High-resolution Soundings from Combined Polar Hyper-spectral and Geostationary Multi-spectral Satellite Infrared Radiance observations

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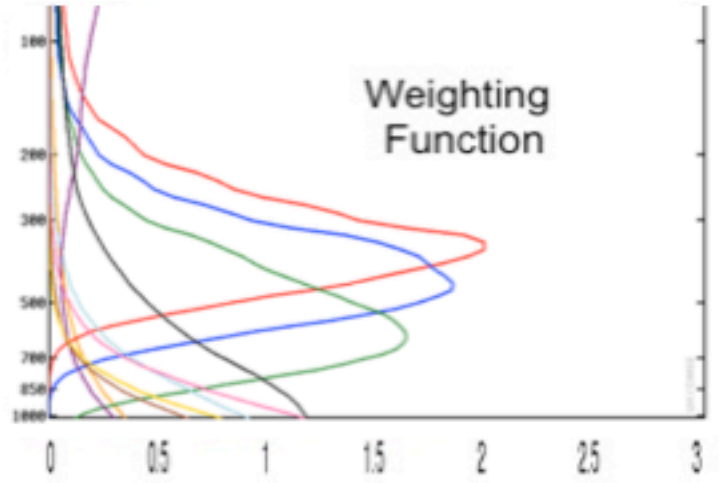
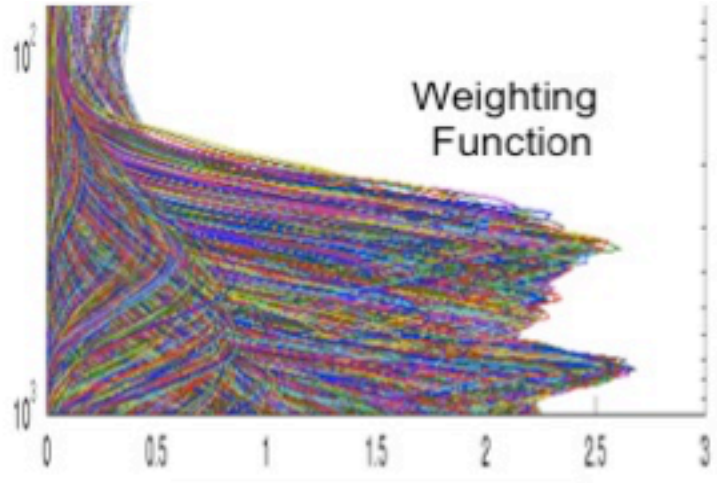
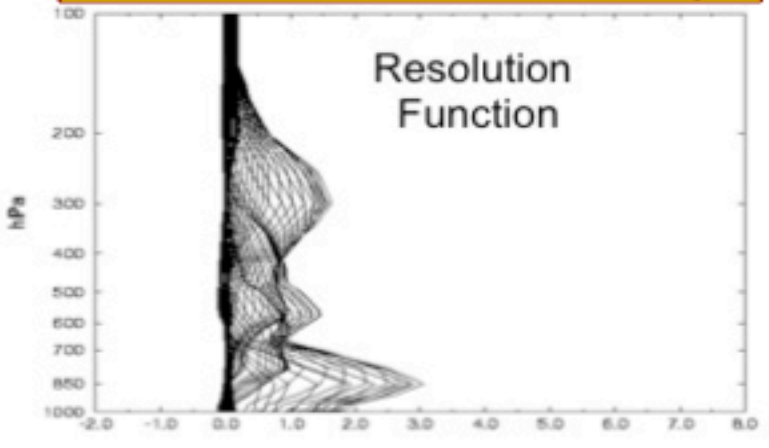
[1]University of Wisconsin, Madison WI. and [2]Hampton University, Hampton VA. USA

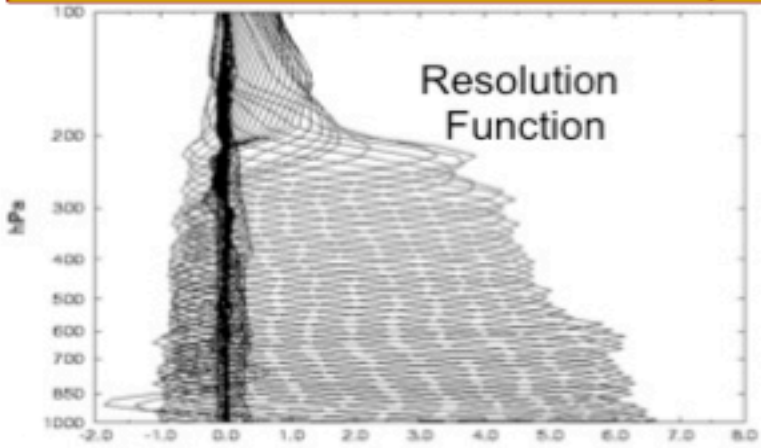


ABI (Vertical Res. 5-10 km; Horizontal Resolution = 2-km)



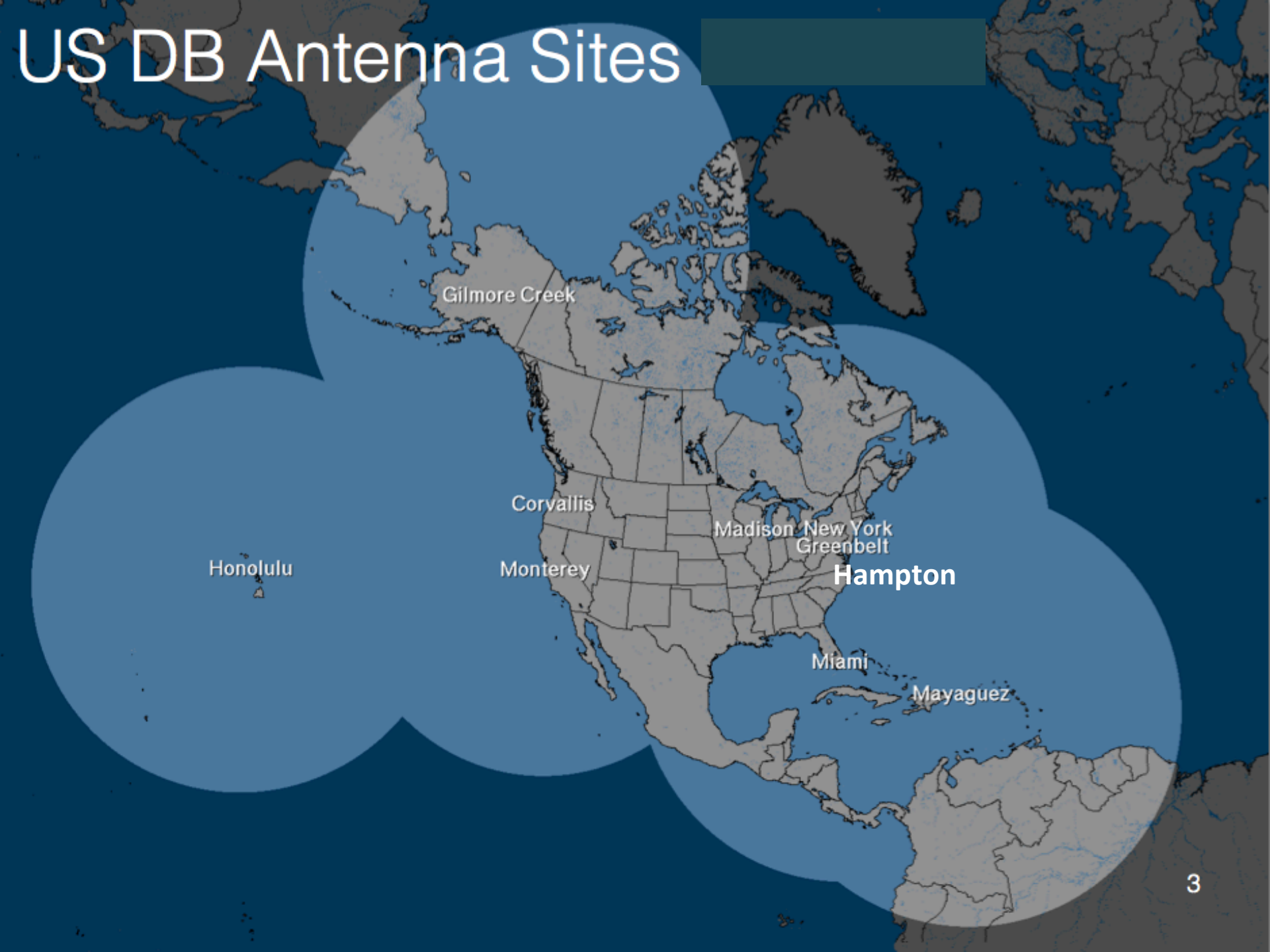
AIRS/IASI/CrIS(Vertical Res. 1-4 km; Horizontal Resolution = 14-km)





NASA Sounder Science Team Meeting, 1-5 October, 2018 Greenbelt MD.

US DB Antenna Sites



PHS (CrIS/IASI) + ABI Sounding

$$\mathbf{PHSnABI}(x,y,t) = [\mathbf{ABI}(x,y,t) + \mathbf{PHS}(x_o,y_o,t_o) - \mathbf{ABI}(x_o,y_o,t_o)]$$

***Where*:**

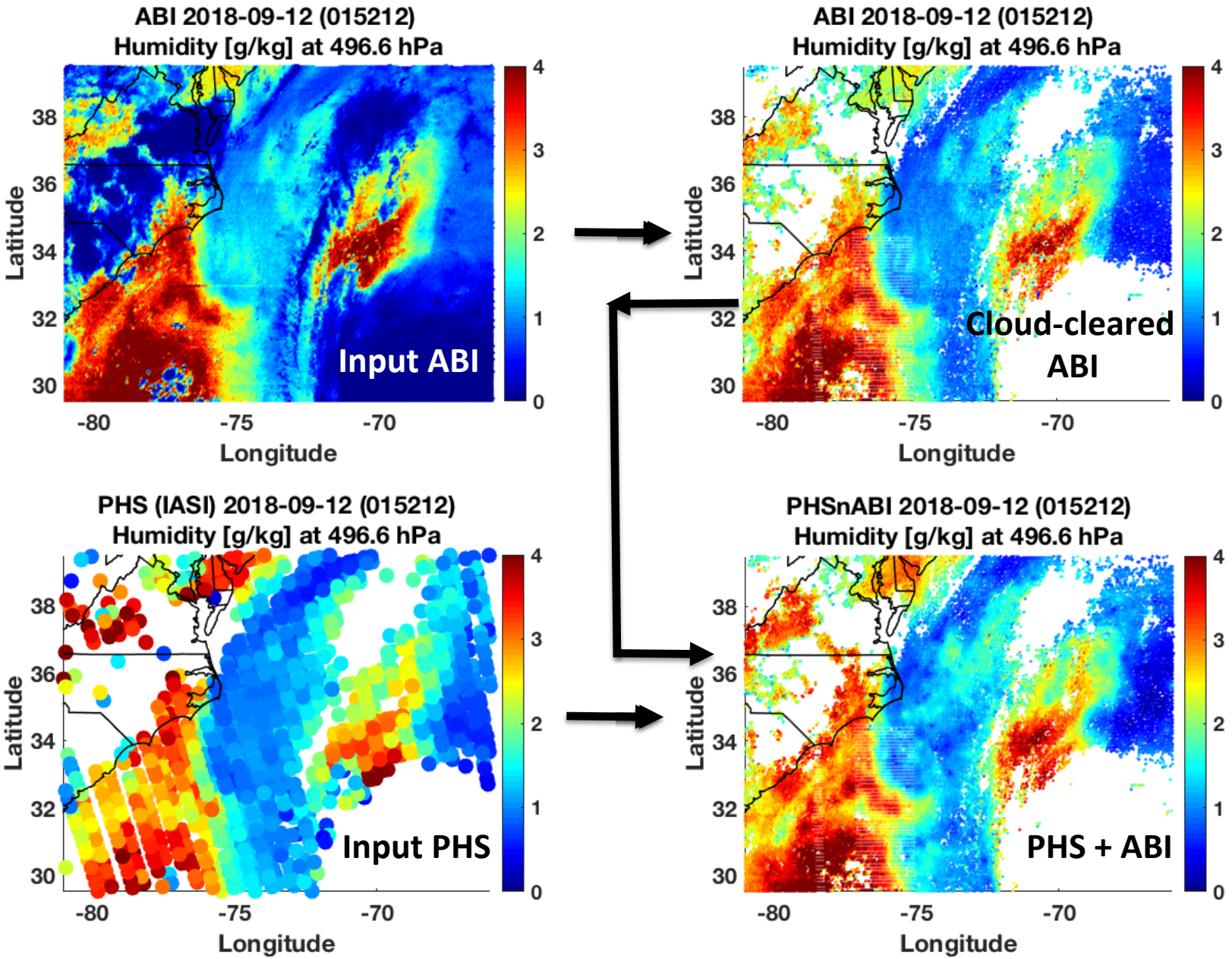
ABI (x,y,t): ABI retrieval value at location and time (x, y , t)

PHS (x_o,y_o,t_o): RMS Weighted Mean of 25 PHS values closest to ABI location and time (x, y, t)

ABI (x_o,y_o,t_o): RMS Weighted Mean of 25 PHS Field-of-View average ABI retrieval values closest to the PHS location and time (x_o, y_o, t_o)

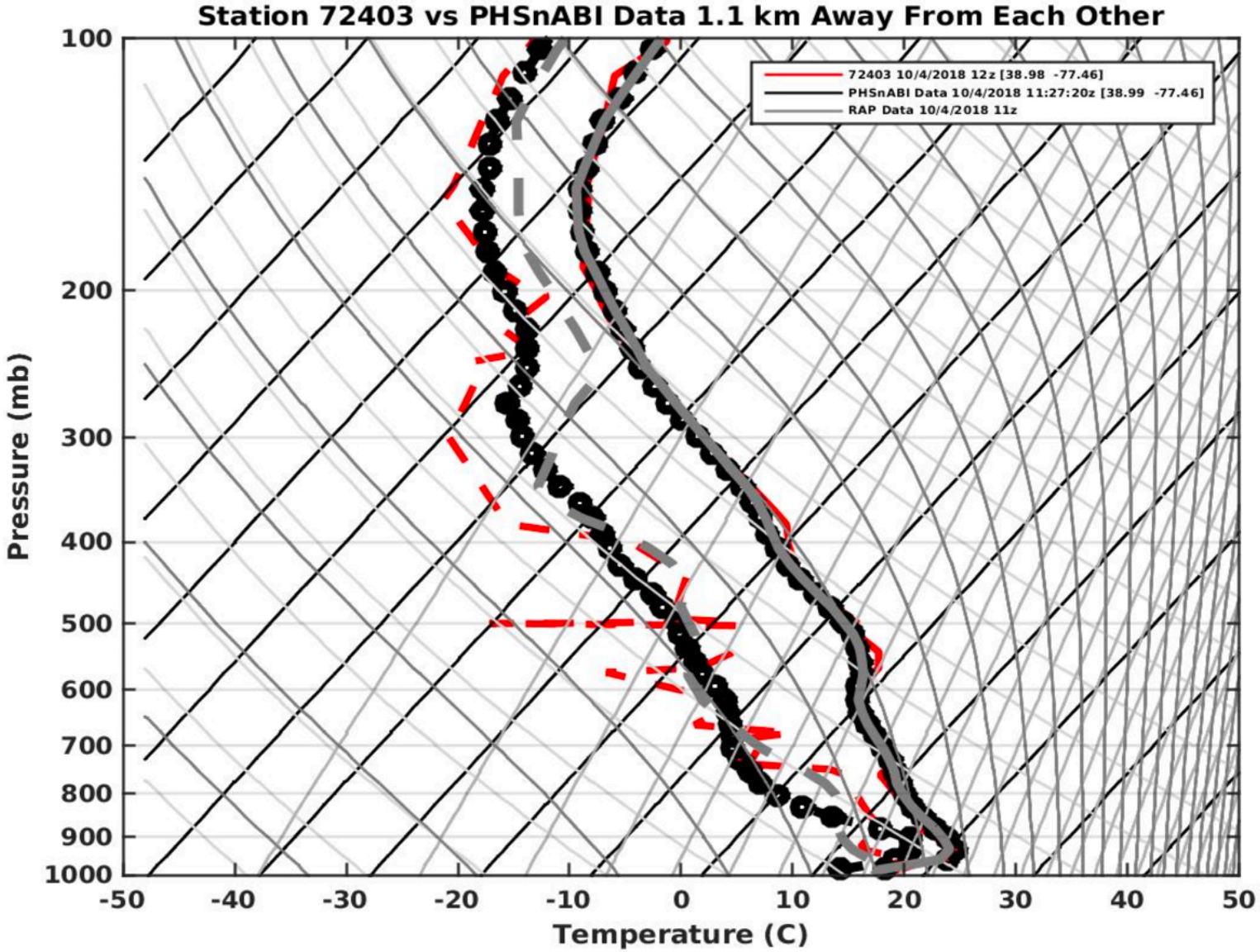
Weights: RMS Difference Computed from the Vertical Profile of Differences Between **ABI (x,y,t) and ABI (x_o,y_o,t_o)**

ABI + PHS Retrieval Example

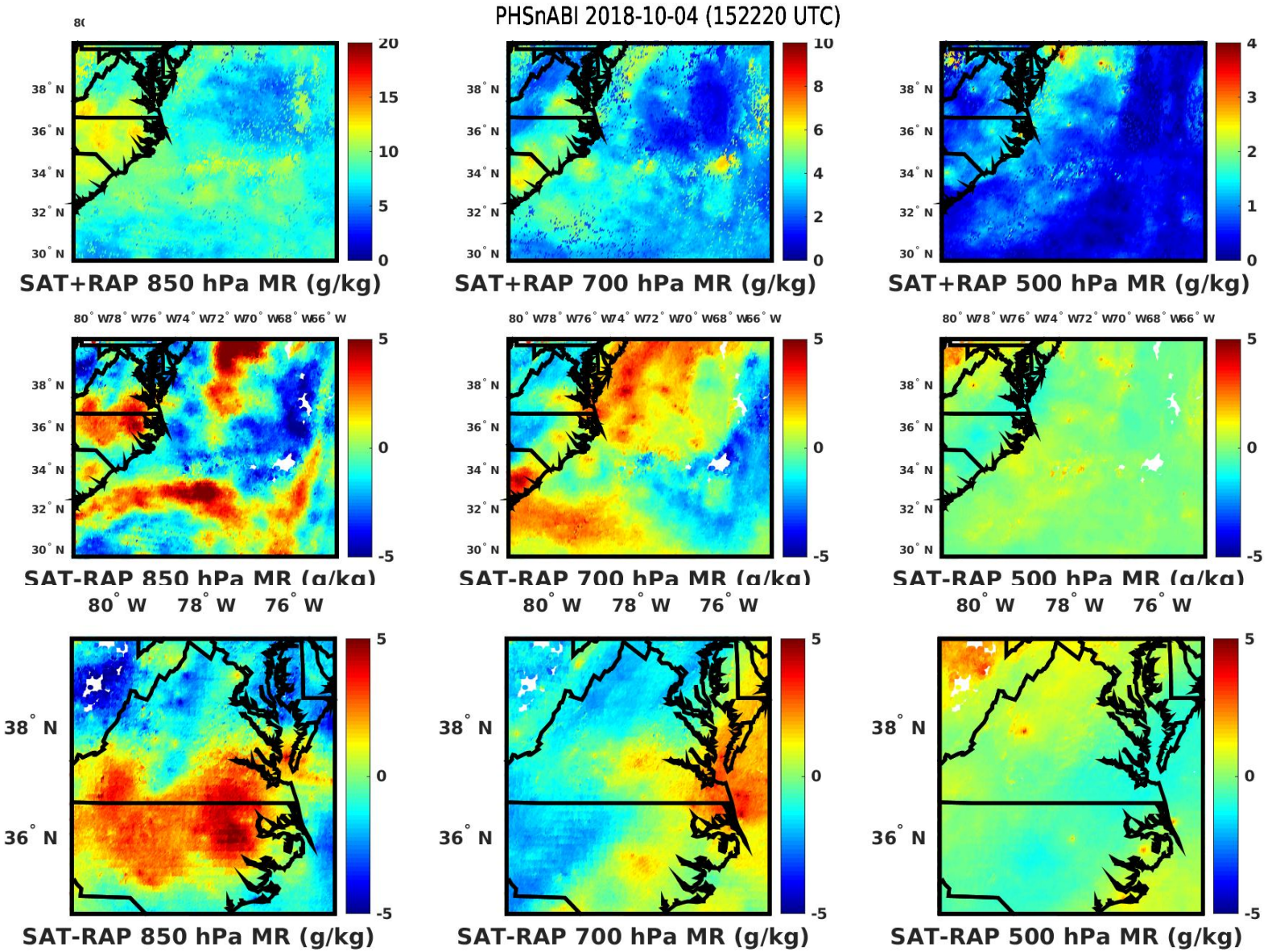


Today's Radiosonde Comparison

Dulles Airport (KIAD) Oct. 4, 2018 (12 UTC)



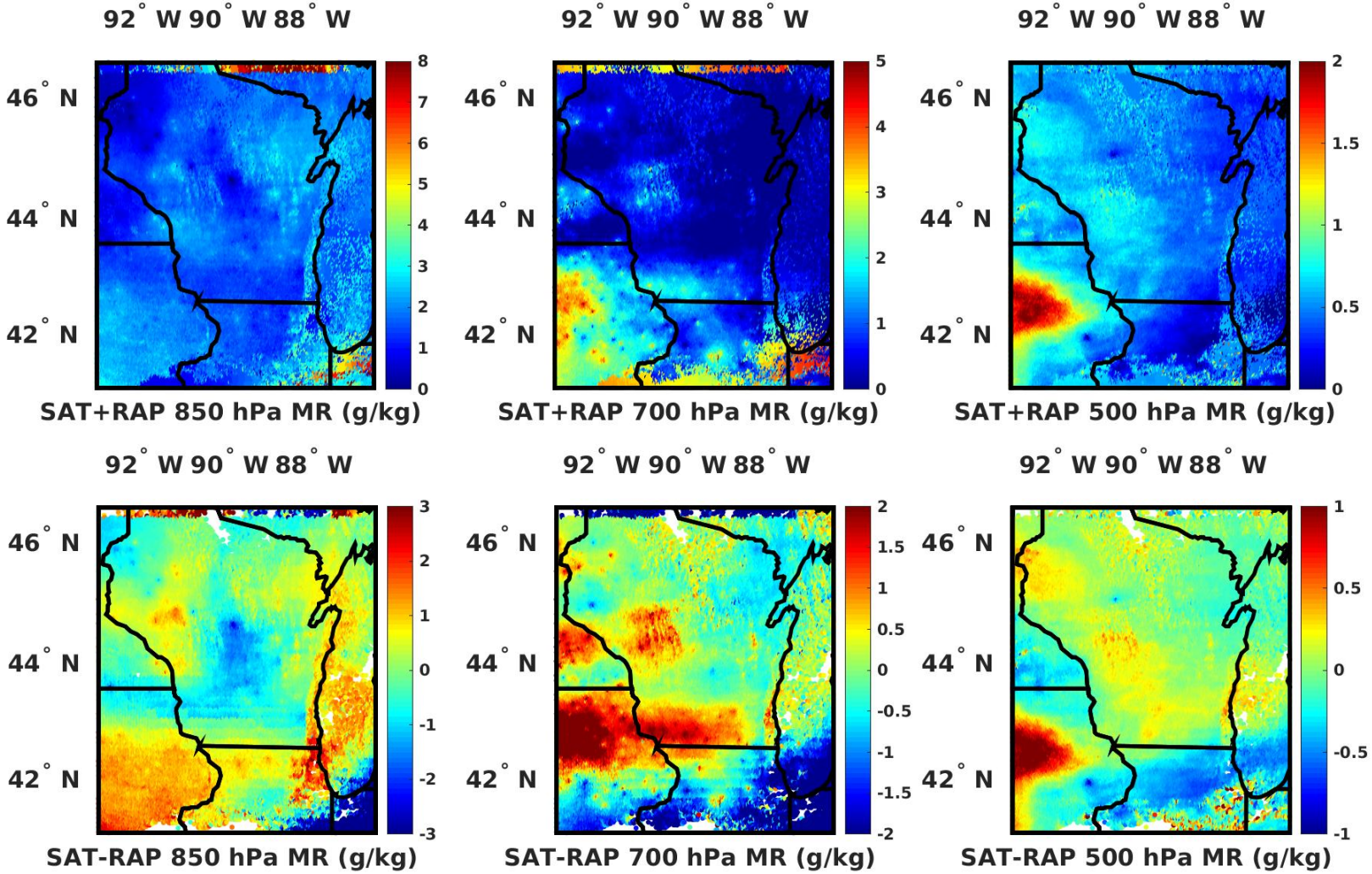
http://dbps.cas.hamptonu.edu/development/



Products are available within 1-hr every hour 24/7

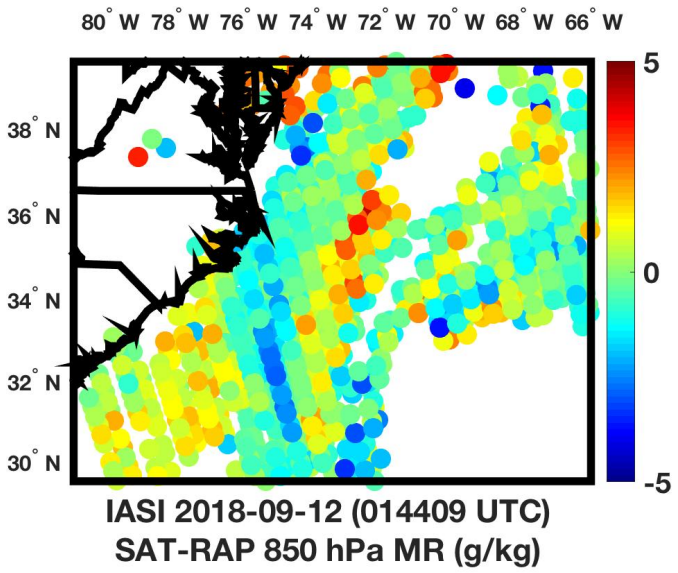
Wisconsin (MKX WFO)

PHSnABI 2018-10-04 (155720 UTC)

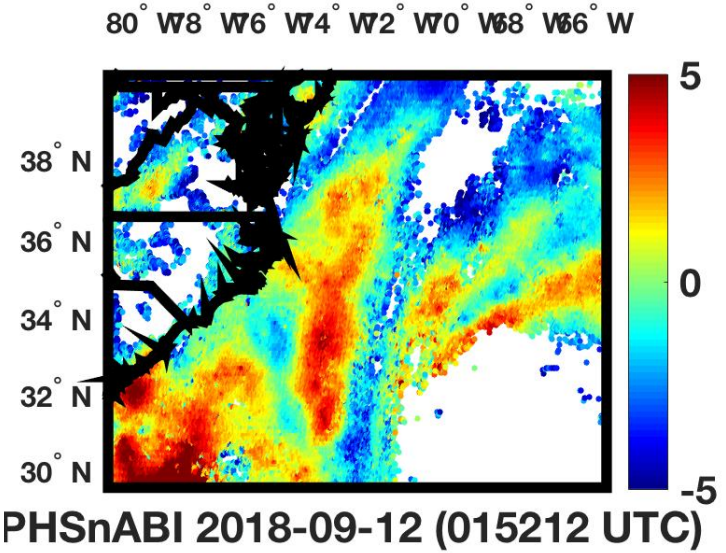


Products are available within 1-hr every hour 24/7

‘Florence’ Satellite Deviations from RAP



IASI 2018-09-12 (014409 UTC)
SAT-RAP 850 hPa MR (g/kg)



PHSnABI 2018-09-12 (015212 UTC)
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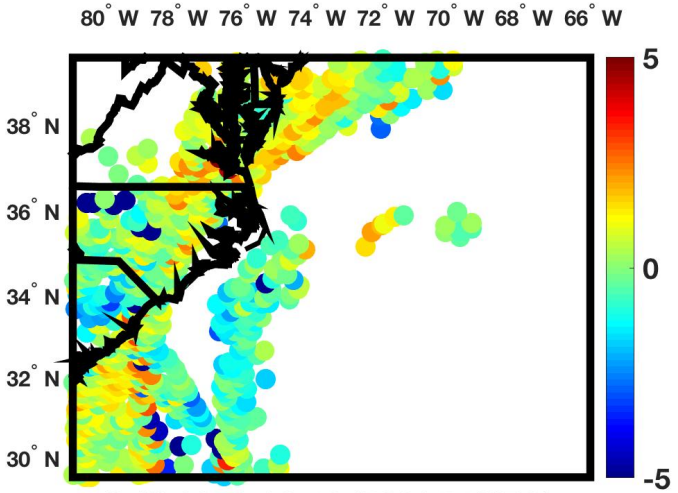

CrIS 2018-09-12 (182047 UTC)
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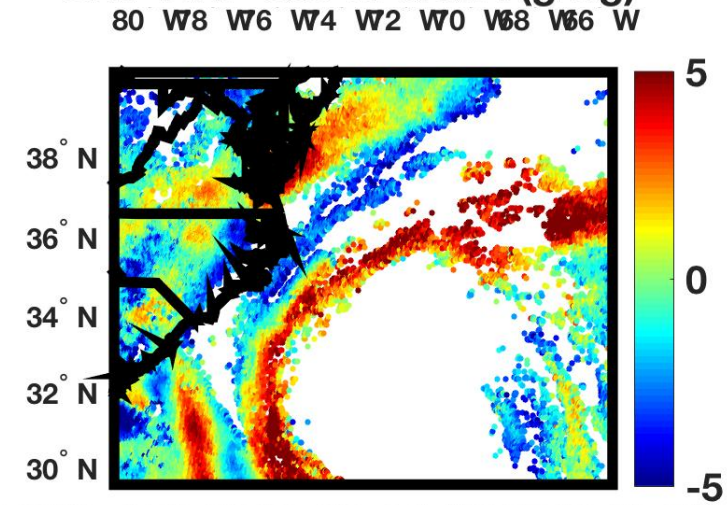

PHSnABI 2018-09-12 (182712 UTC)
SAT-RAP 850 hPa MR (g/kg)

GFS Opnl (28-km)
Vs
WRF (3-KM) with PHSnABI
18-hr Forecasts of
Hurricane Florence

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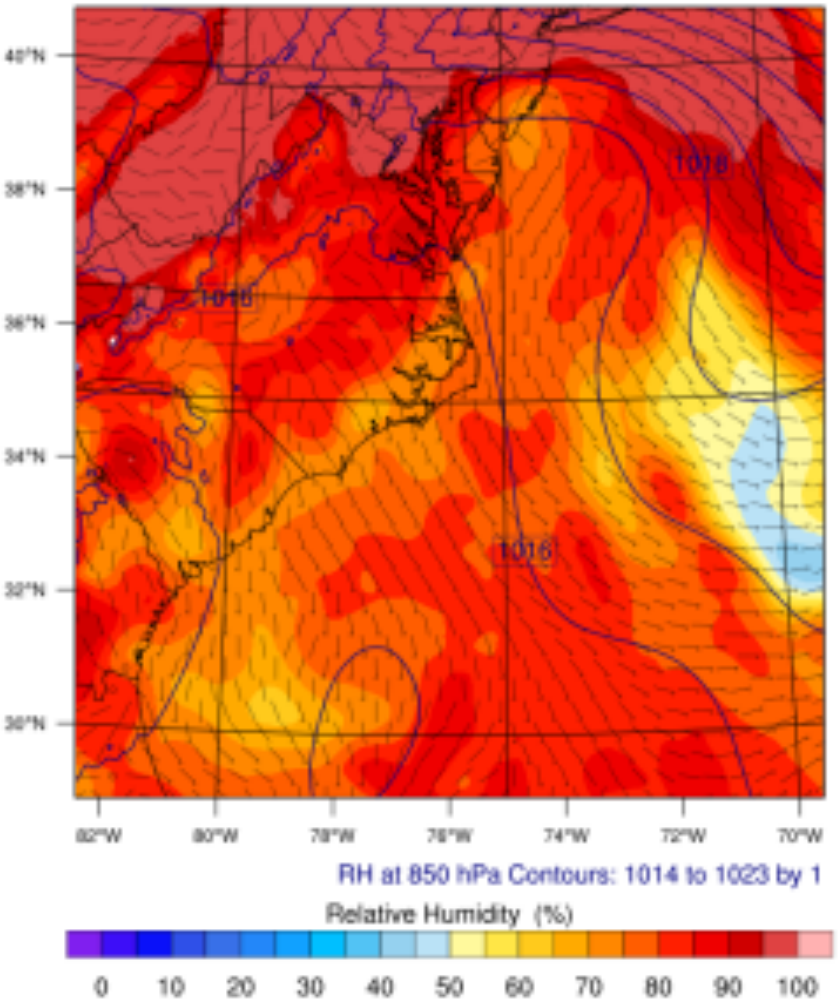

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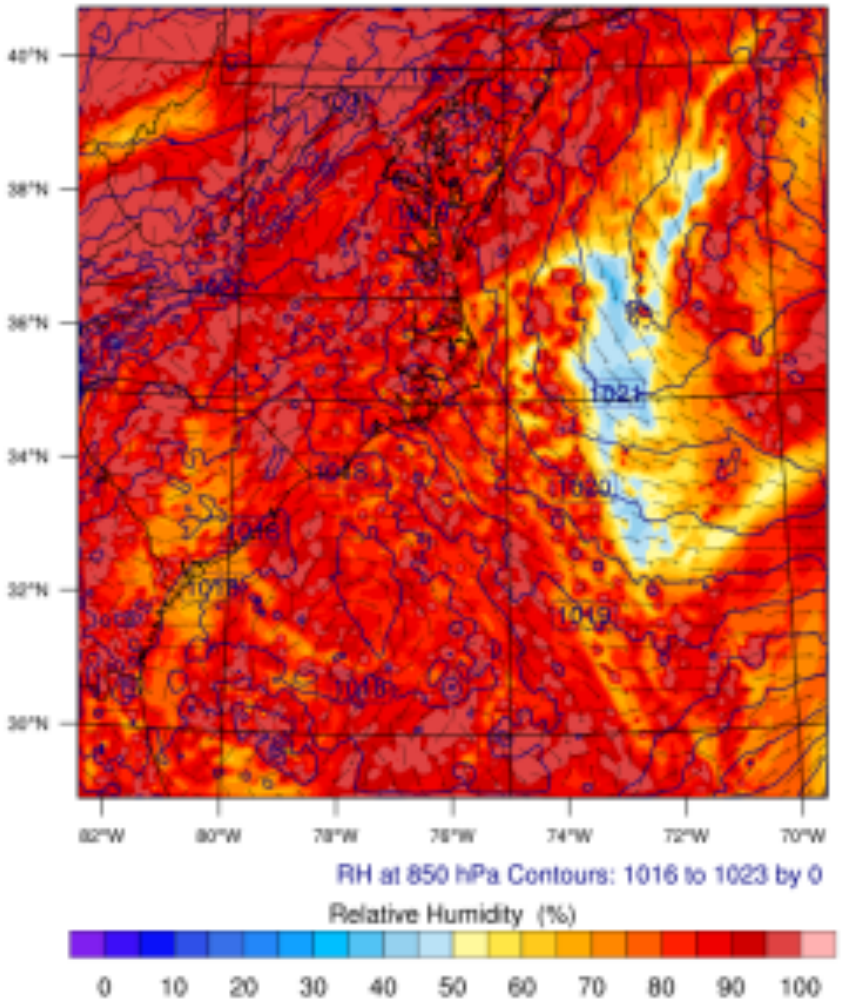

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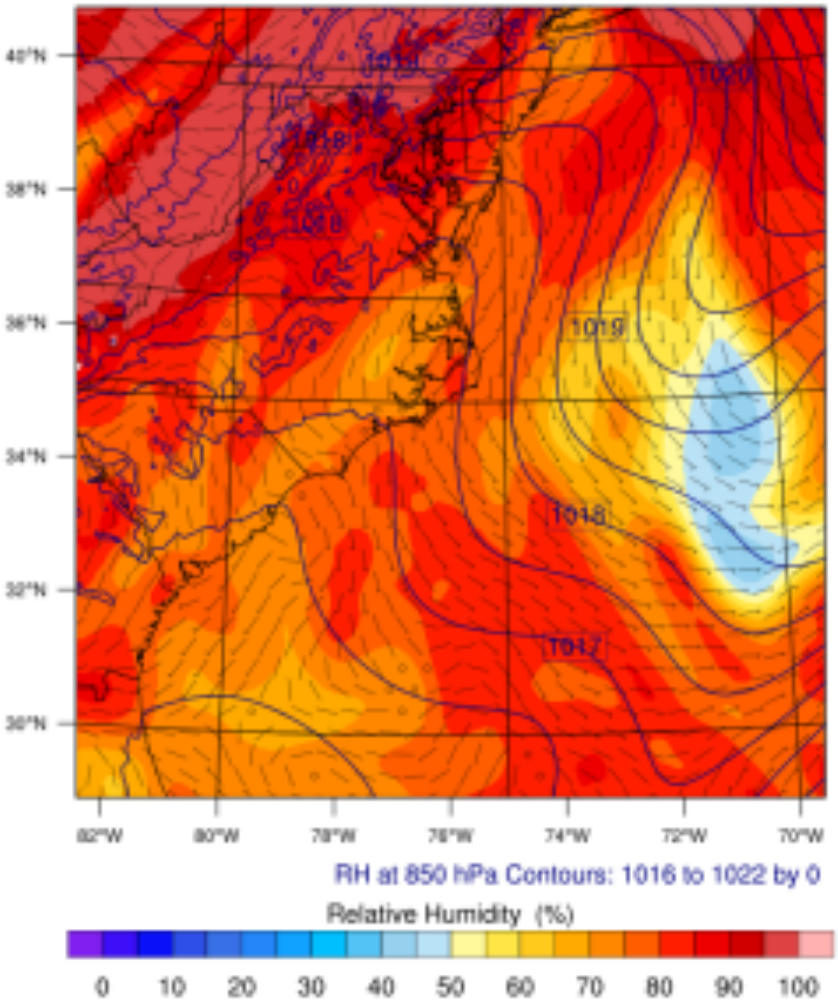

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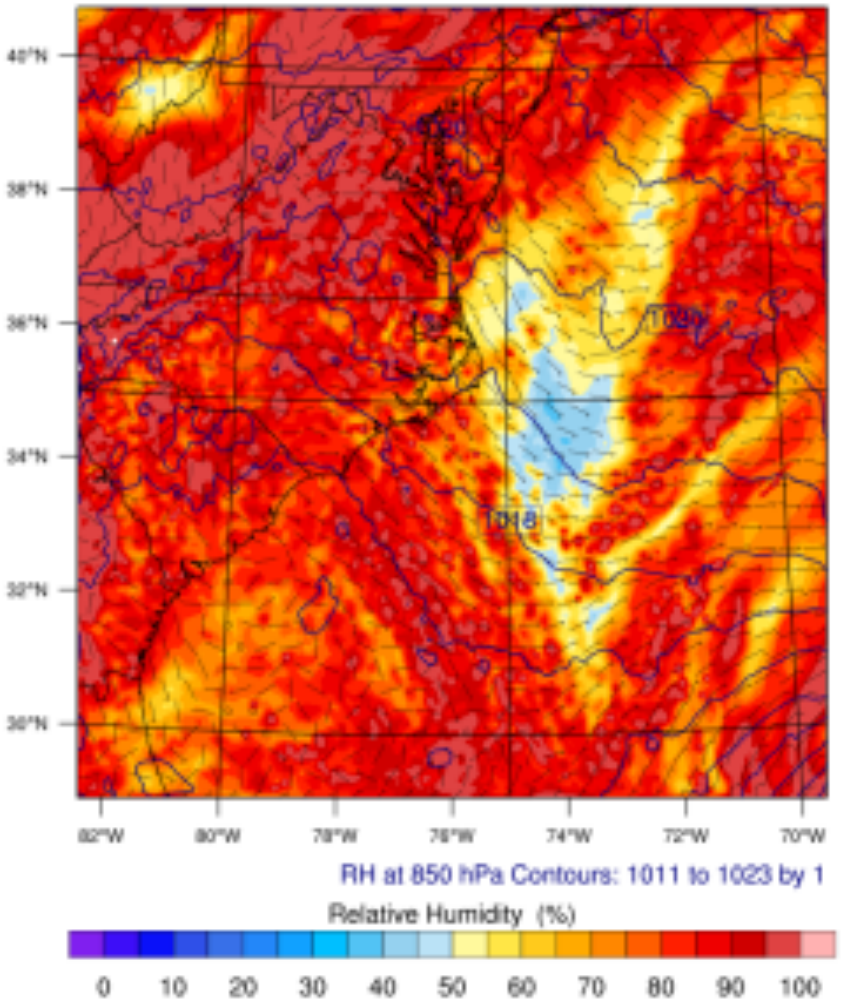

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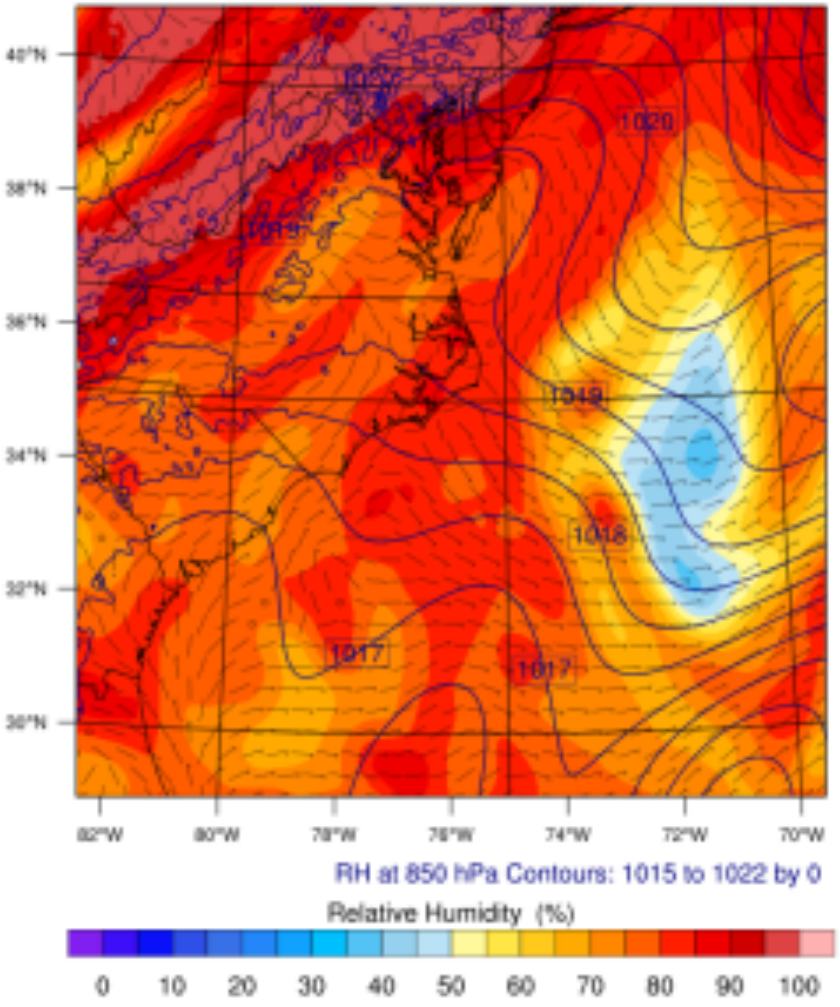

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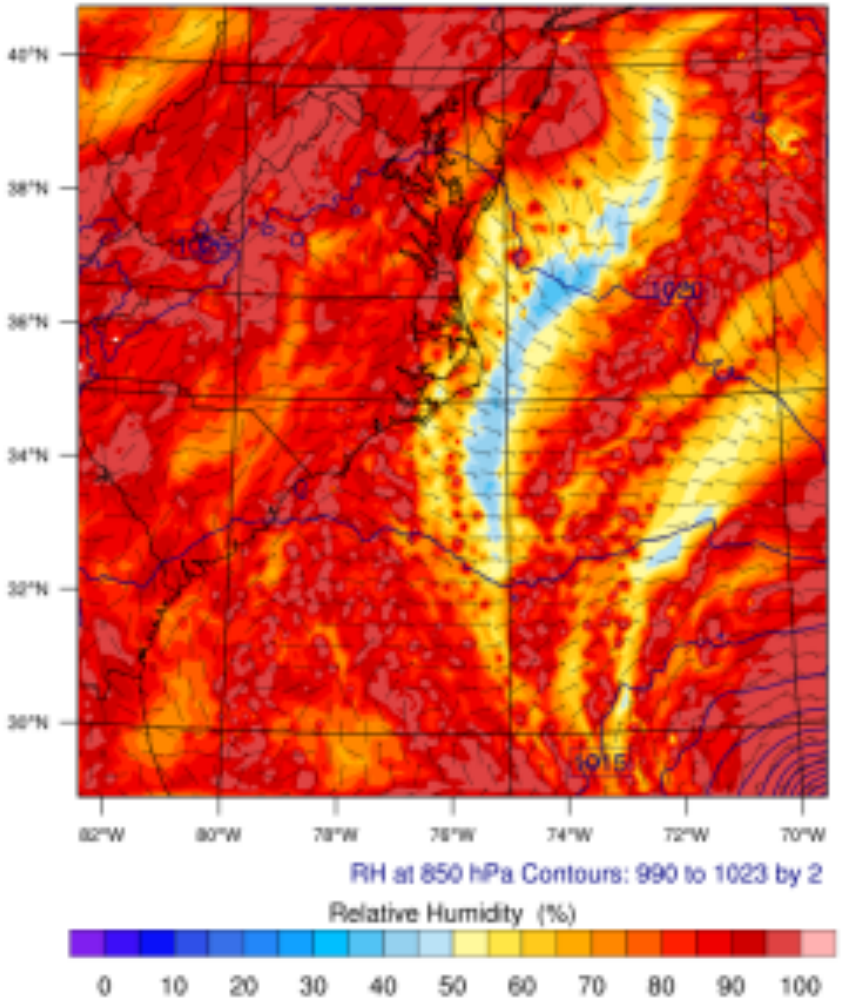

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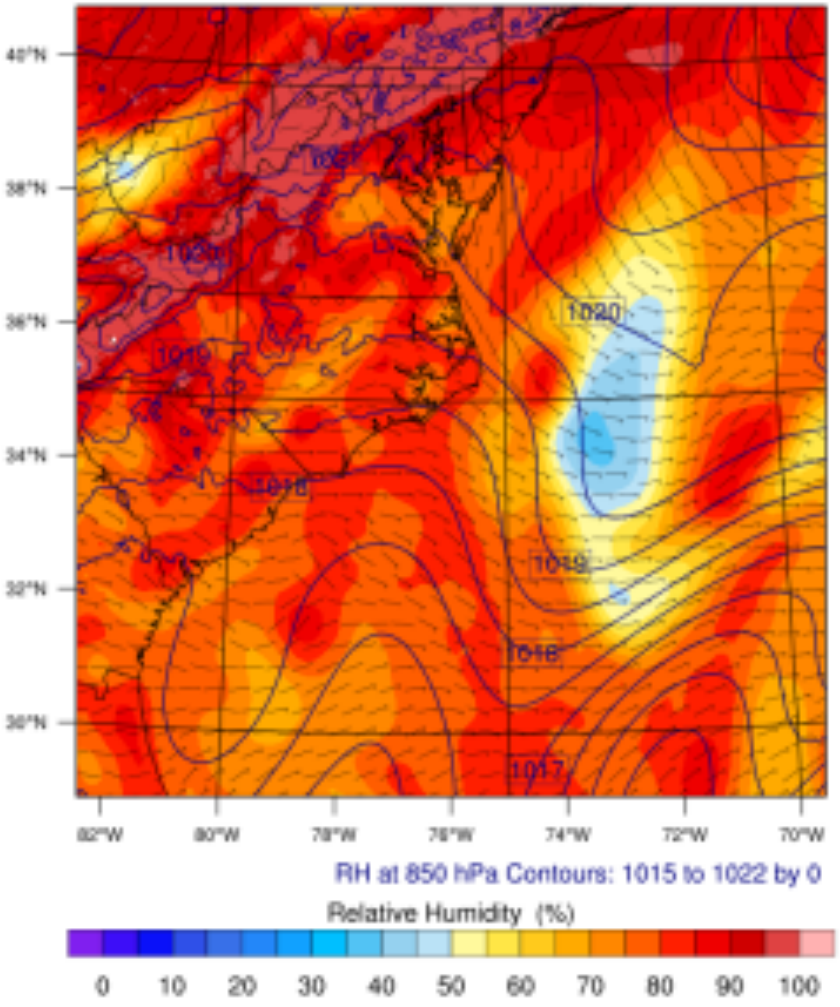

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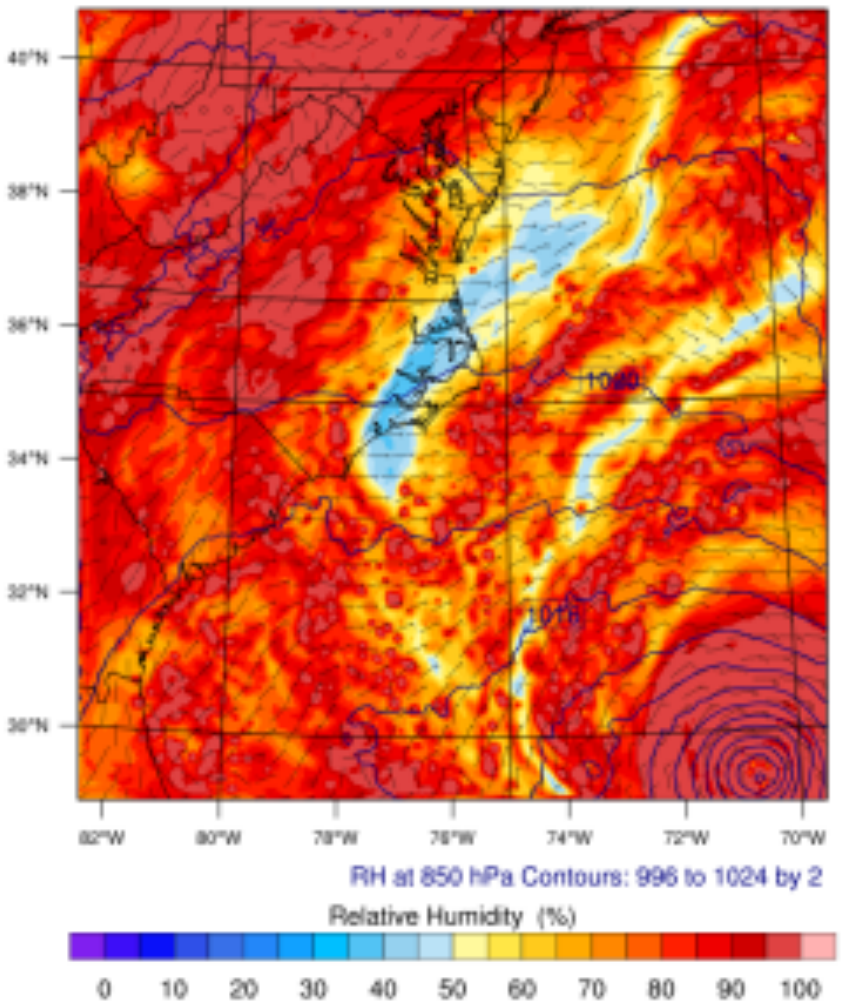

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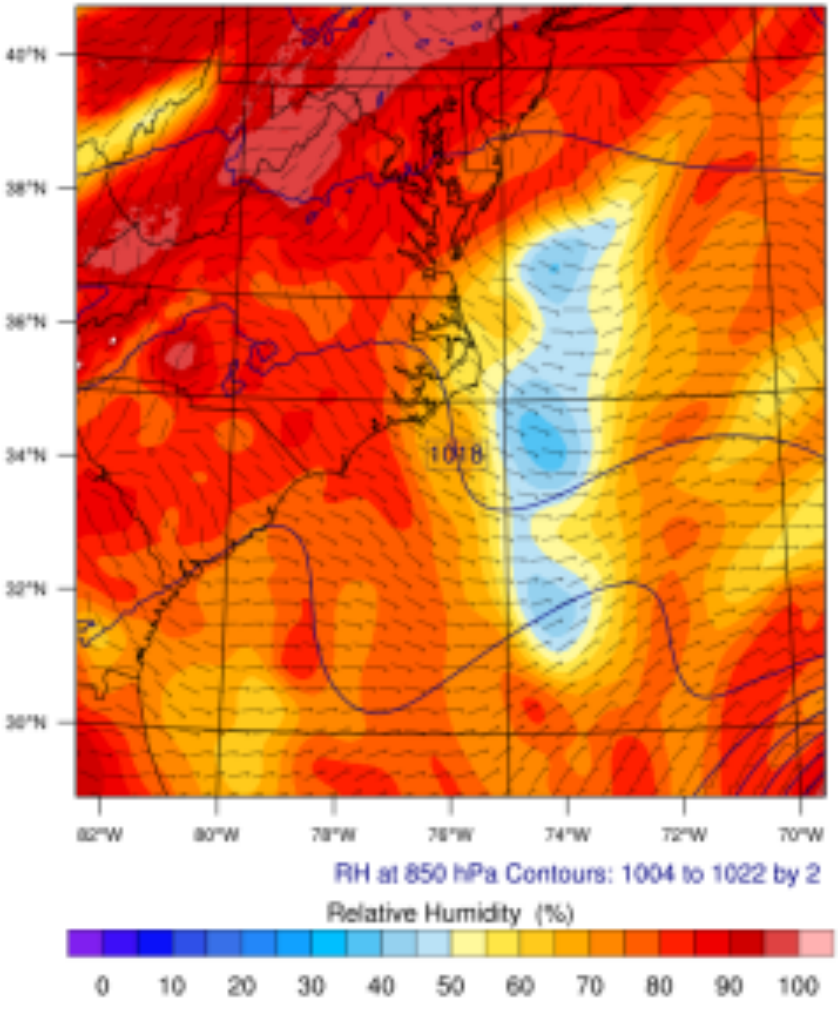

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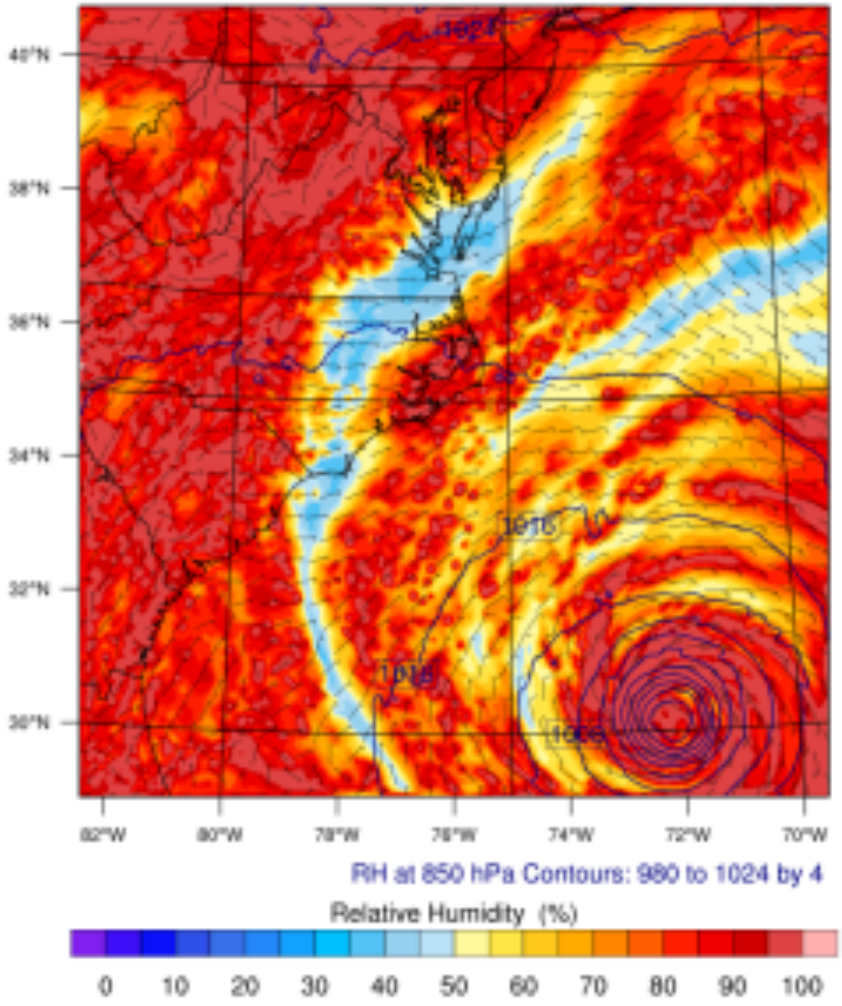

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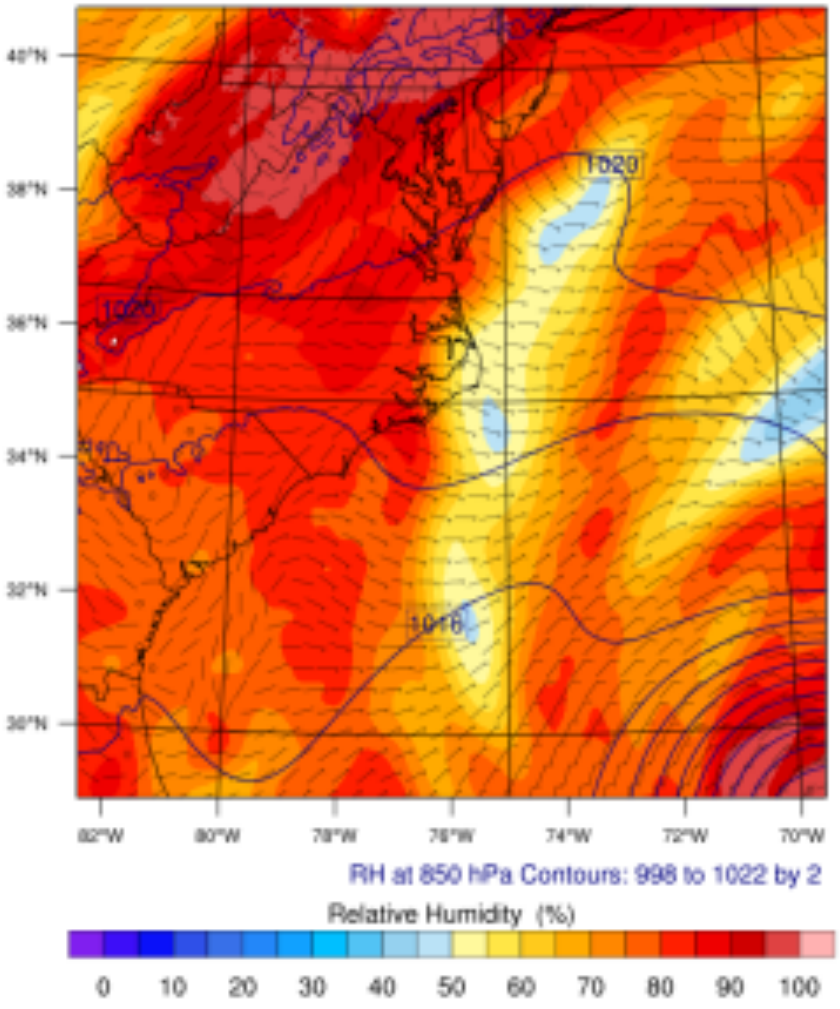

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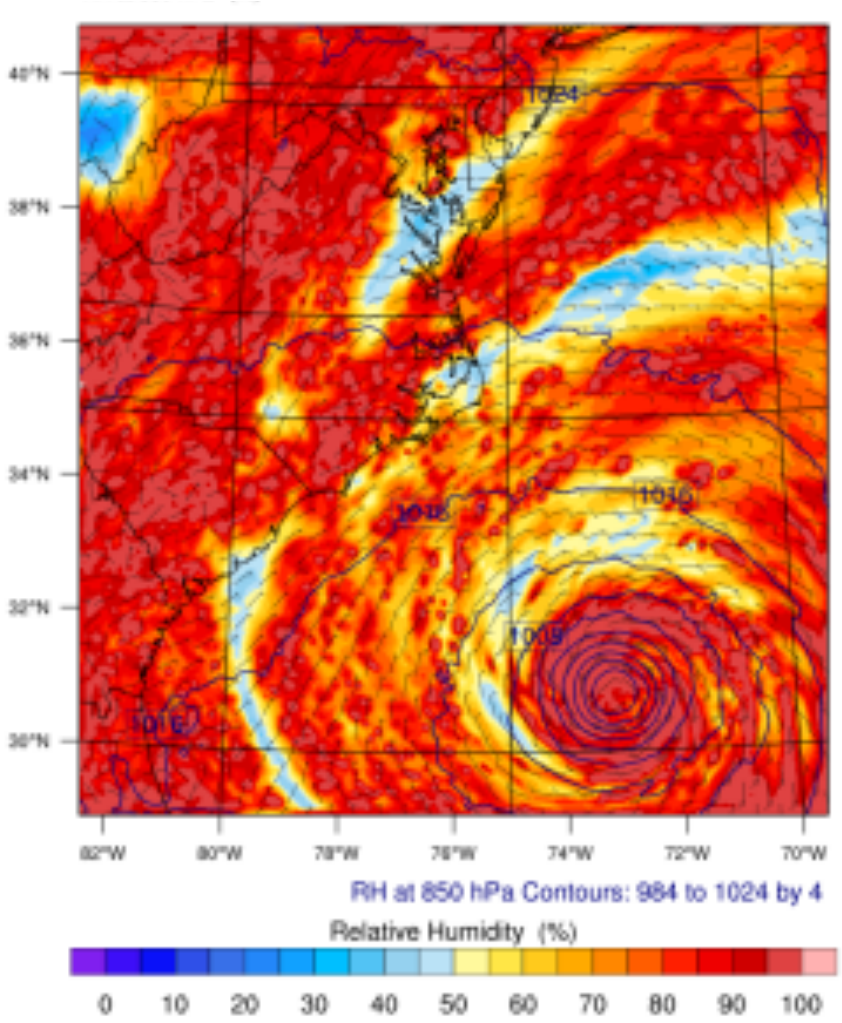

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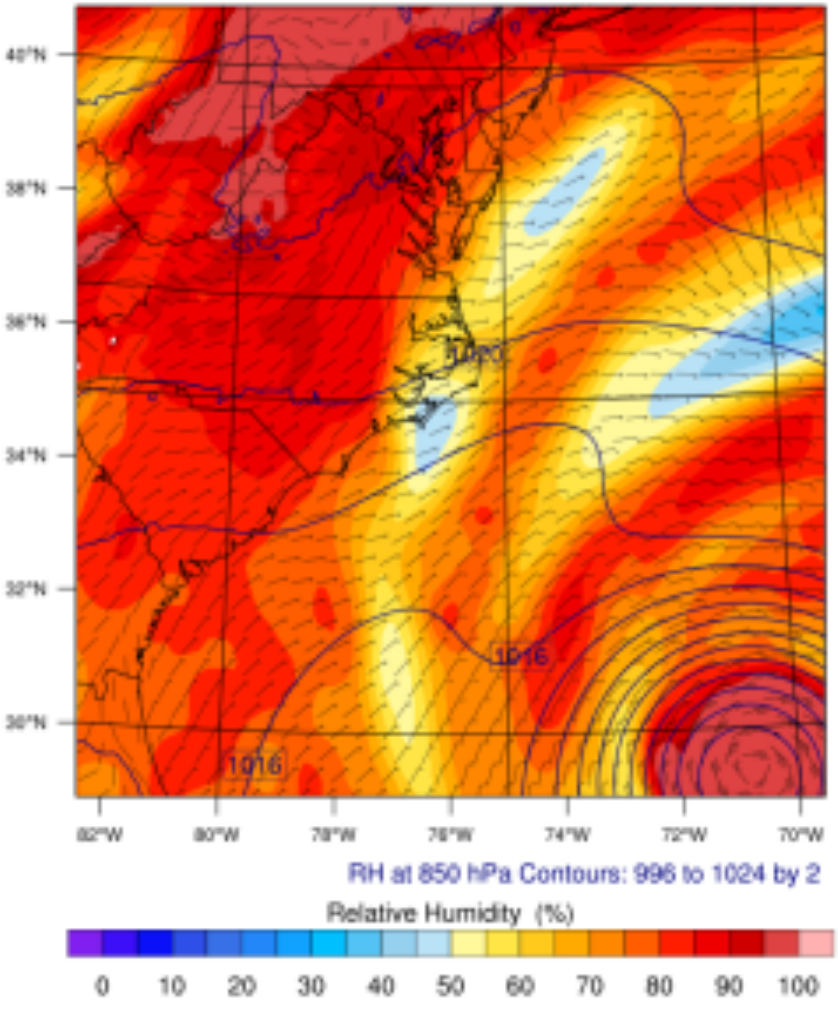

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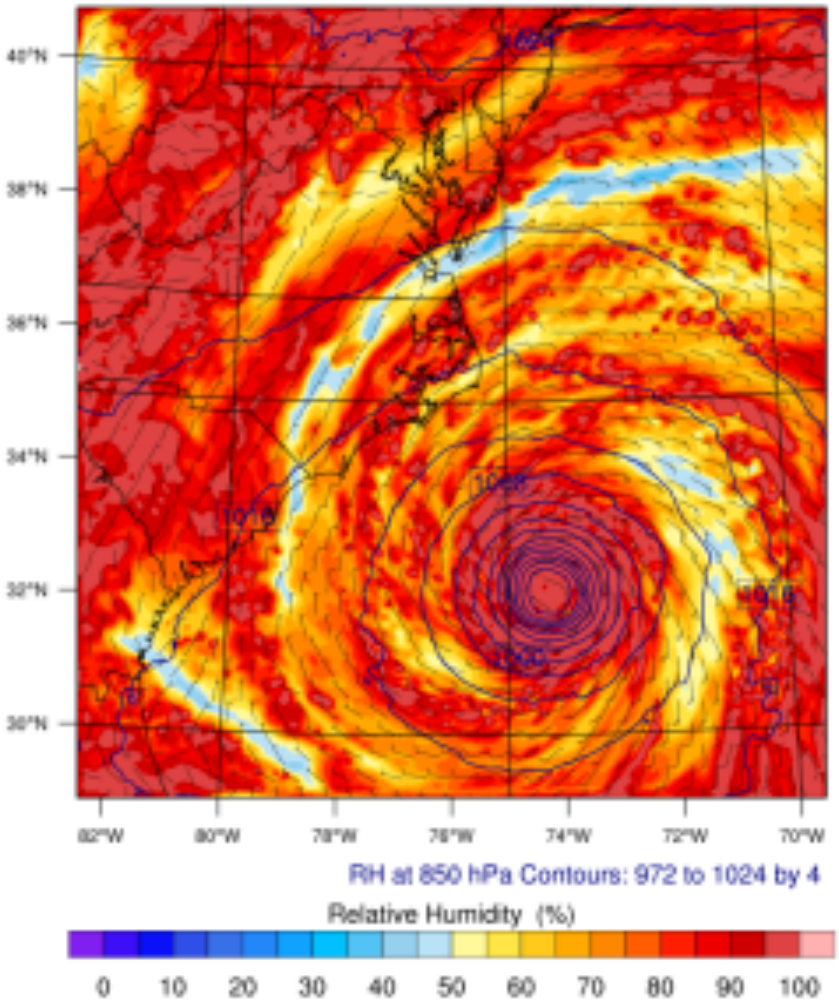

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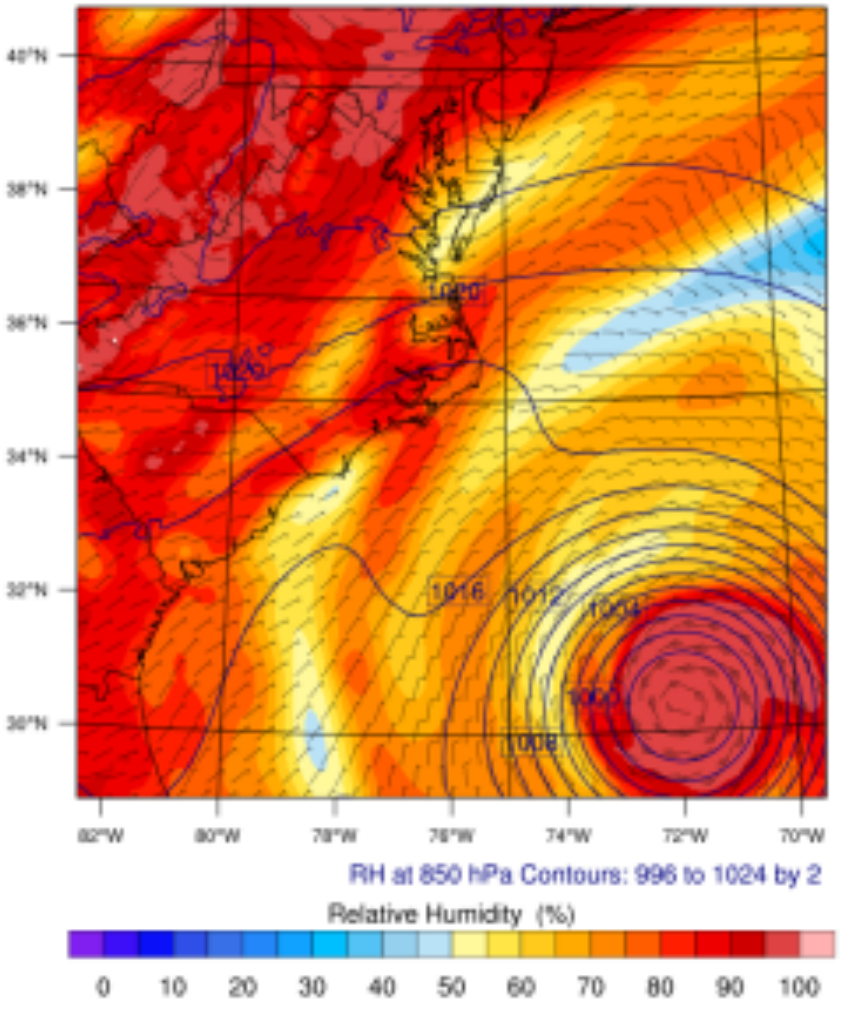

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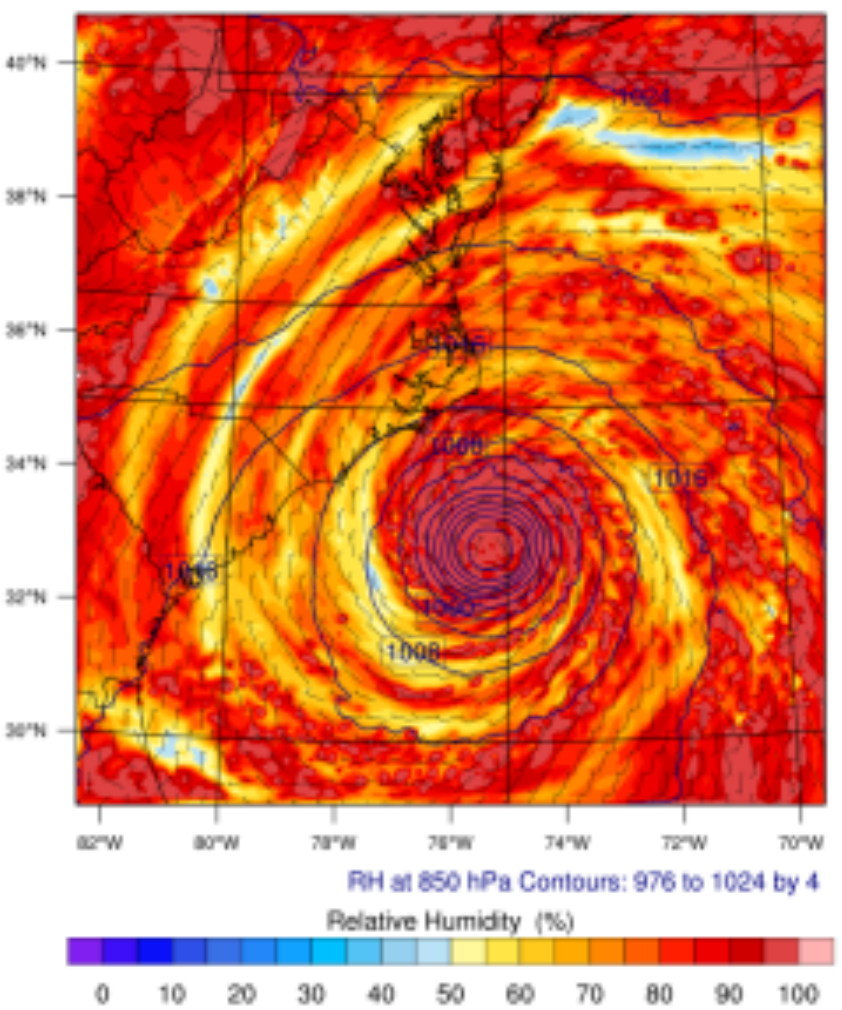

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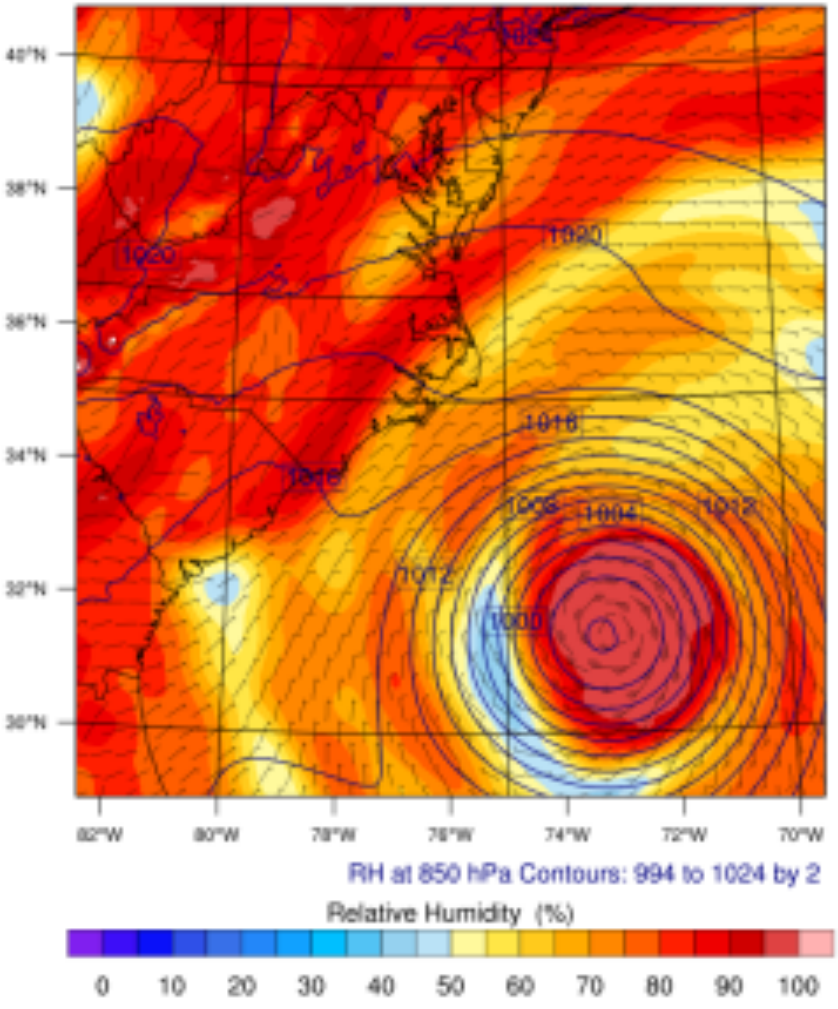

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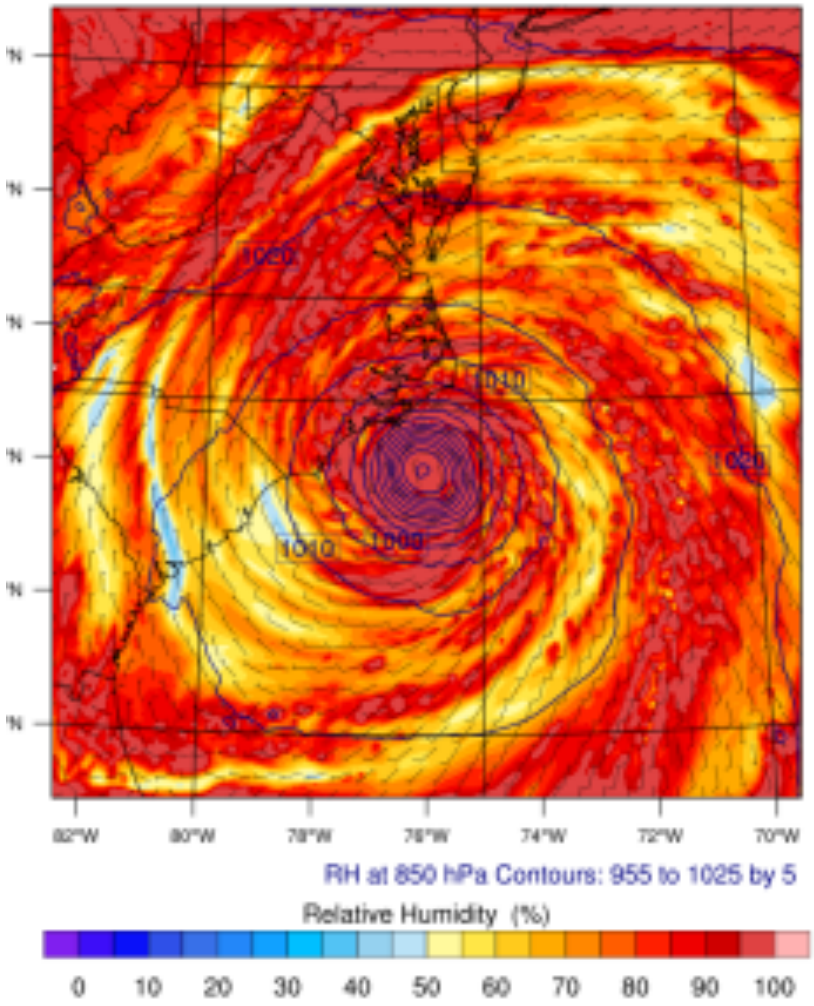

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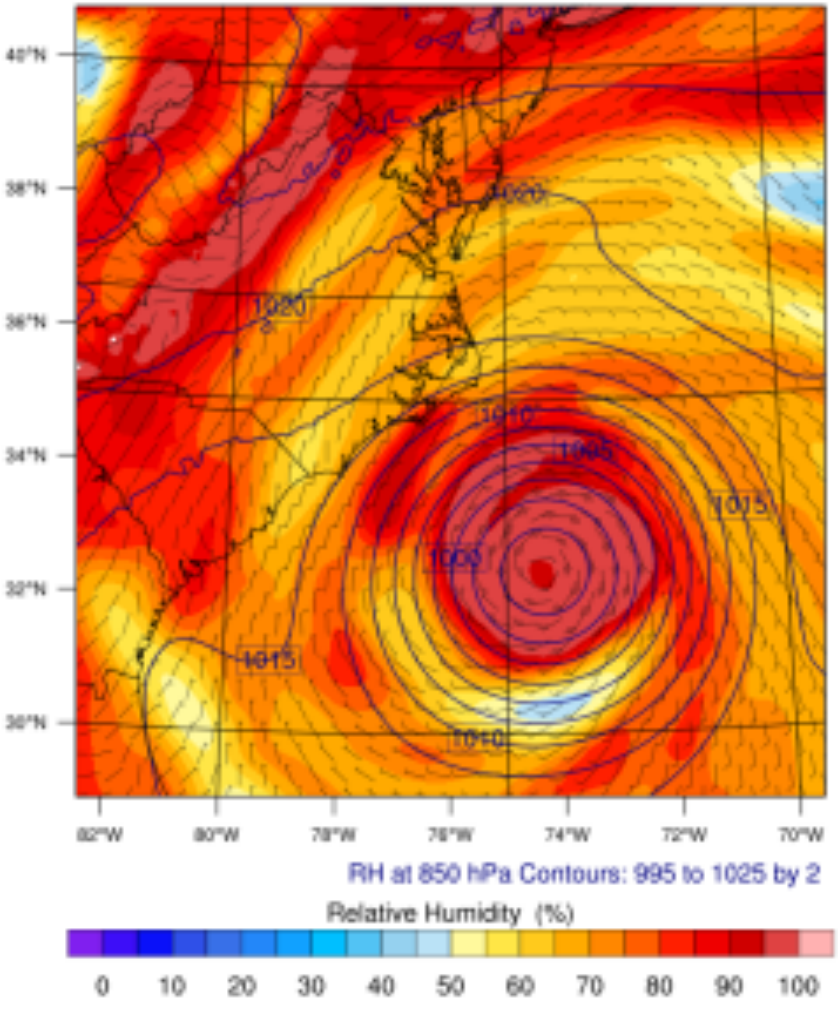

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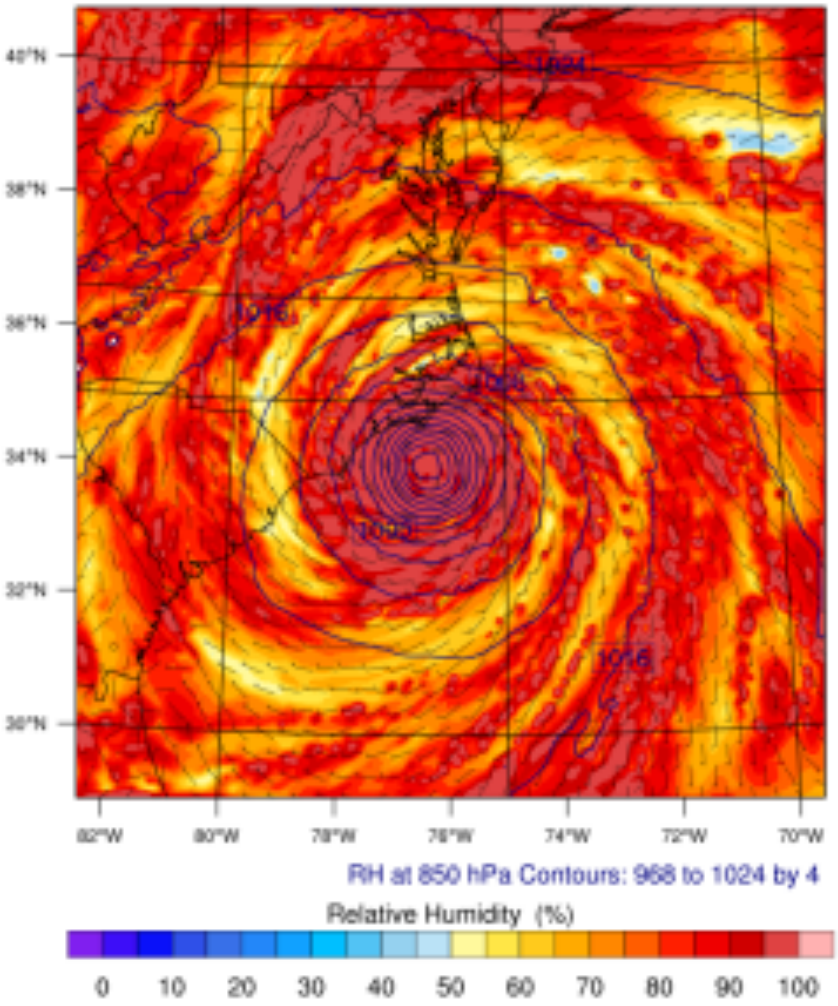

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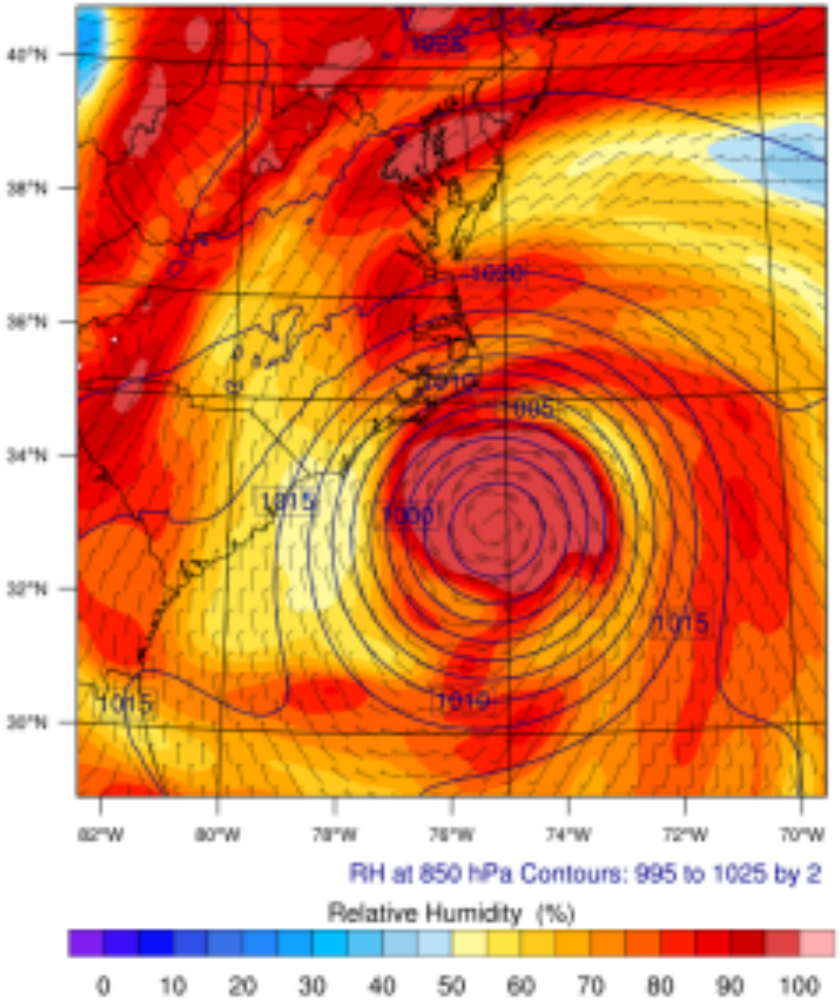

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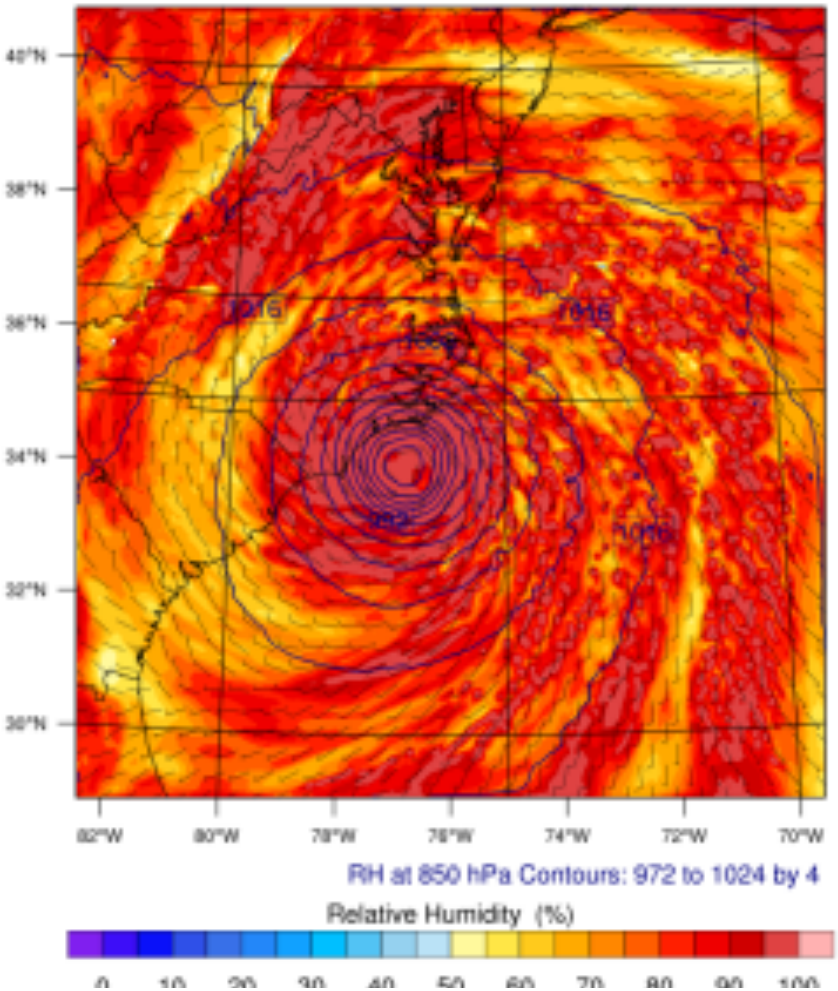

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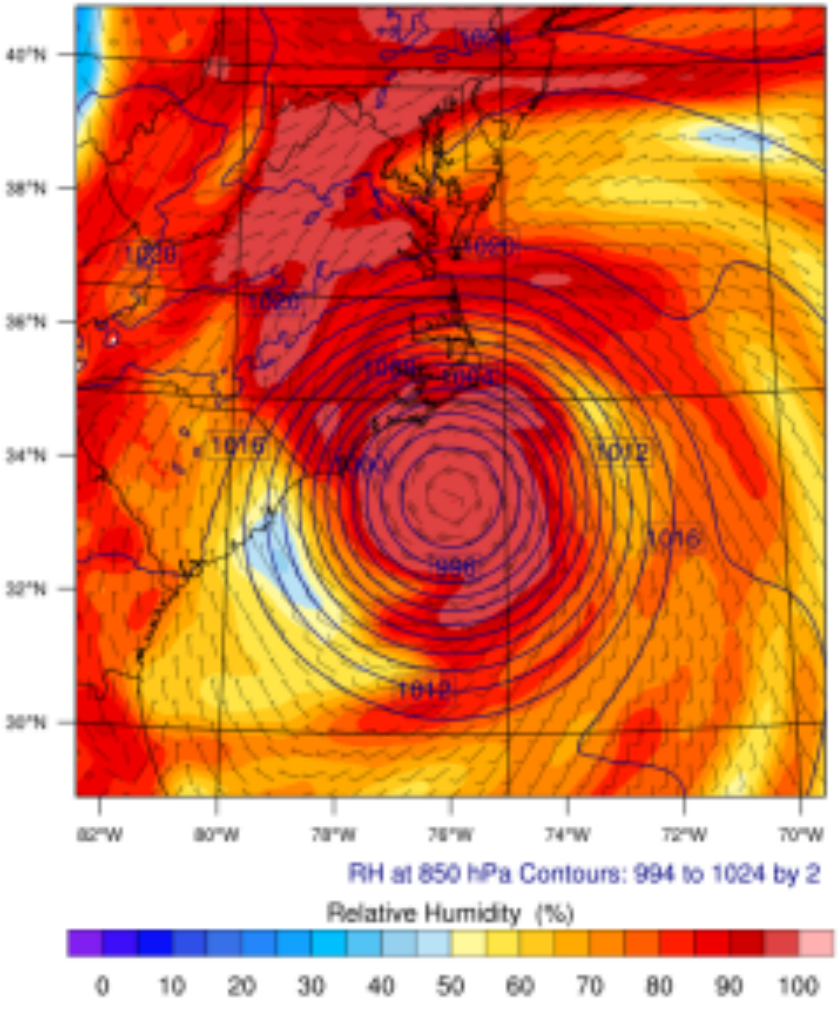

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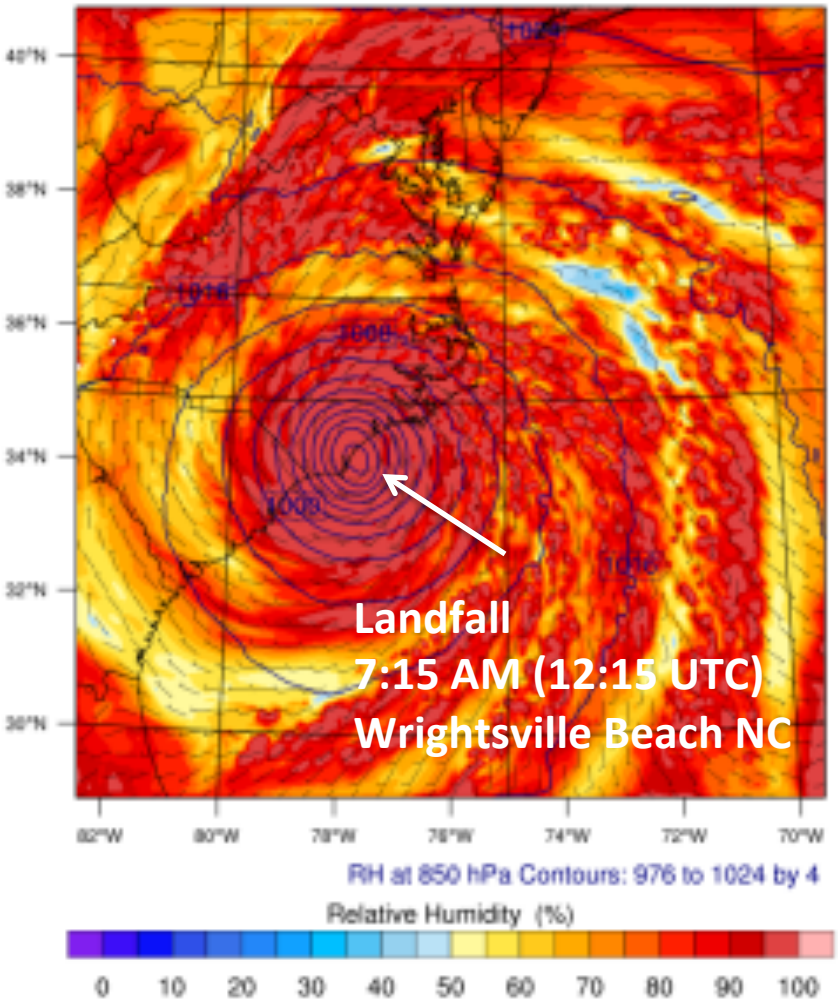

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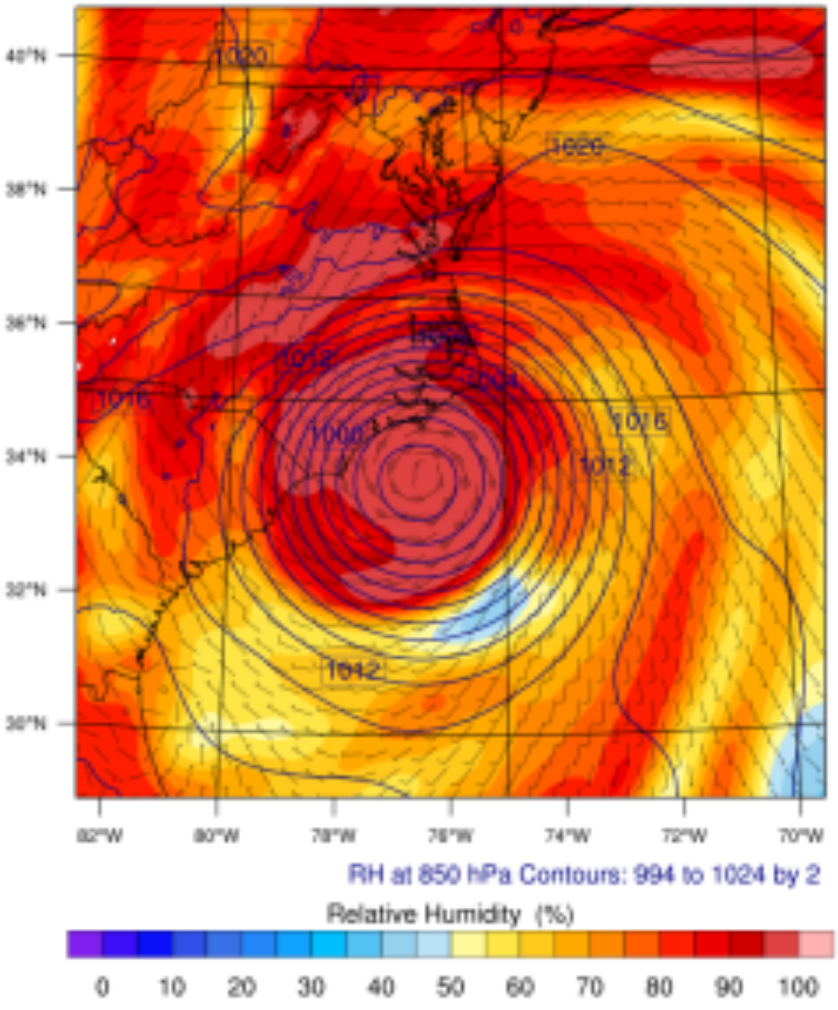

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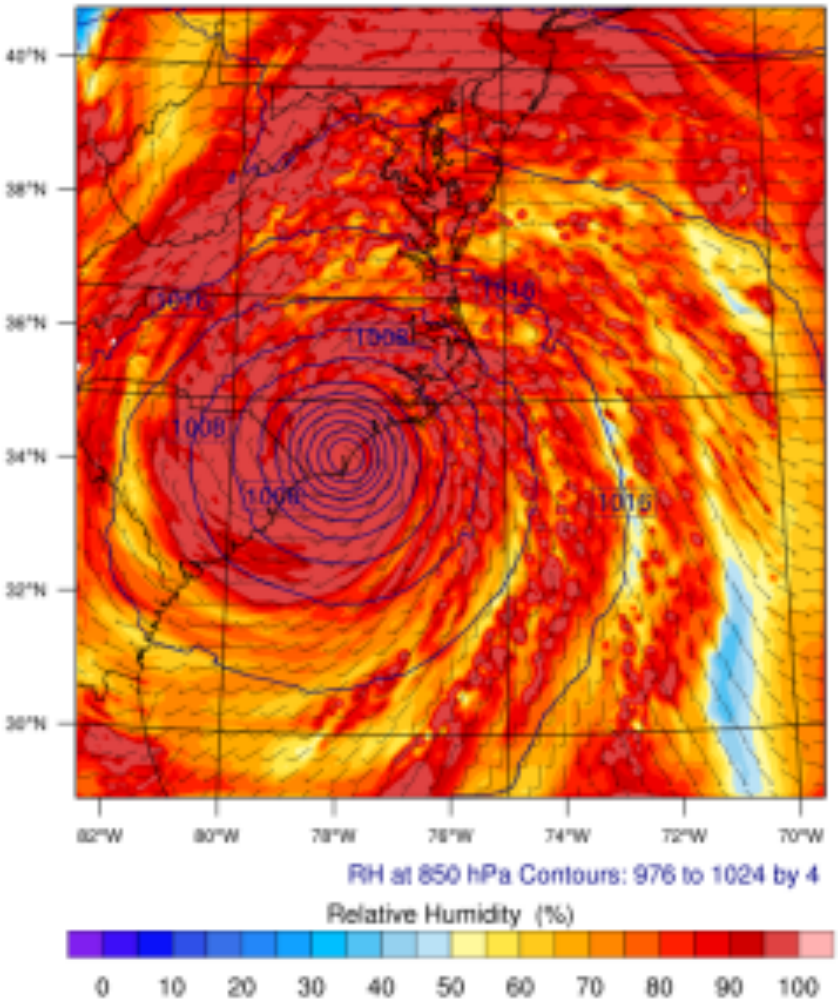

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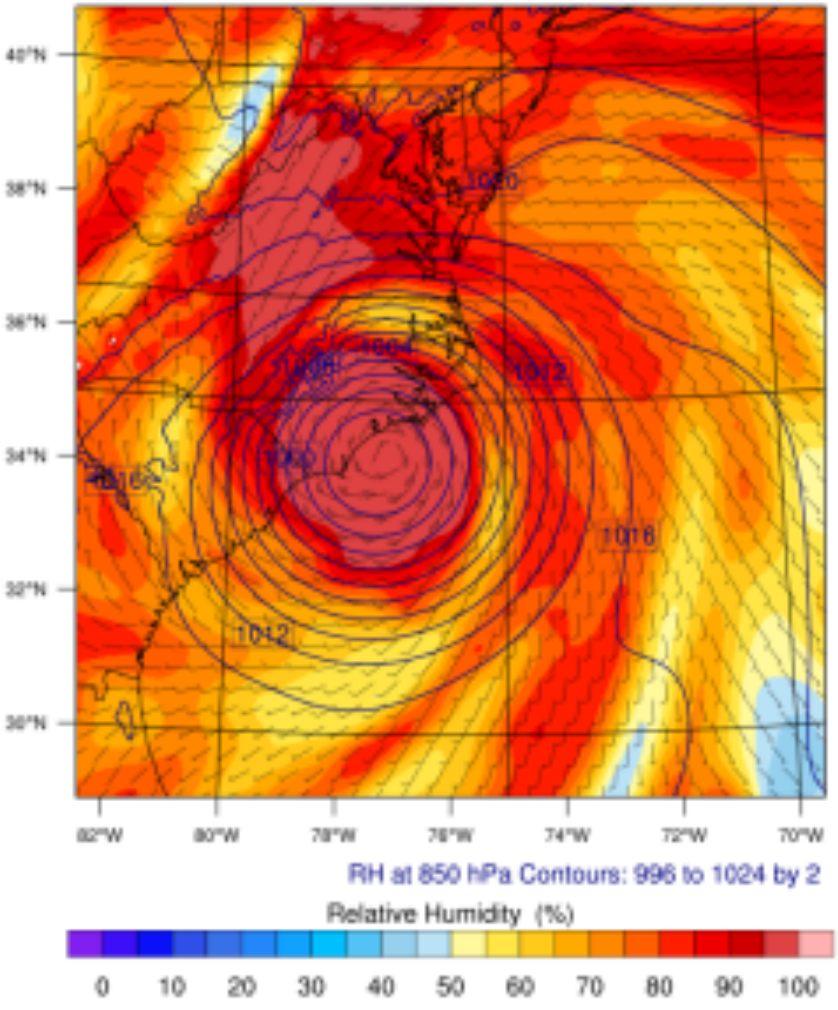

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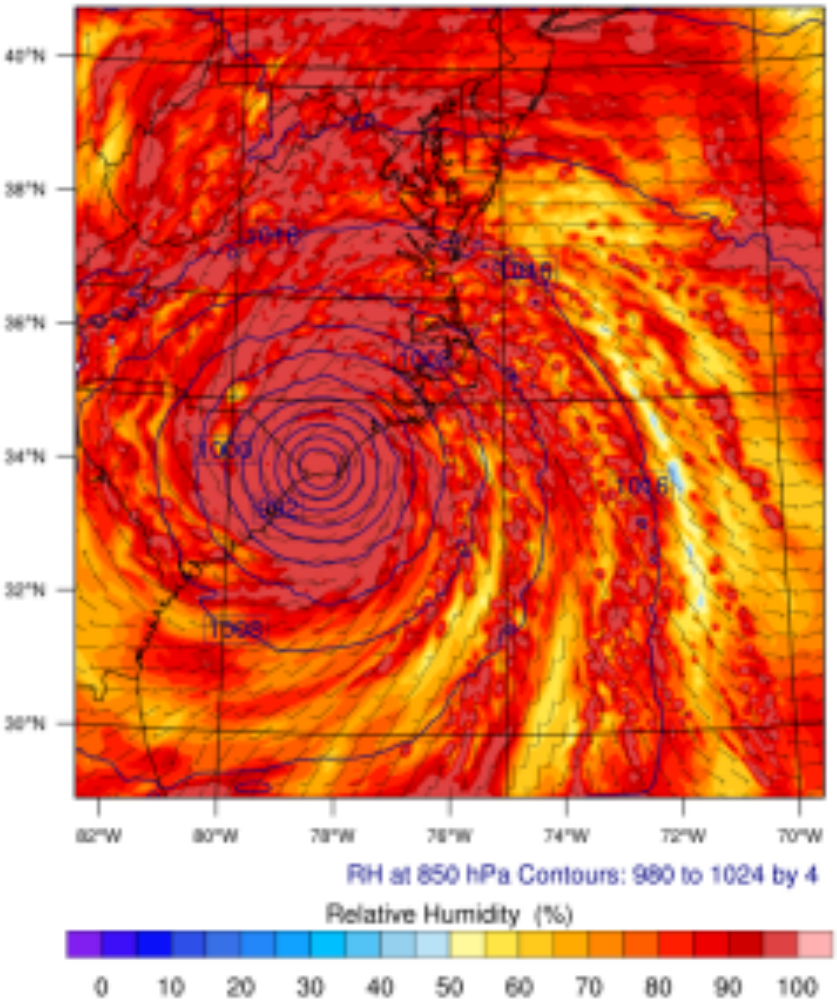

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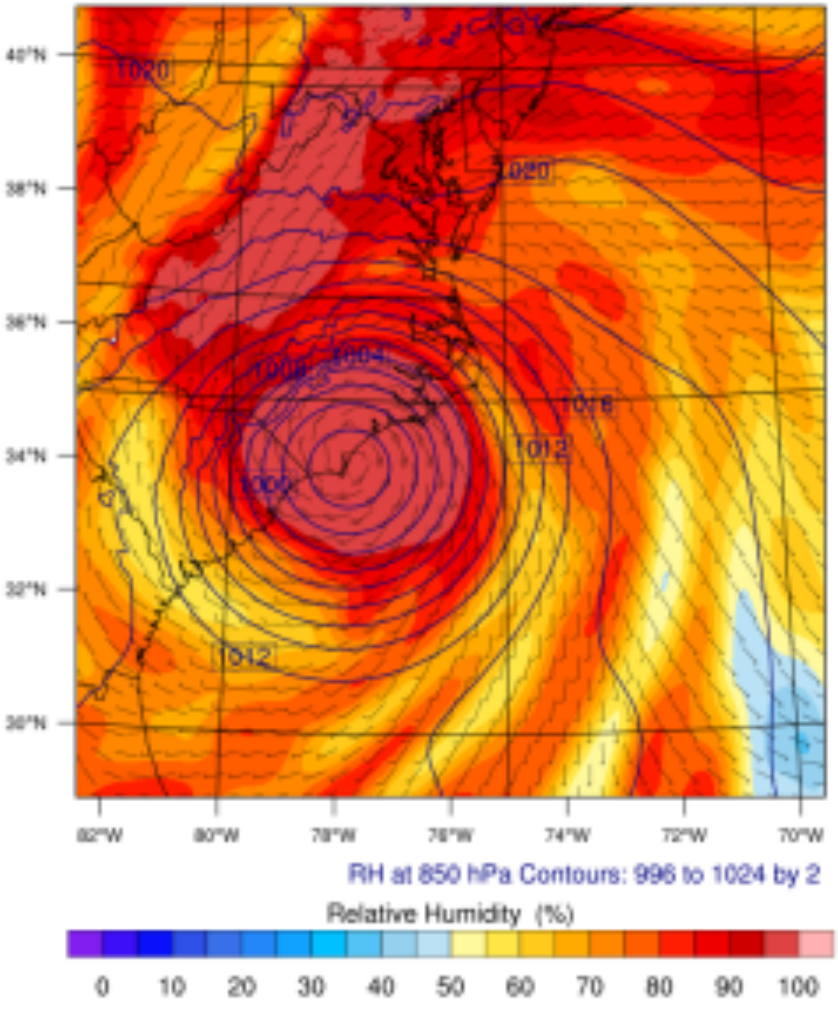

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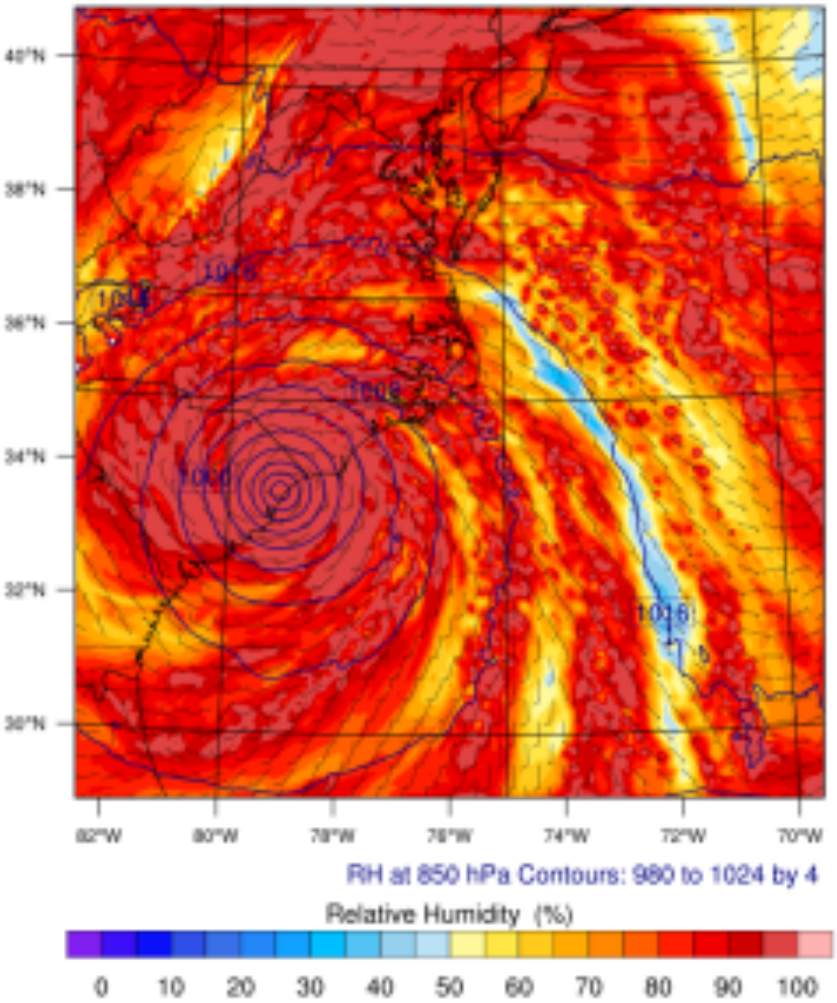

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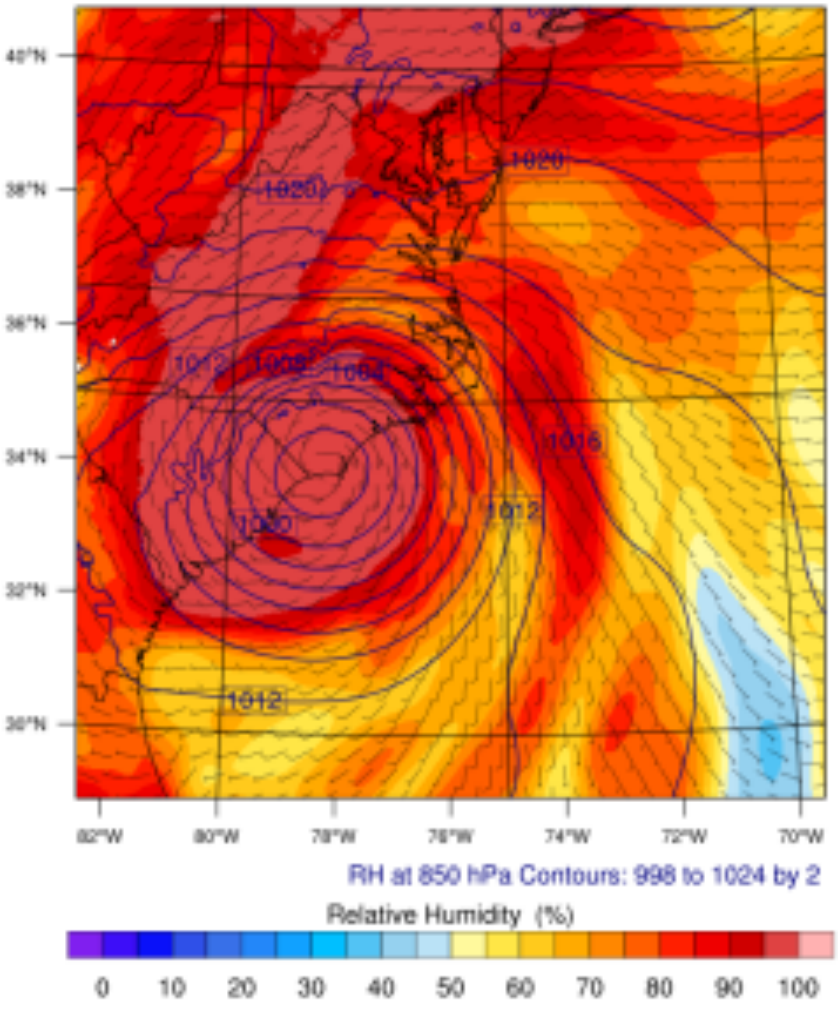

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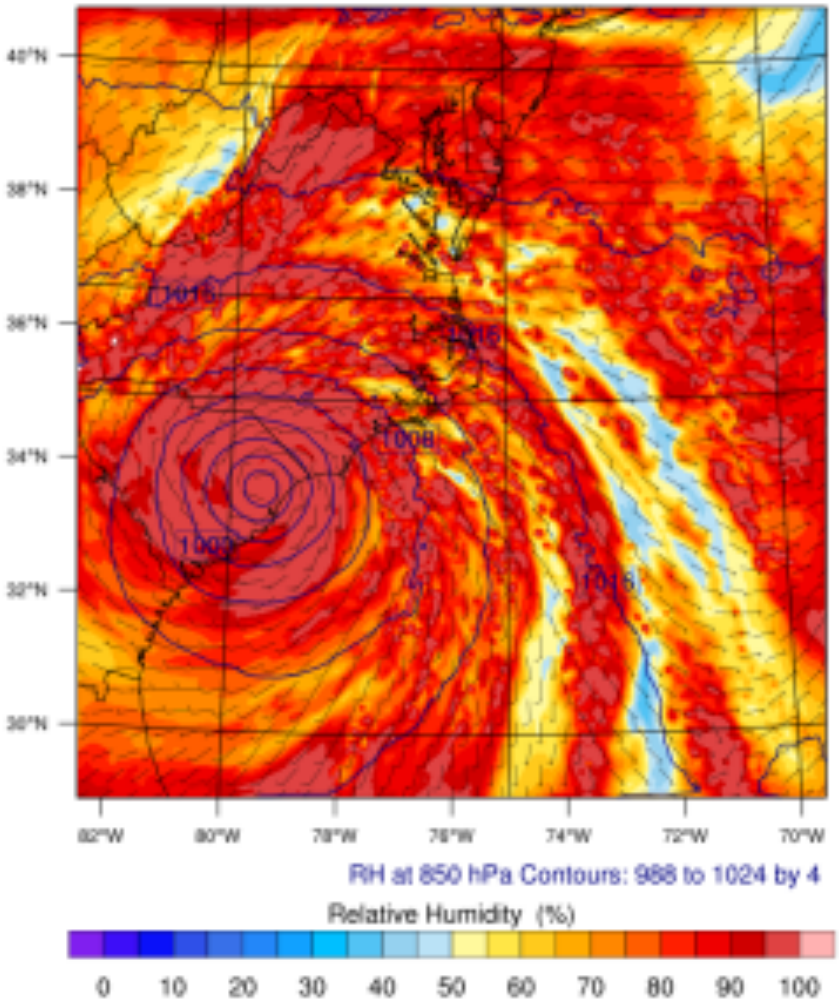

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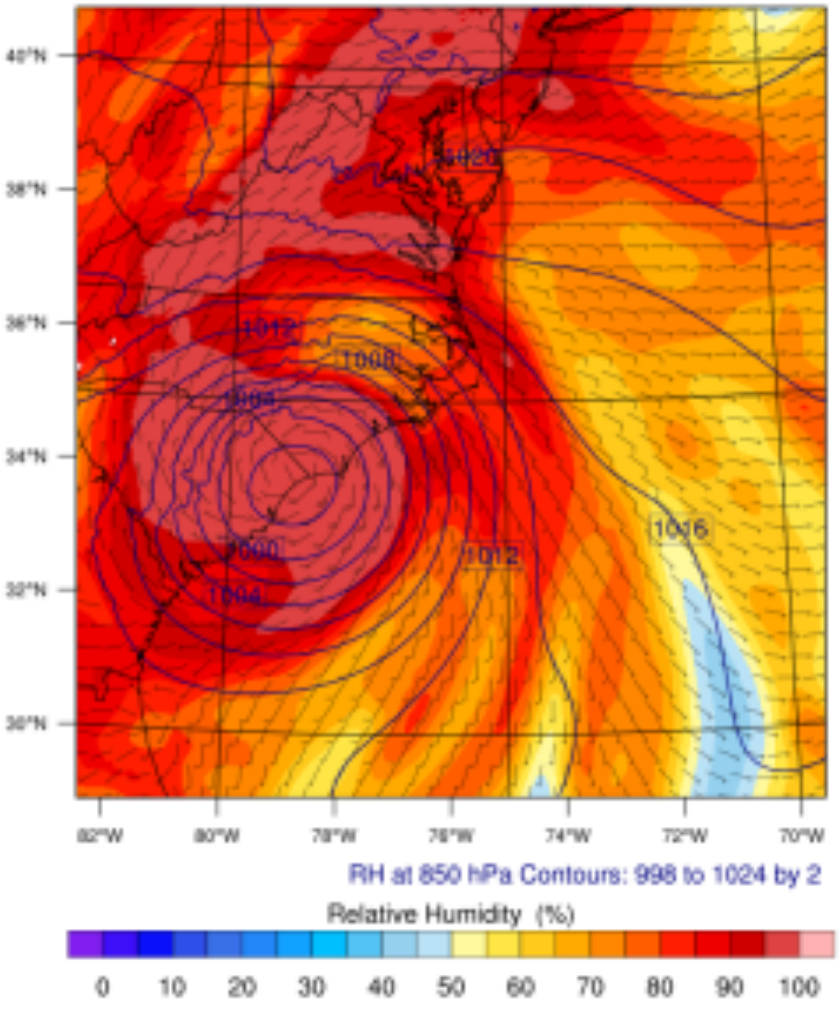

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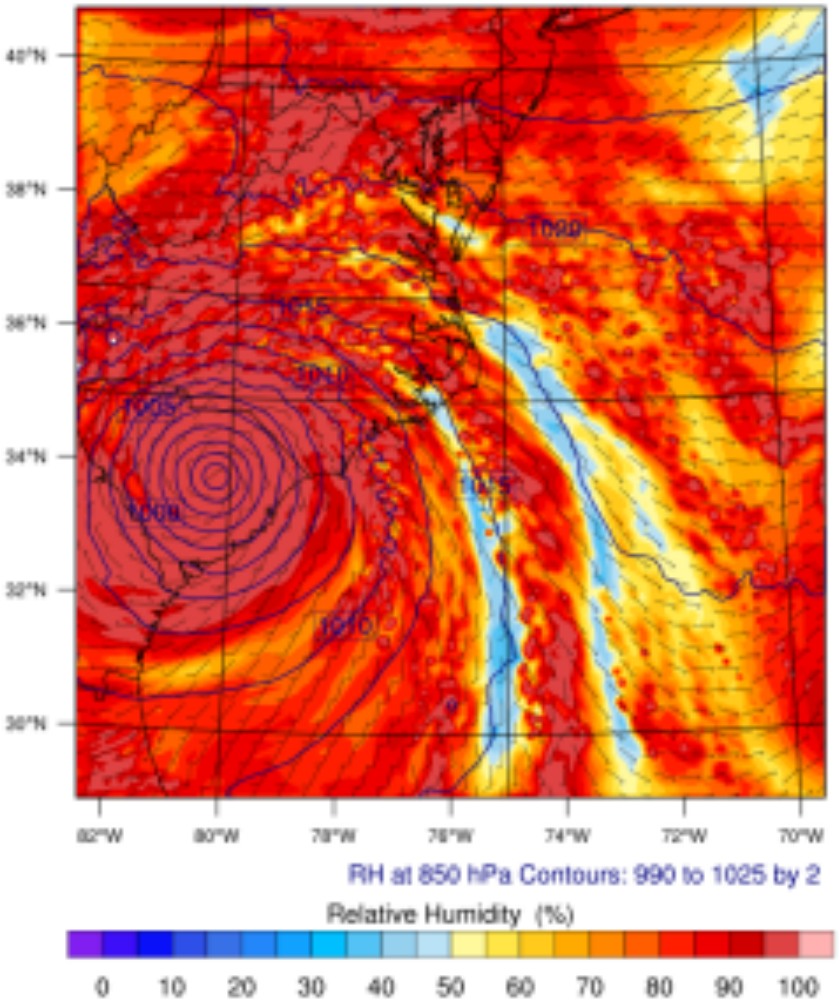

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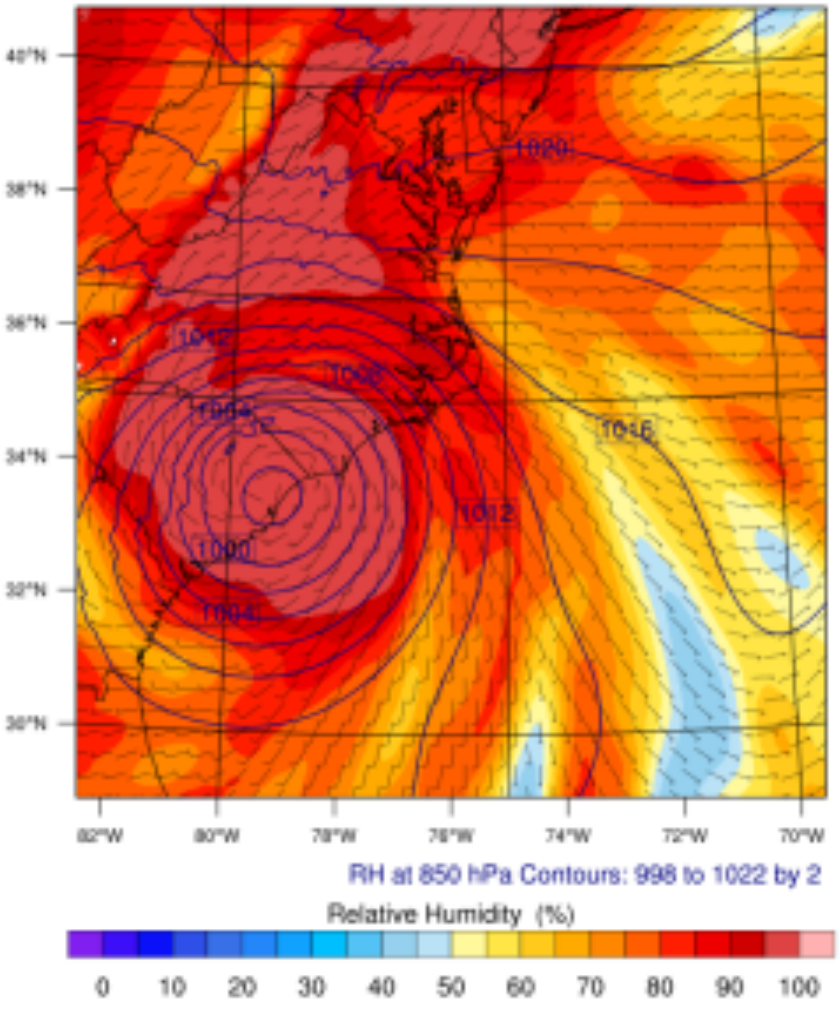

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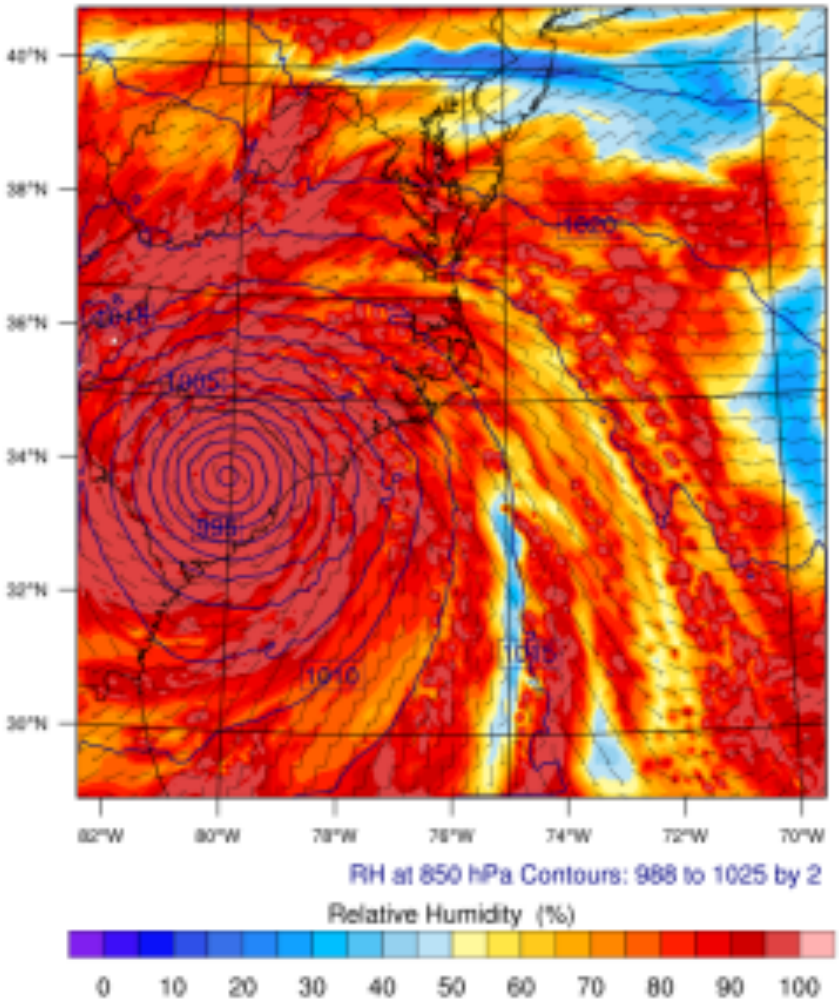

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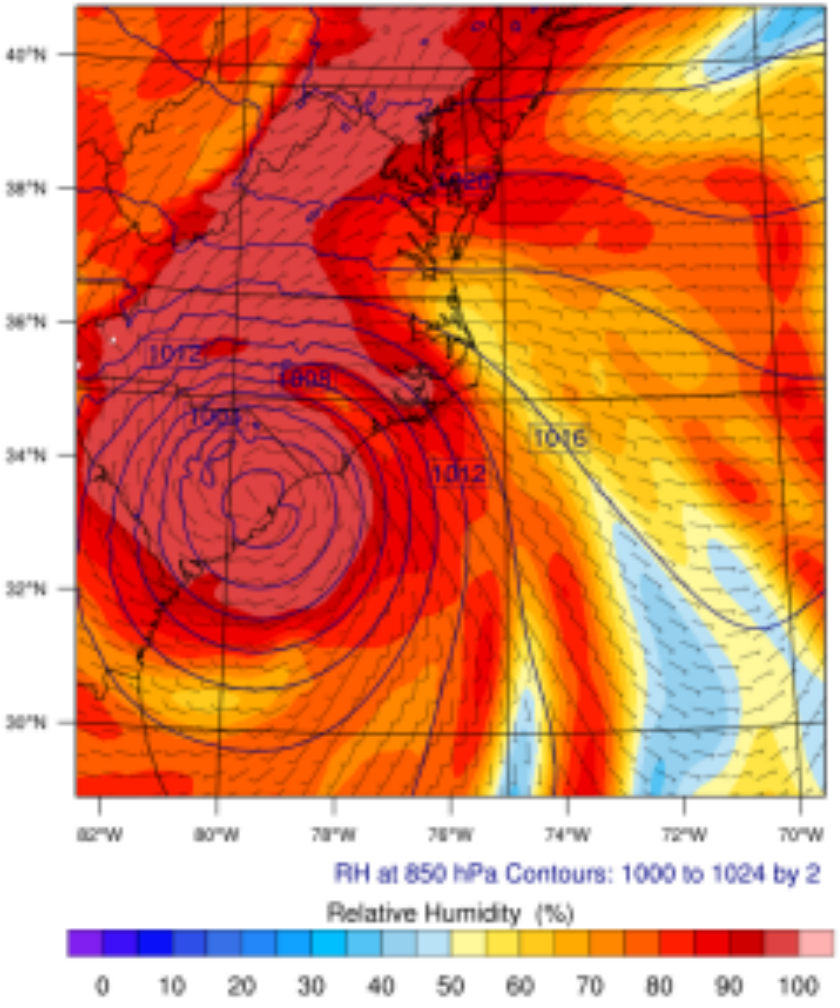

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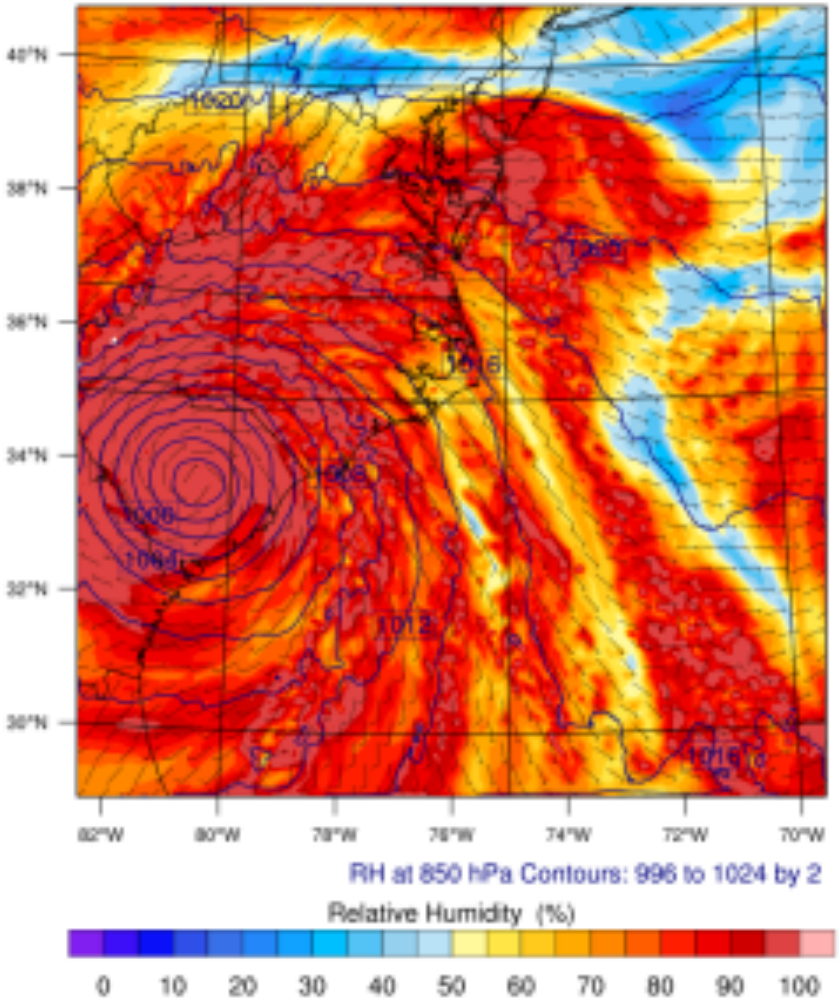

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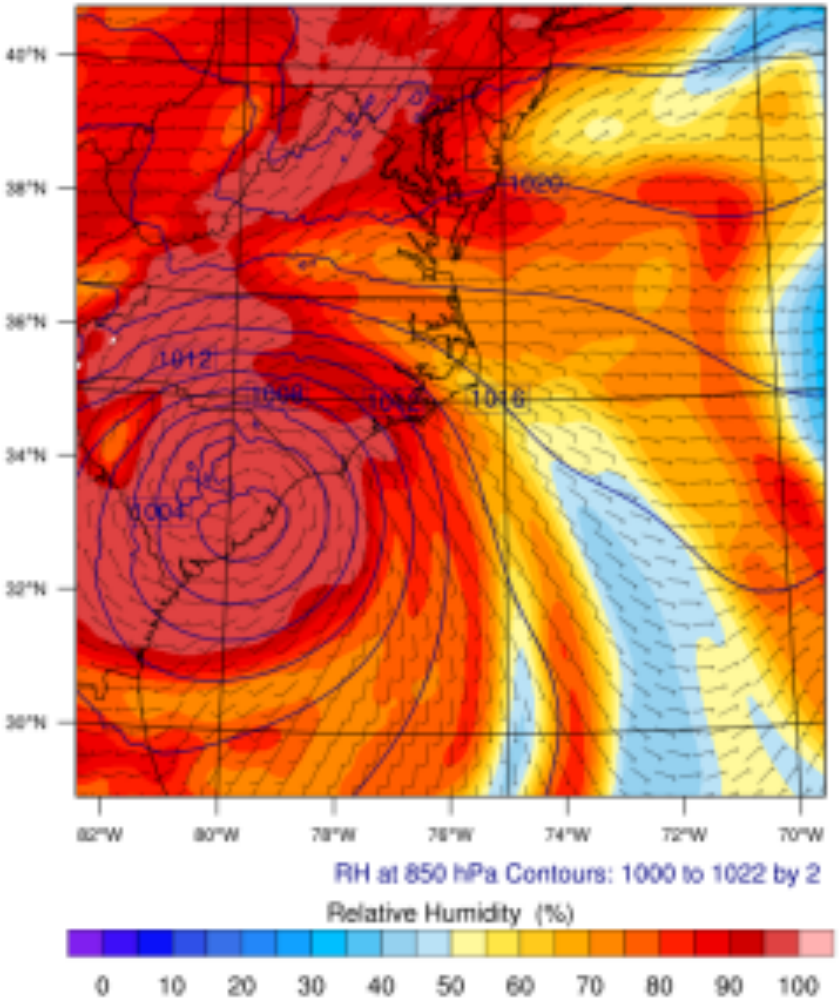

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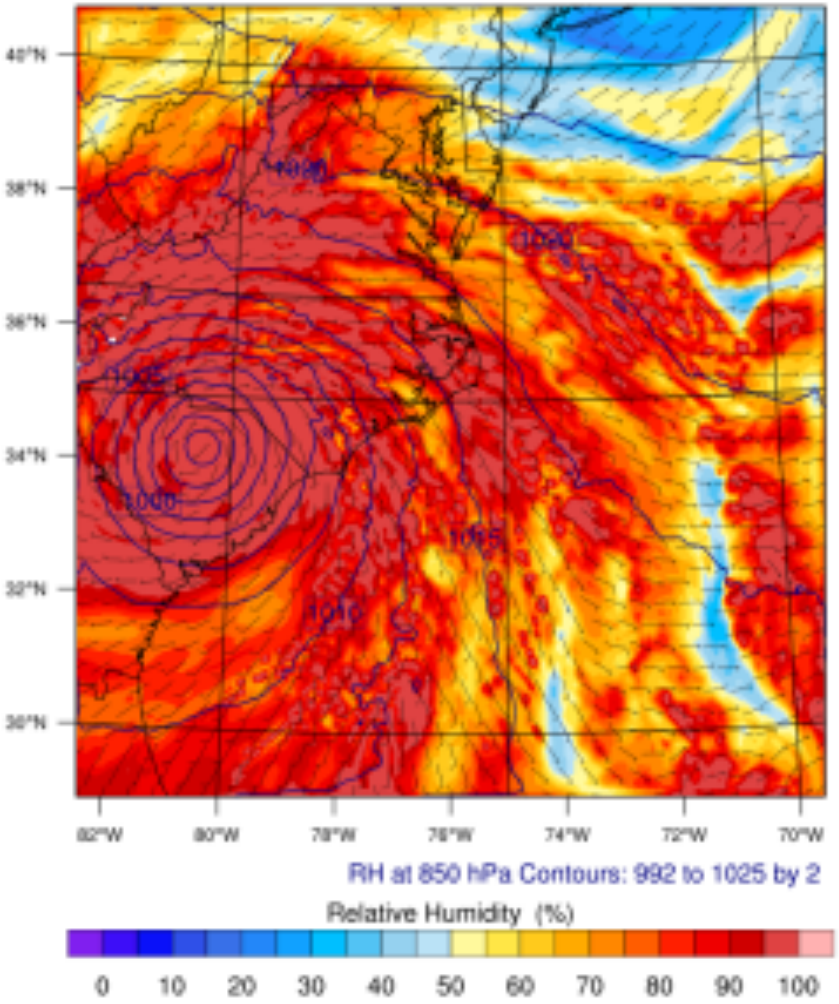

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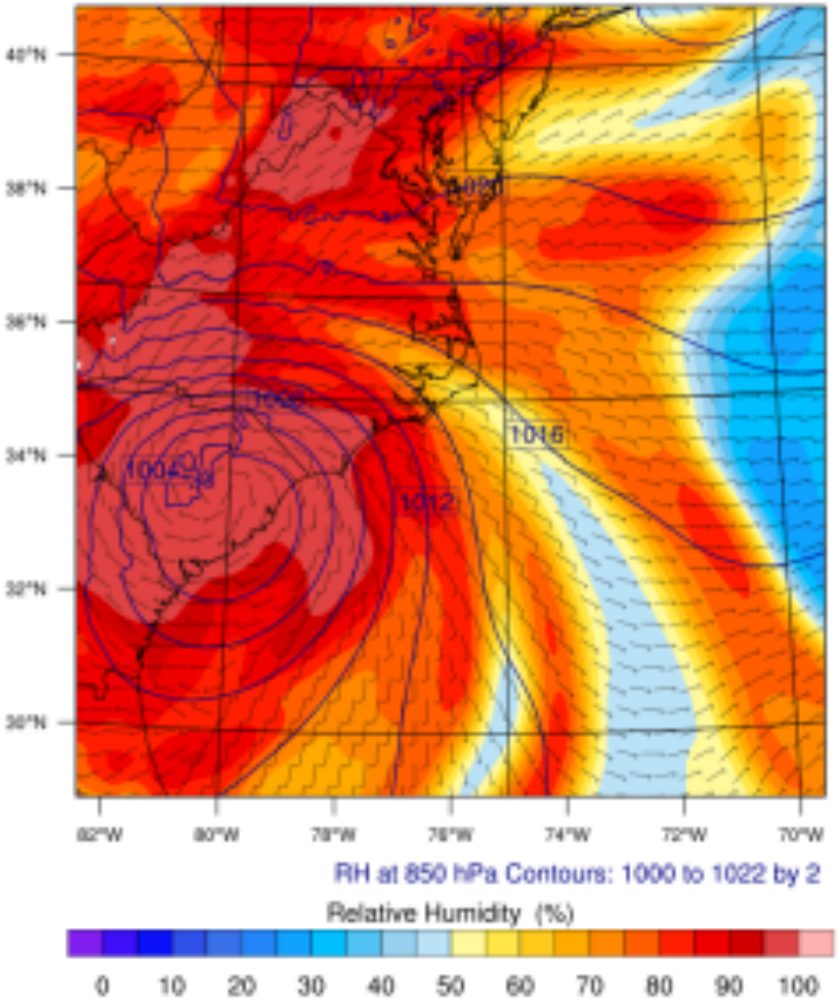
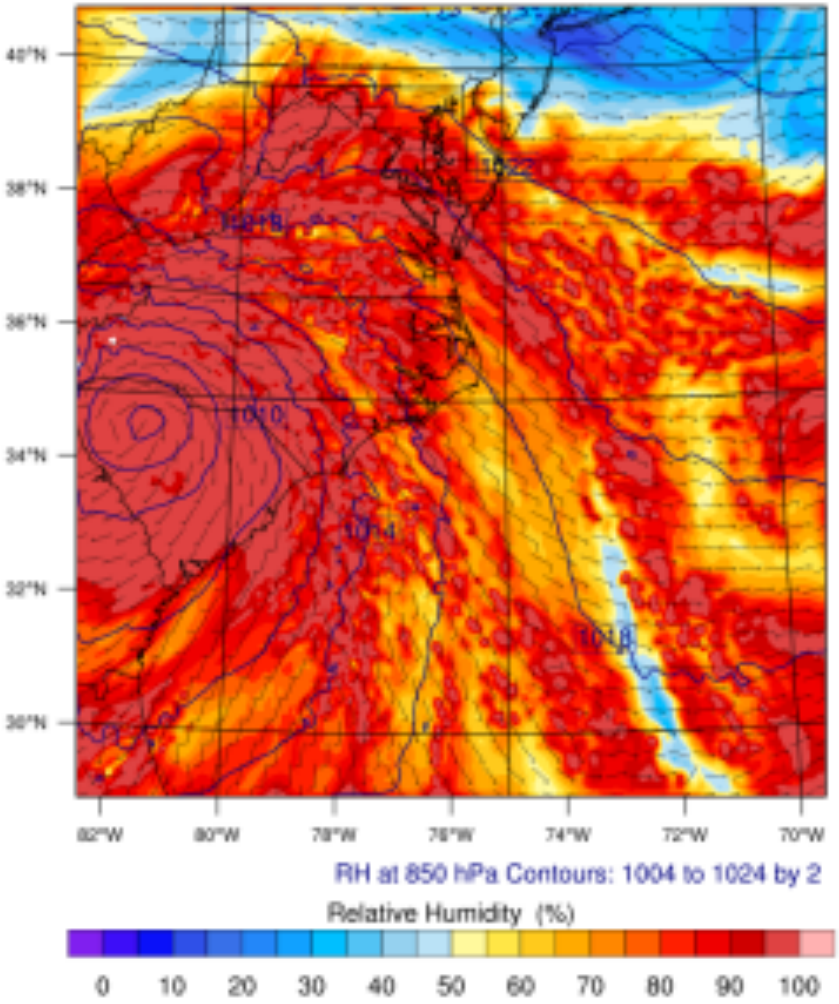


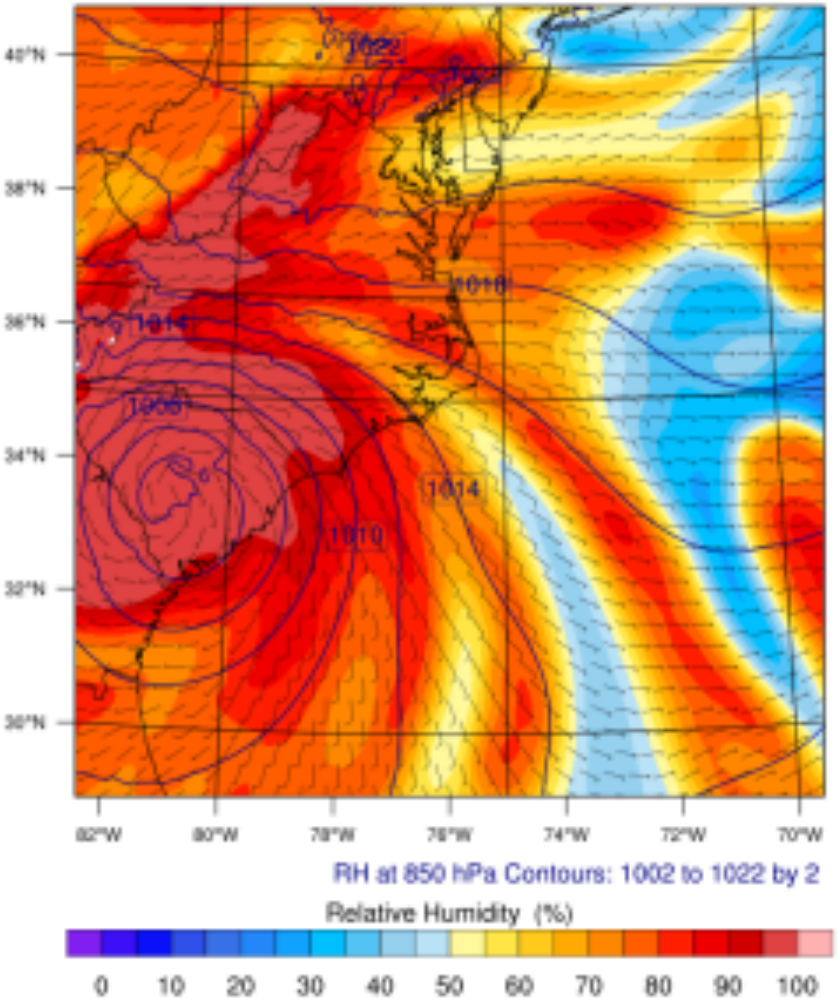
WRFwPHSnABI



Initial:
20180916 06 UTC

Validation:
20180917 00 UTC

GFS



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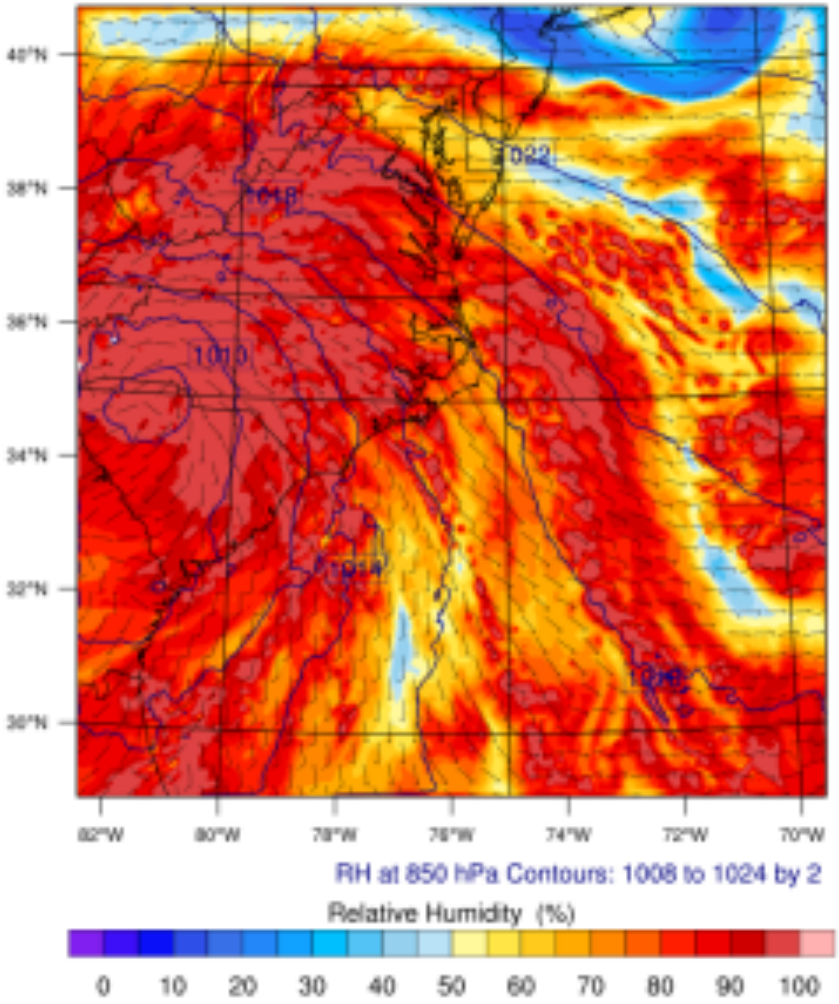
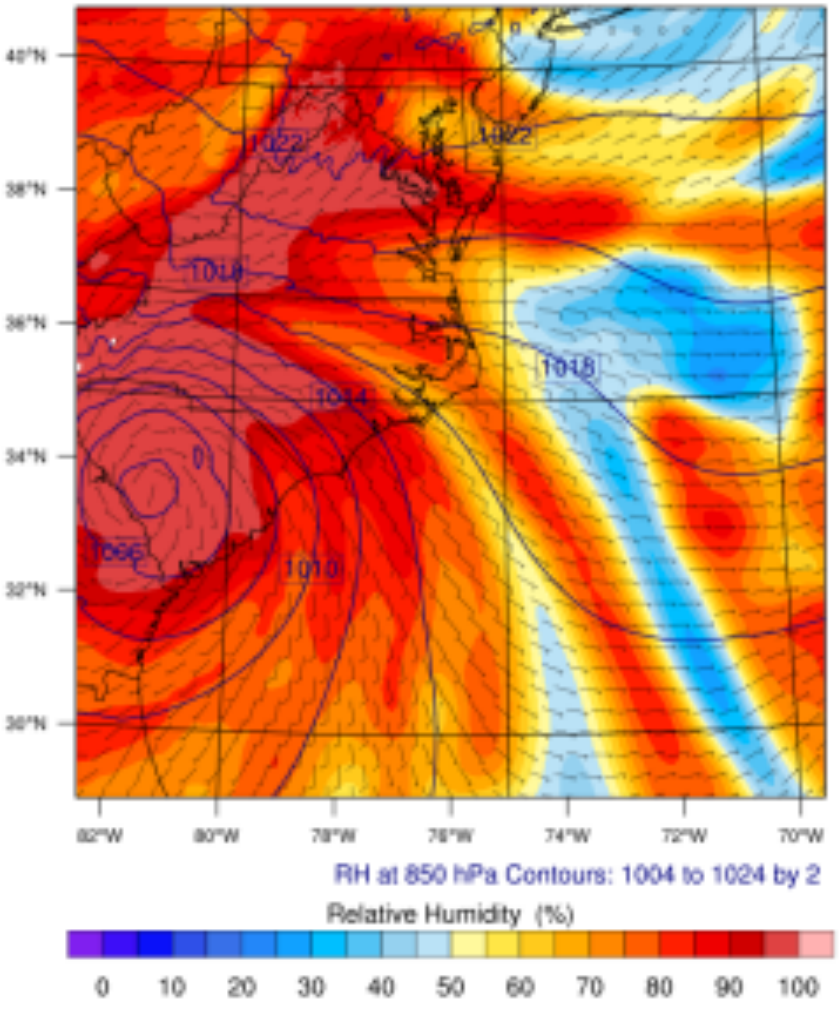


Initial:
20180916 12 UTC

Validation:
20180917 06 UTC

GFS



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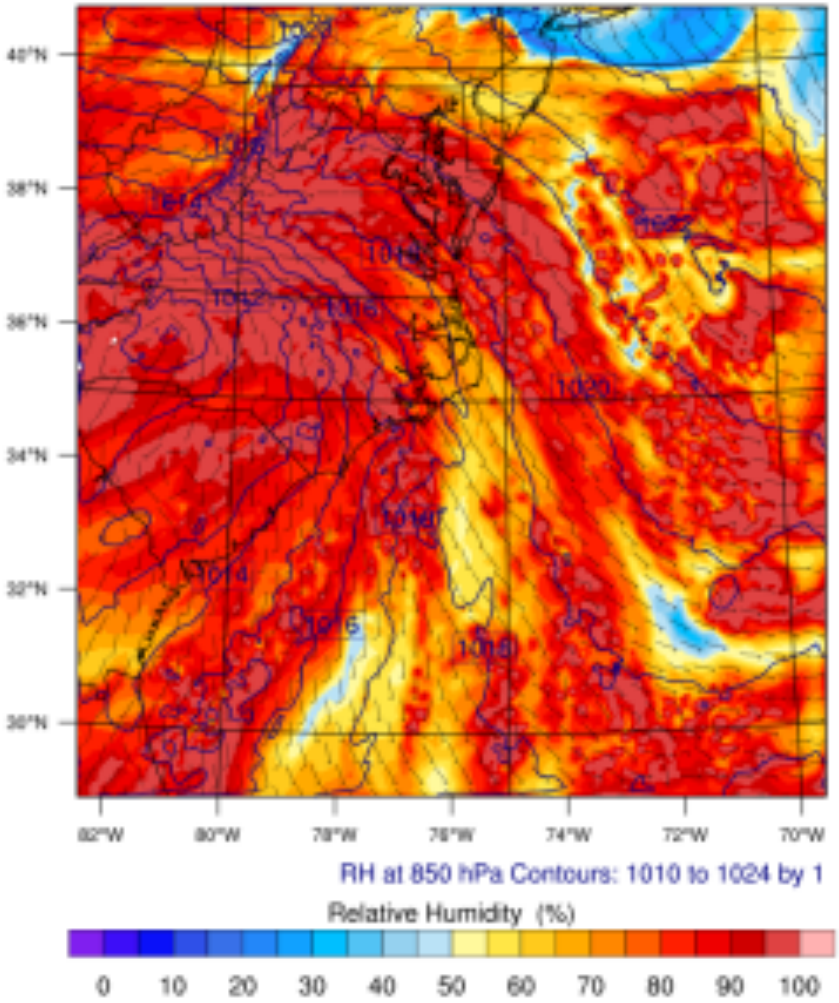
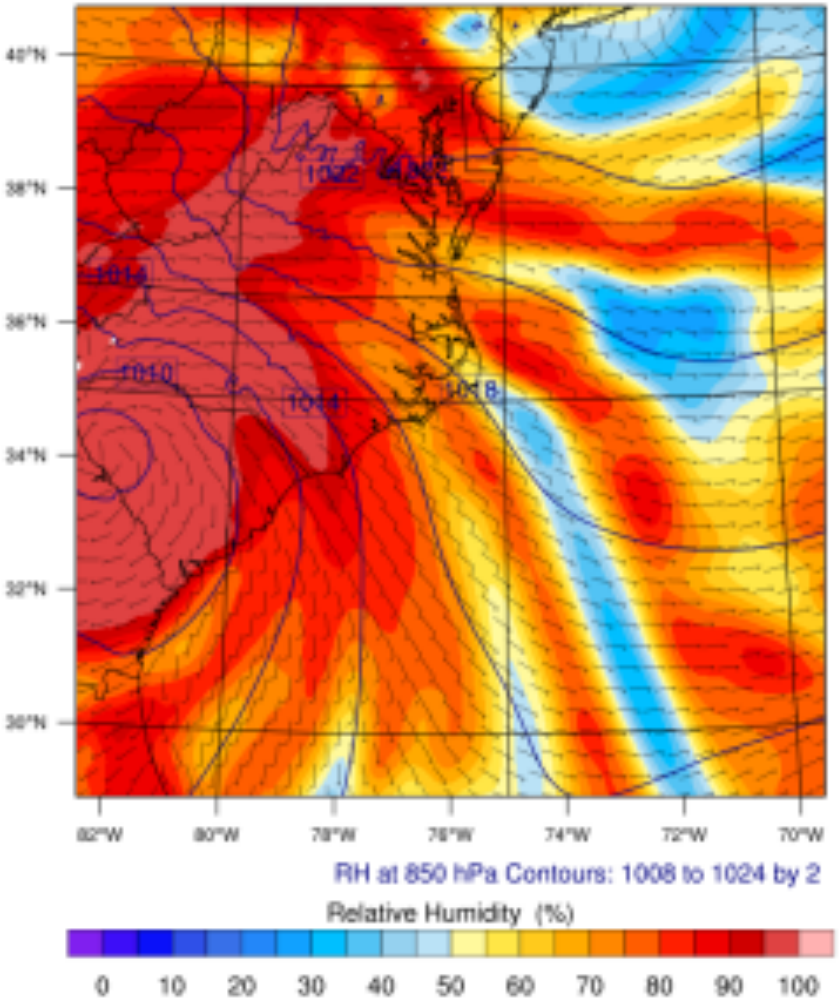


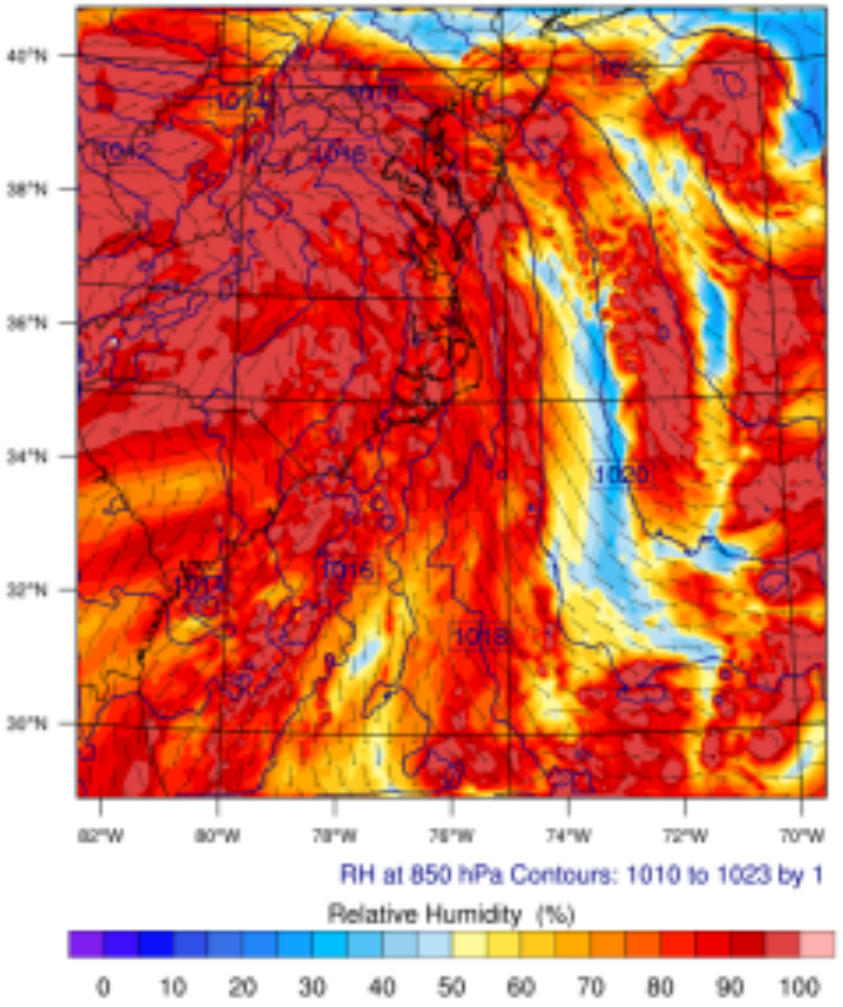
Initial:
20180916 18 UTC

Validation:
20180917 12 UTC

GFS



WRFwPHSnABI



Hurricane Florence Landfall

WRF Control (without PHSnABI Data)
Vs
WRFwPHSnABI

September 14, 12:00 UTC

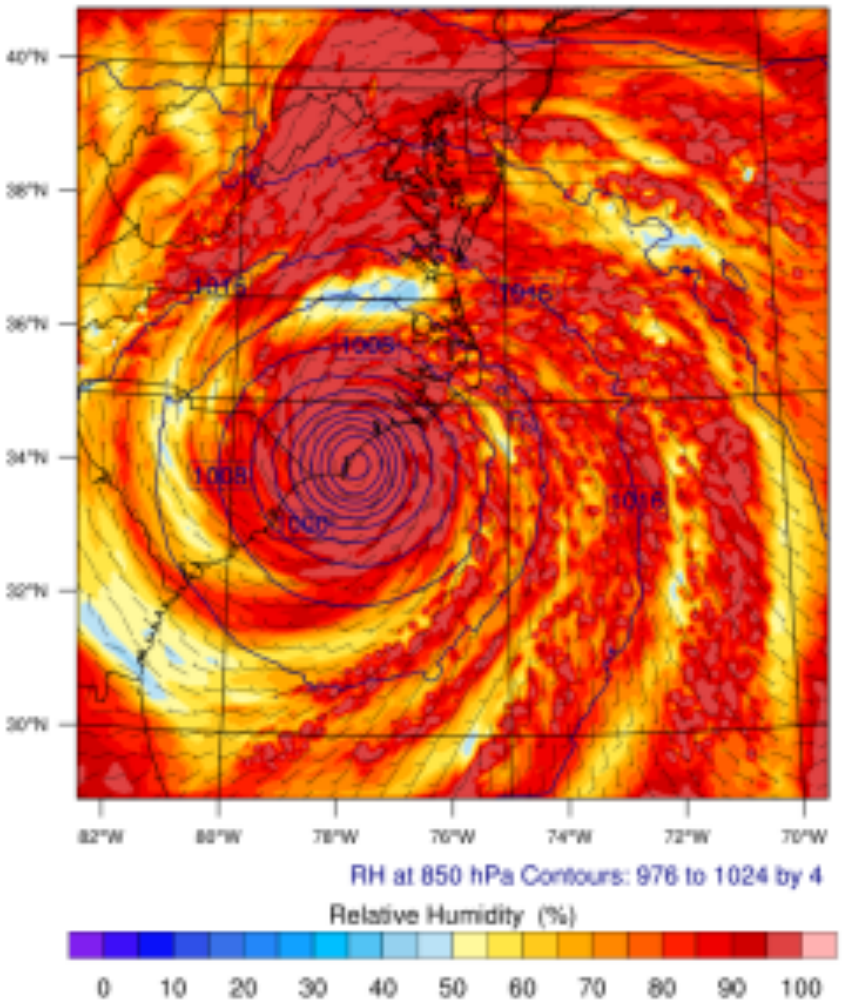
WRF Control Vs WRFwPHSnABI

Initial:
20180913 18 UTC

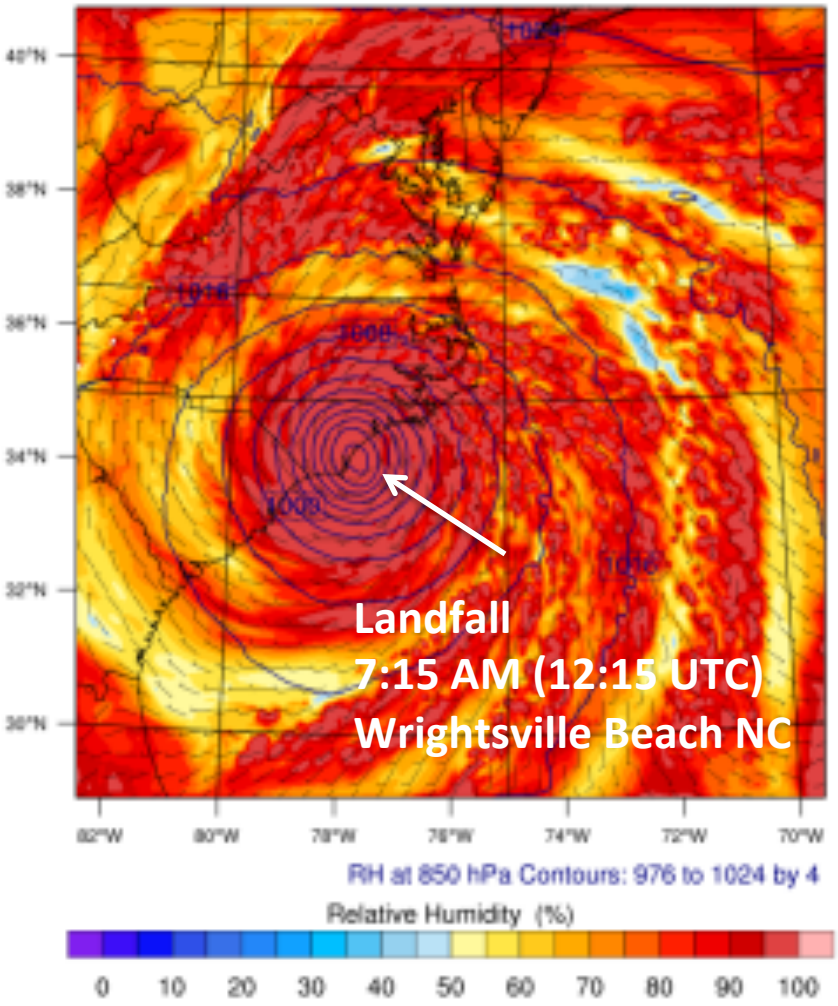
Validation:
20180914 12 UTC

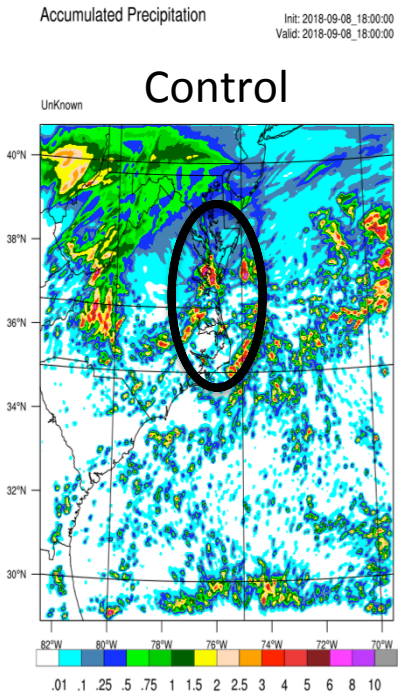
00:00
00:00

Control

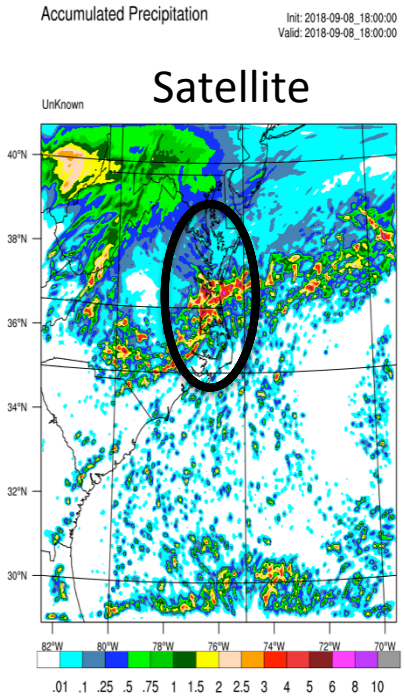


WRFwPHSnABI



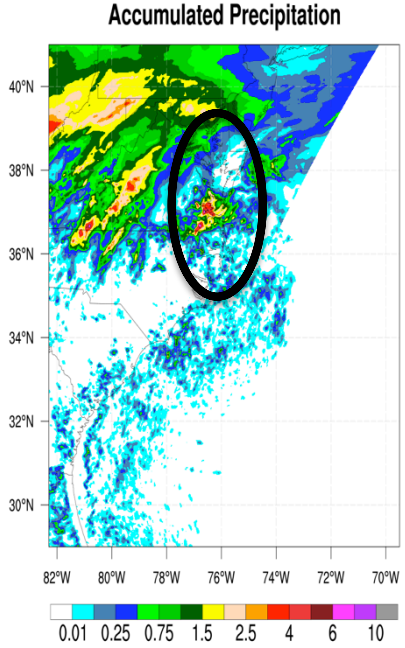


Control



Satellite

Observed



Missed

AP_18h_2018090818_CNT

AP_18h_2018090818_RAPoboPHSnA BI

AP_18h_2018090818_ST4

OUTPUT FROM WRF V3.9.1.1 MODEL
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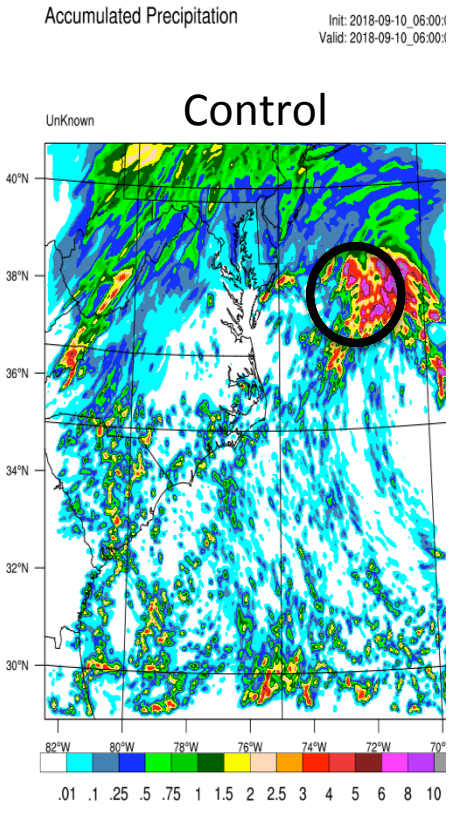

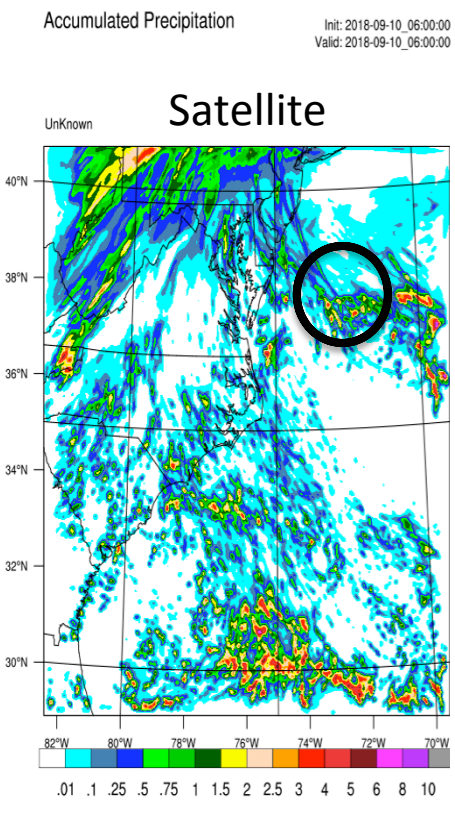

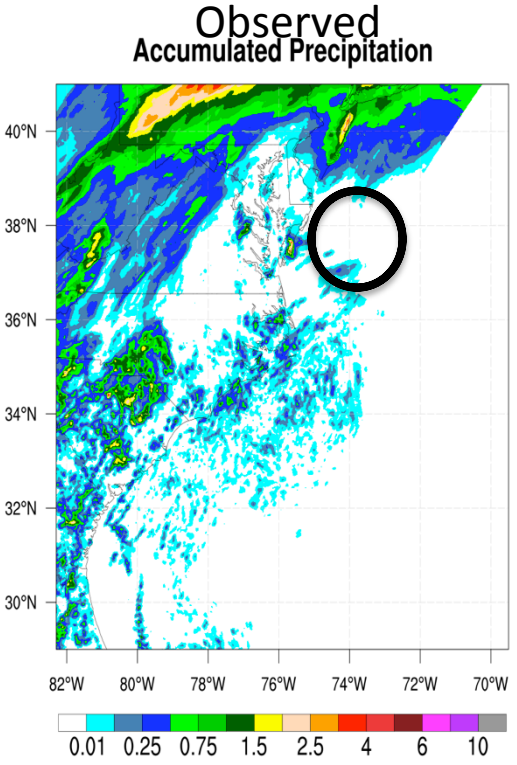

AP_18h_2018091006_CN

AP_18h_2018091006_ST4

AP_18h_2018091006_RAPoboPHSnABIthin

OUTPUT FROM WRF V3.9.1.1 MODEL
WE = 420 ; SN = 442 ; Levels = 51 ; Dis = 3km ; Phys Opt = 28 ; PBL Opt = 5 ; Cu Opt = 0

OUTPUT FROM WRF V3.9.1.1 MODEL
WE = 420 ; SN = 442 ; Levels = 51 ; Dis = 3km ; Phys Opt = 28 ; PBL Opt = 5 ; Cu Opt = 0

Hurricane Florence Forecast Experiment Conclusions

- *Combined Polar Hyper-spectral + Geostationary Multi-spectral radiances provide high spatial/temporal resolution soundings that can be assimilated into high resolution NWP models.*
- *Model Resolution Matters: 3-km much better than 28-km*
- *Use of PHSnABI satellite sounding data in a 3-km RAP configured WRF model has provided improved forecasts, particularly in the precipitation forecasts.*
- *Validations to determine the significance of the use of the high resolution PHSnAVI soundings in models are currently in progress.*

Satellite Sounding Data Web-site

- Main Site:
  - http://dbps.cas.hamptonu.edu/development/
- Polar Hyperspectra Products:
  - http://dbps.cas.hamptonu.edu/development/polar_sounding/
- Polar + Geo Products
  - http://cas.hamptonu.edu/~adinorscia/ABInPHS_plots/
- PHS Radiosonde Validations
  - http://cas.hamptonu.edu/dbps_cron/adinorscia/JOBS/
- PHS + ABI Radiosnde Validation
  - http://cas.hamptonu.edu/~adinorscia/RadiosondesCompare/