monitoring the carbon dioxides distribution from the space. The GOSAT-OCO preflight cross-calibrations were carried out at JPL in April and at JAXA in December in 2008. The GOSAT team employed three radiometers for the transfer standard. They were calibrated at National Institute of Advanced Industrial Science and Technology (AIST) and transferred to JPL and JAXA to measure the OCO and GOSAT integrating spheres. The OCO and GOSAT teams provided their spectral radiance data of the spheres. The GOSAT team calculated the outputs of the radiometers from the spectral radiance of the sphere and the spectral responsivity of the radiometers. The measured outputs were compared to the calculated outputs. Agreements with the OCO and GOSAT spheres were a few percents.

The aperture diameter and the measuring distance of fixed-point blackbodies at the AIST calibration were 6 mm and 490 mm and those of the OCO integrating sphere were 130 mm and 1500 mm. The apertures of the GOSAT 1 m integrating sphere and 50 cm one were 280 mm and 130 mm, respectively and both measuring distances were 1m. Therefore the differences of the aperture diameter and measuring distance should be corrected in the cross-calibration. The AIST used the indirect method to estimate the size-of-source effect (SSE). A black spot on a quartz plate or a blackbody cavity was

placed before the integrating sphere aperture. The radiometer measured the black spot and the bright area and the ratio between the two outputs was the SSE between the two diameters.

Because the diameters were so different that it was difficult to measure the SSE between 6 mm and 280 mm directly. Therefore some steps were used. An example was given for the 1 m sphere. At first the SSE between 6 mm and 24 mm at the measuring distance of 490 mm was measured. Next the distance effect (DE) of the aperture 24 mm between 490 mm and 1 m distance was measured. Then the SSE between 24 mm and 50 mm at 1m distance was measured. These were measured at the AIST laboratory. At last the SSE between 50 mm and 280 mm at 1 m distance was measured. All these data were summed up to obtain the correction for the difference of the two measuring conditions. The total corrections were about half a percent for three radiometers.

One of the important things was that the black spot was not really black in the infrared. The transmittance at 2 μm was about a thousand times larger than that at 0.65 μm. Both a black paint and silk print showed similar wavelength dependence. If the transmittance was neglected the SSE value at 2 mm showed an extremely high value.

Bibliography

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