IROWG Recommendations

Recommendation to CGMS

1. **IROWG also notes that the risk of degrading the current RO observing system as COSMIC-2 nears the end of its life is high, which would result in a serious degradation of NWP accuracy. Therefore, IROWG recommends the development of a reliable replacement for the COSMIC-2 tropical and subtropical radio occultations observations to be in place by 2030 at the latest.**
2. **IROWG notes that the current radio occultation observational network is highly beneficial to NWP (among the top two or three observational systems). Initial results from ROMEX suggest that increases in daily radio occultation profiles with global coverage can provide significant additional impact on the accuracy of NWP forecasts.**

~~**(Achieving this via agency-funded missions avoids the risks associated with commercial data purchases.)**~~
Note: science data has not been purchased w/ open license. Add to NWP BP document for commercial.

~~The rationale for this statement is that agency funded missions currently provide stable,~~ ~~continuous~~~~, long-term, traceable and reliable observations.~~ Acknowledge that commercial missions add valuable data and do not single it out as less stable, etc.) Commercial companies can be part of the solution. The expertise of publicly funded data-processing centres is invaluable in assessing and archiving commercial data provision. They also help to reduce the risk to the global observing system if one or more commercial providers were to go out of business, or if the market became dominated by a single ~~player~~ provider. The CGMS baseline also provides a reference point against which the commercial companies can compare and innovate. It is helpful to have this baseline based upon multiple different satellite instruments / platforms.

Recommendations

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- Level 0/open data policy
  - Archiving, open data for archives, centralized archiving of Level 0. Government agencies must archive the purchased data.
  - NASA purchase asked commercial to archive the data. Not true.
  - There are data that are collected that are not archived anywhere (at least, not by government)
  - As collected and not degraded. (no pre-filtering). Degraded data will be used for research and is suboptimal for research, scientific applications. “Value for money” statement in the BP document. For climate, reproducibility is the issue. Degraded data impacts PBL research use. Might impact use in reanalysis. For science, we don’t want data that’s filtered.
  - Is there a formal definition? Can we do that? CEOS groups have a formal definition. “Raw” is transmitted. Level 0 is what instrument generated. Reference the CEOS definition.
- ROMEX for space weather
  - OSSE capability workshop. Stress ROMEX for space weather. Add work needed to do a ROMEXsw. Space weather requirements are distinct. Seek support from the government agencies – has been important for ROMEX.
- PBL w/ water vapor (use case needed)
  - Combine recommendations from NWP, Climate and Innovation.
  - Use NWP case needed. Develop offline.
  - RO-Trend in the PBL region. Chi Ao and Rob Kursinksi volunteer to lead.

- Risk to the system is imminent
  - IROWG notes that the current observational network is very beneficial, and that degrading this brings negative impacts. **IROWG recommends that the degradation of current capabilities should be avoided, and achieving this via agency-funded missions avoids the risks associated with commercial data purchases. Initial results from ROMEX suggest that substantial increases in data volume can be beneficial to NWP forecasts.**
  - **Ensure continuity and long-term availability of climate quality RO measurements with global coverage and full local time coverage through a coordinated and sustained effort. Operational GNSS RO missions for continuous global climate observations need to be established and maintained as a backbone to ensure continuity with at least 20,000 occultations per day. This could be achieved with satellites in sun-synchronous and low inclination orbits with satellites in at least four evenly-spaced orbital planes providing observations with uniform global coverage. Level 0 data need to be freely available for reprocessing.**
  - **Risk of low inclination orbit loss, do not stress source of data, stress stability, leading to severe degradation of the weather forecast, include needs of climate community.**
  - **What should we emphasize in terms of the system: numbers? Refresh? What is the evidence?**
  - **Is 20,000 the right number? But more shows larger impact, so what is our long-term number? Let's revisit the number as the ROMEX results come in. Is a number valuable? Speak about marginal impact of additional numbers.**
  - **1: severe degradation associated w/ current RO risk. 2: what is optimal numbers.**

Response

- Joint IROWG/SWCG workshop
- Best practices:
  - PRO. Estel is leading this. Roadmap
  - Space weather data types (HLPP coordination rec.)
  - NWP additions to commercial BP (sudden data changes)
    - E.g. provide test data. Provide warning of data quality changes.
    - Business models are evolving. One cannot anticipate the commercial market. What agency practices are conducive to a more stable commercial market?

Internal actions (besides subgroup actions):

- Intermediate meetings:
  Subgroup
  Group lead
  Subject-focus workshop/meetings (e.g., ROMEX)
- Document to be reviewed
  Bufr (deadline: Oct 18, 2024)
  PRO document (upcoming)
- Email list transition (by end of 2024)
- Subgroup name change: Technology and Innovative Techniques-> Innovation
- Meeting minutes from each of subgroup leads due on Oct 18, 2024
- Two year meetings are OK. Interstitial meetings.
- Next IROWG date conflicts w/ ION GNSS.
- GPS Solutions special issue. There is a topical issue right now.
- JPL update on refractivity – report
- Offer Climate BP document for adoption by CGMS

Additional Detailed Notes: See Document

Meeting Notes IROWG-10 Sessions 20-Sep-2024

BACKUP

Recommendation to CGMS

1. IROWG notes that the current observational network is very beneficial, and that degrading this brings negative impacts. **IROWG recommends that the degradation of current capabilities should be avoided, and achieving this via agency-funded missions avoids the risks associated with commercial data purchases. Initial results from ROMEX suggest that substantial increases in data volume can be beneficial to NWP forecasts.**

   The rationale for this statement is that agency funded missions can provide stable, continuous, long-term, traceable and reliable observations. The expertise of publicly funded data-processing centres is invaluable in assessing and archiving commercial data provision. They also help to reduce the risk to the global observing system if one or more commercial providers were to go out of business, or if the market became dominated by a single player. The CGMS baseline also provides a reference point against which the commercial companies can compare and innovate. It is helpful to have this baseline based upon multiple different satellite instruments / platforms.

1. Climate Subgroup – Recommendations to CGMS: (Main Recommendations)

1) **Ensure continuity and long-term availability of climate quality RO measurements with global coverage and full local time coverage through a coordinated and sustained effort. Operational GNSS RO missions for continuous global climate observations need to be established and maintained as a backbone to ensure continuity with at least 20,000 occultations per day. This could be achieved with satellites in sun-synchronous and low inclination orbits with satellites in at least four evenly-spaced orbital planes providing observations with uniform global coverage. Level 0 data need to be freely available for reprocessing.** The community is currently short of 20,000 evenly-distributed occultations per day, but IROWG acknowledges the recommendation of CGMS to achieve this target. For climate studies, the effects of local time-related sampling errors should be examined and minimized. We acknowledge the contributions of commercial data providers, pending validation of their climate data quality, including long-term and full access to the data by independent processing centers. Climate requirements should be taken into consideration when purchasing commercial data.

2) **Acknowledging CGMS recommendation WGIIA50.04 on long-term data access, we recommend that government agencies providing data, whether generated internally or purchased from commercial entities, ensure that all information necessary for independent processing towards climate data products is freely available (following WMO Unified Data Policy Resolution 1, GCOS requirements), including long-term archiving of all measured and acquired data without filtering, sub-selection, and "intentional degradation" (i.e., including the data not passing quality control), starting with level 0 data, and public data access, thus assuring full climate traceability.** This needs to include information on instrument/software updates and full documentation of the processing chains that keep track of any introduced changes/updates (e.g., POD-induced uncertainties). We also recommend that the impact of instrument software updates on climate products be evaluated beforehand. All level 0 data providers should make available phase data, amplitude data, and satellite orbit data in a well-documented format (such as NetCDF).