



Introducing an Absolute Cavity Pyrgeometer for improving the atmospheric longwave irradiance traceability to SI

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Advancing climate change research requires accurate and traceable measurement of the atmospheric longwave irradiance. Current measurement capabilities are limited to an estimated uncertainty of larger than ± 4 W/m² using the interim World Infrared Standard Group (WISG). WISG is traceable to the Système international d'unités (SI) through blackbody calibrations. An Absolute Cavity Pyrgeometer (ACP) is being developed to measure absolute outdoor longwave irradiance with traceability to SI using the temperature scale (ITS-90) and the sky as the reference irradiance, instead of a blackbody. The ACP was optically characterized by the National Institute of Standards and Technology (NIST). Under clear sky and stable conditions, the responsivity of the ACP is determined by lowering the temperature of the cavity and calculating the rate of change of the thermopile output voltage versus the changing net irradiance. The absolute atmospheric longwave irradiance is then calculated with an uncertainty of ± 3.96 W/m² with traceability to SI. The measured irradiance by the ACP was compared with the irradiance measured by two pyrgeometers calibrated by the World Radiation Center with traceability to the WISG. A total of 408 readings were collected over three different clear nights. The calculated irradiance measured by the ACP was 1.5 W/m² lower than that measured by the two pyrgeometers that are traceable to WISG. Further development and characterization of the ACP might contribute to the effort of improving the uncertainty and traceability of WISG to the SI.

Reference: Reda, I.; Zeng, J.; Scheuch, J.; Hanssen, L.; Wilthan, B.; Myers, D.; Stoffel, T. Dec. 2011. "An absolute cavity pyrgeometer to measure the absolute outdoor longwave irradiance with traceability to International System of Units, SI". Journal of Atmospheric and Solar-Terrestrial Physics. <http://dx.doi.org/10.1016/j.jastp.2011.12.011>