Regional MPAS-JEDI

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What are differences from global MPAS-JEDI?

1. namelist.atmosphere

```
&limited_area
   config_apply_lbcs = true
/
```

2. streams.atmosphere

```
<immutable_stream name="lbc_in"
                  type="input"
                  io_type="pnetcdf,cdf5"
                  filename_template="lbc.$Y-$M-$D_$h.$m.$s.nc"
                  filename_interval="input_interval"
                  packages="limited_area"
                  input_interval="3:00:00" />
```

You need to set this, but no need of LBC file.

3. 3denvar.yaml

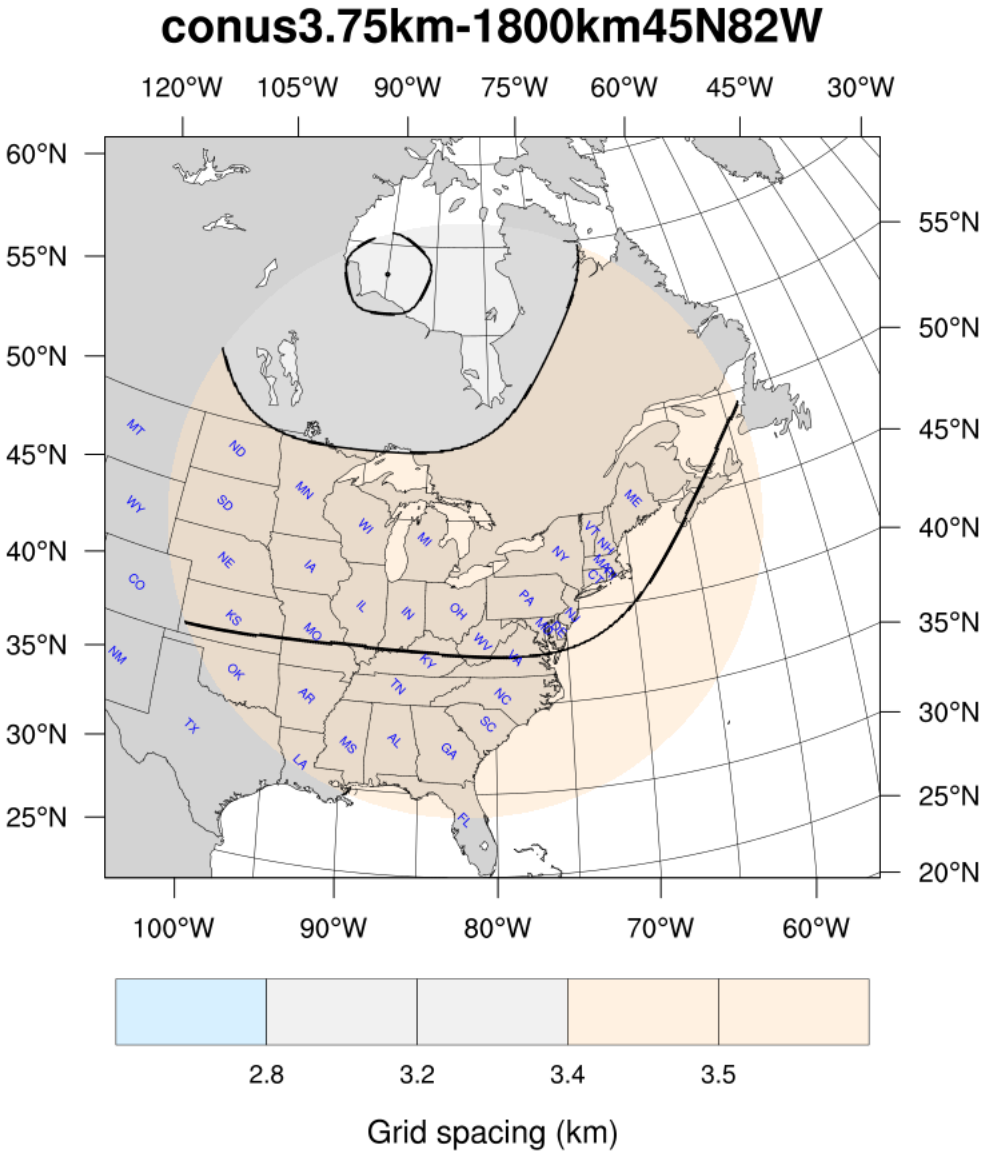
```
obs filters:
- filter: Bounds Check
  filter variables:
  - name: airTemperature
  - name: windEastward
  - name: windNorthward
  - name: specificHumidity
  test variables:
  - name:  LAMDomainCheck@ObsFunction
    options:
      map_projection: circle # an option
      save: true # will save the Derived
      cenlat: 40.0    # central lat
      cenlon: 260.0  # central lon
      radius: 2750.0  # km
  minvalue: 1.0 # will filter all obs ou
```

Reject obs outside a circular domain

Recent update about regional obs filtering

- Latest code has another more generic way to reject obs outside a regional domain of any shape

Regional **hybrid-3D/4DEnVar at 3.75km** over Eastern US



Ensemble B (weight 0.6): from 30-member ensemble input at 15km mesh from MPAS downscaled forecasts from GEFS ICs

Static B (weight 0.4): univariate, statistics from 960 downscaled 6-h ensemble forecasts

2-week period 6-hourly cycling: 7 – 18 July, 2023

assimilates:

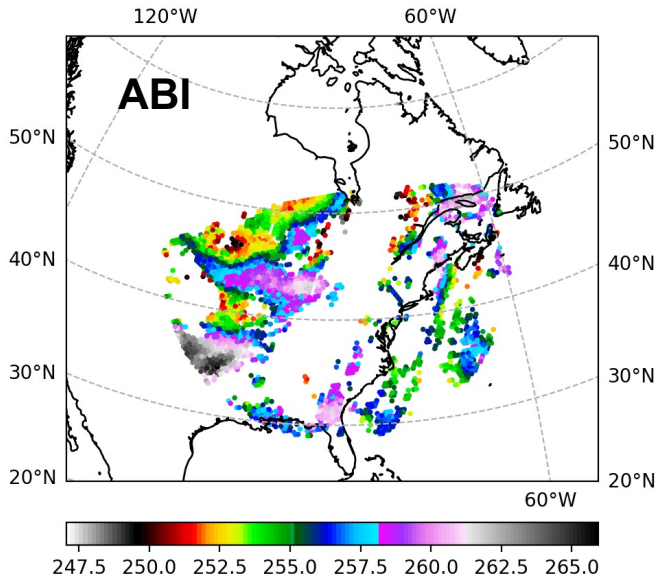
- T/Q/U/V from radiosonde
- T/Q/U/V from aircraft
- U/V from satellite track winds
- GNSSRO refractivity
- surface pressure
- +- 3-h time window

2 experiments:

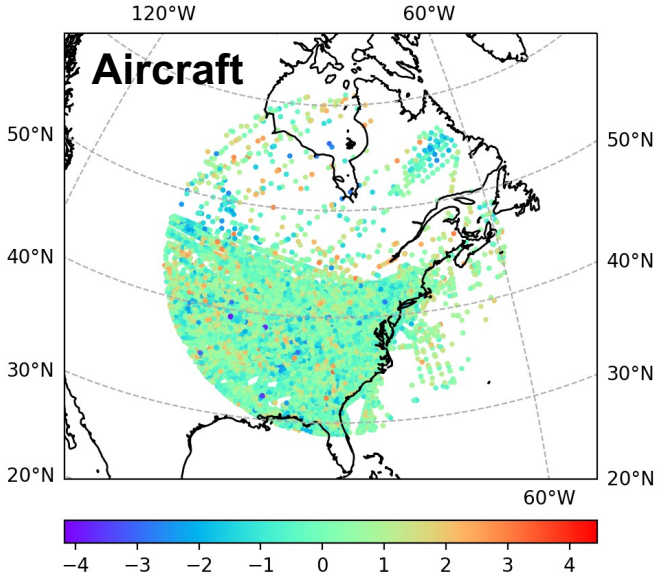
- Hybrid-3DEnVar
- Hybrid-4DEnVar

Obs coverage (all vertical levels together) at 2023070900

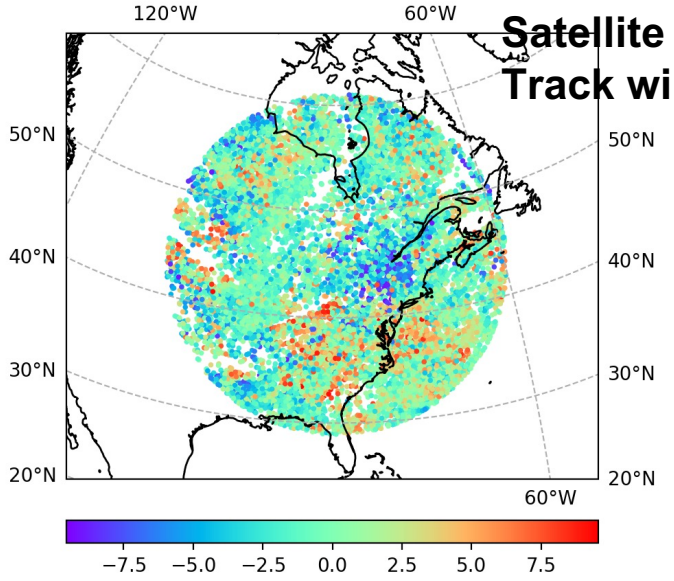
abi_g16 BT10 K nlocs:2871



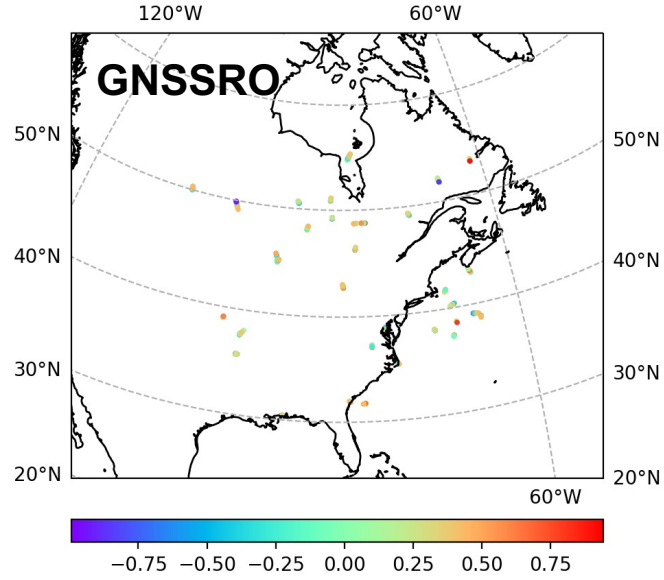
aircraft airTemperature K nlocs:46981 nflight:1541



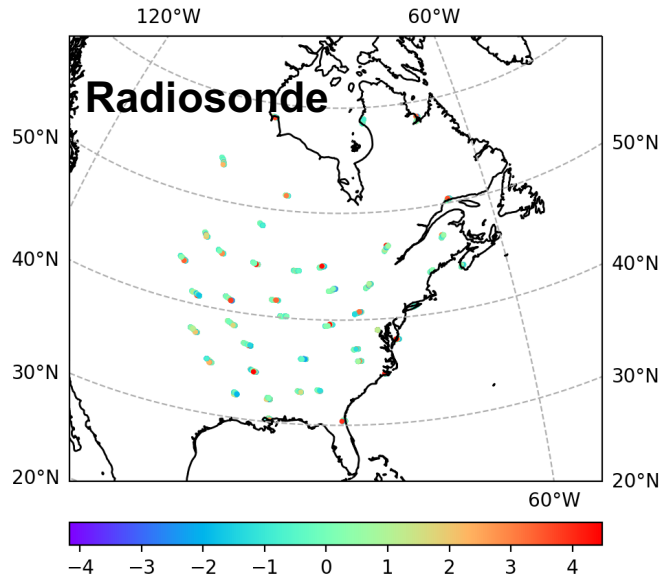
satwnd windEastward m/s nlocs:8132



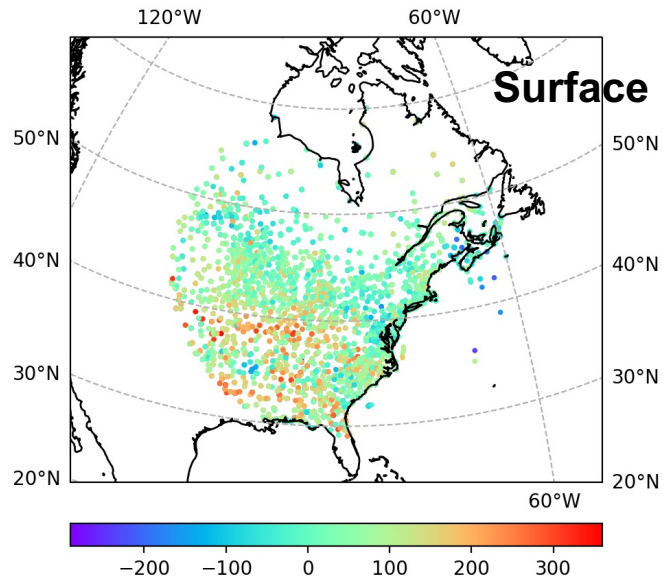
gnssroref atmosphericRefractivity % nlocs:1028 nprofile:32



sondes airTemperature K nlocs:3530 nstation:43

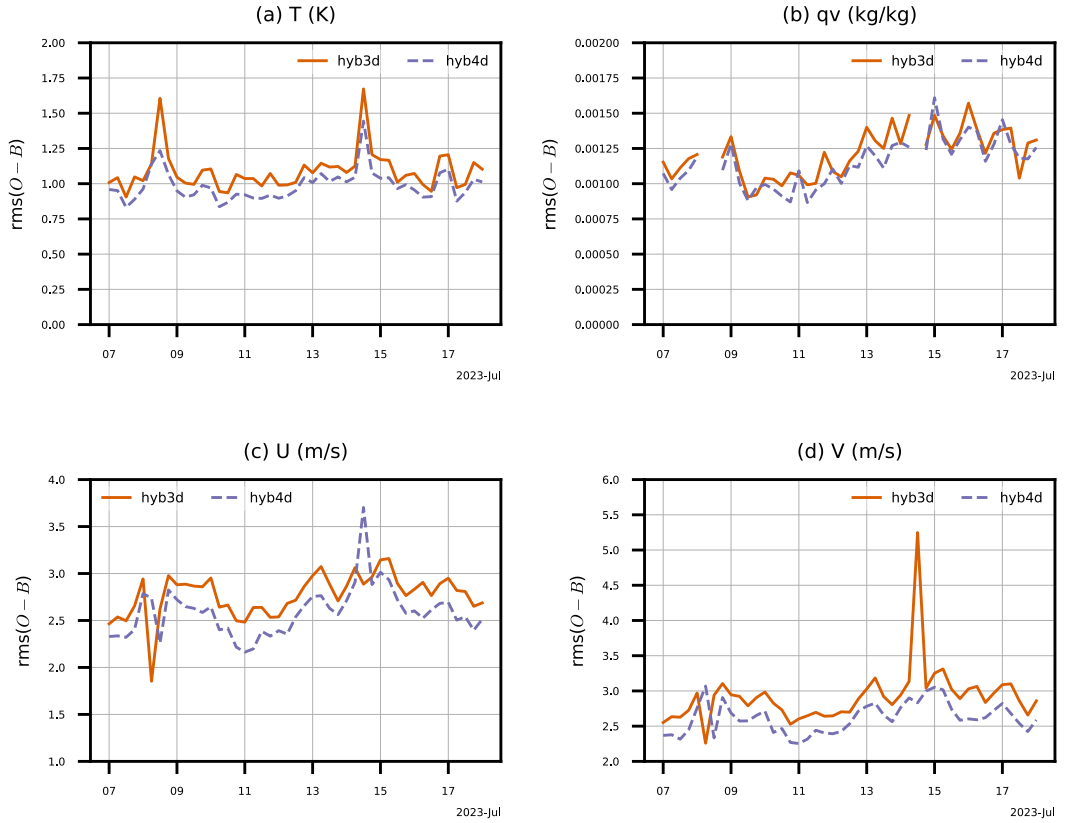


sfc stationPressure Pa nlocs:19013 nstation:1848

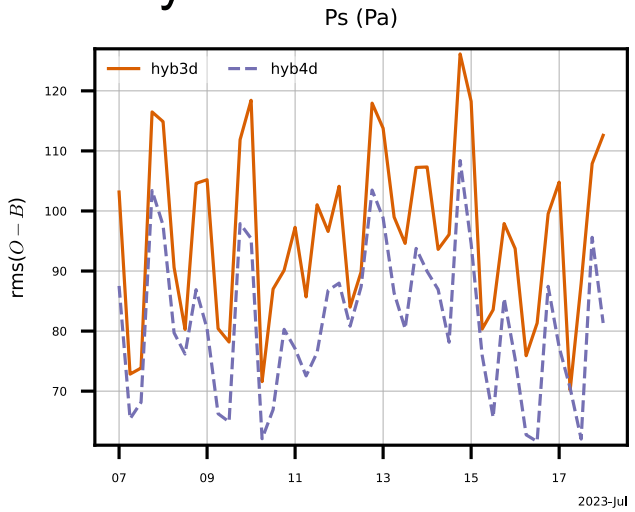


RMS of OMB: hybrid-3DEnVar vs. hybrid-4DEnVar

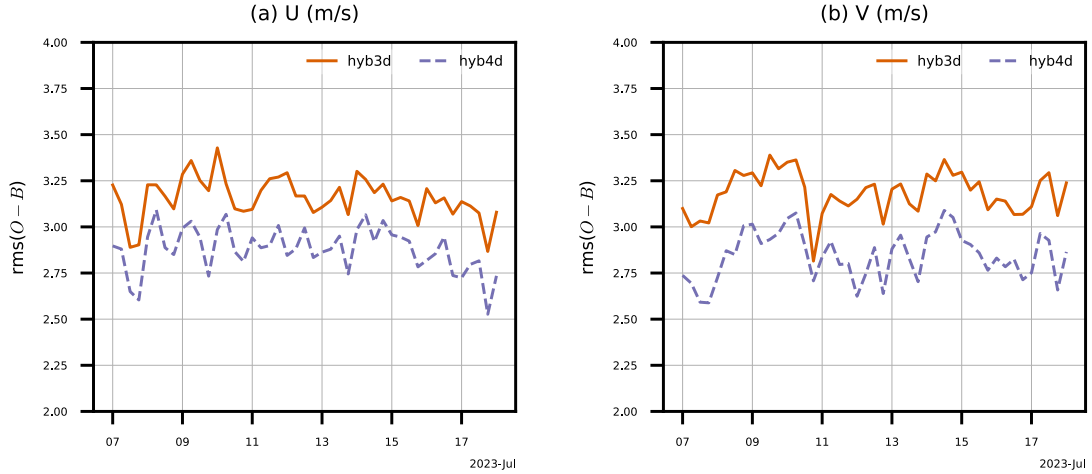
Clear better background-obs fitting from hybrid-4DEnVar



Aircraft
(spikes: times with missing obs)



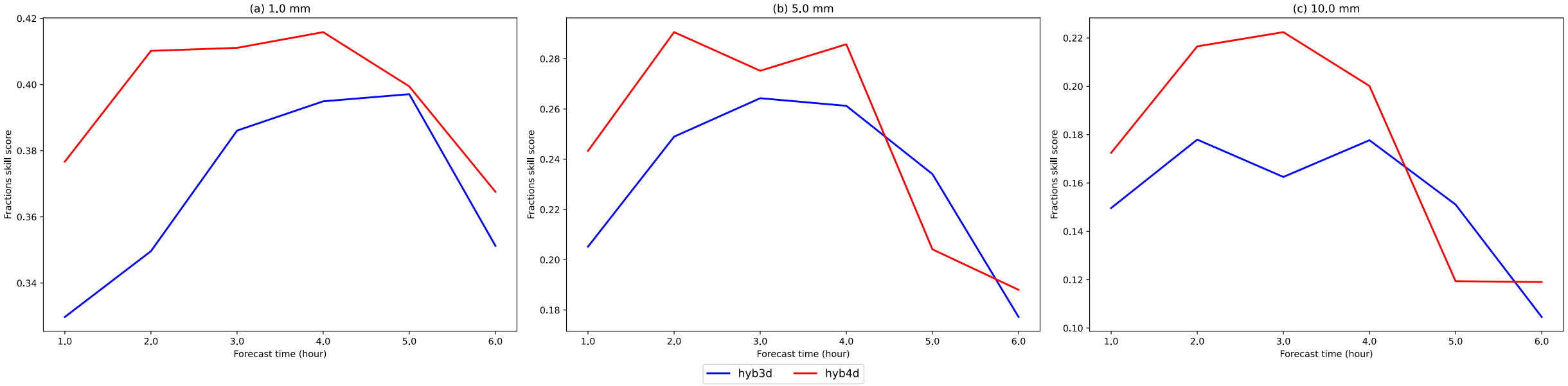
Surface Pressure



Satellite track winds

1-h accumulated rainfall forecast FSS scores: 1h - 6h lead time

Hybrid-3DEnVar vs. Hybrid-4DEnVar

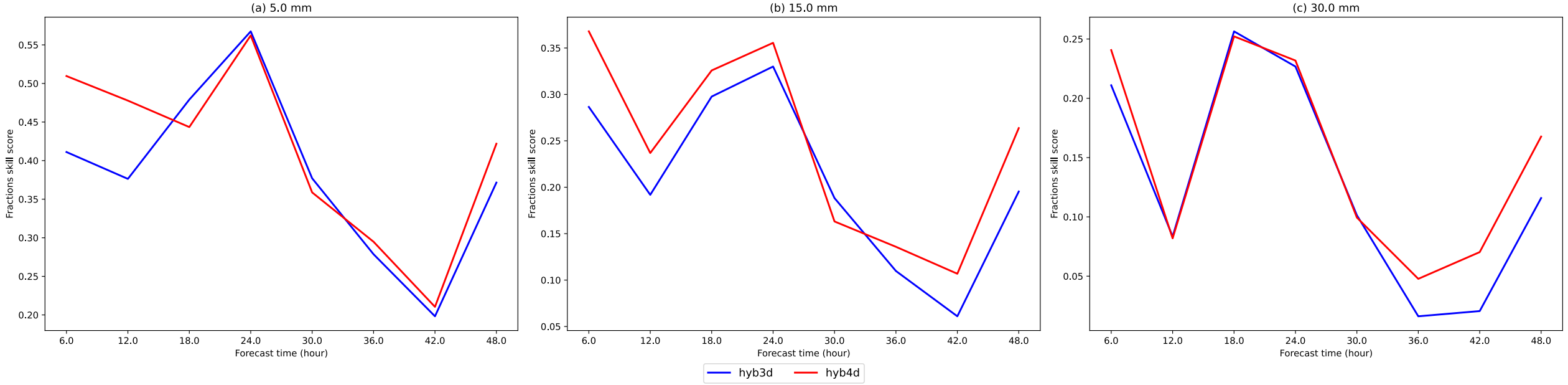


Clear improvement for the first several hours from hybrid-4DEnVar

Fraction Skill Scores (FSS) computed against Stage-IV obs with a radius of 25km, from 21 forecasts from 00 UTC 8 to 00 UTC 13 July.

6-h accumulated rainfall forecast FSS scores: up to 48-h lead time

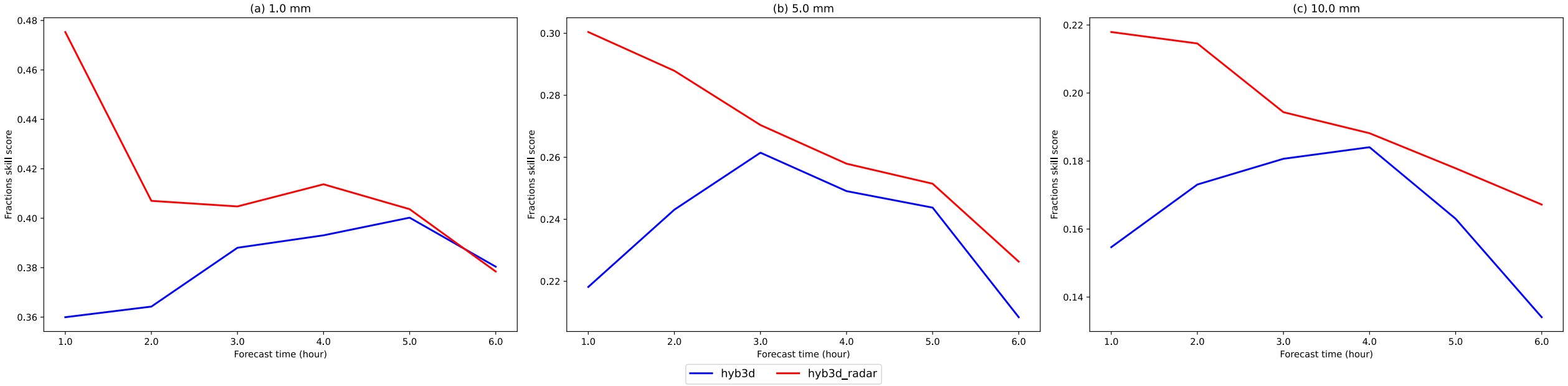
Hybrid-3DEnVar vs. Hybrid-4DEnVar



Computed from 6 forecasts at 00 UTC, 8 - 13 July, 2023

Preliminary Radar DA

Hybrid-3DEnVar: without vs. with radar (radial wind + reflectivity)



33 forecasts from 00 UTC 9 to 18 UTC 17, July

Future Perspectives for improvement

- Assimilate hourly ABI radiances in all-sky mode with hybrid-4DEnVar (in progress)
- Combine ABI and Radar DA
- More frequent cycling: e.g., hourly with assimilation of sub-hourly ABI and radar data
- Use MPAS-JEDI's own ensemble with more members from LETKF
- Use higher-resolution ensemble

Regional MPAS-JEDI test case

- cd ~/mpas_jedi_tutorial/conus15km
- sbatch run_conus15km.sh
  - 15km 3DEnVar with only radiosonde obs and 5-member ensemble input