

LONG-TERM COMPARISON OF SPECTRALON BRDF MEASUREMENTS IN THE ULTRAVIOLET

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MOTIVATION

For successive generations of remote sensing instruments, pre-launch calibration must be of high accuracy and precision and must be consistent across all instruments.

The pre-launch calibration is transferred to on-orbit operation and must be monitored over the instruments' mission lifetimes

From 1994 to 2003, the DCaF made repeated measurements of the UV BRDF of two Spectralon diffuse targets used in the pre-launch calibration of the Solar Backscatter Ultraviolet/2 (SBUV/2) instruments on NOAA 14 and 16.

BACKGROUND

Is referred to as the ratio of the scattered radiance L_s scattered by a surface into the direction (θ_s, ϕ_s) to the irradiance E_i incident on a unit area of the surface

$$BRDF = \frac{L_s(\theta_i, \phi_i, \theta_s, \phi_s, \lambda)}{E_i(\theta_i, \phi_i, \lambda)}$$

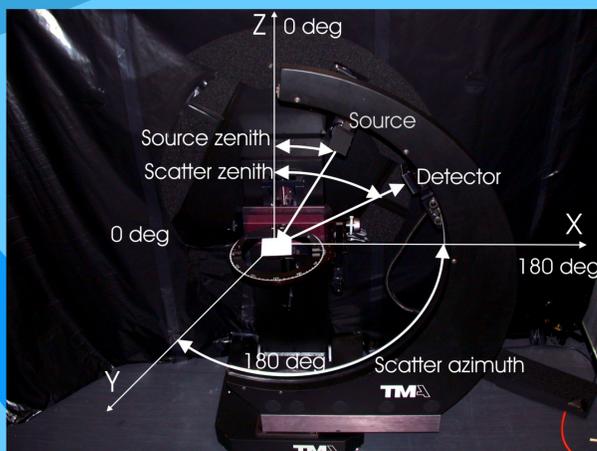
where θ is the zenith angle, ϕ is the azimuth angle, the subscripts i and s represent the incident and scattered directions, and λ is the wavelength

In practice, BRDF is described in terms of the incident power, scattered power and the geometry of the reflected scatter. It is equal to the scattered power per unit solid angle normalized by the incident power and the cosine of the detector view angle

$$BRDF = \frac{P_s / \Omega}{P_i \cos \theta_s}$$

P_s is the scatter power, Ω is the solid angle determined by the detector aperture area, A , and the radius from the sample to the detector, R , or $\Omega = A/R^2$, P_i is the incident power, and θ_s is the scatter angle

BRDF SETUP AND MEASUREMENTS



- BRDF at 13 wavelengths: 230, 252, 273.5, 283, 292.2, 301.9, 312.5, 331.2, 339.8, 350, 375, 400, and 425nm,
- Light source: 75 W Xenon lamp,
- Chromex monochromator,
- silicon photodiode,
- P & S polarization = unpolarized scatter,
- Incident angles: 63.2°, 51.8°, 54°, and 0°,
- Scatter zenith angles: 16° to 40°, 22° to 52°, step of 3°,
- The results shown at 28°,
- Samples H1, H2, H3 SBUV/2 project and 401 OMPS project,
- Instruments NOAA 14 & 16 and Ozone Mapping and Profiling Suite
- Measured from 1994 to 2004

RESULTS

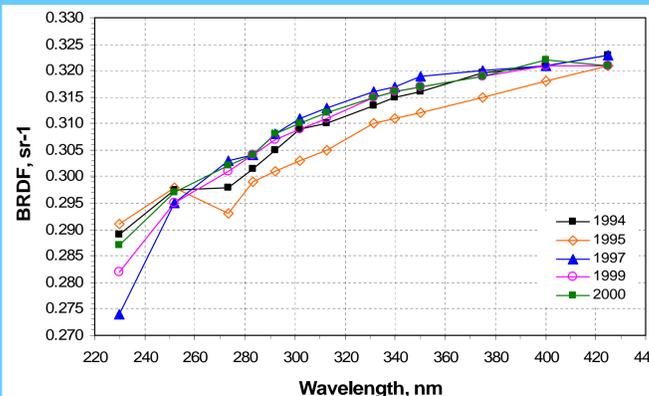


Fig.4: BRDF of H1 at 63.2 deg inc. and 28 deg viewing angles

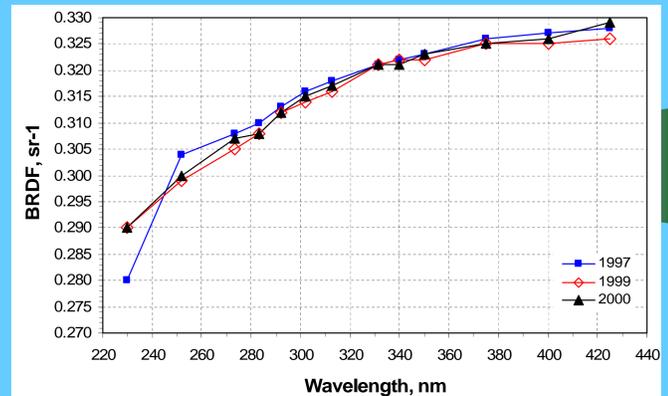


Fig.5: BRDF of H1 at 51.8 deg inc. and 28 deg viewing angles

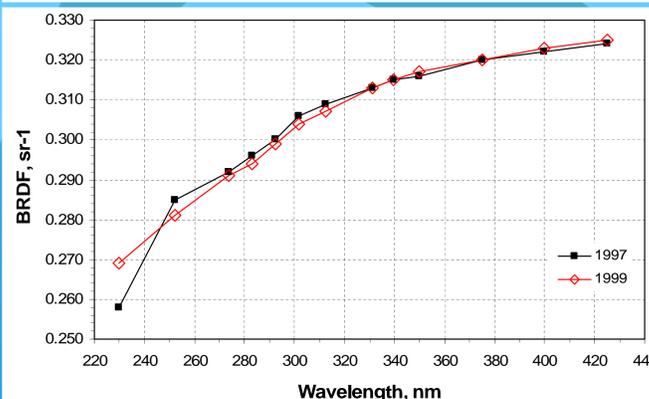


Fig.6: BRDF of H2 at 51.8 deg inc. and 28 deg viewing angles

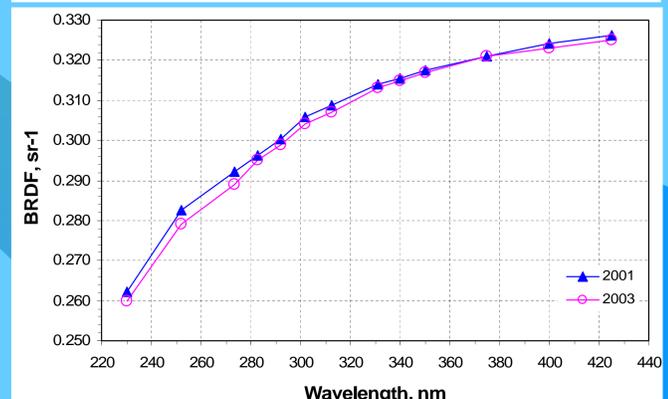


Fig.7: BRDF of H2 at 54 deg inc. and 28 deg viewing angles

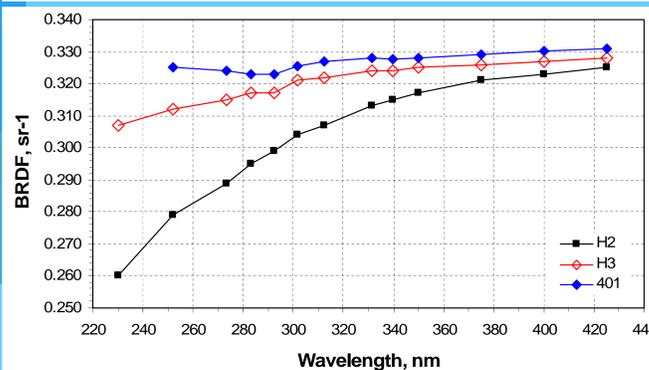


Fig.8: BRDF of H2 and H3 at 54 deg inc. and 28 deg viewing angles in 2003 and 401 at 0 deg inc and 28 deg viewing angles in 2004

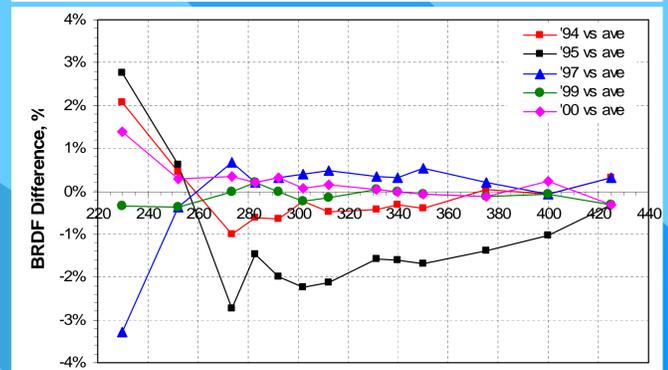


Fig.9: BRDF difference of H1 at 63.2 deg inc. and 28 deg viewing angles

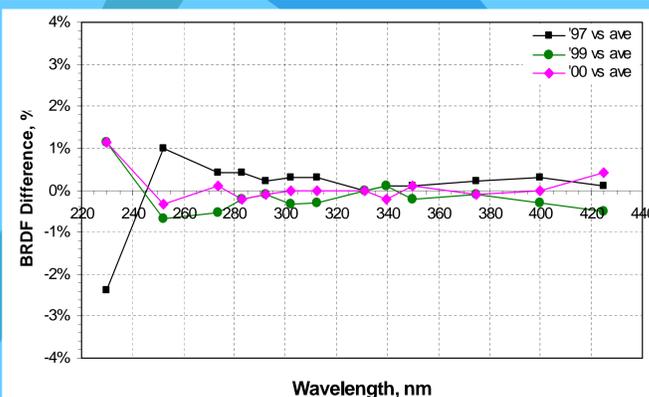


Fig.10: BRDF difference of H1 at 51.8 deg inc. and 28 deg viewing angles

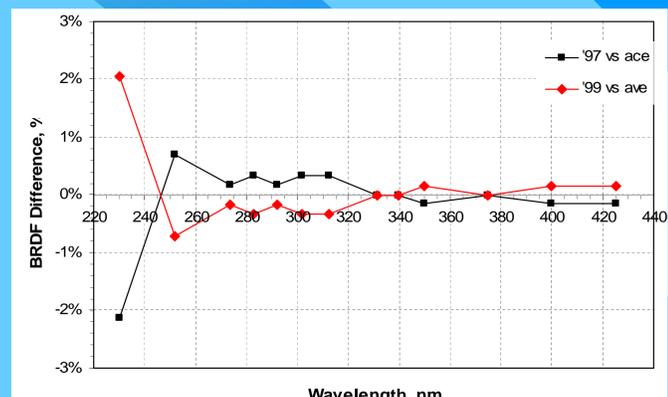


Fig.11: BRDF difference of H2 at 51.8 deg inc. and 28 deg viewing angles

CONCLUSIONS

- Long-term changes in the uv BRDF of two diffuse Spectralon targets used in the pre-launch calibration of the NOAA 14 and 16 SBUV/2 instruments were examined
- The percent change in BRDF of the target H1 measured in 1994, 1999, and 2000 was less than $\pm 0.7\%$ from 252nm to 425nm.
- The percent change in BRDF of target H2 measured in 1999, 2000 and 2003 was also less than $\pm 0.7\%$ from 252nm to 425nm
- DCaF measurements of both targets at 230nm showed spreads of $\pm 1.25\%$ and $\pm 0.6\%$ for H1 and H2, respectively
- NIST measurements of H1 and H2 in 1997 showed good agreement with the DCaF measurements with the exception of the 230nm data
- H3 (2003) and 401 (2004) measurements of BRDF spectral feature seems to be related to the age of the targets
- BRDF was seen to decrease between 252nm and 300nm with the 252nm data unchanging
- The reported data were measured in clean room calibration facility and the results presented are NIST traceable