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The Compact Lightweight Absolute Radiometer (CLARA) for Total Solar Irradiance Measurements on the NORSAT-1 Satellite

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Continuous and precise Total Solar Irradiance (TSI) measurements are indispensable to evaluate the influence of short- and long-term solar variability on the Earth's energy budget. The existence of a potential long-term trend in the suns activity and whether or not such a trend could be climate effective is still a matter of debate. The Compact Lightweight Absolute Radiometer (CLARA) is one of PMOD/WRC's future contributions to the almost seamless series of space borne TSI measurements since 1978. CLARA was designed and built by PMOD/WRC and characterized and calibrated by PMOD/WRC as part of the "European Metrology Research Program" (EMRP) project "European Metrology for Earth Observation and Climate" (MetEOC-2) funded by the European Commission. The main goals of the CLARA experiment are to continue the TSI data record with high accuracy and precision and to facilitate monitoring with its compact and adaptable design. CLARA will be one of three payloads of the Norwegian micro satellite NORSAT-1, along with Langmuir probes for space plasma research and an Automatic Identification System (AIS) receiver to monitor maritime traffic in Norwegian waters. The launch of NORSAT-1 is planned for March 2017.

We present the design and calibration of CLARA, a new generation of Electrical Substitution Radiometers (ESR) comprising the latest radiometer developments of PMOD/WRC: i) A three-detector design for degradation tracking and redundancy, ii) a digital control system, iii) a new reference block and detector design to minimize size and weight of the instrument. The characterization of the CLARA instrument components provides an overview on the improvements that were achieved with the latest radiometer developments. An end-to-end calibration of CLARA against the SI-traceable cryogenic radiometer of the TSI Radiometer Facility (TRF) at the Laboratory for Atmospheric and Space Physics (LASP) in Boulder (Colorado) results in a combined measurement uncertainty of 0.05% (k = 1) for the CLARA flight instrument.