Wavelet Satellite Data Thinning and Targeting Observations

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Introduction

- Satellite data is huge in size for data assimilation and a thinning scheme is necessary;
- Conventional data thinning by skipping observation data at regular intervals, may not be the best way to preserve information and save space and compute time;
- Using a targeting method, a high observation data impact region can be identified of more manageable size;
- A sophisticated wavelet thinning technique can keep maximum fine scale information over the data sensitive area while saving more space over other less impact areas.

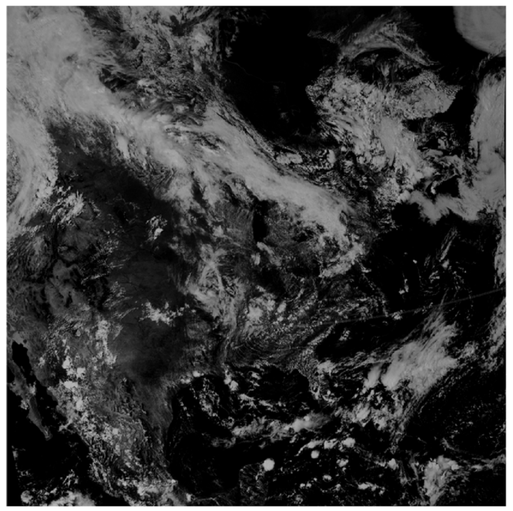
Wavelet Thinning Concept

- Wavelet transformation is a localized orthogonal or bi-orthogonal transformation;
- It is more flexible to deal with data over non-periodic regional domains;
- For targeting observation areas, both fine scale and coarse scale wavelets are computed; only fine scale wavelets are applied in the target area.

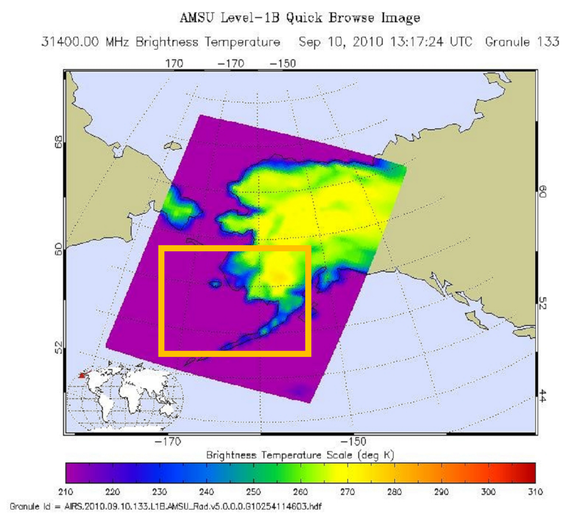
Targeting Observation

- Targeting observation methods identify data sensitive areas for improving weather forecasts;
- Fine scale satellite data could contribute the forecast improvement.
- A wavelet thinning could allow users to select areas for fine scale thinning and applied coarse thinning over others so satellite data would be used more efficiently.

This is a full satellite image of visible channel nominal resolution.

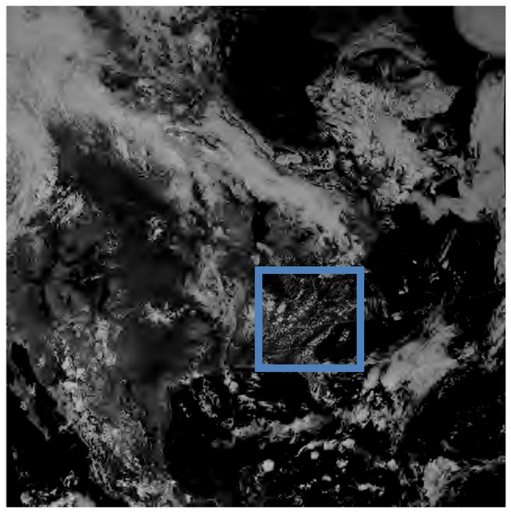


It covers the US, Atlantic, and Gulf of Mexico area; The data size is 5120 x 5120 points.



The above figure illustrates a domain of interest with a sensitive area marked with an orange rectangle. Only fine scale data in this area could help improve forecasts.

The targeting observation areas is assumed in the blue rectangular box below.



The size of the satellite data is reduced from 25MB (full resolution) to less than 0.4MB (wavelet-thinned); Since the fine scale information is kept, a similar GSI analysis is expected.

Conclusion

A wavelet thinning would thin the data by 600 times so that GSI or other data assimilation techniques greatly improve the forecast with a little expense on the satellite data.

Future Work

A test of GSI with full and the thinned data and evaluate the cost/benefit.