



NCAR
OPERATED BY UCAR

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Regional MPAS-JEDI

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MPAS-A and MPAS-JEDI Tutorial, Boulder CO, AUGUST 10-14, 2026

What changes going from global to regional 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

Reject obs outside a circular domain (see next slide)

Regional Obs Domain Filtering



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
```

- filter: Bounds Check

filter variables:

- name: airTemperature
- name: windEastward
- name: windNorthward
- name: specificHumidity

test variables:

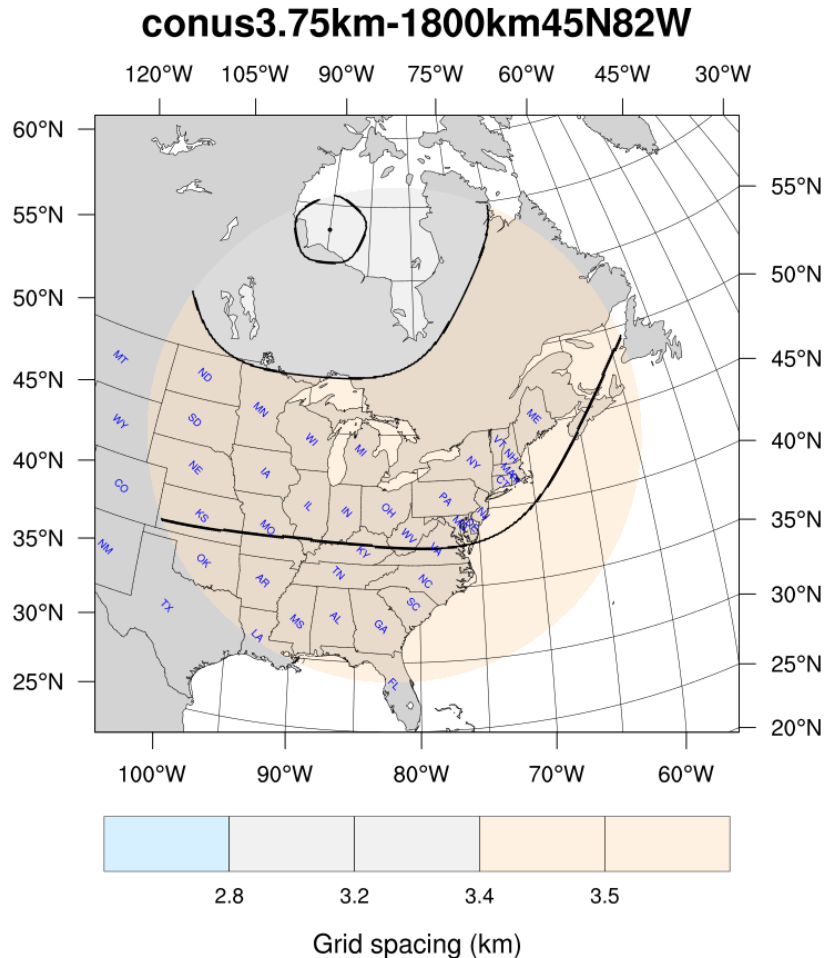
- name: GeoVaLs/observable_domain_mask

flag all filter variables if any test variable is out of bounds: true

minvalue: 0.0

maxvalue: 0.1

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**

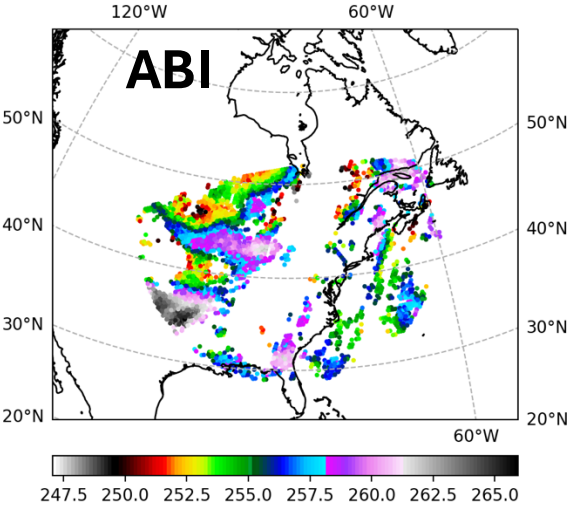
2 experiments:

- Hybrid-3DEnVar
- Hybrid-4DEnVar

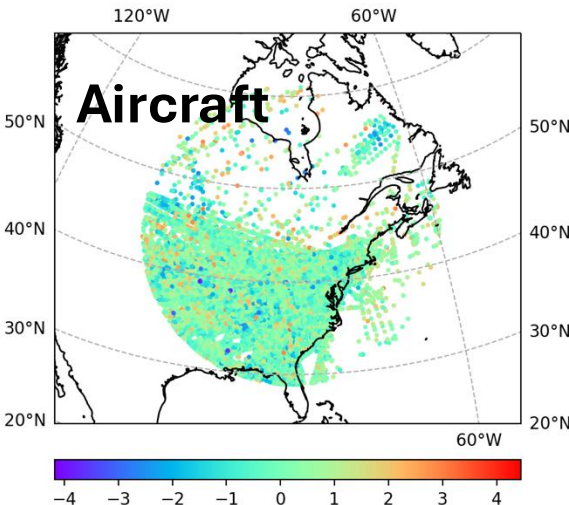
Obs coverage at 00 UTC 09 July, 2023



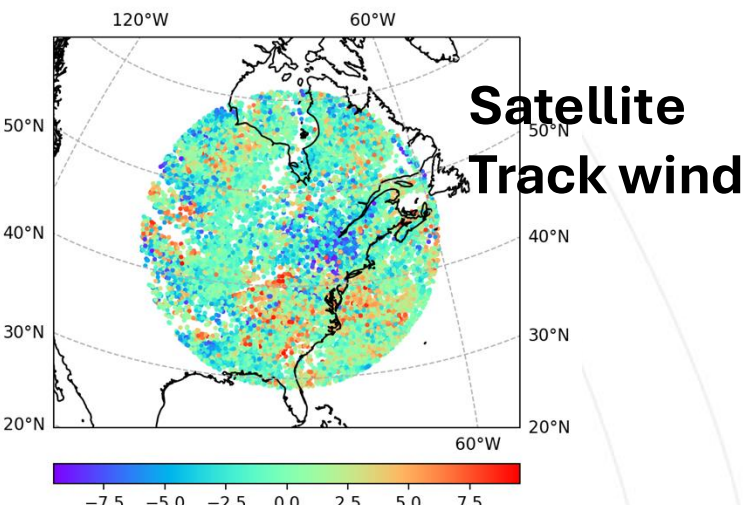
abi_g16 BT10 K nlocs:2871



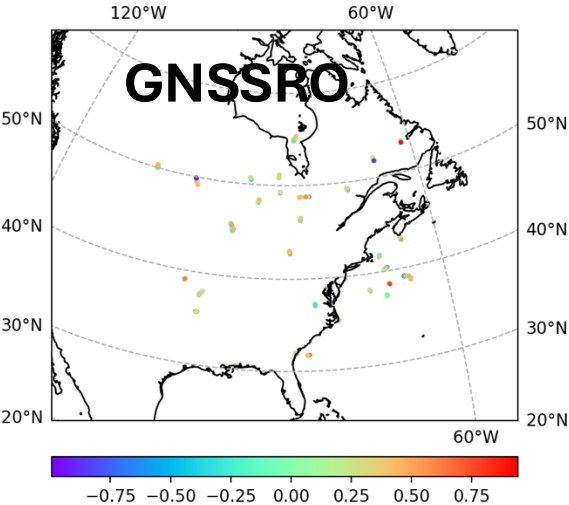
aircraft airTemperature K nlocs:46981 nflight:1541



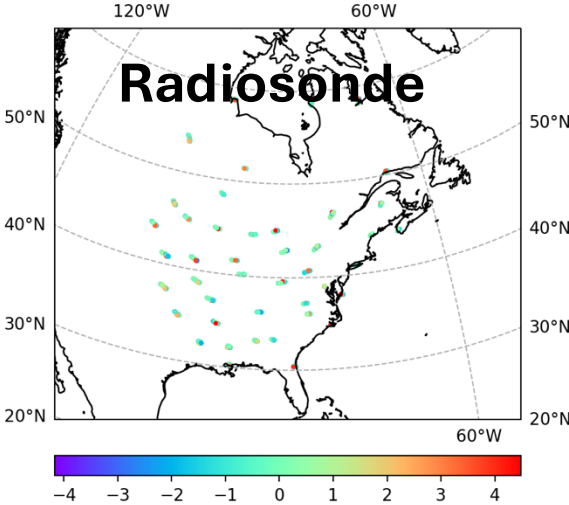
satwnd windEastward m/s nlocs:8132



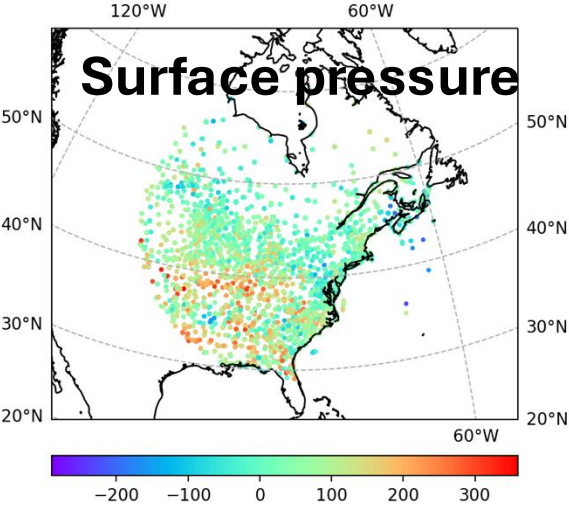
gnssroref atmosphericRefractivity % nlocs:1028 nprofile:32



sondes airTemperature K nlocs:3530 nstation:43



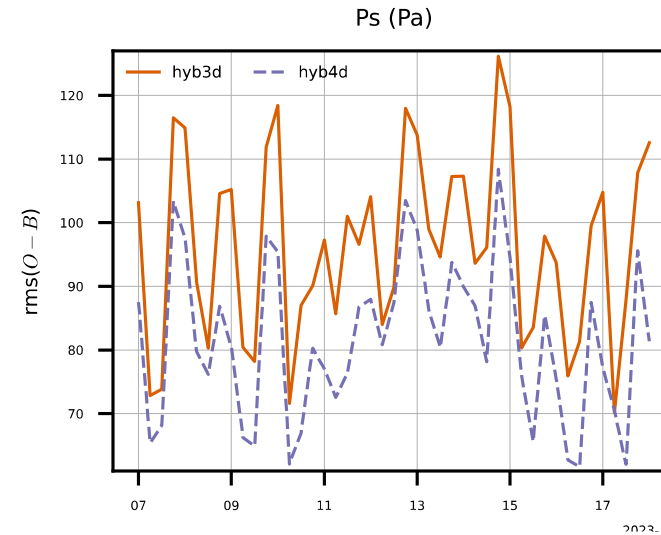
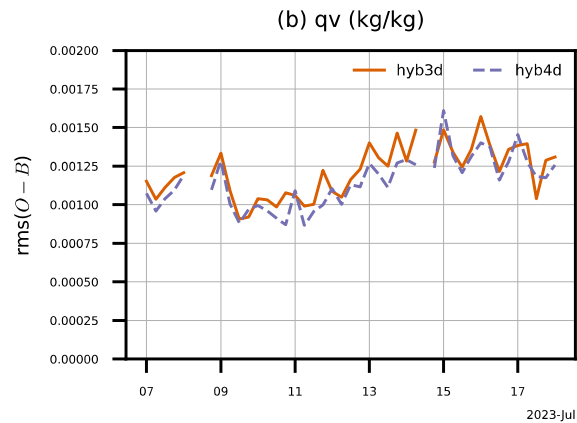
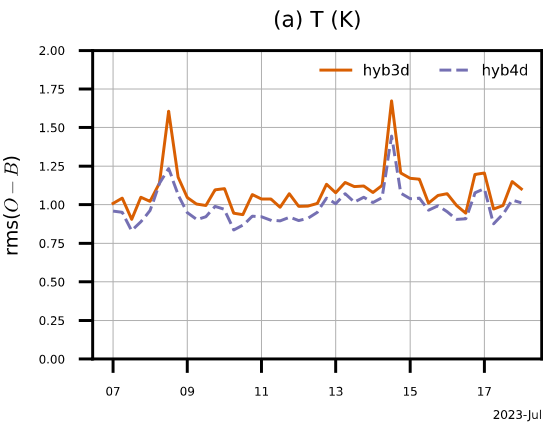
sfc stationPressure Pa nlocs:19013 nstation:1848



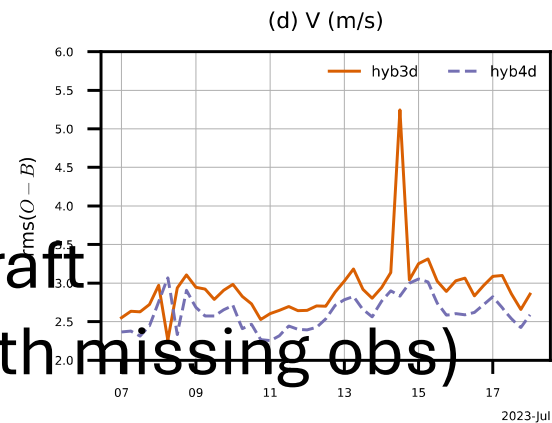
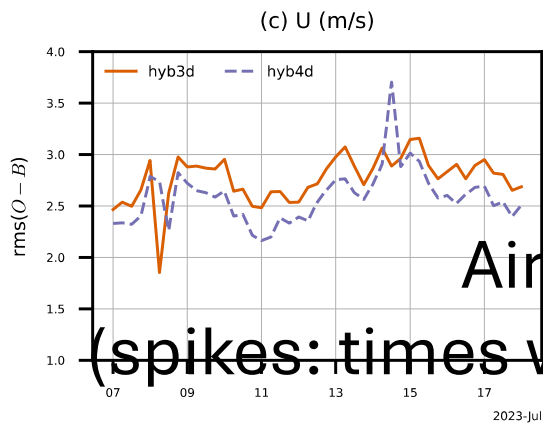
RMS of OMB : hybrid-3DEnVar vs. hybrid-4DEnVar



Clear better background-obs fitting from hybrid-4DEnVar

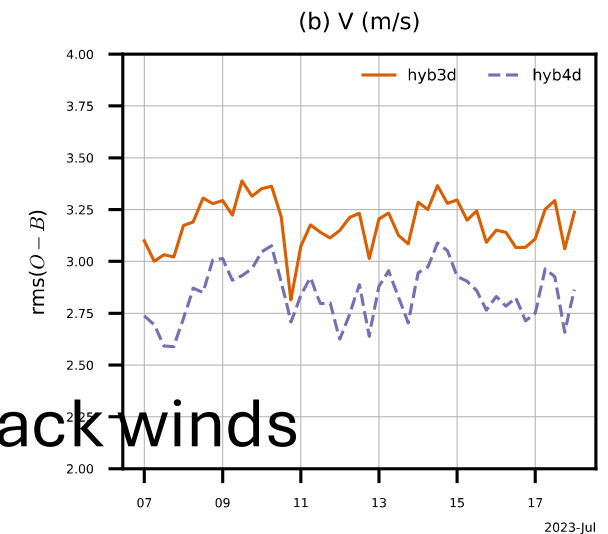
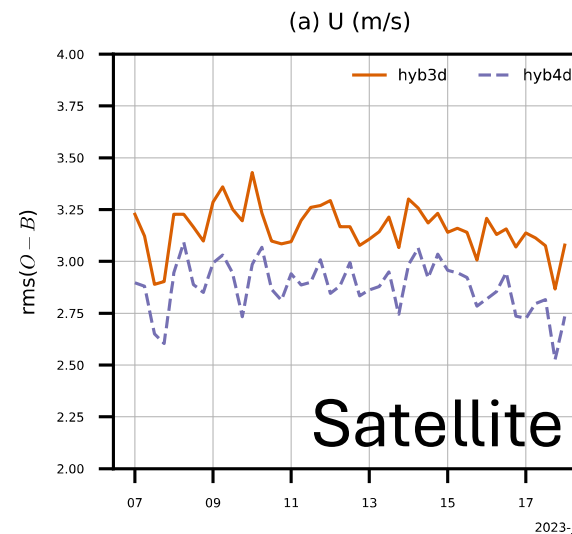


Surface Pressure



Aircraft

(spikes: times with missing obs)

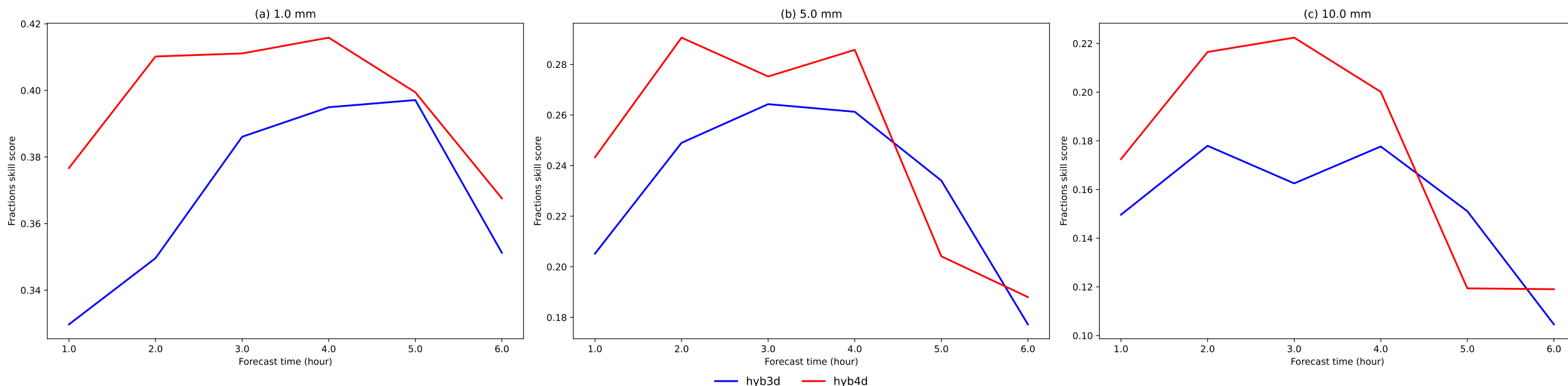


Satellite track winds

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



Hybrid-3DEnVar vs. Hybrid-4DEnVar

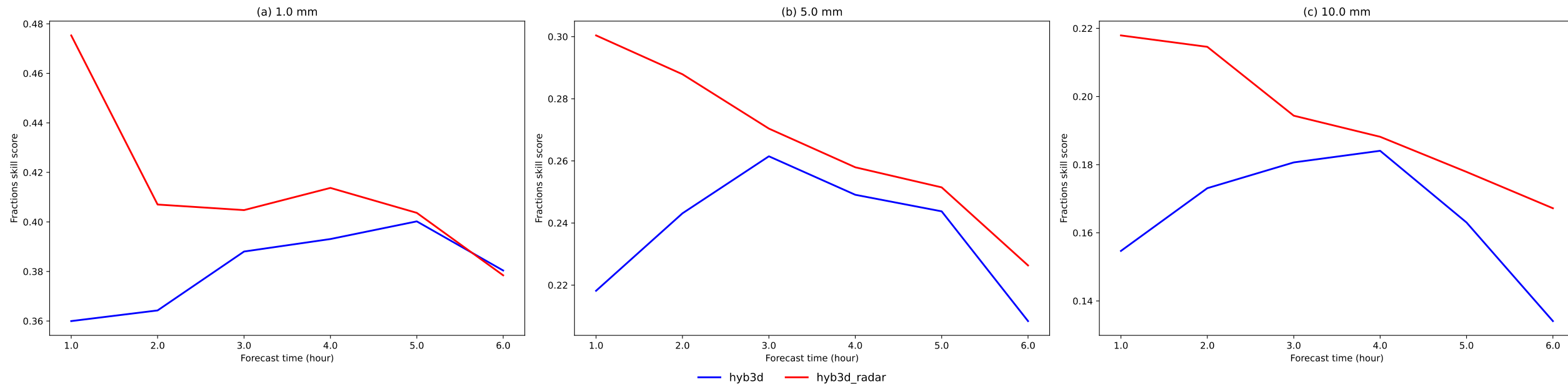


Clear improvement for the first several hours from hybrid-4DEnVar

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.

Preliminary Radar DA

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



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

Regional MPAS-JEDI test case



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

