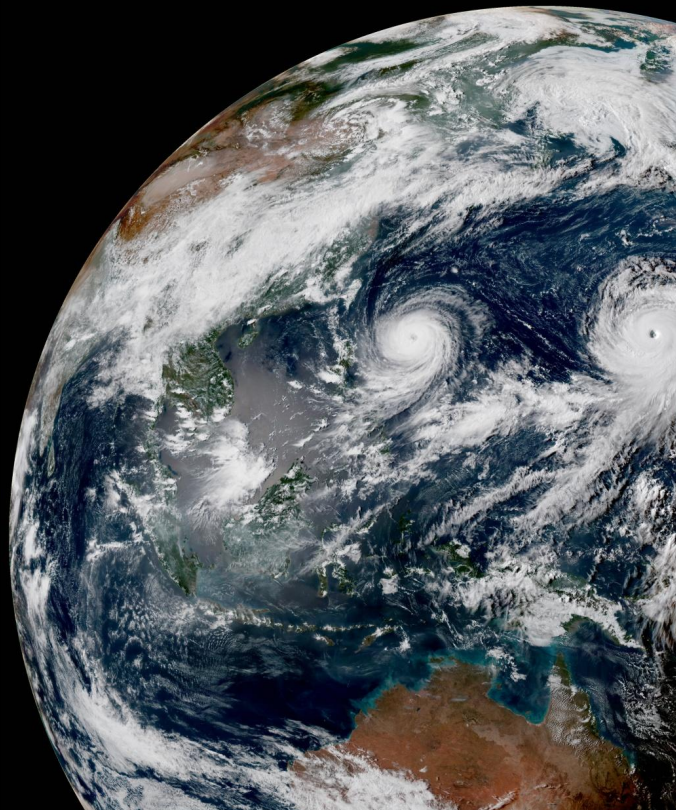
Evaluation of background error models for JEDI-based data assimilation.

Dan Holdaway (JCSDA), Benjamin Ménétrier (JCSDA) and Catherine Thomas (NOAA-EMC)

Collaborators: Yannick Trémolet (JCSDA), BJ Jung (NCAR), Marek Wlasak (Met Office), Ricardo Todling (NASA), Jeff Whitaker (NOAA)



BUMP Static B

Training setup for GFS:

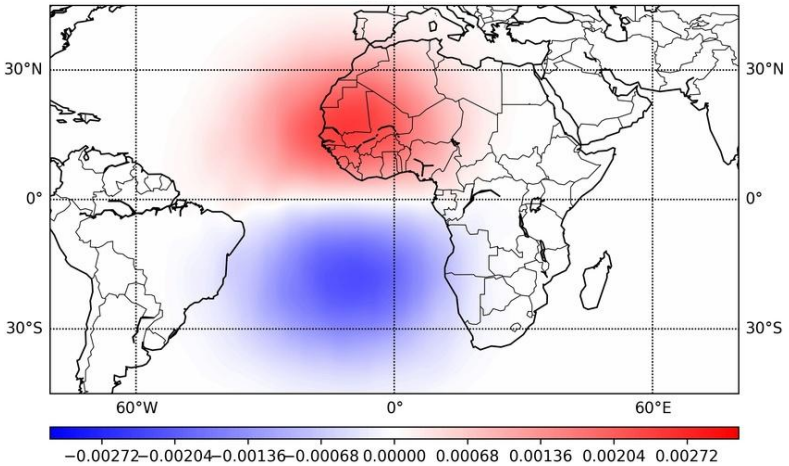
- GFS ensemble at C384 (25km) L127 covering Jan 2020 and July 2020. 4960 members total, requiring 50Tb of data. Initial testing with ~30% of the data to cement the infrastructure.
- Ensemble converted to stream function and velocity potential using cubed sphere Poisson solver. Stored on AWS-S3 for community use.
- Workflow for staging data, running transforms, checkpointing and generating vertical balance, standard deviation and correlation statistics. Initial training completed on AWS to avoid high egress costs.
- Workflow includes checkpointing so training does not need to be restarted to add more members and can remain flexible to available resources.

Dirac test for BUMP static B

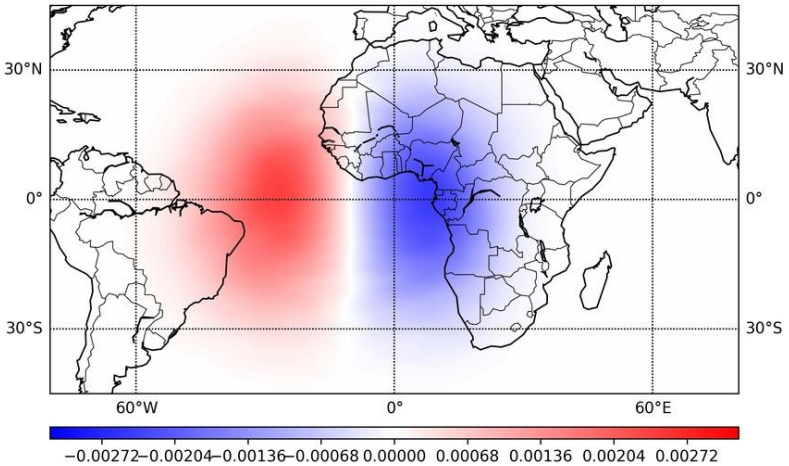
Perturbation of 1.0K at 0ºN, 0ºE and a height at around 500hPa, 0.0K everywhere else.

Response shows the expected dipole in the resulting wind perturbation.

Zonal Wind Response (ms^{-1})



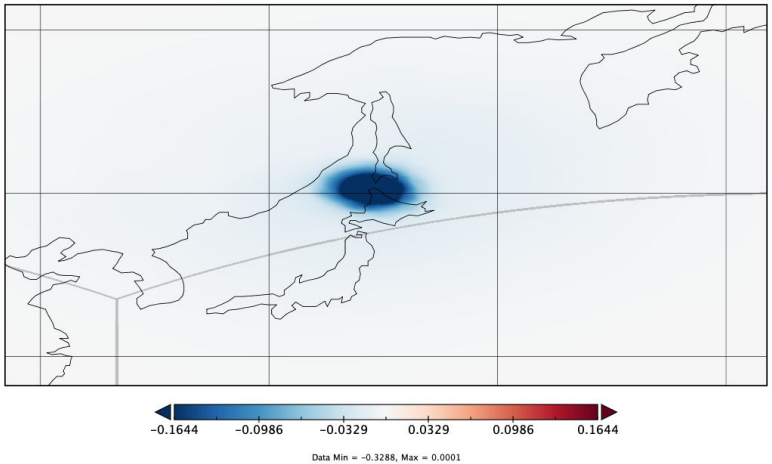
Meridional Wind Response (ms^{-1})



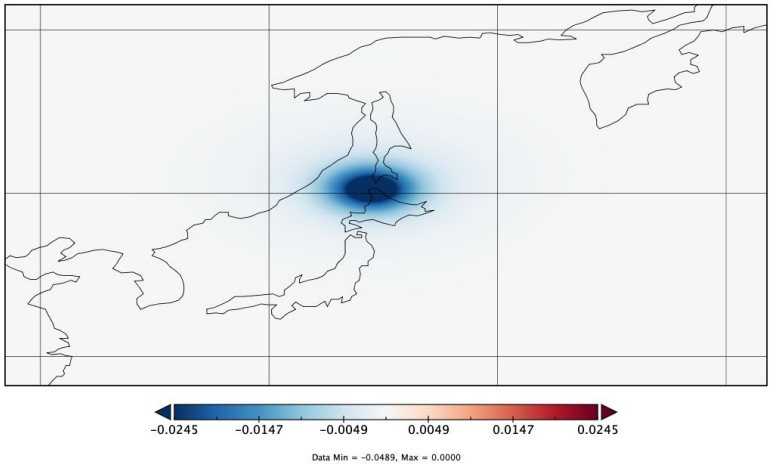
Comparison of JEDI and GSI

- Single radiosonde observation located at 45.4°N, 141.7°E and 500.0hPa.
- Model backgrounds at C768 (~12.5km) and increment at C384 (~25km).
- 3DVar (no ensemble and no TLNMC in the GSI run).
- Cubed sphere increment for JEDI, Gaussian grid for GSI.
- 2020-12-15T00:00:00

JEDI Temperature Increment at ~500hPa (K)



GSI Temperature Increment at ~500hPa (K)

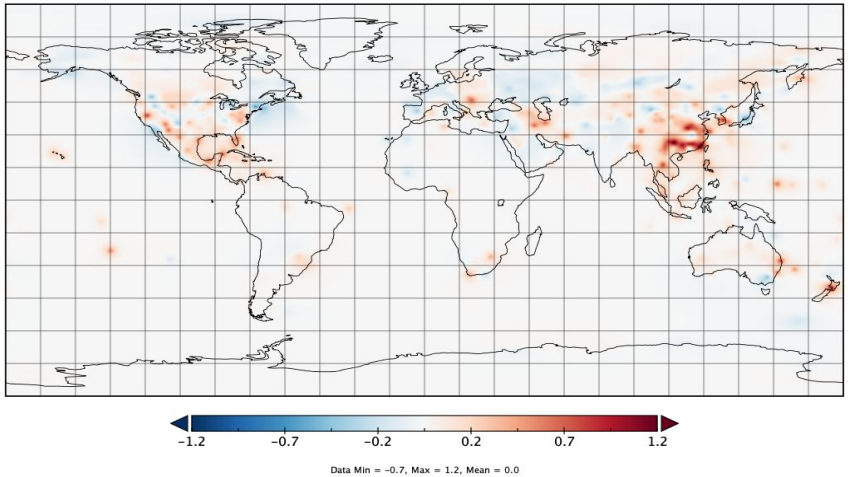


Structures look reasonable but the increment is quite a bit larger in the JEDI system.

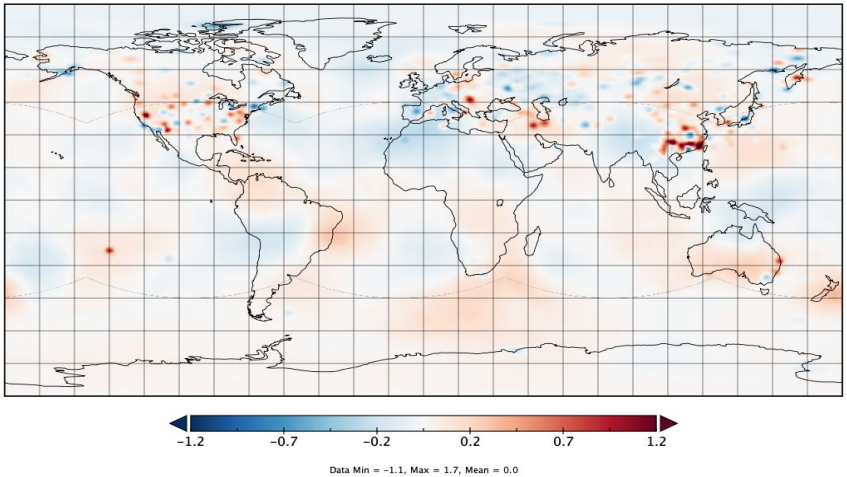
Comparison of JEDI and GSI

- All radiosonde observations.
- Model backgrounds at C768 (~12.5km) and increment at C384 (~25km).
- 3DVar (no ensemble and no TLNMC in the GSI run).
- Cubed sphere increment for JEDI, Gaussian grid for GSI.
- 2020-12-15T00:00:00

JEDI Temperature Increment at ~150hPa (K)



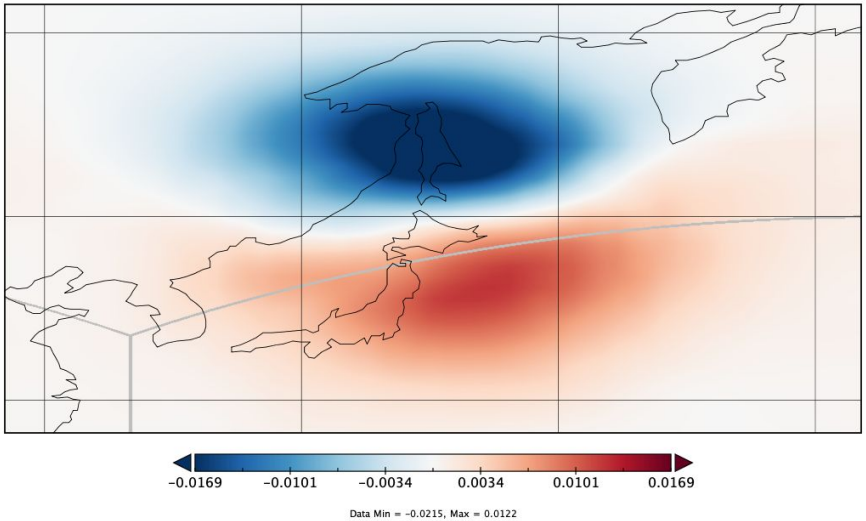
GSI Temperature Increment at ~150hPa (K)



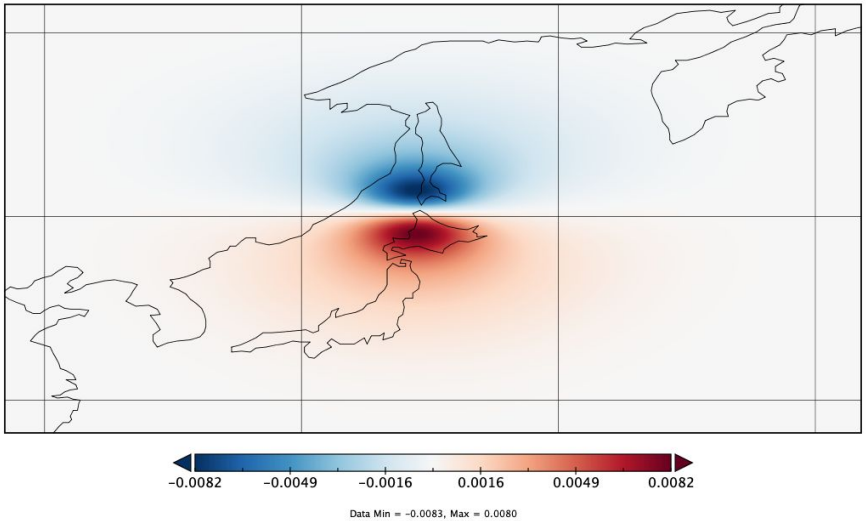
Comparison of JEDI and GSI

As can be seen from this single observation test the response to a temperature observation in the zonal wind is too large scale. Some tuning is underway to adjust these scales.

JEDI Zonal Wind Increment at ~500hPa (ms^{-1})



GSI Zonal Wind Increment at ~500hPa (ms^{-1})



The full sample will be needed to reduce the scales in wind.

Summary

- Training was completed with a subset of the ensemble so drawing strong conclusions is tricky.
- Nevertheless there are encouraging signs that BUMP is producing reasonable statistics.
- Training will be completed with the entire ensemble.
- The GSI recursive filter will be added to SABER to provide additional tools and a way of making more direct comparisons with BUMP.