

Progress towards a global hourly-updating data assimilation system

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Motivation for hourly updates

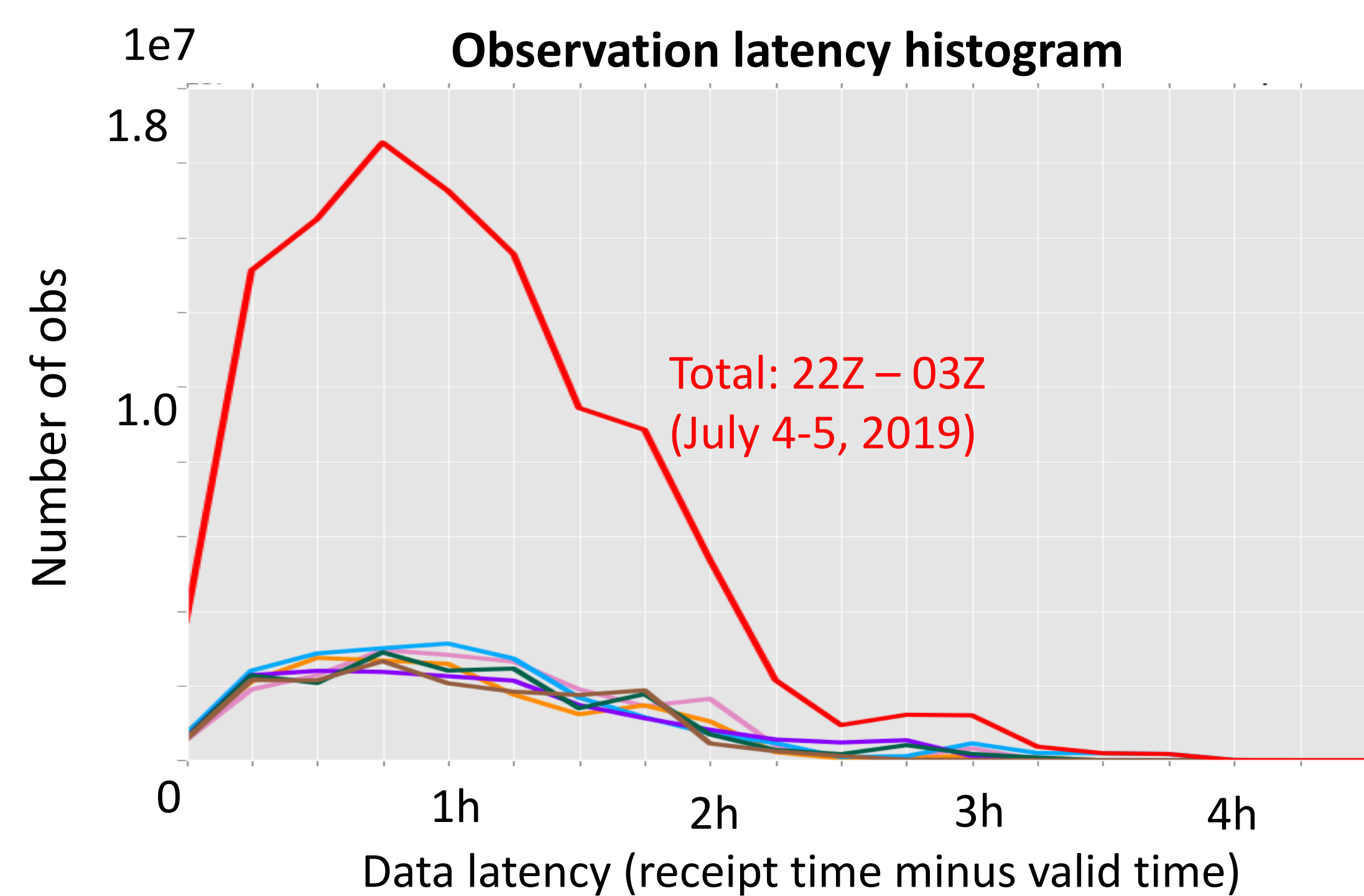
- The current operational global forecast system assimilates observations in 6-hour cycles
- Not frequent enough to accurately constrain hurricane positions
- High-res regional models need an intermediary for hourly lateral boundary conditions
- Want to take advantage of high frequency observations

Experiment setup

- US Global Forecast System: FV3GFSv15
- Hybrid gain assimilation method (similar to Kalman filter, but gain matrix is linear combination of ensemble gain and 3DVar gain)
- 4D incremental analysis update (IAU) to prevent gravity wave noise from dominating the short-term forecast (used in control, not hourly)
- Extra ensemble inflation added to hourly (previous results suggested that hourly updates without IAU had inadequate ensemble spread)

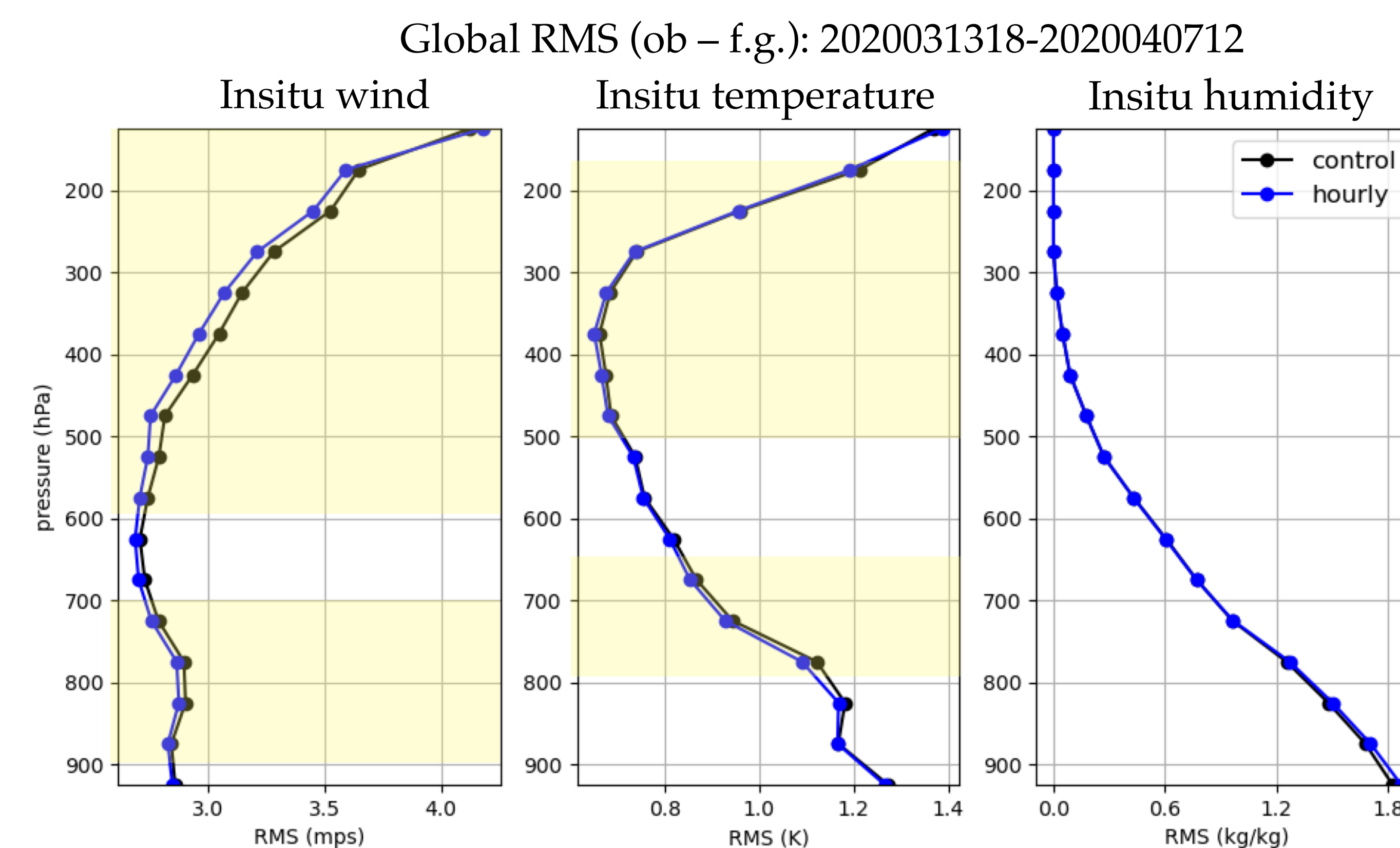
Challenge: delayed observations

- Issue for real-time hourly assimilation: many observations arrive 1-3 hours after their valid time



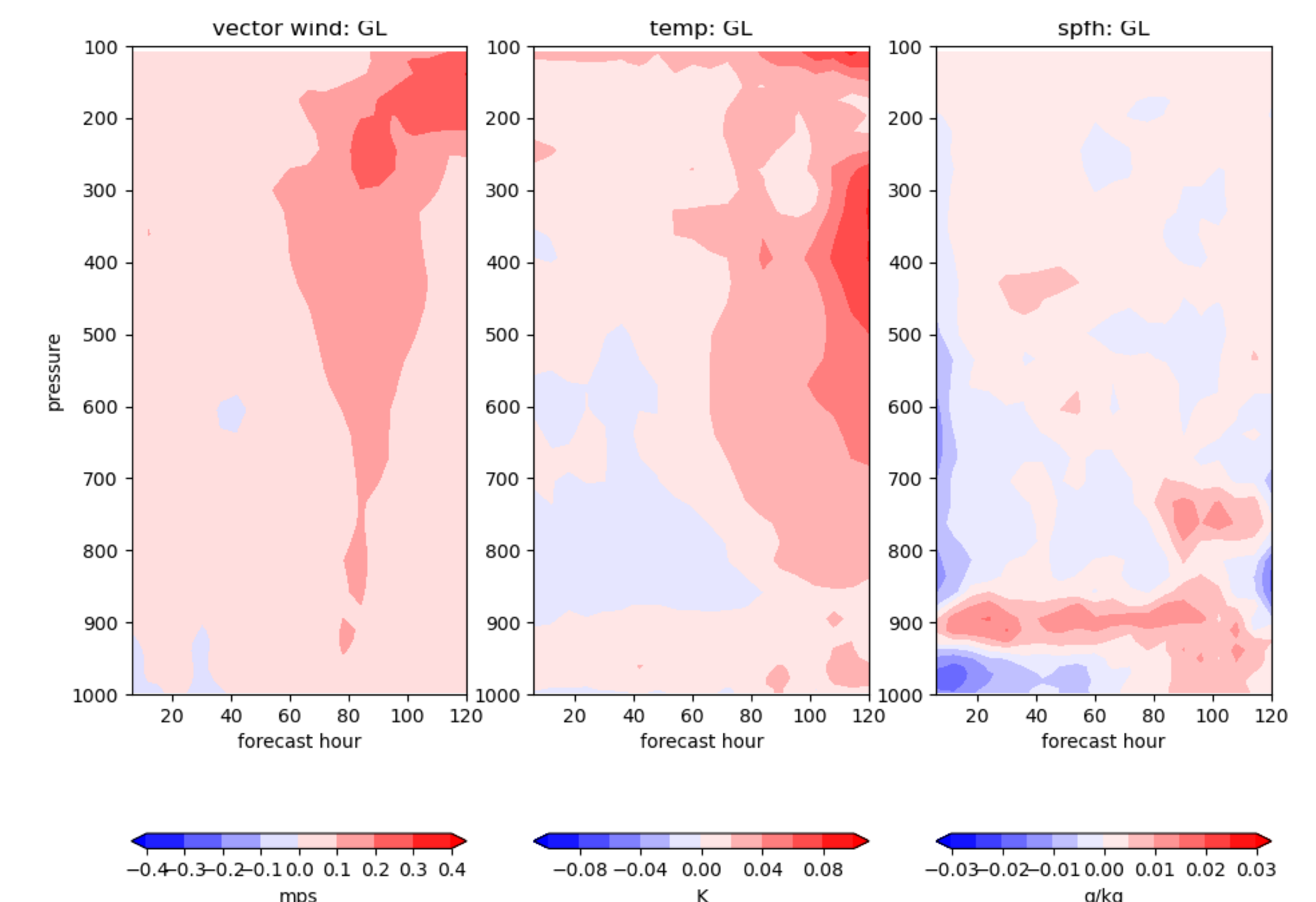
Note: this figure does not include many conventional observations, which are generally low-latency.

Results



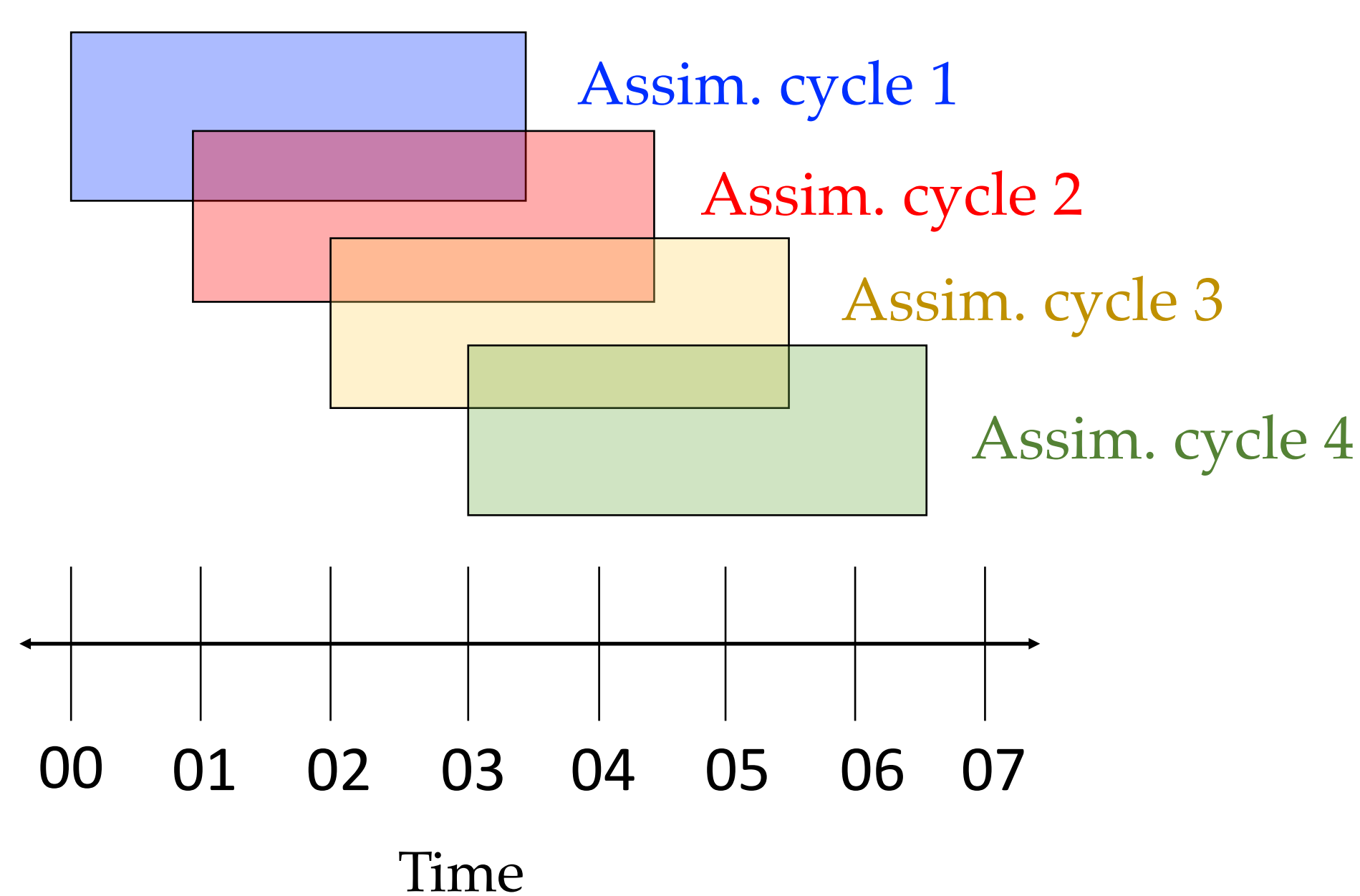
- Short (4-6h) forecast RMS fit to in-situ observations (yellow shading denotes significant differences): **hourly DA significantly outperforms 6-hourly control in preliminary test.**

RMSD relative to IFS analysis: hourly minus control 20200314-20200320 (00Z)



- **Long forecast** fit to IFS analyses (blue=hourly expt is closer to IFS analysis than control): small differences for first 2-3 days; growing differences at 5 days may not be significant. **Generally encouraging results.**

Solution: overlapping windows



Update every hour, assimilating observations that have **arrived within the past hour** and are **valid within the past 3 hours**

- Duplicate obs are removed so that **each ob is only assimilated once!**

Conclusions & next steps

- Overlapping windows provide a viable method to overcome the challenge of data latency in a real-time global hourly assimilation system
- Results suggest performance is similar to current operational setup, with the benefit of providing updates every hour
- Next steps:: test using this method to provide boundary conditions to regional models; assimilate high-frequency observations not currently assimilated operationally