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| WEATHER CLIMATE WATER | **World Meteorological Organization**  **COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS**  **Second Session** 24 to 28 October 2022, Geneva | **INFCOM-2/Doc. 6.2(5)** |
| Submitted by: Chair of SC-MINT  10.X.2022  **DRAFT 1** |

**AGENDA ITEM 6: TECHNICAL REGULATIONS AND OTHER TECHNICAL DECISIONS**

**AGENDA ITEM 6.2: Standing Committee on Measurements, Instrumentation and Traceability (SC-MINT)**

# radiation references

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| **Summary** |
| **Document presented by:** Chair of SC-MINT  **Strategic objective 2020–2023:** 2.1  **Financial and administrative implications:** within the parameters of the Strategic and Operational Plans 2020–2023, will be reflected in the Strategic and Operational Plans 2024–2027.  **Key implementers:** INFCOM  **Time frame:** 2023–2027  **Action expected:** review the proposed [draft Recommendation 6.2(5)/1 (INFCOM-2)](#_DRAFT_RESOLUTION_4.2/1_(EC-64)_-_PU) |

# DRAFT RECOMMENDATION

## Draft Recommendation 6.2(5)/1 (INFCOM-2)

### Towards a change of radiation references

THE COMMISSION FOR OBSERVATION, INFRASTRUCTURE AND INFORMATION SYSTEMS,

**Recalling:**

1. [Recommendation 3 (CIMO-7)](https://library.wmo.int/doc_num.php?explnum_id=8305#page=89) – World Radiometric Reference,
2. [Resolution 13 (EC-XXXIV)](https://library.wmo.int/doc_num.php?explnum_id=6098#page=136) – Development and comparison of radiometers,
3. [Resolution 1 (CIMO-17)](https://library.wmo.int/doc_num.php?explnum_id=5683#page=9) – Governance and traceability of atmospheric longwave irradiance,

**Reaffirming** the importance of accurate and stable references for solar and terrestrial irradiance measurements and WMO’s role in the maintenance of the current World Radiometric Reference,

**Taking note** of the report from SC-MINT Expert Team on Radiation References proposing conditions to be met for a change in solar and terrestrial radiation references summarized in [INFCOM-2/INF. 6.2(5)](https://meetings.wmo.int/INFCOM-2/InformationDocuments/Forms/AllItems.aspx),

**Welcoming** the developments of the Cryogenic Solar Absolute Radiometer (CSAR) and Monitor to Measure the Integral Transmittance of Windows (MITRA), of the Infrared Integrated Sphere Radiometer (IRIS) and of the Active Cavity Pyrgeometer (ACP),

**Recognizing** that recent technological developments enable to significantly reduce the uncertainties of those references,

**Having been informed** about the apparent offsets of both the World Radiometric Reference and of the World Infrared Standard Group relative to the International System of Unit (SI),

**Noting:**

1. The need for stable and accurate references to underpin climate datasets,
2. The impact of a change of reference for climate time series,
3. The request from the renewable energy community for the prompt introduction of a SI-based solar irradiance reference,

**Agrees** on the need to plan for the establishment of new solar and terrestrial irradiance references,

**Recognizing further** the risks inherent with establishing a new reference based on a single instrument,

**Approves** the conditions provided in the annex the draft resolution that is available in the annex to the present Recommendation be met before deciding on the introduction of changes in references for solar and terrestrial radiation references;

**Recommends** to Executive Council the adoption of the conditions for a change of solar and terrestrial radiation references throughthe draft resolution provided in the [annex](#Annex_to_draft_Recommendation) to the present Recommendation.

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[Annex: 1](#Annex_to_draft_Recommendation)

## Annex to draft Recommendation 6.2(5)/1 (INFCOM-2)

**Draft Resolution ##/1 (EC-76)**

THE EXECUTIVE COUNCIL,

**Recalling** that WMO established the World Radiometric Reference (WRR) for solar irradiance measurements and an Interim WMO Pyrgeometer Infrared Reference for terrestrial irradiance measurements,

**Recognizing** that recent technological developments enable to significantly reduce the uncertainties of those references,

**Reaffirming** the importance of accurate and stable solar and terrestrial irradiance references for the assessment of the Earth energy budget and climate monitoring,

**Being mindful** of the impact of a change of references for climate time series,

**Noting** the request from the renewable energy community for the prompt introduction of a SI-based solar irradiance reference,

**Having examined** [Recommendation 6.2(5)/1 (INFCOM-2)](#_Draft_Recommendation_6.2(5)/1),

**Agrees** with the conditions proposed by INFCOM (provided in the [annex](#Annex_to_Resolution) to this resolution), that will have to be met before deciding on the introduction of changes in references for solar and terrestrial irradiance measurements,

**Decides** that INFCOM shall oversee the entire process from the development of the new procedures, the establishment of the new references and of their associated transfer standard groups, to their maintenance and the dissemination of the new references to regional and/or national standard instruments;

**Requests** INFCOM and the World Radiation Centre to develop all the necessary procedures to enable a change of references (including required changes to WMO regulatory material), for the establishment and maintenance of a transfer standard group for dissemination of the reference to regional and/or national standard instruments, as well as for overseeing the stability of the new reference instruments;

**Requests further** INFCOM to follow the metrology best practices for planning the change of references, collaborating with the metrology community as needed, and ensuring that the new references are properly characterized and described;

**Calls on** the World Radiation Centre, radiation centres, and the metrology and research communities:

1. To publish the uncertainty budget of proposed solar and terrestrial reference instruments in the peer-reviewed literature;
2. To perform intercomparisons of these instruments to demonstrate their performances and the stability of the proposed new references; and
3. To develop other independent realization of the solar irradiance reference and/or a second instrument of the same design as CSAR/MITRA to mitigate risks linked with a technical failure of one single instrument.

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See [INFCOM-2/INF. 6.2(5)](https://meetings.wmo.int/INFCOM-2/English/Forms/AllItems.aspx?RootFolder=%2FINFCOM%2D2%2FEnglish%2F1%2E%20DRAFTS%20FOR%20DISCUSSION&FolderCTID=0x012000DFD47F9206CDD640A4FDFBAA2EB0EF6E&View=%7BDBBC48FA%2DBEE2%2D4A94%2D8905%2DFBE98B87E342%7D) for more information.

**Annex to draft Resolution ##/1 (EC-76)**

**Conditions for changes of irradiance references**

The following conditions are the minimal conditions to be met before deciding on the introduction of changes in references for solar and/or terrestrial irradiance measurements

### Terrestrial radiation

1. The new reference(s) must have a demonstrated traceability to SI, for instance established by an approved Calibration and Measurement Capabilities (CMC), and must be documented in the scientific literature with performances characterized by an uncertainty budget. In case more than one new reference is eligible, the new references must agree within their stated uncertainties in international comparisons.
2. A standard group of reference pyrgeometers (similar to the current World Infrared Standard Group (WISG)) must continue to be operated as main transfer standard with an updated calibration with respect to the new references following state-of-the-art metrology methods.
3. Procedures must be available for correcting measurement data traceable to the current WISG for harmonization to the new reference scale, in particular for major climate time series.
4. The Baseline Surface Radiation Network (BSRN) should make mandatory the recording of pyrgeometer raw data (net IR signal in volts and temperature) using the newly defined logical record LR4000 and BSRN should investigate how many stations are able to provide this record for historical data.

### Solar radiation

1. The proposed new reference instrument (CSAR/MITRA) must have been characterized and its uncertainty budget published, preferably in a peer-reviewed publication to demonstrate its operational performances.
2. The proposed new solar radiation reference instrument must have been compared bilaterally with another cryoradiometer from a National Metrology Institute with a CMC for spectral sensitivity and the comparison results published.
3. A standard group of ambient cavity radiometers (similar to the current World Standard Group (WSG)) must continue to be operated as main transfer standard.
4. Procedures must be available for correcting measurement data traceable to the current WRR for harmonization of historical data series to the new reference scale, in particular for major climate time series.

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