IROWG Key Recommendations to CGMS Plenary

Presented to CGMS-53 Plenary, agenda item 5

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With contributions from the IROWG members

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IROWG-10 Meeting

IROWG-10 was held on the UCAR campus in Boulder, Colorado, United States, 12-18 September, 2024 in conjunction with the COSMIC/JCSDA Workshop. It was the largest IROWG workshop so far, with approximately 180 abstracts and over 150 participants attending in person.

IROWG wants to express its gratitude for the perfect organization of this meeting by UCAR and JCSDA.

Full workshop minutes and CGMS working papers from IROWG-10 are available at https://irowg.org/documents/

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Workshops

IROWG-10

- Opening address by the Governor of Colorado, Jared Polis
- 60th anniversary of the first radio occultation – Mariner IV, Mars, July 1965
- 30th anniversary of the first terrestrial RO – GPS/MET, launched April 1995
- 20th anniversary (upcoming): COSMIC-1 / FORMOSAT-3, launched April 2006
- Many science highlights, see the workshop presentations: www.cosmic.ucar.edu/events/cosmic-jcsda-workshop-irowg-10
- Splinter meetings: Updates to the BUFR format, ROMEX
- Meeting Report submitted to BAMS

IROWG held ROMEX workshops on 17 – 19 April 2024 and on 25 – 27 February 2025 at EUMETSAT, Darmstadt, Germany (see next presentation).

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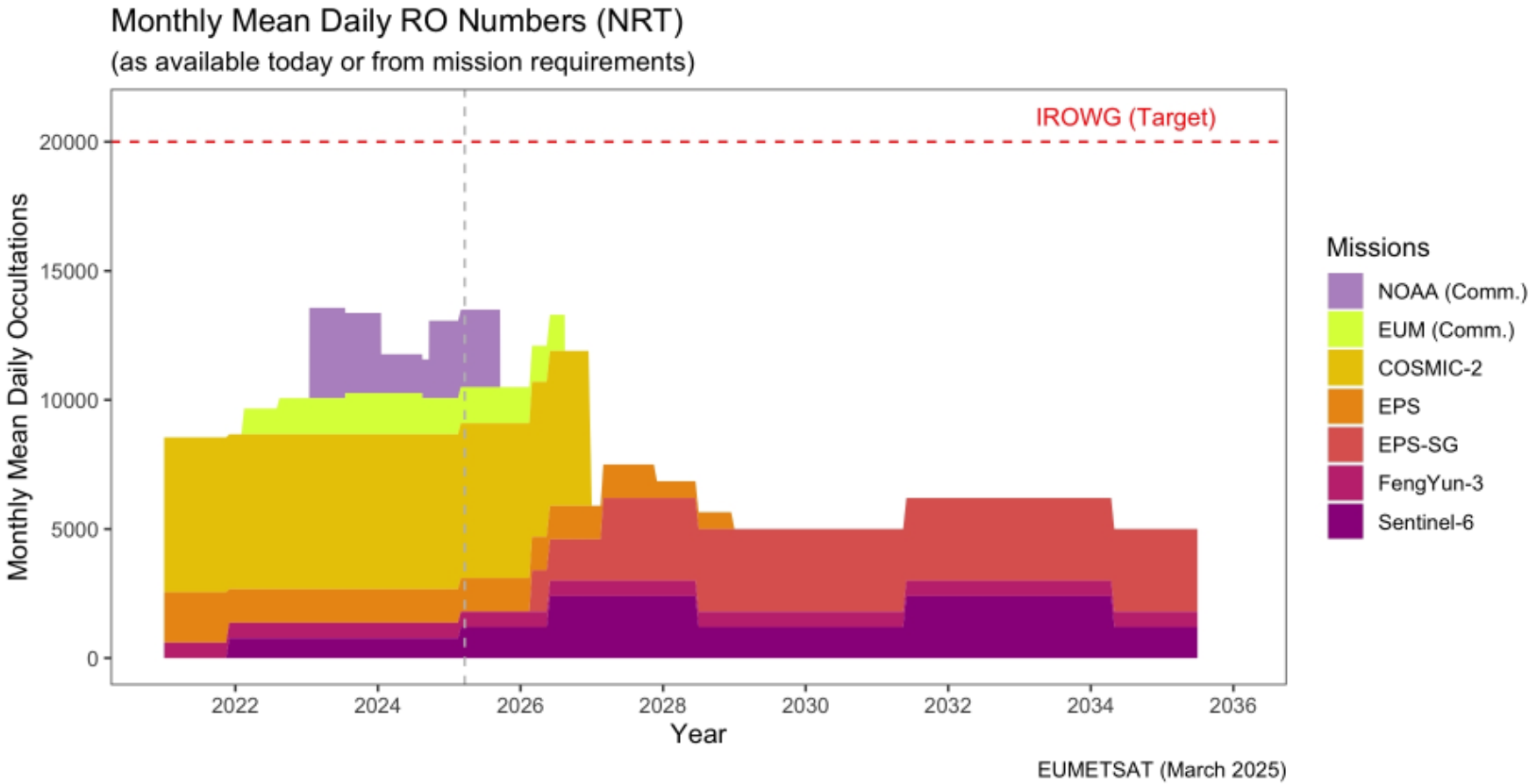
Projected RO observation numbers in next decade



- COSMIC-2 profiles are limited to latitudes between ± 40°
- This update reflects a revised schedule for EPS-SG, Sentinel-6 Michael Freilich Galileo RO
- It is imperative to recognize the potential risks associated with the lack of future planning for (low-inclination) RO observations after COSMIC-2.

Credit: Christian Marquardt (EUMETSAT)

COSMIC-2 reached nominal end of life in June 2024. While all six satellites continue to operate nominally, most have subsystems with single points of failure such that a malfunction of the subsystem will lead to loss of RO measurements from the affected satellite.

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CGMS-53-WGIII-WP-02, Version 3, 17 April 2025 – updated following discussions in WGIII

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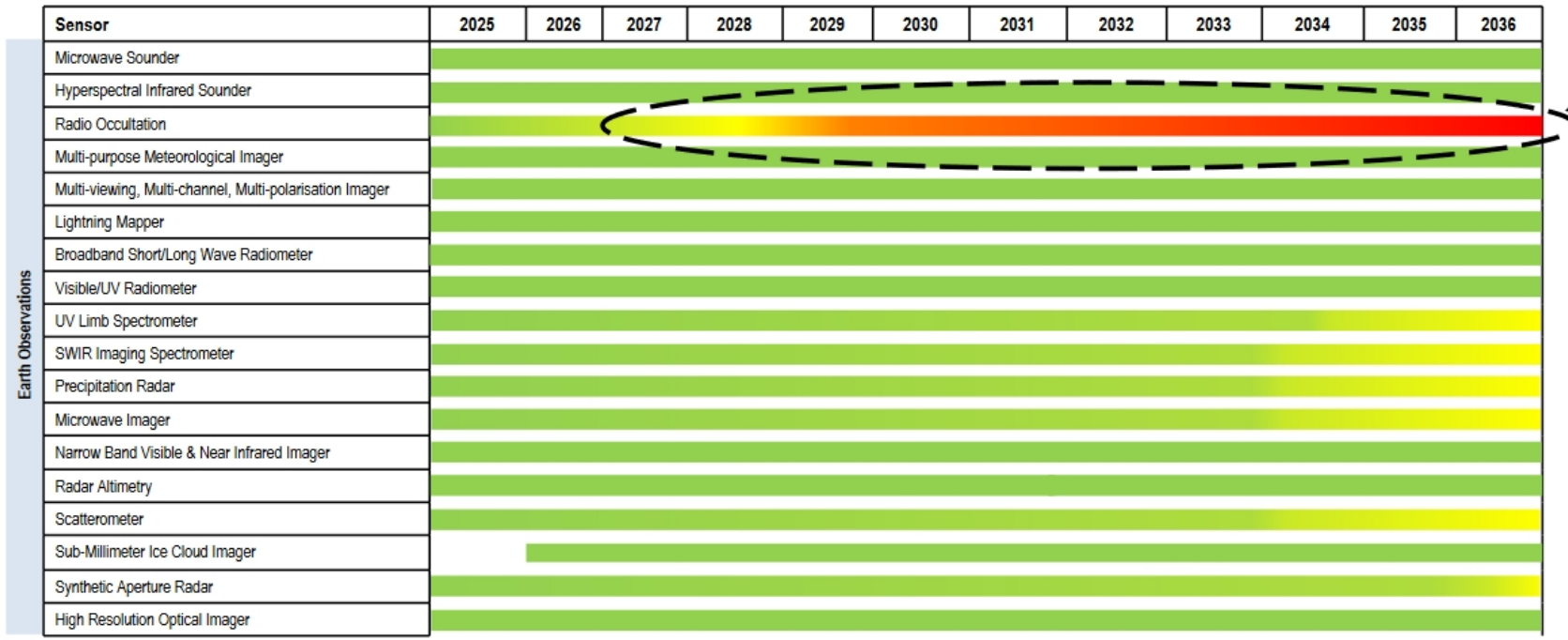
Top-Level Risk Assessment - Earth Observations (2025)



We note the recent Request For Information from NOAA issued on March 11, 2025: “Global Navigation Satellite System Radio Occultation Instruments and Spacecraft Request for Information”

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- CGMS is aware of this risk

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MAIN RECOMMENDATIONS FROM IROWG-10 PLENARY TO CGMS

1. **IROWG recommends that a reliable replacement for the FORMOSAT-7/COSMIC-2 tropical and subtropical radio occultation observations be in place by 2030 at the latest. As FORMOSAT-7/COSMIC-2 is past its nominal end of life, there is a high risk of serious degradation to numerical weather prediction (NWP) accuracy due to the degradation of the current RO observing system, as FORMOSAT-7/COSMIC-2 satellites stop acquiring observations over the coming years.**

2. **IROWG notes that the current radio occultation observational network is highly beneficial to NWP and is among the top two or three observational systems in terms of forecast impact. IROWG therefore recommends the continuation and expansion of the RO observational network. Initial results from ROMEX suggest that increasing the numbers of daily radio occultation profiles with global coverage provides significant additional positive impact on the accuracy of NWP forecasts.**

RO Modeling Experiment (ROMEX) results (see next presentation) support the IROWG recommendation, which is to acquire at least 20,000 occultations per day with uniform spatial and local time coverage (HLPP 1.2.8). Besides this, also **refresh** should be considered.

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MAIN RECOMMENDATIONS FROM IROWG-10 PLENARY TO CGMS

3. **IROWG recommends that Level 0 (raw) data from RO missions be permanently archived and that the government agencies that purchase the data be responsible for its archiving with an open data policy. All data acquired by RO instruments should be archived without pre-filtering or editing and without intentional degradation.**

4. **IROWG recommends that relevant agencies undertake a ROMEX-like study for space weather.**

   ROMEX-SWx would help to quantify the benefits of RO measurements in improving global ionospheric specification.

5. **IROWG recommends improving planetary boundary layer (PBL) profiling from GNSS-RO through technology and retrieval developments, and utilization of information from the PBL in NWP data assimilation as well as the further exploitation of RO-derived water vapor.**

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BACKUP

For consideration by CGMS: Best Practices document "IROWG best practices in support to radio occultation observations for long-term climate studies"

- IROWG proposes a Best Practices (BP) draft document "IROWG best practices in support to radio occultation observations for long-term climate studies"
  - Started within the climate sub-group at IROWG-9 but that also addresses numerical weather prediction applications, endorsed by IROWG-10

- This document might be useful to support CGMS-51 Plenary Action A51.08
  - Action to "develop…a CGMS statement on the optimum composition of hybrid architectures (combining reference platforms, small satellites and procurement of commercial data)..."

- A further document "Roadmap towards full exploitation of the GNSS Polarimetric Radio Occultations" was developed by the Innovation Sub-Group of the IROWG. It may be of great interest to agencies in WGII and may merit publication on the CGMS web site.

Both documents have been sent to the WGII rapporteurs.

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IROWG-11 organization

- September 10 – 16, 2026, Seggau Castle, Austria, together with OPAC-8
- Hosted by the University of Graz
- The website for the workshop will be: http://irowg.org/workshops/irowg-11/
- Full workshop, including presentations, posters, sub-group discussions, and social activities.
- Four working subgroup meetings: Numerical Weather Prediction (NWP); Climate; Innovation; Space Weather
- Feature special ROMEX sessions
- Outcome: CGMS recommendations (including ROMEX), internal action items, a summary of relevant activities, and meeting minutes

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Thank you for your attention !

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