

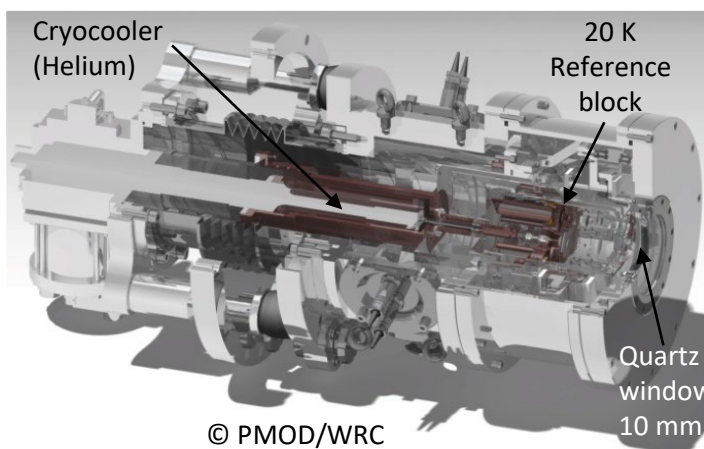


Update of Radiation References: Results from the WMO Expert Team on Radiation References

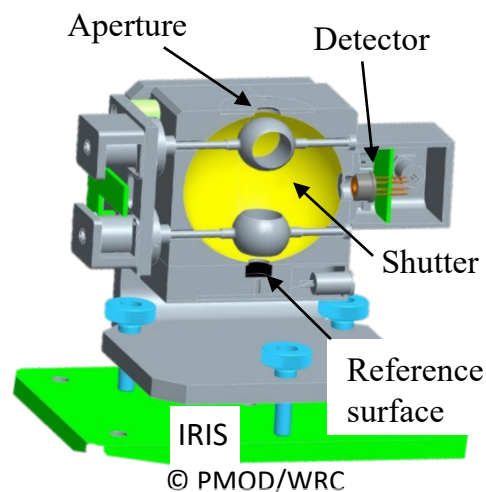
Primary references for solar and terrestrial radiation are instrument-based

New references (new instruments) have been proposed with improved traceability to SI. **However, comparisons show bias between the old and new references.**

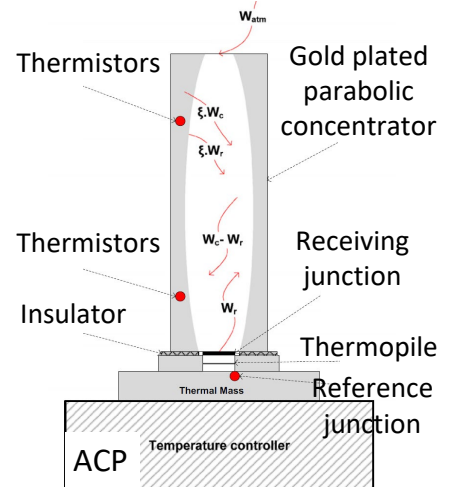
Balance to be found between 1) updating the references ASAP to benefit from improved accuracy and traceability and 2) waiting that conditions are met to insure change without excessive disruptions to meteorology and climatology.



Cryogenic Solar Absolute Radiometer (CSAR) → better traceability to SI, standard uncertainty ~0.03%, **Goal ~0.01%**



Infrared integrating sphere (IRIS) and Absolute Cavity Pyrgeometer (ACP) solved transmittance issues & better traceability to SI; uncertainty IRIS $\pm 2.4 \text{ Wm}^{-2}$, ACP $\pm 4 \text{ Wm}^{-2}$



Impacts and potential problems

- Terrestrial radiation scale change comparable to level of agreement between multimodel mean (climate modelling) and observations, anticipated **impact on trend analysis**
- Terrestrial radiation scale change ($\sim 5 \text{ Wm}^{-2}$ for clear-sky situations) significantly larger than mean bias of satellite monthly mean downward longwave irradiance
- Instruments traceable to new references progressively to be used by monitoring / measurement community (potential inhomogeneity in long-term data series)

Recommendations

- Status finalized as operational reference for **solar** and **terrestrial** radiation; status fully documented (traceability and accuracy), preferably in peer-reviewed journals
- Current **solar** and **terrestrial** reference instrument groups (**WSG** and **WISG**) to be continued/renewed as transfer standard
- Second instrument of CSAR/MITRA design available + other independent realization of cryogenic **solar** radiation reference
 - Planning for backup system ready before radiation references update is implemented
- Data homogenization necessary for major climate time series: harmonizing historical data to new references