Impact of commercial Radio Occultation observations in global weather forecasting

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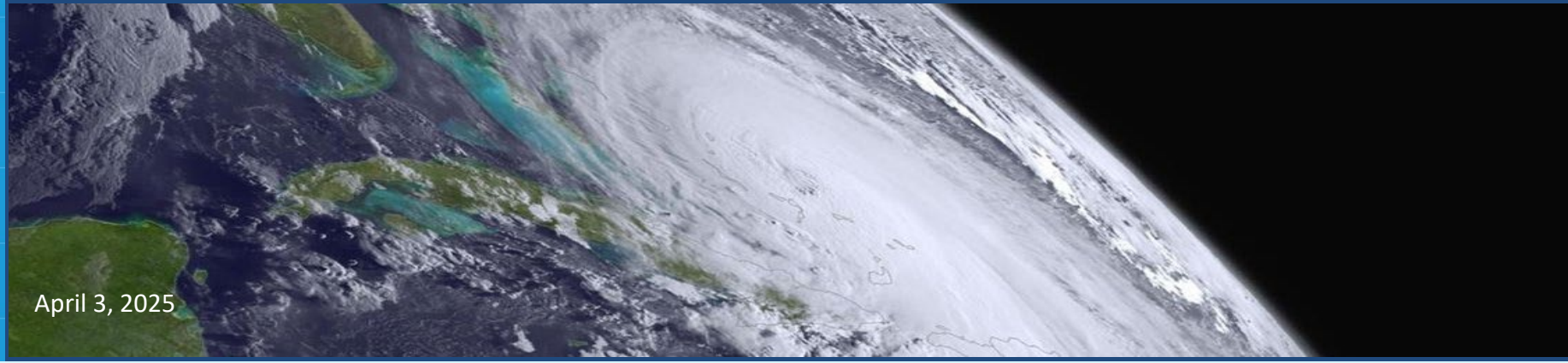

Objective

- Evaluate quality of commercial RO data
  - NESDIS Commercial Data Program (CDP)
- Quantify impact of commercial RO data in global numerical weather prediction
- Relative impact to a US Government RO source (COSMIC-2)
- Results can be found in *Cucurull et al., 2025 (under review at WAF)*
- **Commercial RO is operationally assimilated at NOAA**

NESDIS Commercial Data Program (CDP)

Delivery Order (DO)	Provider	RO Profiles per day	Period of Performance
DO1	Spire GeoOptics	500 500	Dec 2020 - Jan 2021
DO2	GeoOptics	1,300	March - Sept 2021
DO3	Spire	3,000	Sep 2021 - March 2022
DO4	GeoOptics Spire	500 5,500	March 2022 - Jan 2023
DO5	Spire	3,300	Jan - July 2023

Methodology

- Each DO was evaluated independently
- Slightly different version of NOAA's global data assimilation and forecast system
- RO forward operator: NCEP's Bending Angle Method (NBAM)
- GDAS/GFS system (NOAA's operational model) at research resolution
- Time period: 2 August 2022 – 30 September 2022 (DO4)

Distribution of RO observations

Experiments (number of profiles/day)

- **NORO**: All operational data except RO
- **COSMIC2**: NORO + COSMIC-2 (5,500)
- **SPIRE**: NORO + Spire (5,500)
- **COSMIC2+SPIRE**: NORO + Spire (5,500) + COSMIC-2 (5,500)
- **ALLRO**: NORO + COSMIC-2 (5,500) + Spire (5,500) + GeoOptics (500) + MetOP (1,200) + other missions (400)

Assimilated RO observations/analysis cycle

Percentage of RO obs that passed QC

COSMIC2:
assimilates COSMIC-2 only

Spire:
assimilates Spire only

- Overall reduction of RMSE with COSMIC-2 observations
  - Impact is larger in the tropics

- Reduction in RMSE extends to longer forecast lead times and vertical pressure levels in Spire
  - Slight increase of geopotential heights RMSE

COSMIC2+Spire:
assimilates COSMIC-2 and Spire only

ALLRO:
assimilates all RO, including COSMIC-2 and Spire

- Best results when both COSMIC-2 and Spire are assimilated.

Conclusions

- COSMIC-2 and Commercial RO Data show similar statistics.
- Quality of RO commercial data is sufficient for current NWP applications.
- Global RO distribution is needed to improve NWP globally.