CMA updates on private sector engagement

Presented to CGMS-53 Working Group Ⅲ session, agenda item [6.2]

Coordination Group for Meteorological Satellites

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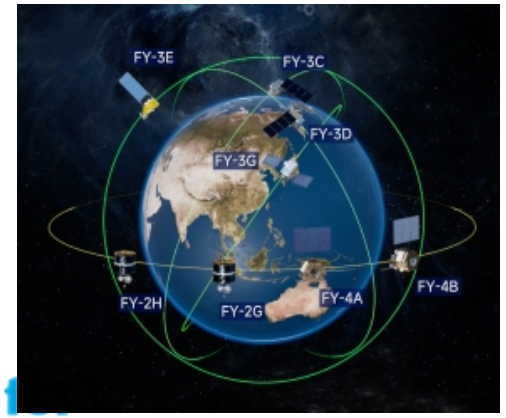
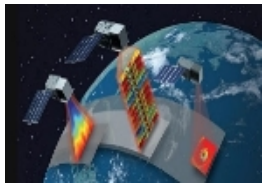
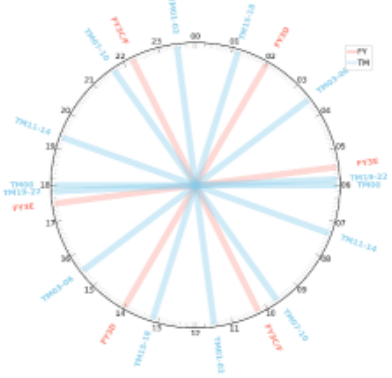
Great demands to balance between the hybrid satellite observing architecture

The need to balance the hybrid satellite observing architecture:

- Deliver cost-effective and high-quality data to operational meteorological users and respond to their evolving operational and possible demand for more R&D-focused observations.
- Demand for higher performance data (accuracy, resolution, temporal refresh, etc.)
- Demand for more observations to further support Earth system science and modelling.
- Opportunities to provide additional data from constellations of smaller satellites with less accurate sensors, complementing the large satellite constellations.
- Complementary advantages:
  - Large satellites: Strong comprehensiveness, long-life span, more stability
  - Mini/nano satellites: more flexible, lower cost, more observations







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Ongoing CMA efforts to guide the developments of hybrid satellites

- China encourages creating space for commercial aerospace development, and point out the encouragement of “**business if possible**“
- CMA explore the development of small satellite constellations, such as microwave temperature and humidity profiles, GNSS radio occultation and reflective wind measurement, high spatiotemporal resolution cloud and precipitation observation. Gradually launch the "the Belt and Road" meteorological small satellite constellation.
- ***Fengyun plus*** framework, aims to explore business cooperation patterns for coordinated observation between large and small satellites.

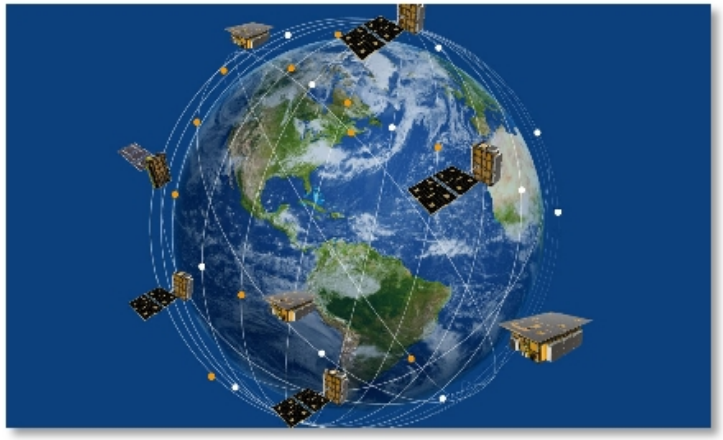
Ongoing CMA efforts to guide the developments of hybrid satellites

- CMA has issued operational requirements for commercial satellite meteorological observation services at the end of 2024, so the first batch of commercial RO data from two companies Tianmu and Yunyao was brought into CMA.
- Operational data delivering to CMA: Stable, real-time delivery of RO profiles and sea surface wind speed from 23 Tianmu satellites. Integrated GNSS-RO & GNSS-R Detection. 12 Yunyao satellites, GNSS-RO profiles.
- Providing ~ 45,000 RO profiles and ~660 reflective documents daily, including GPS, BDS, GLONASS, Galileo navigation satellite systems.
- Stability and quality was evaluated.
- Operational application in CMA: Assimilated into CMA's operational NWP system(CMA-GFS 4.2), and other use.

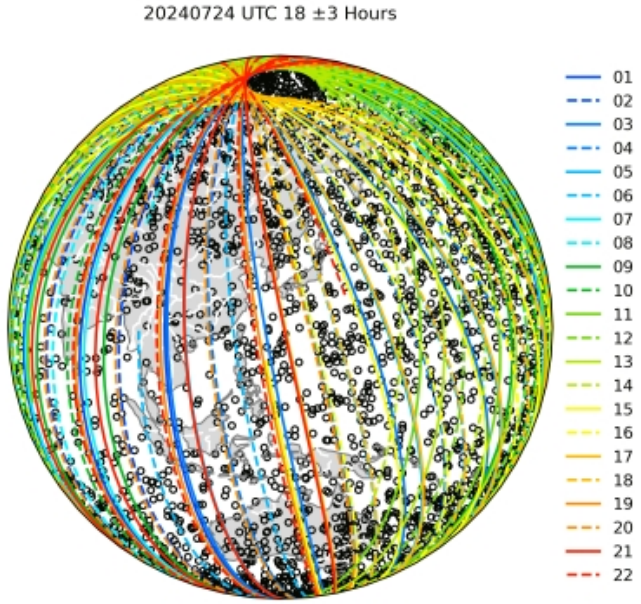
Overview of two kinds of operational commercial RO data

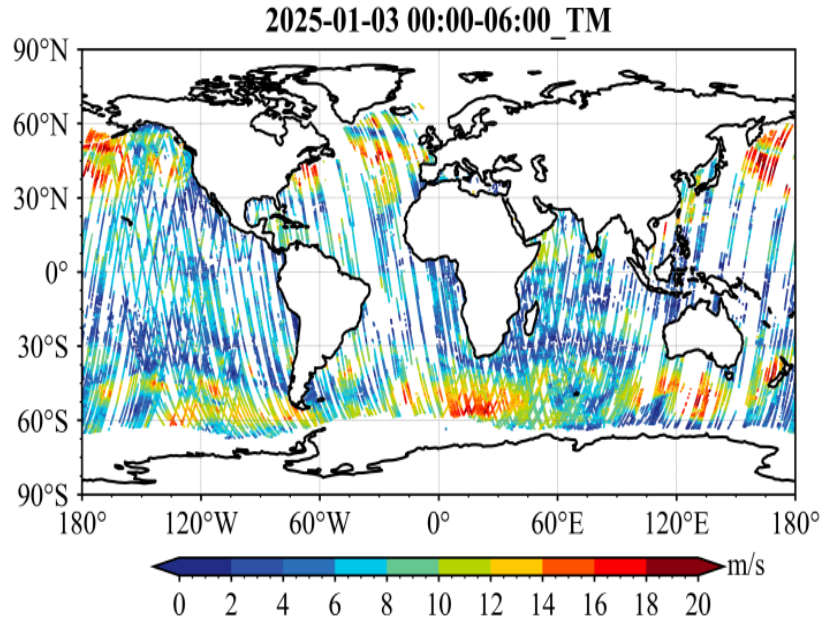
- Diverse local time coverage and more dense space coverage
- Another 10 small satellites from Yunyao is testing, and will be permitted into CMA operational stream as well.

Yunyao constellation



Tianmu constellation





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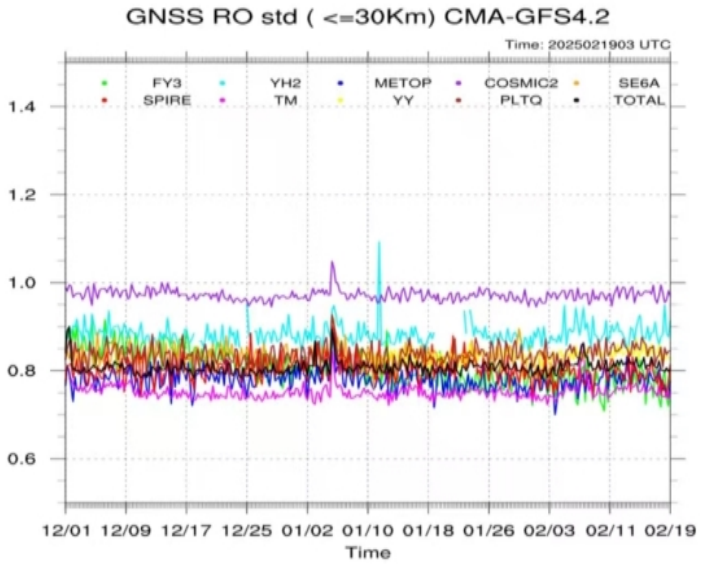
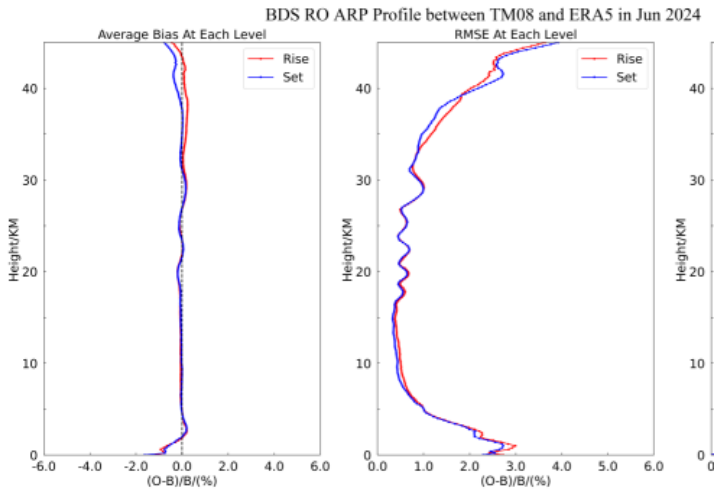
Quality of various RO data evaluated by CMA

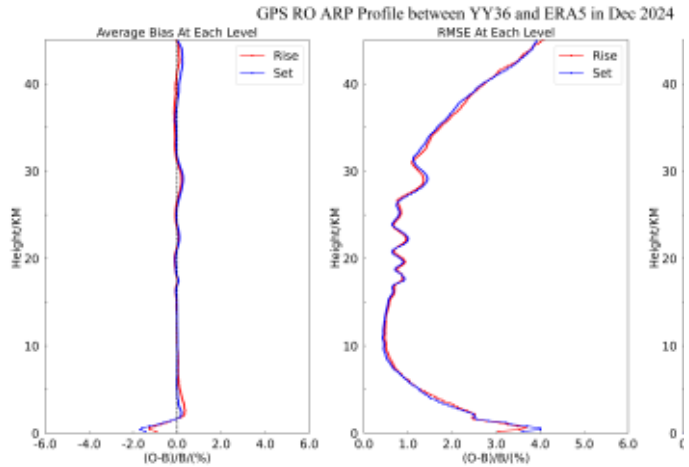
- FY3 series, Tianmu and Yunyao show stable standard deviation.
- Vertical bias and standard deviation of Tianmu and Yunyao performs similar with current RO data from large satellite.



Tianmu BDS RO



Yunyao GPS RO



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Concluding remarks

- CMA will keep on supporting and guiding hybrid satellites development.
- Established a mechanism for commercial meteorological satellite data, operationally access to CMA.
- Up to now, 35 commercial small meteorological satellites have been brought into CMA operational stream.
- Quality and stability performs similar compared to large satellites.
- Massive commercial RO data has been used in NWP assimilation system and Various RO data fusion could be used in weather and climate monitoring.

Core principle : Guide, Support and Cooperation

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