Impact of NOAA Low Latency LEO DBNet Constellation Infrared Sounder Data on GFS global forecasts

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Introduction

○ For the National Center for Environmental Prediction (NCEP) Global Forecast System (GFS), a huge number of satellite observations are actively assimilated, leading to increasing the impact of satellite observations in the weather forecast.

○ In order to ensure timely delivery of forecasts to the forecasters, the GFS is triggered after a predefined data cut off time. Thus, satellite observations that arrive later than the cut off time are not assimilated in the operational GFS.

○ Considering that the accuracy of the initial condition significantly depends on how many satellite data are assimilated in the NWP system, it is required to maximize the usage of satellite observation by speeding up the timely arrival of satellite observations at the GFS.

○ In this study, we made an attempt to assess the forecast impact depending on the different length of data latency of low earth orbit (LEO) satellite using the operational NCEP GFS data assimilation system.

Purpose of this study:

This study aims to asses the forecast impact under “what if” scenario where data latency is further reduced up to 20 minutes and 5 minutes rather than current data latency (more than 20 minutes).

Data and method

GFS (Global Forecast System)

○ Data assimilation system: Gridpoint statistical interpolation (GSI)
○ DA scheme: four-dimensional ensemble variational (4D-EnVar)
○ Analysis cycle:
- early run (00UTC) where the long-range forecast (up to T+160 hours) is provided.
- late run* (00, 06, 12, and 18 UTC) where the short-range forecast as a first-guess for next cycle run is provided.

* The late run is initiated 5 hours 50 minutes after the analysis hour, meaning the this cycle is not affected by data latency and all available satellite data are assimilated

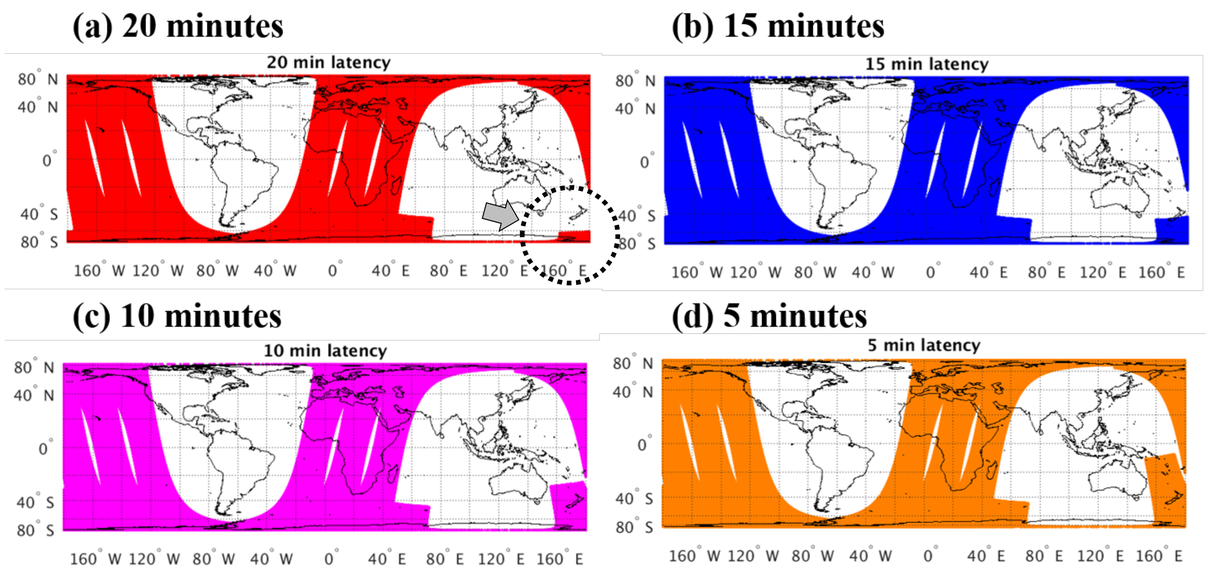
Satellite data

○ AMSU-A (NOAA-15, 18, 19, Aqua, and MetOp-A/B)
○ MHS (NOAA-17, 18, 19, and MetOp-A/B)
○ AIRS (Aqua)
○ IASI (MetOp-A/B)
○ CrIS and ATMS (S-NPP and NOAA-20)

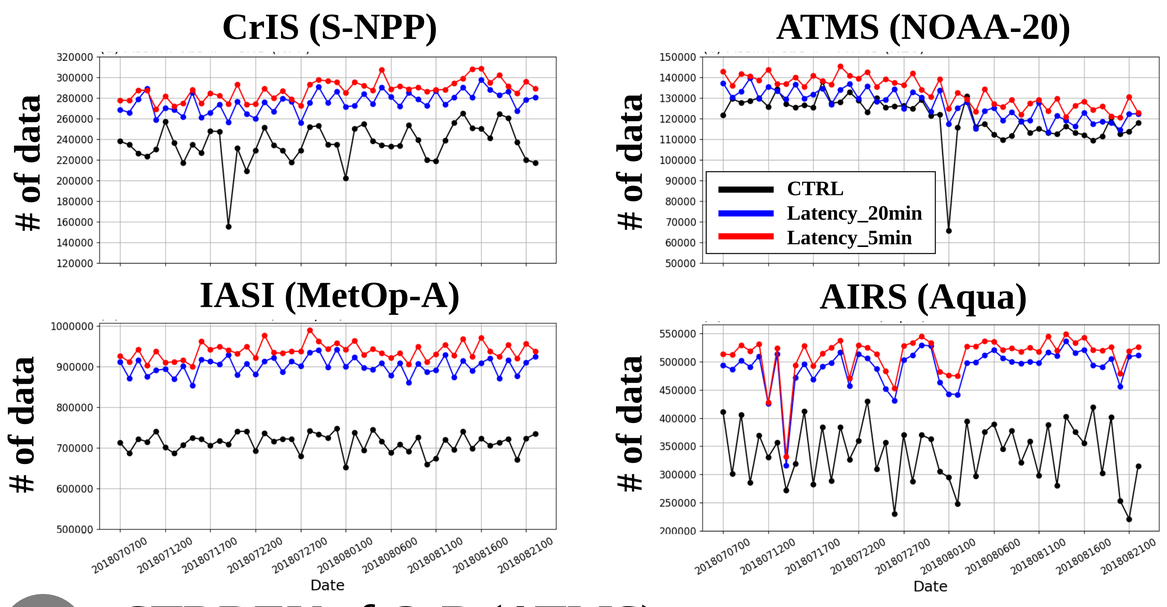
Trial experiment

○ Period: 30 June – 22 August 2018, including 7-days of spin up (30 June – 6 July)
○ Three trial runs:
- Control run (CTRL) with Operational set-up (data latency > 20 min)
- Experimental run 1 (EXP1) with 20 minutes of data latency
- Experimental run 2 (EXP2) with 5 minutes of data latency

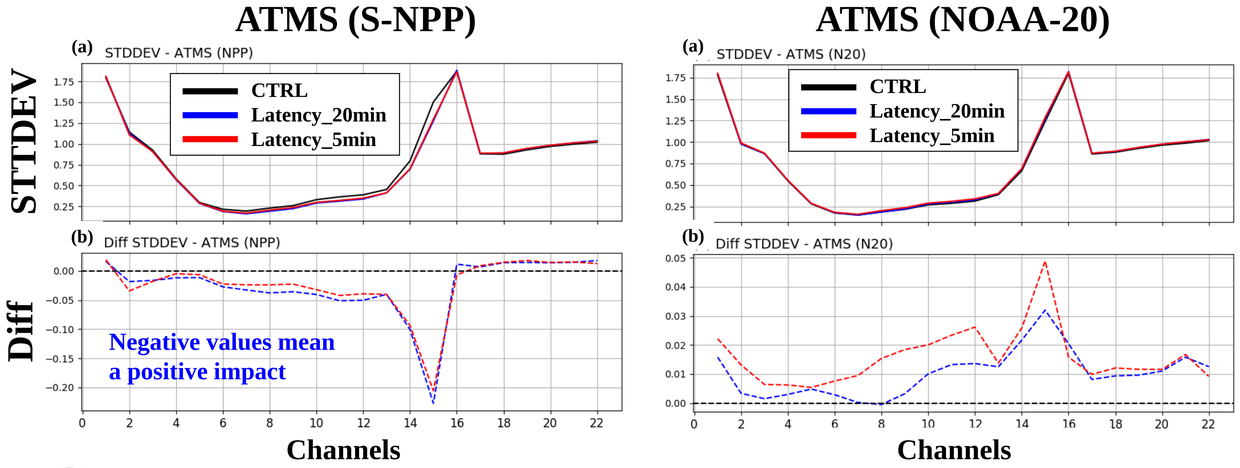
CrIS data depending on different data latency



Times series of data

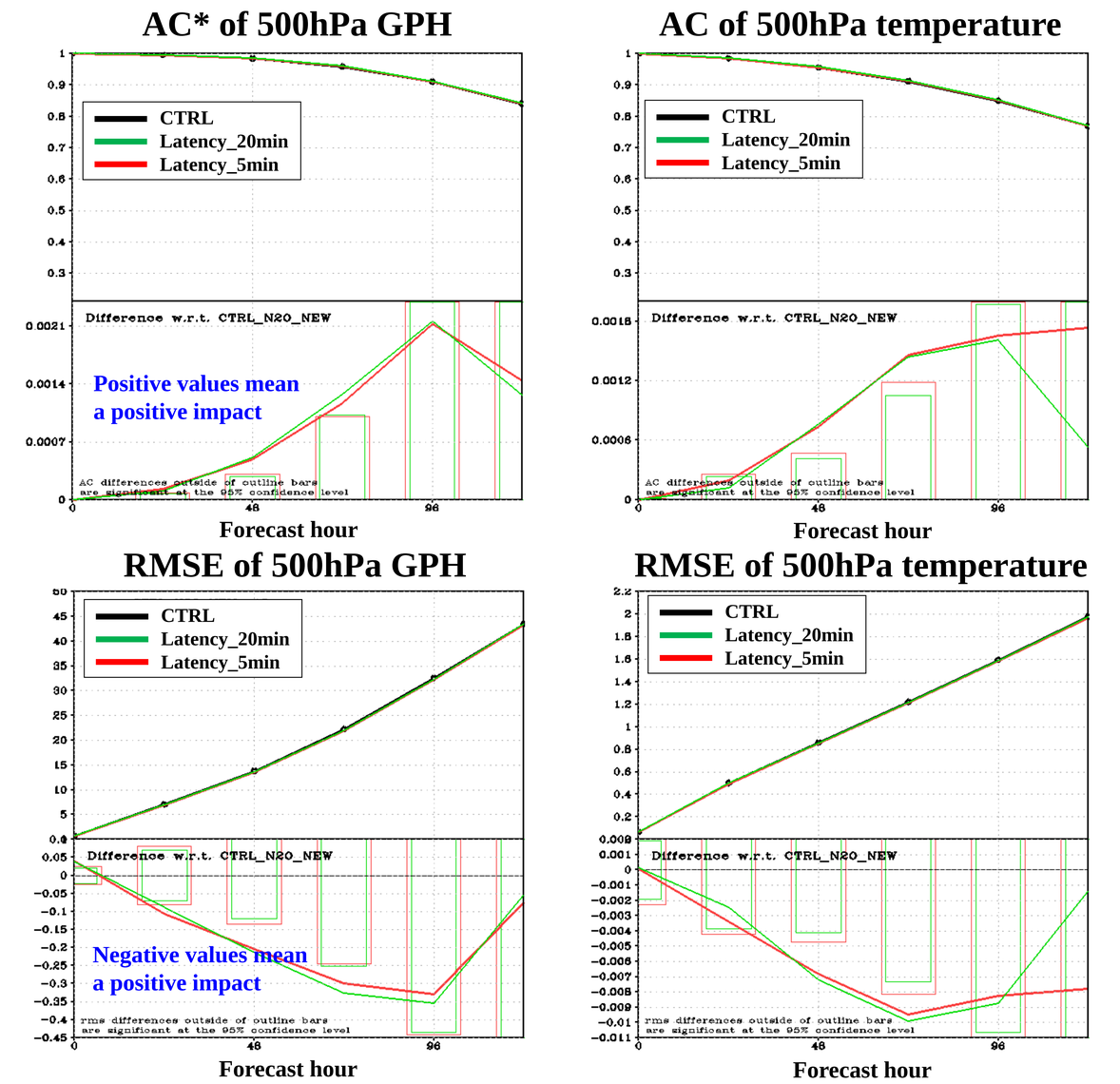


STDDEV of O-B (ATMS)



Forecast impact

* Anomaly correlation (AC)



Summary

○ Reducing the latency time to 5 minutes increases the number of assimilated LEO satellite observations up to a maximum of about 20%, and the positive impact is shown in a range of T+0 to T+72 forecast hours.

○ It suggests that reducing the latency time by adding the global broadcast stations and optimizing the data processing system can contribute to improving the weather forecasting accuracy.