Background error covariance progress

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Background Error Covariances – Story so far!

1. Creating a static background error covariance model similar to what is done operationally in VAR.

Features:

1. Linear variable change that applies hydrostatic balance, linear balance, vertical regression, equation of state, humidity control variable.

2. Have the spatial spreading done spectrally using ECMWF's TRANS library via an atlas interface.

3. We are reading in covariance statistics in um-jedi (SABER is not involved!)

Differences:

1. Uses EndGame grid (not NewDynamics) … i,e. only v component at the poles and extra level in theta, moisture at surface. Wind transforms needed to be adapted accordingly.

2. For control variables (streamfunction, velocity potential, unbalanced pressure and moisture control variables) we interpolate to a Gaussian grid before going into spectral space. Operationally we have a finite volume approximation to the spectral transform that is hardwired to the NewDynamics grid.

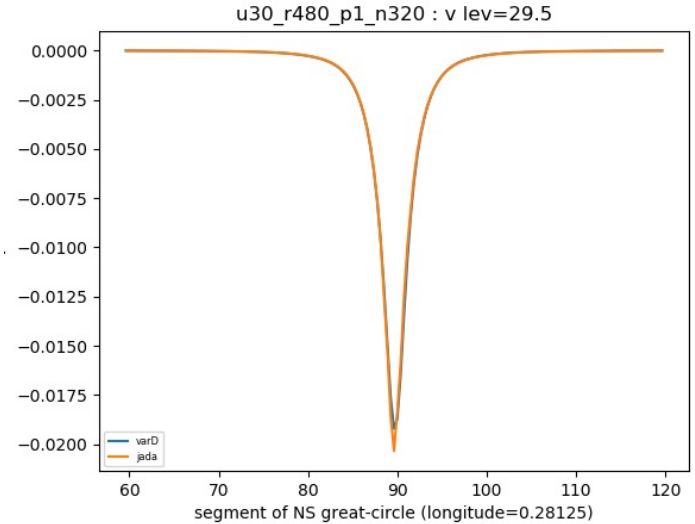
3. Moisture control variable is currently linear (based around background) unlike the operational one.

4. No dust, no visibility control variables yet.

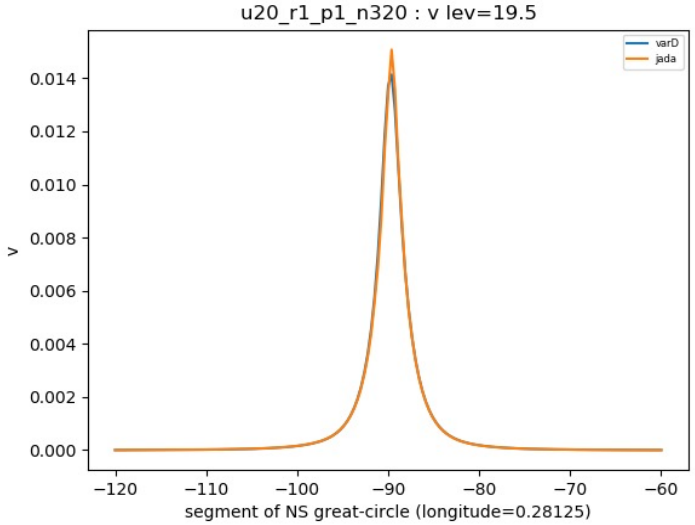
Dirac test results

Plots shows v for part a longitude great circle, with sign reversed on crossing the pole.
Strong agreement between all variables except moisture (where the science is different).

Dirac $\mathbf{d}$ in u level 30, row 480, point 1 (near N pole)



Dirac $\mathbf{d}$ in u level 20, row 1, point 1 (near N pole)



Background Error Covariances – Story so far!

2. Creating a static background error covariance model based on this for LFRic using what we have done with the EndGame grid.

So far:

1. Refactored ErrorCovariance to separate the interpolation and interpolation adjoint from the spectral part.
2. Capability to interpolate from Gauss grid to cubed-sphere and adjoint (done in prototyping).
3. Created atlas LFRic geometry in um-jedi (in review).

To do:

1. Extend um-jedi to read LFRic files and generalize state, increment, model classes.
2. Adapt current linear variable change (control 2 analysis to work for both EndGame and LFRic)
3. Redo the wind transform and linear balance in spectral space.
4. Move code to alternate repositories if possible. (SABER, VADER) etc.

Questions

1) Is there a plan to have a generic NetCDF data format for dumping/reading covariance statistics in JEDI?
2) How developed is the workflow for generating covariance statistics. What is currently being used? How generic is the workflow? Is it tied to BUMP?