Recent and New GNSS-RO missions: Quality Assessment and Comparative Data Assimilation

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Joint Center for Satellite Data Assimilation (JCSDA)

IROWG 2019, Elsinore Denmark
New platforms are evaluated for operations during a Winter and Summer season in two steps:

1. **O-B statistics** (Count, Bias, RMSE, rejection) are computed against NCEP operational 3-9hr forecasts.

2. **Assimilation impact**: the full operational suite is applied in cycling mode to assimilate the new dataset with current operational observations and compare to a control run.
Current platforms assimilated in operations are:

**COSMIC-1, MetOp-A&B, TerraX & TandemX**

Recent JCSDA evaluations include:

- **Kompasat-5** Jun & Dec 2016
- **Megha-Tropiques** Jan & Jun 2018
- **PAZ** Jun 2018
- **MetOp-C** Jan 2019
- **COSMIC-2** Aug 2019 (first look)
MetOp-C data count, 19 Dec 2018 – 17 Jan, 2019
PAZ data count

Daily PAZ RO Profiles
11 May - 09 Jun, 2018

PAZ data count, 11 May – 09 June, 2018
PAZ Bias and RMSE, 11 May – 09 June, 2018
MetOp-C Statistics (after GSI QC)

MetOp-C Bias and RMSE, 19 Dec – 17 Jan, 2019

Mean Bias [(Omb)/O]
19Dec2018-17Jan2019

BIAS

RMS [(Omb)/O]
19Dec2018-17Jan2019

RMSE

MetOp-C Bias and RMSE, 19 Dec – 17 Jan, 2019
5-day forecast 500hPa Height Anomaly Correlation

**CTRL**: operational configuration

**PAZRO**: CTRL + PAZ assimilation

**KOMPSAT5**: CTRL+KOMPSAT5 assimilation

June 01-30, 2018
5-day forecast 500hPa Height Anomaly Correlation

**CTRL**: operational configuration

**METOPC**: CTRL + METOP-C assimilation

January 01-31, 2019
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<thead>
<tr>
<th>Anomaly Correlations</th>
<th>N. America</th>
<th>N. Hemisphere</th>
<th>S. Hemisphere</th>
<th>Tropics</th>
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<td>Temp</td>
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PAZ June 1-30, 2018

MetOp-C Jan 1-30, 2018
First Look at COSMIC 2

13 days between July 26-August 15, 2019
COSMIC2 Data Counts

Daily Number of COSMIC-2 GNSS-RO Profiles
26Jul-15Aug 2019

~2300 occs/day
COSMIC-2 Statistics (13 days)

**COSMIC-2: Diagnostics - PreQC [(OmB)/B]**
26Jul-15Aug2019 - Global

**Mean Count (in thousands)**

**Before GSI QC**

**COUNT ... (Dotted Line)**
**BIAS - (Solid Line)**
**RMS -- (Dashed Line)**

**COSMIC-2: Diagnostics - PostQC [(OmB)/B]**
26Jul-15Aug2019 - Global

**Mean Count (in thousands)**

**After GSI QC**

**COUNT ... (Dotted Line)**
**BIAS - (Solid Line)**
**RMS -- (Dashed Line)**

COSMIC-2 Bias, RMSE and data count, 26Jul – 15 Aug 2019

GFS v14
COSMIC-2 Statistics (13 days)

COSMIC-2 Bias and RMSE, 26Jul – 15 Aug 2019

GFS v14
COSMIC-2 Bias (13 days)

COSMIC-2 Bias Global vs Tropics, 26Jul – 15 Aug 2019

GFS v14
COSMIC-2 RMSE Global vs Tropics, 26Jul – 15 Aug 2019

GFS v14
1. PAZ (Summer) and MetOp-C (Winter) found to have a neutral/positive impact on forecast.

2. COSMIC-2 initial data look promising.

3. Fair comparisons to COSMIC-2 can only be made in the tropics.

4. GSI not tuned for COSMIC-2.
COSMIC-2 Statistics (13 days)

COSMIC-2 Bias, RMSE and data count, 26Jul – 15 Aug 2019

GFS v14
COSMIC-2 Statistics (13 days)

% of data passing GSI QC and assimilated

% of COSMIC-2 data assimilated per vertical layer
## EMC Verification Scorecard

### Symbol Legend

- ▲ PAZRO is better than CTRL at the 99.9% significance level
- ▲ PAZRO is better than CTRL at the 99% significance level
- ⬆ PAZRO is better than CTRL at the 95% significance level
- No statistically significant difference between PAZRO and CTRL
- ▼ PAZRO is worse than CTRL at the 95% significance level
- ▼ PAZRO is worse than CTRL at the 99% significance level
- ▼ PAZRO is worse than CTRL at the 99.9% significance level
- Not statistically relevant

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