



NOAA

IROWG-8

April 7-13, 2021

An investigation of COSMIC-2 impact at NOAA

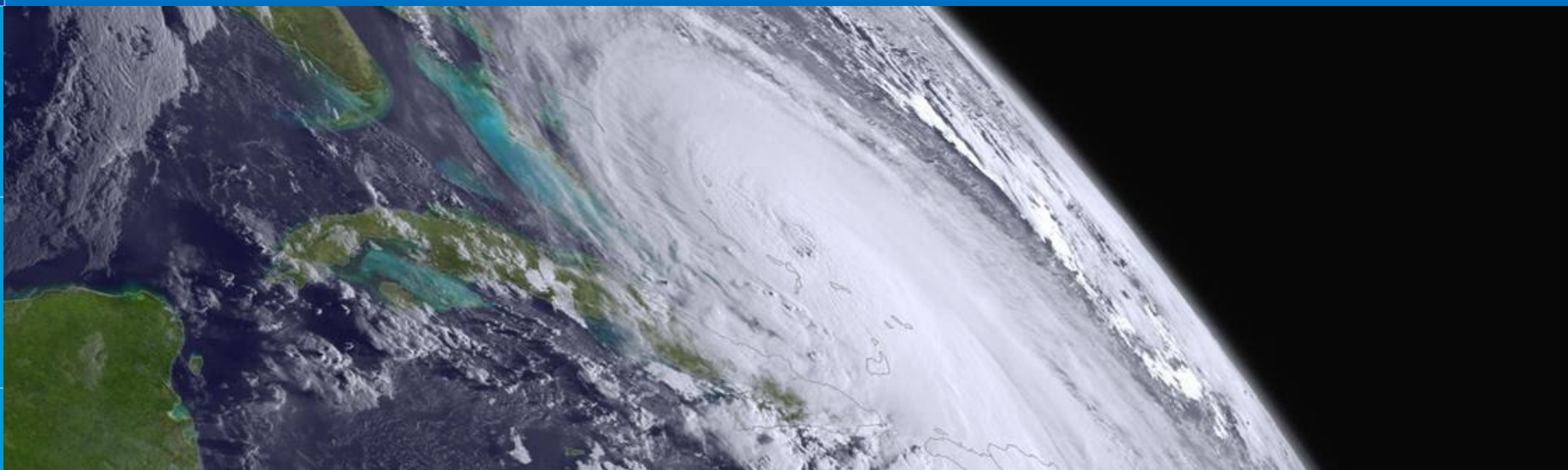
Lidia Cucurull¹, Daryl Kleist², Jim Yoe², Nai-Yu Wang³,
Xuelel Feng⁴

¹ NOAA/OAR/AOML

² NOAA/NWS/NCEP

³ NOAA/NESDIS/OPPA

⁴UCAR @ NOAA/OAR/AOML





Early COSMIC-2 evaluation

Model versions: v15.2, v15.3 (C2 operational), and early V16

- Assimilation of C2 resulted in significant degradation in Southern Hemisphere (SH, v15.2) – this degradation was attributed to the assimilation of C2 observations.
 - Adding C2 was a compromise between degrading SH and improving NH and TR. How many observations were allowed by QC set the level of compromise.
- The same level of degradation existed in the pre-operational run at NCEP (v15.3).
- Need for a quick fix to the pre-operational parallel run so C2 could improve performance and potentially be assimilated operationally at NOAA.
- After conducting several tests, an updated (stricter) quality control configuration for C2 profiles was delivered. This fixed the degradation in SH (changes rolled into v15.3).



C2 became operationally assimilated at NCEP on May 27, 2020. This was a

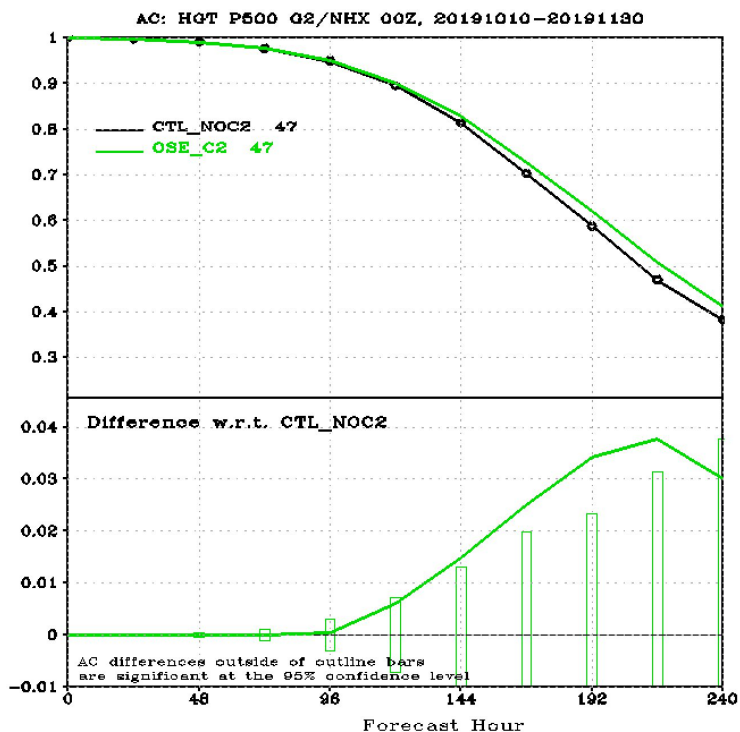
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coordinated effort between FMO, JCCDA, NESDIS, and OAR. It included the

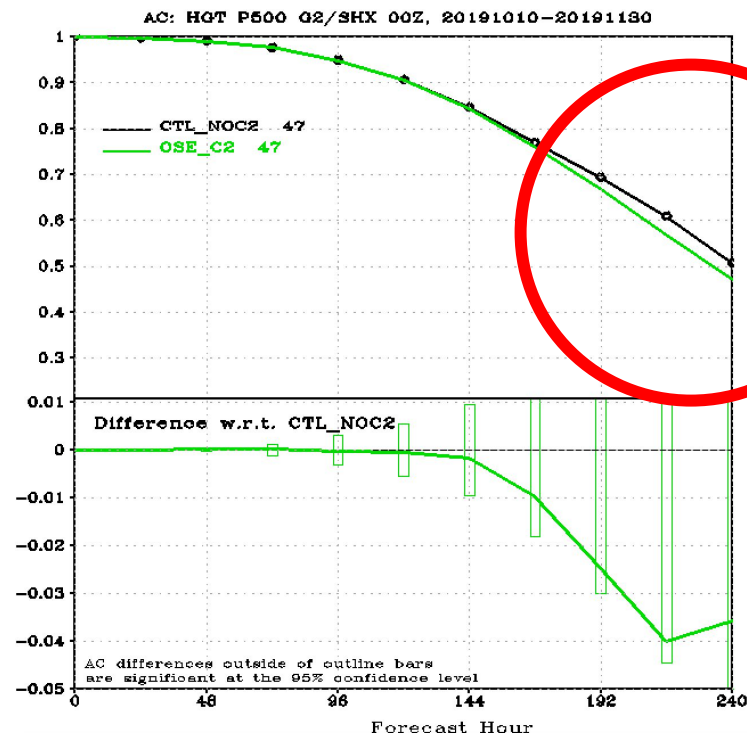


Extratropical Forecast Results

Northern Hemisphere Extratropics (NHX) (500 hPa HGT AC)

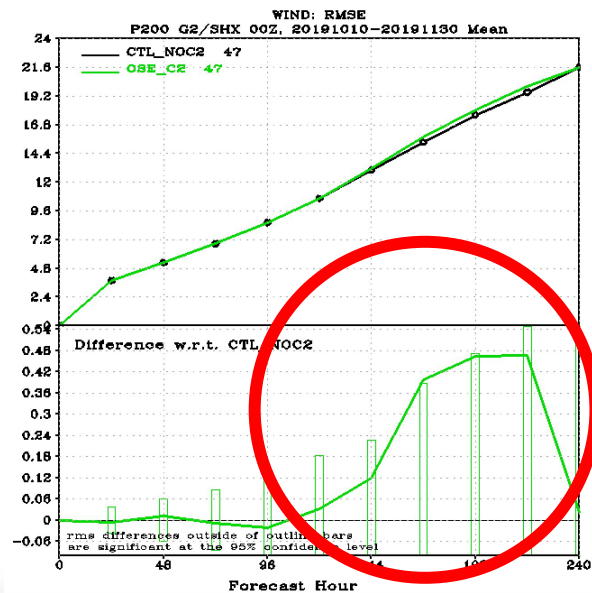
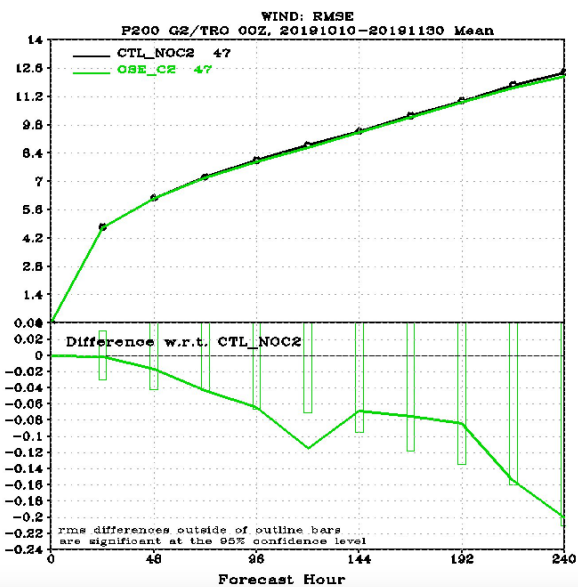
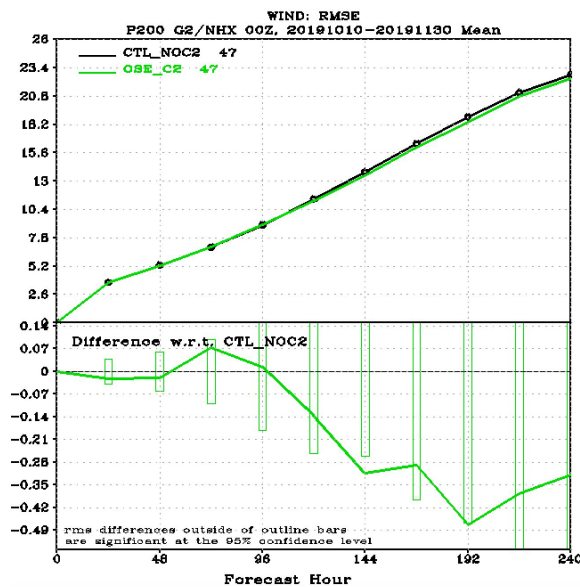


Southern Hemisphere Extratropics (SHX) (500 hPa HGT AC)





200 hPa vector wind RMSE





Some take-aways from earlier C2 evaluation

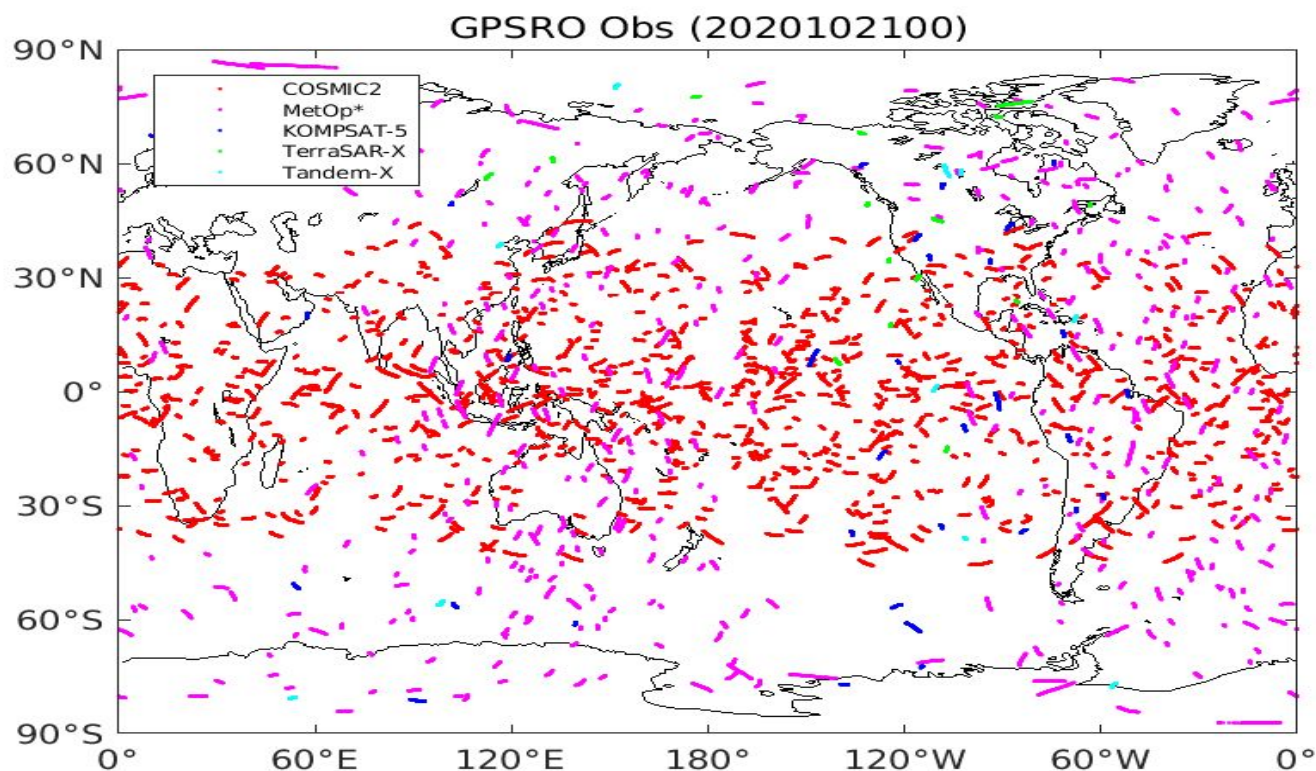
- Recommendation to turn on Metop-C RO assimilation (operational in v16).
- Early evaluation of C2 showed larger variability (biases and standard deviation) as compared to other RO missions (v15.2/v15.3 and v16).
- Larger RO biases and standard deviation were confirmed above 50 km – v16 assimilated RO to 55 km.
- Sub-optimal errors for COSMIC-2: too small in v15.2 and too large in v15.3/v16 (new error structure was implemented).
- Non-C2 RO variability and innovations had increased in v15.3 and v16 from previous model versions in the lower and upper sections.
- Non-C2 RO errors were too slightly too small in v15.3/v16 as compared to earlier model versions.



Ongoing Work

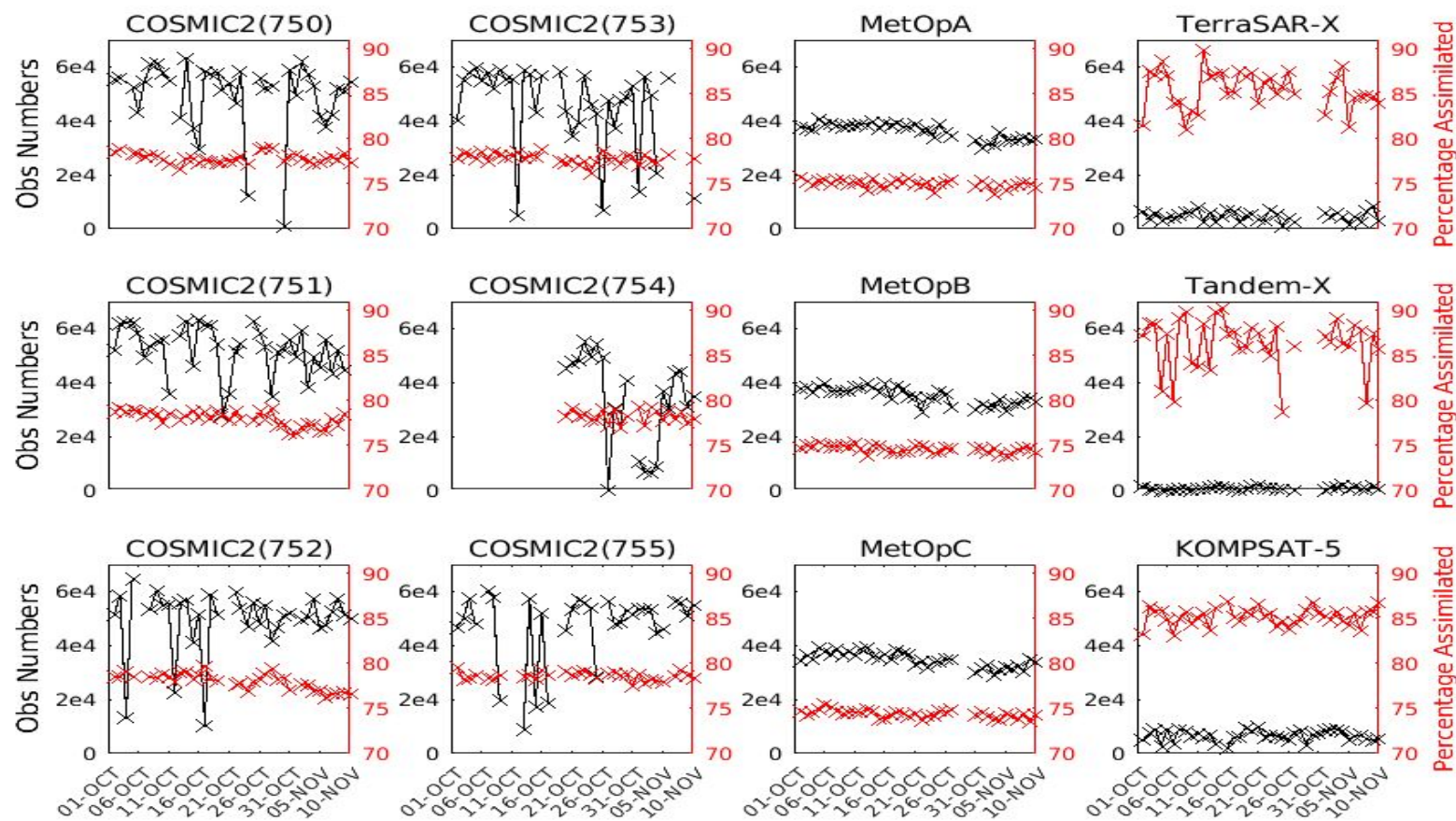
current model configuration (v16)

RO Observation Distribution





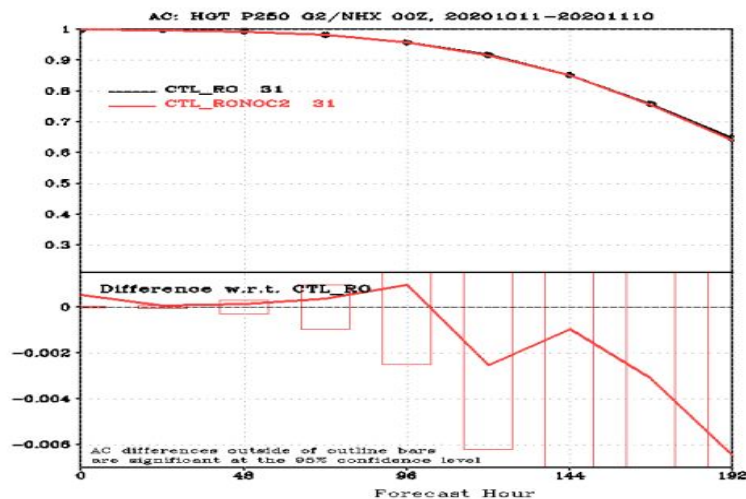
RO observations and percentage assimilated per satellite mission (00 UTC)



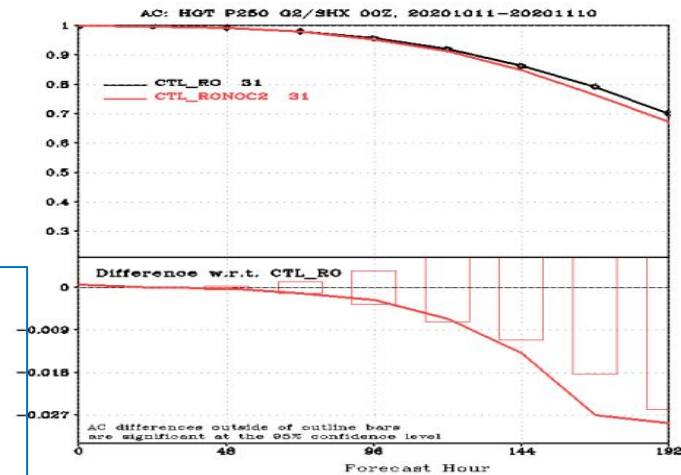


Geopotential heights anomaly correlation

NH

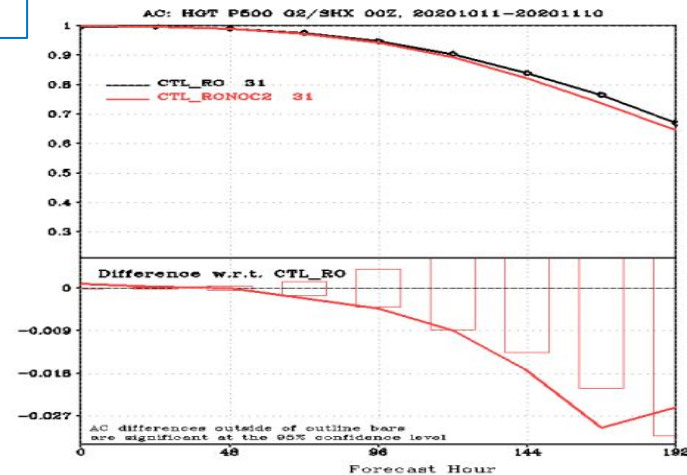
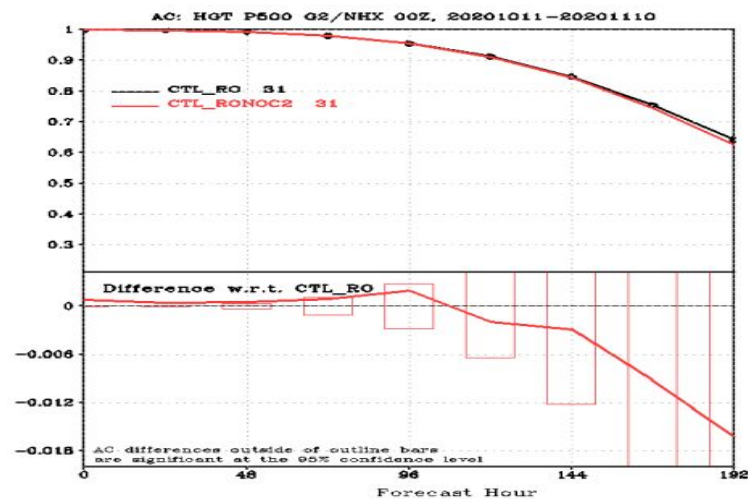


SH



Assimilation of C2

- NH: neutral impact
- SH: Significant positive impact





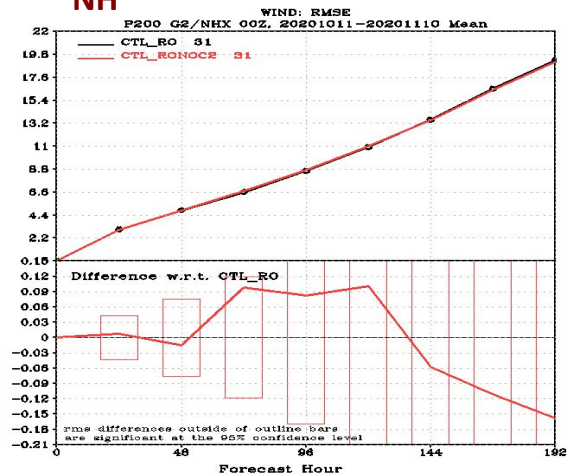
Neutral impact from C2
assimilation in the NH

Wind RMSE

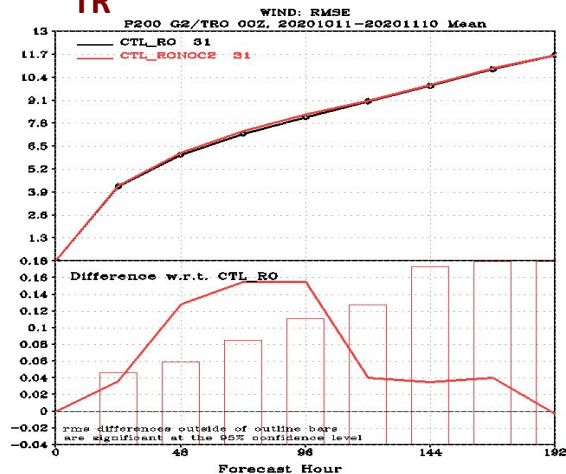
Positive impact from C2 in TR/SH (larger in upper levels)



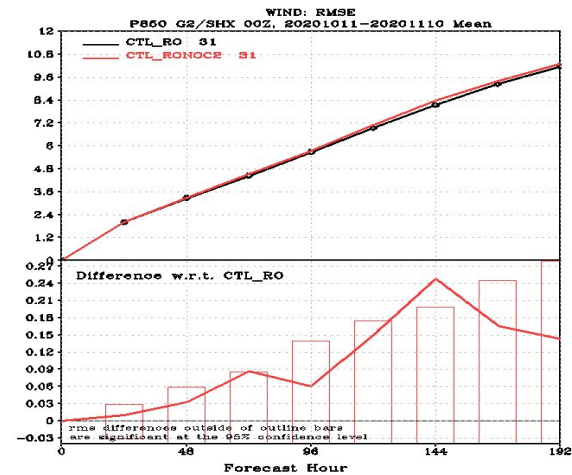
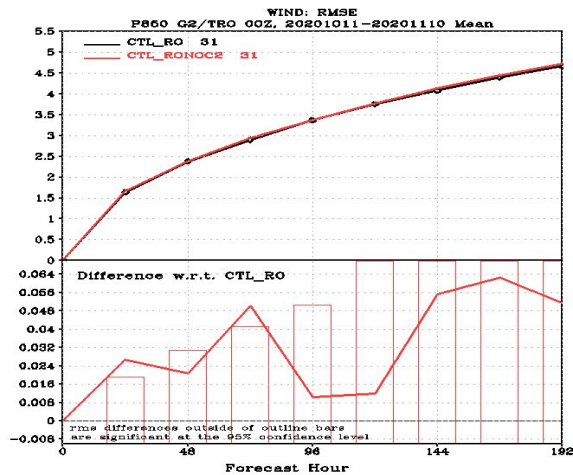
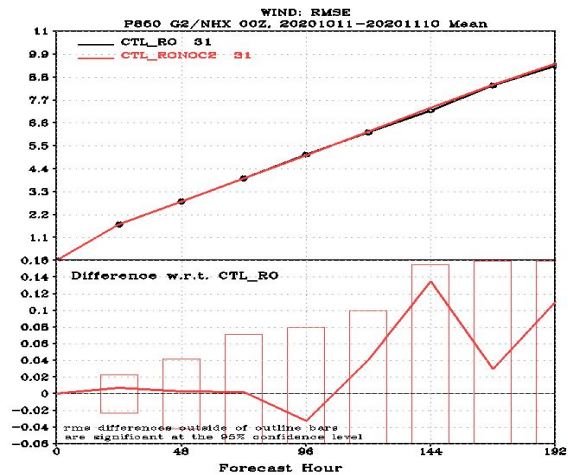
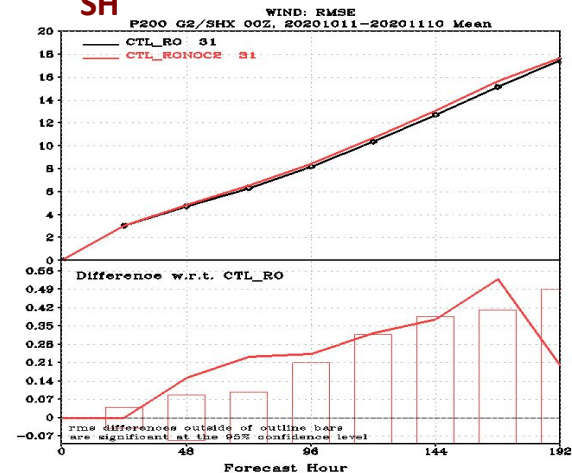
NH



TR



SH





Concluding thoughts

- Current positive impact from C2 – though a larger percentage of observations is rejected due to stricter QC
- Can we optimize performance by assimilating more C2 data?
 - Optimize observation error structures
 - Normalized innovations for C2 are too small – errors are too large.
 - Normalized innovations for non-C2 RO are slightly larger than they should be – errors are too small.
 - Optimize quality controls
 - Improve forward operators
 - Mix of C2 and commercial data