Validation of JEDI Software for NCEP's Unified Data Assimilation System

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Introduction

- **Data Assimilation (DA) is** the science of combining observations with prior forecasts.
  - Compares short-term forecasts to observations valid at the same time

- **The Joint Effort for Data Assimilation Integration (JEDI)** is a collaboration between NOAA and federal partners for a new DA framework.
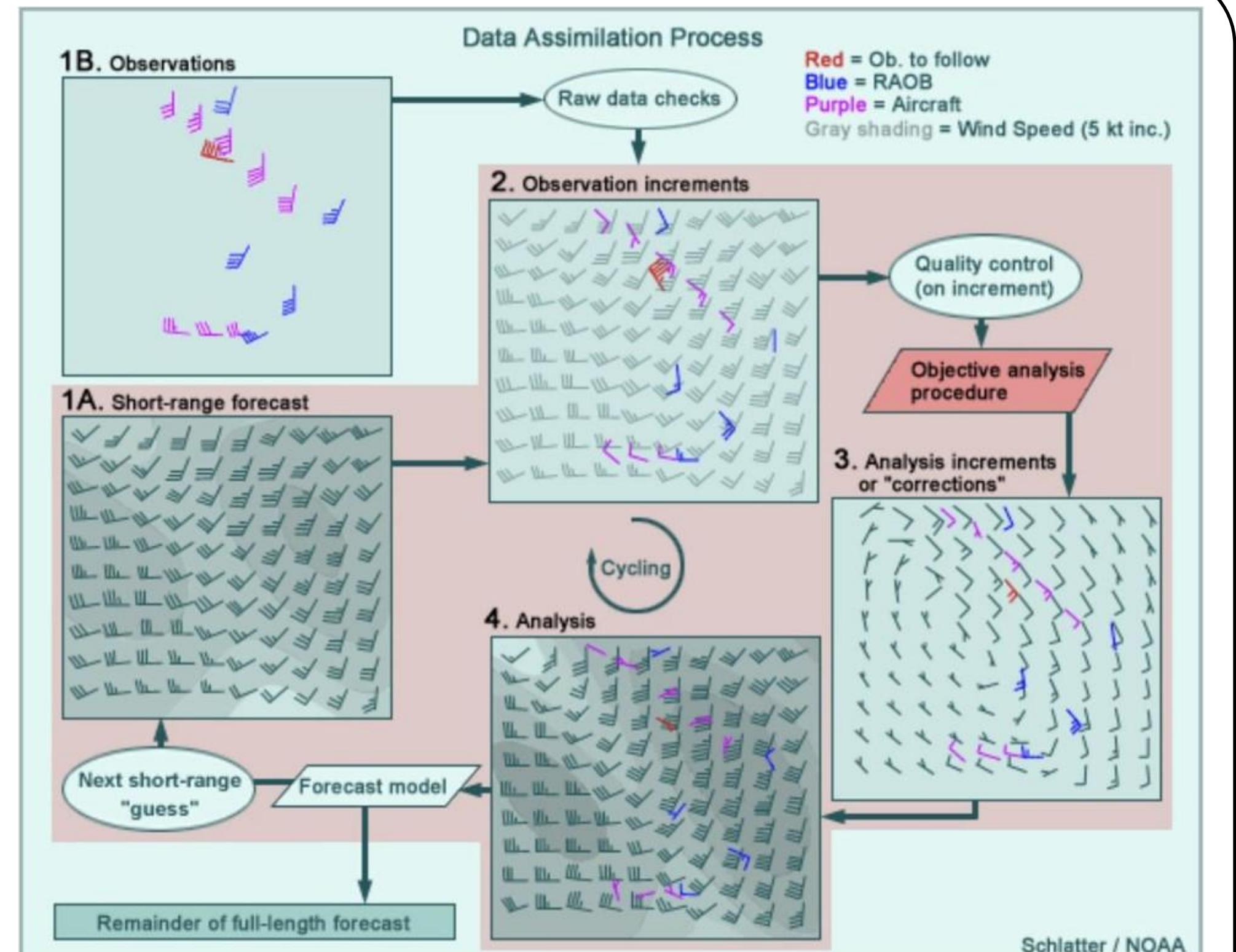
Credit: UCAR 2015

Methods

Project Goal: Examine JEDI software for scientific validity and potential bugs.
- Single observation impact tests using air temperature
- 3DVar assimilation on a forecast from the Global Forecast System (GFS)
- Innovation values of +5 Kelvin

Hypothesis: Impact tests should result in isotropic increments that are consistent spatially and computationally.

Independent Variables	Dependent Variables
Latitude / Longitude	Increment Temperature
Pressure	
	Increment Wind
Observation Error	
Background Error	
	Computation Time
Processor Count	

```
obsdataout: singleob.nc
lockeys:
    latitude: 0.0 # degrees
    longitude: 0.0 # degrees
    datetime: '2021-08-01T00:00:00Z'
    pressure: 100000.1 # pascals
variable:
    name: 'air_temperature'
    obsvalue: 300 # kelvins
    obserr: 1.0
    preqc: 0
```

Sample observation file

Key Terms

First Guess
- a short-range model forecast

Innovation: obs. - forecast
- how the observations differ from the first guess

Increment: analysis - forecast
- corrections to the first guess after data analysis

Isotropic:
- Background model errors are distributed evenly in the x- and y- planes

Results & Findings

Increment | 0,0 | Air T at 1000 hPa
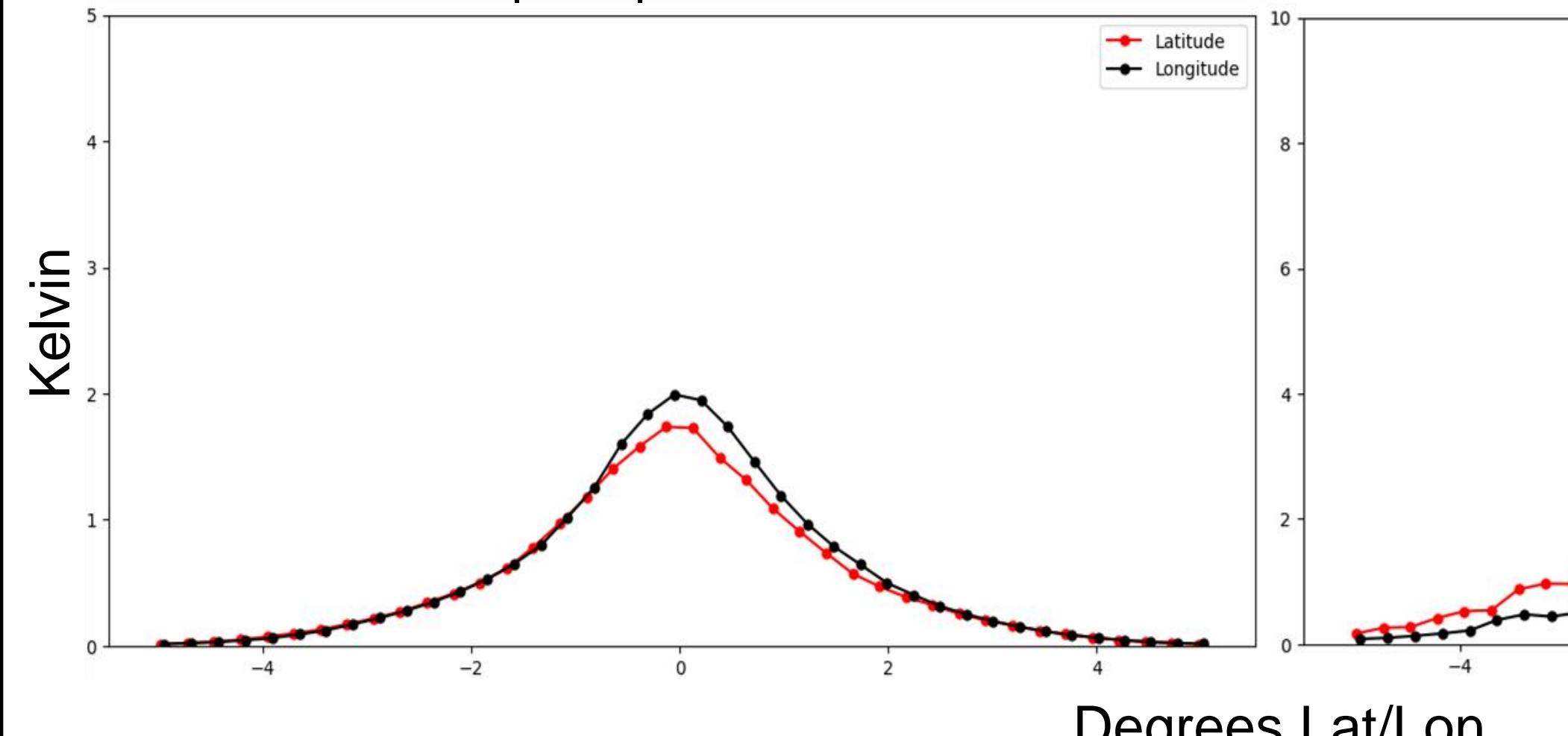
Increment | 0,0 | Air T at 1 hPa
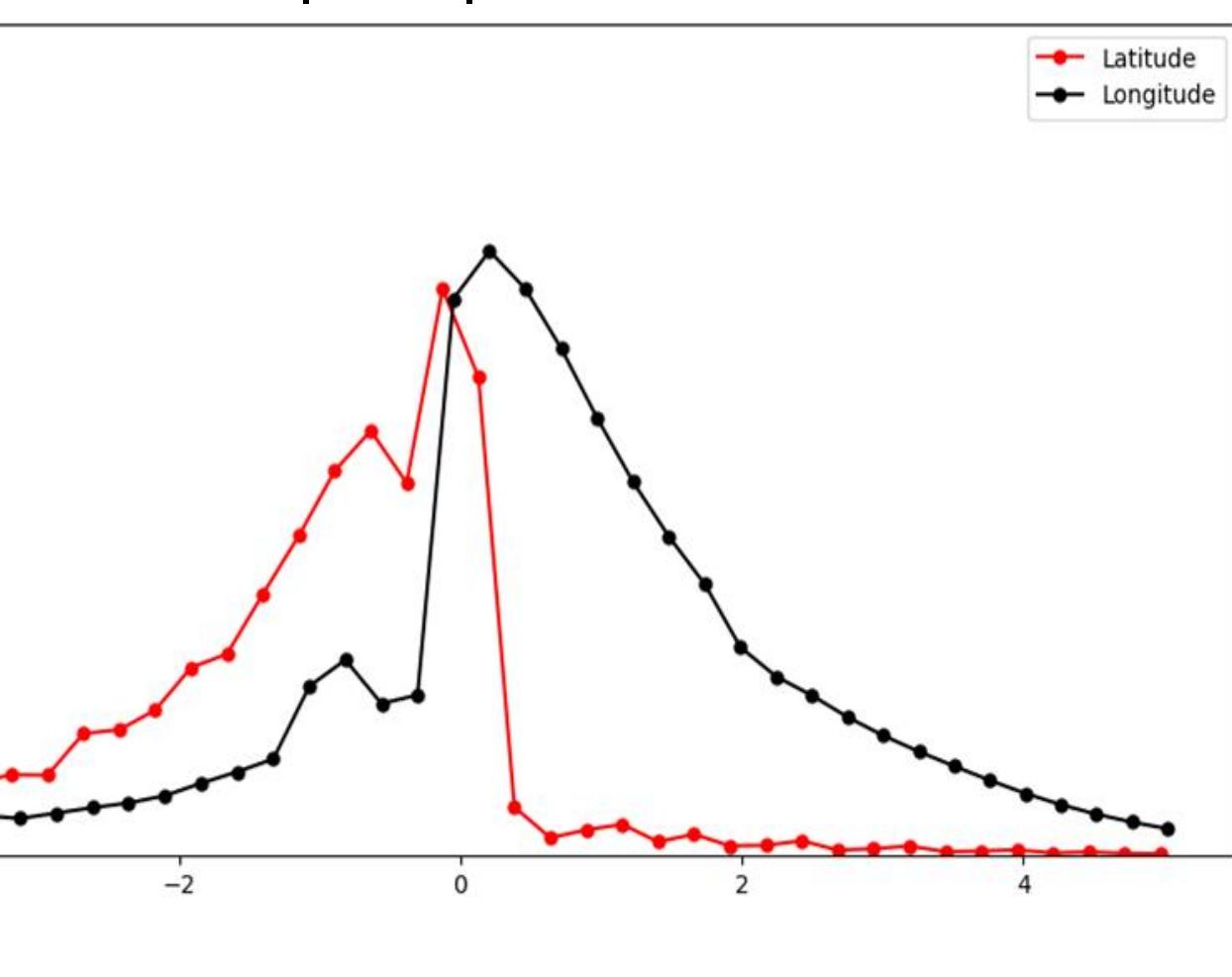
Increment | 0,0 | Air T at 1000 hPa
216 CPUs   294 CPUs

Kelvin (shading)
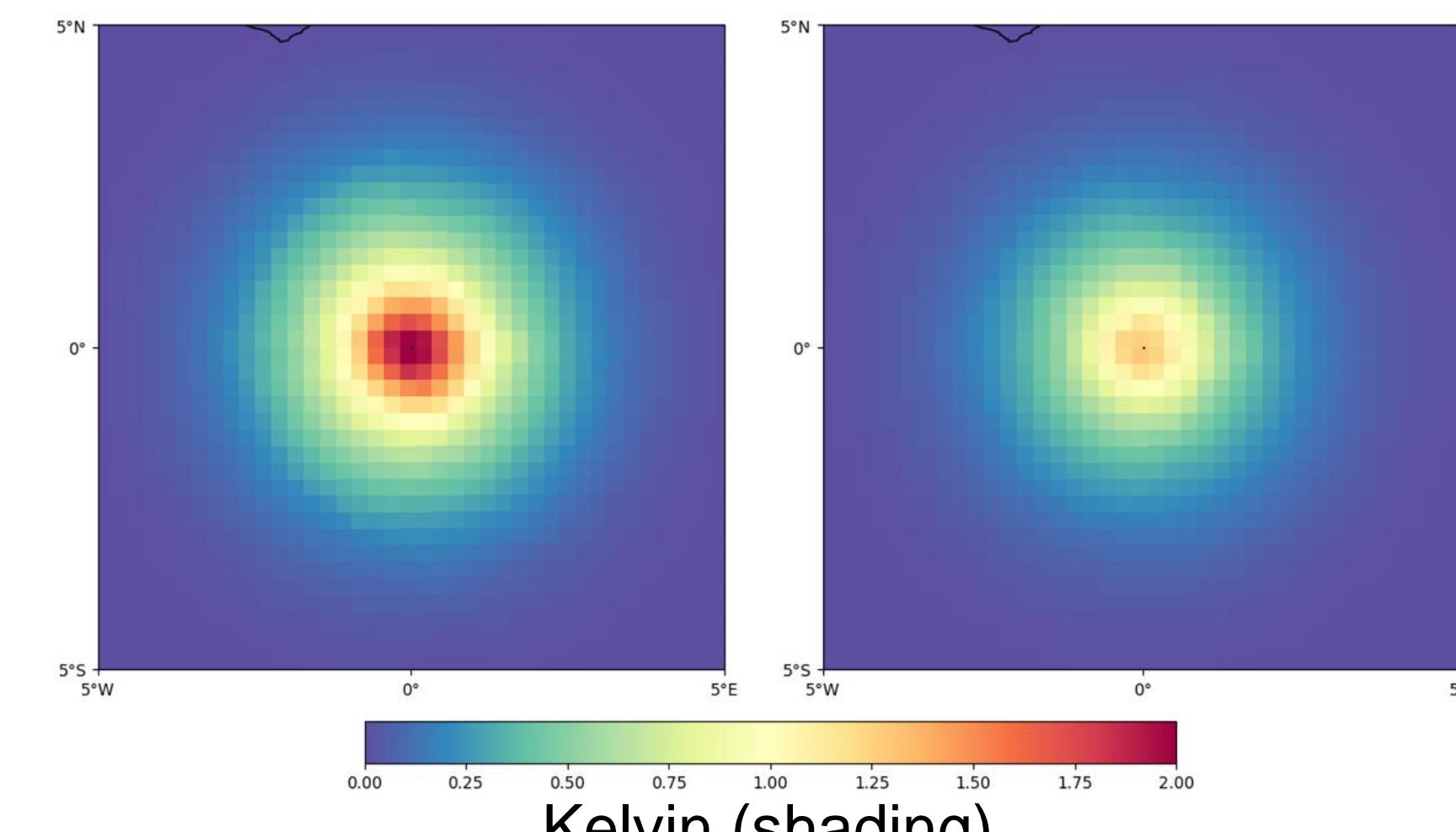
- Impact tests created isotropic increments of air temperature in most model layers.
- Changing values for observation error and background error impacted the magnitude and shape of the gaussian distributions, respectively.
- Above 10 hectopascals, increment fields became noisy or incoherent.

- Increasing the processor count changed the magnitude of the resulting increments.
- The analysis procedure was not reproducible on different machine configurations.

Conclusion: Issues of reproducibility and non-physical results are being investigated before JEDI software becomes operationally ready.