Results of second outdoor comparison between Absolute Cavity Pyrgeometer (ACP) and Infrared Integrating Sphere (IRIS) Radiometer at PMOD

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The Absolute Cavity Pyrgeometer (ACP) and InfraRed Integrating Sphere radiometer (IRIS) are developed to establish a world reference for calibrating pyrgeometers with traceability to SI units. The two radiometers are un-windowed with negligible spectral dependence, and traceable to SI units through the temperature scale (ITS-90).

The second outdoor comparison between the two designs was held from September 30 to October 11, 2013 at the Physikalisches-Meteorologisches Observatorium Davos (PMOD). The difference between the irradiance measured by ACP and that of the IRIS was within 1 W/m² (3 IRISs: PMOD + Australia + Germany).

From the first and second comparisons, a difference of 4-6 W/m² was observed between the irradiance measured by ACP&IRIS and that of the interim World Infrared Standard Group (WISG).

This presentation includes results from the first and second comparison in an effort to establish the world reference for pyrgeometer calibrations, a key deliverable for the World Meteorological Organization (WMO), and the DOE-ASR.
Absolute Cavity Pyrgeometer (ACP)

InfraRed Integrating Sphere (IRIS) Radiometer
Night-Time IR irradiance measured at PMOD by ACP & IRIS on February 5, 2013
(~8 mm H₂O vapor column)

UTC

Night-Time IR irradiance measured at PMOD by ACP & IRIS on October 2&3, 2013
(~15 mm H$_2$O vapor column)
ACP, IRIS02, IRIS04, and WISG at night on Feb. 5, 2013
(~8 mm H$_2$O vapor column)

Night-Time IR irradiance measured at PMOD by ACP, IRIS, & WISG on October 2&3, 2013 (~15 mm H₂O vapor column)
Irradiance difference (WISG minus IRIS) at PMOD

**Results**

**Average Offset** \((\text{IWV}>10)\) 
-4.1 ± 1.5 Wm\(^{-2}\)

**Gradient** \((\text{IWV}<10)\) 
-0.45 ± 0.1 Wm\(^{-2}\)mm\(^{-1}\)

From Julian’s presentation, IRS2012-Germany (Data from 180 nights)
The (4 to 6)\(\text{W/m}^2\) difference between the irradiance measured by ACP&IRIS and that of the Interim WISG might be attributed to the variation in dome transmittance when there is a spectral difference.
Transmission Curves of Pyreometer Domes

The (4 to 6) W/m² difference between the irradiance measured by ACP&IRIS and that of the Interim WISG might be attributed to the variation in dome transmittance when there is a spectral difference.

From: Jörgen Konings, Hukseflux Thermal Sensors
Preliminary Conclusions & Recommendations

1. Outdoor agreement between ACP & IRIS to within 1 W/m² at water vapor of 8 mm of H₂O & 15 mm of H₂O
2. Irradiance measured by WISG is 4 W/m² to 6 W/m² lower than that measured by ACP&IRIS, for 8 to 15 mm of H₂O
3. Future comparison with lower water vapor might resolve observed spectral effect on outdoor pyrgeometer calibrations (research!!)
4. Other designs might increase confidence in establishing a consensus reference with traceability to SI units
5. Once a consensus reference is established, a group of pyrgeometers with minimum dome-transmittance variation would be used as Transfer-Reference-Group for the pyrgeometers outdoor calibration.