Some Advected Layered Precipitable Water (ALPW) Comparisons Between Florence, Harvey (2017), Maria (2017) and Matthew (2016) with Respect to Rainfall and Severe Weather

By
Sheldon Kusselson
CIRA/Colorado State University Research Associate

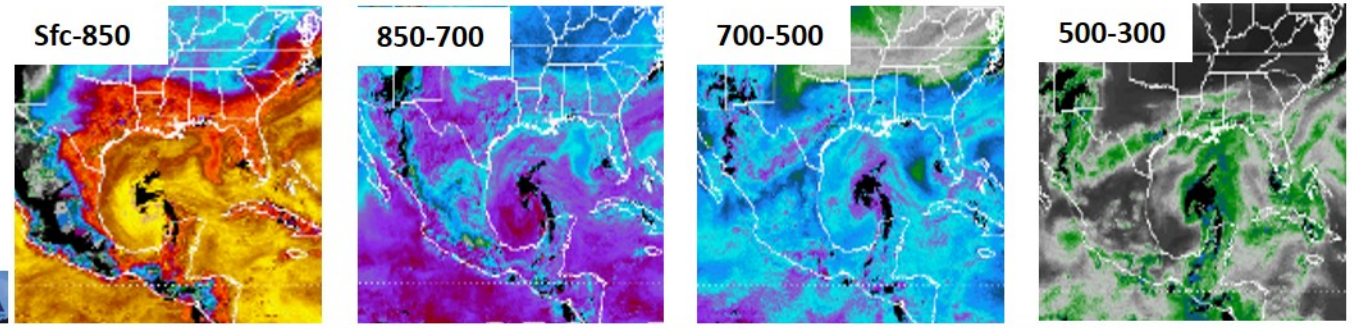
September 21, 2018

Advected Layered Precipitable Water Comparison Between Harvey (2017) and Florence (2018)

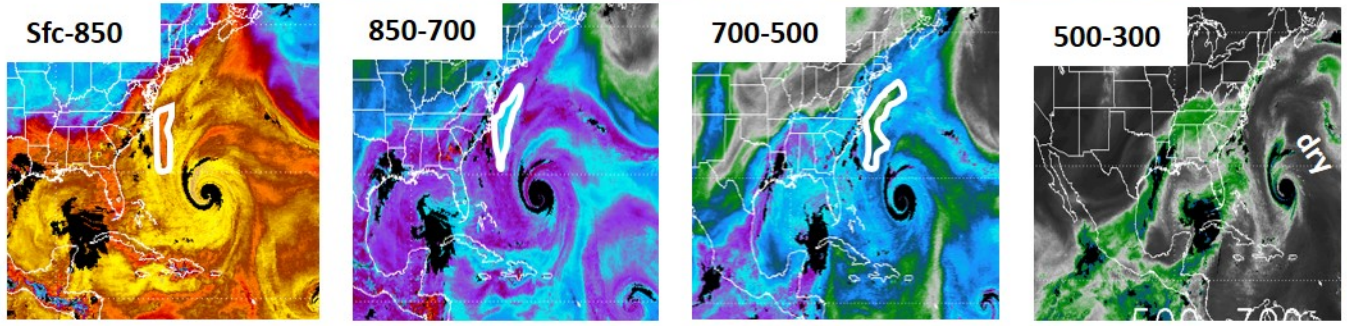
Analysis and discussion by
Sheldon Kusselson,
CIRA Research Associate

Experimental CIRA Advected Layered Precipitable Water for 06 UTC 24 August 2017

2017 Harvey within 48 hrs of SE TX Landfall



2018 Florence within 60 hrs of Carolina Landfall



relative PW min

Experimental CIRA Advected Layered Precipitable Water for 00 UTC 12 Sept 2018

Some talking points for 48 to 60 hrs before landfall: **Sfc-850 hPa layer PW looks better for Florence, while 850-700, 700-500 and 500-300 hPa layer looks a bit better for Harvey. Some caveats include relative min of precipitable water NW of Florence at the Sfc-850, 850-700 and 700-500 hPa layer and what influence, if any, that may have on her. Moisture plumes originating from tropics are available at 700-500 and 500-300 hPa to help Florence give excessive rainfall, while Harvey already had one moisture plume with similar max values originating at both 700-500 and 500-300 hPa over Mexico and extending across SE Texas.**

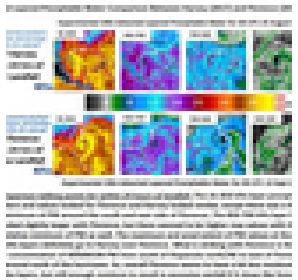
For more information on CIRA's Experimental Advected Layered Precipitable Water Product, see http://rammb.cira.colostate.edu/training/visit/training_sessions/advected_layer_precipitable_water_product/

A. Camden Walker

@camdenwalker

Following

Mixed good & bad #hurricane news. Relatively GOOD that #Florence not quite as moist as #Harvey and she probably won't produce 60" of rain; Still BAD that as her *forward motion slows*👉30" or more👈of rain is still on the table for the Carolinas. Horrible flooding expected.



Sheldon Kusselson @wxman27

@amelia_draper @camdenwalker @dougkammerer @laurynricketts @capitalweather @hbwx @abc7alex Layered precip H2O comparison btwn Harvey&Florence 24hr b4 Landfall.Moist nod 2 Harvey;but Flo can still produce excessi...

8:16 AM - 13 Sep 2018 from Austin, TX

Advected Layered Precipitable Water Comparison Between Harvey (2017) and Florence (2018)

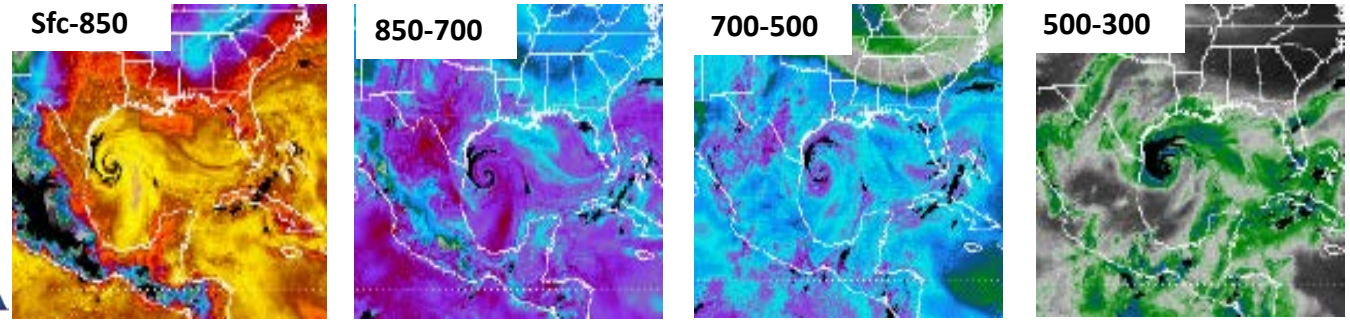
Analysis and discussion by
Sheldon Kusselson,
CIRA Research Associate

Experimental CIRA Advected Layered Precipitable Water for 06 UTC 25 August 2017

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2017Aug2612Advect_LPW_ALT_anim.gif

2017 Harvey within 24 hrs of SE TX Landfall

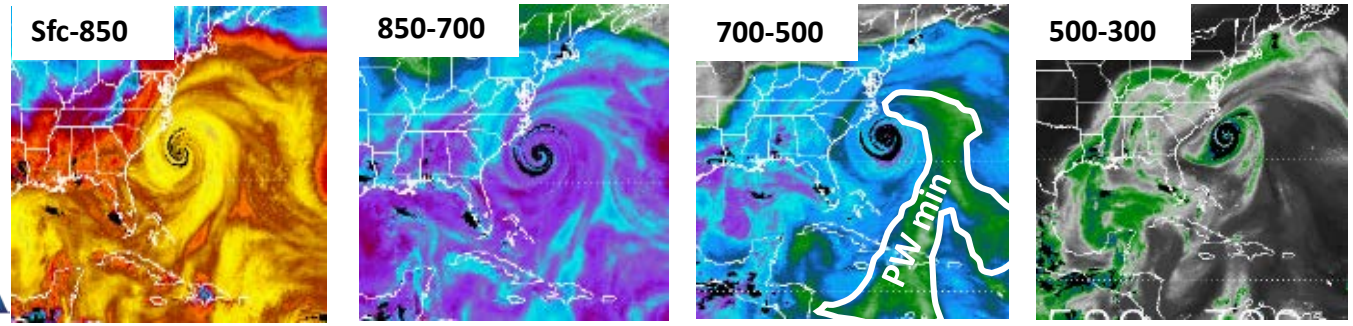
speed 9 kts



ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1312Advect_LPW_ALT_anim.gif

2018 Florence within 24 hrs of Carolina Landfall

speed 13 kts



Relative min of PW

Experimental CIRA Advected Layered Precipitable Water for 09 UTC 13 Sept 2018

For more information on CIRA's Experimental Advected Layered Precipitable Water Product, see http://rammb.cira.colostate.edu/training/visit/training_sessions/advected_layer_precipitable_water_product/

Some comparison talking points for within 24 hours of landfall: **The sfc-850 hPa layer precipitable water (PW) pattern and values looked for Florence and Harvey looked similar, except there was a little more of a relative minimum of PW around the south and east side of Florence. The 850-700 hPa layer PW of high values looked slightly larger with Florence, but there seemed to be higher max values with Harvey and a smaller relative minimum of PW as well. The maximum and areal extent of PW values at the 700-500 and 500-300 hPa layers definitely go to Harvey over Florence. What is striking with Florence is the 700-500 hPa plume or concentration of MINIMUM PW from south of Hispanola north/NE to east of Florence and trying to wrap around north of the hurricane. So, overall Florence seems to have a bit less moisture than Harvey in most of the layers, but still enough moisture to result in excessive rainfall if it slows like forecasted.**

Advected Layered Precipitable Water Comparison Between Harvey (2017) and Florence (2018)

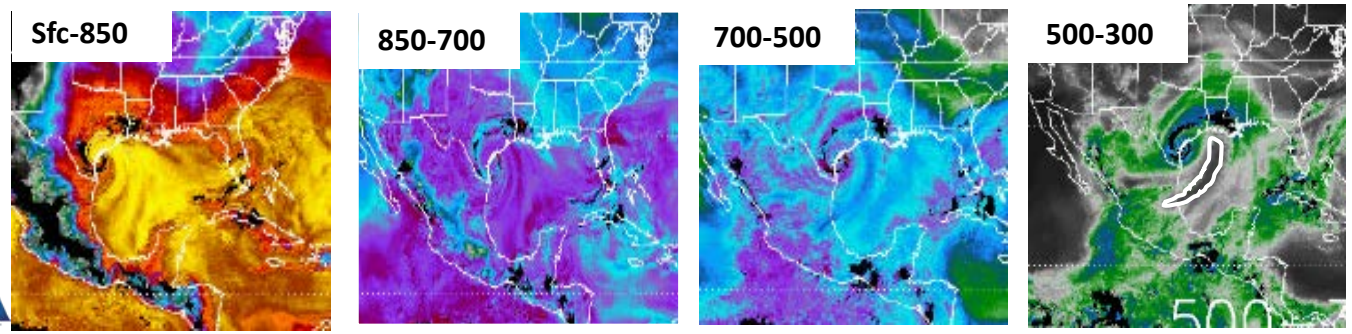
Analysis and discussion by
Sheldon Kusselson,
CIRA Research Associate

Experimental CIRA Advected Layered Precipitable Water for 06 UTC 26 August 2017

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2017Aug2610Advect_LPW_ALT_anim.gif

2017 Harvey near time of SE TX Landfall

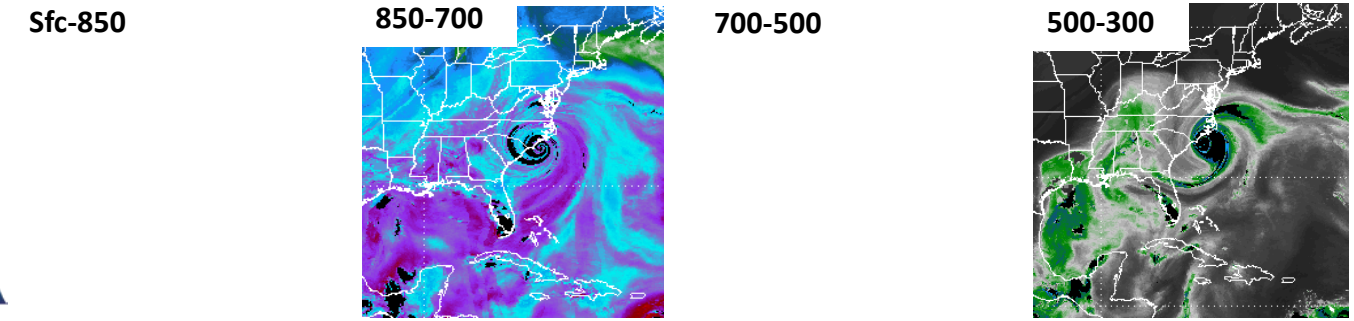
speed 6 to 2 kts



ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1412Advect_LPW_ALT_anim.gif

2018 Florence near time of SE NC Landfall

speed 5 to 3 kts



Relative min of PW

Experimental CIRA Advected Layered Precipitable Water for 09 UTC 14 Sept 2018

For more information on CIRA's Experimental Advected Layered Precipitable Water Product, see http://rammb.cira.colostate.edu/training/visit/training_sessions/advected_layer_precipitable_water_product/

Some comparison talking points around time of landfall: **The sfc-850 hPa layer precipitable water (PW) values and spokes of moisture converging in the western Gulf of Mexico gave Harvey the edge in PW moisture over Florence at that layer. The 850-700 hPa layer PW of high values now looked much larger with Harvey, especially around the center of the Hurricane compared with Florence's high values only just on the east and southeast side. PW values at the 700-500 hPa layer were much higher surrounding Harvey (purple color enhancement) than Florence (blue color). While at the 500-300 hPa layer, the areal extent of higher values (blue color) was greater for Harvey. Still striking, but now probably having no impact was the significantly large extent of lower PWs well east and southeast of Florence at the 500-300 and especially at the 700-500 hPa layer. So, overall Florence has less total moisture than Harvey in all the layers, but still enough moisture to result in excessive rainfall, but probably not of the magnitude of Harvey.**

Advected Layered Precipitable Water Comparison Between Harvey (2017) and Florence (2018) and Maria (2017)

David J. Phillip / AP

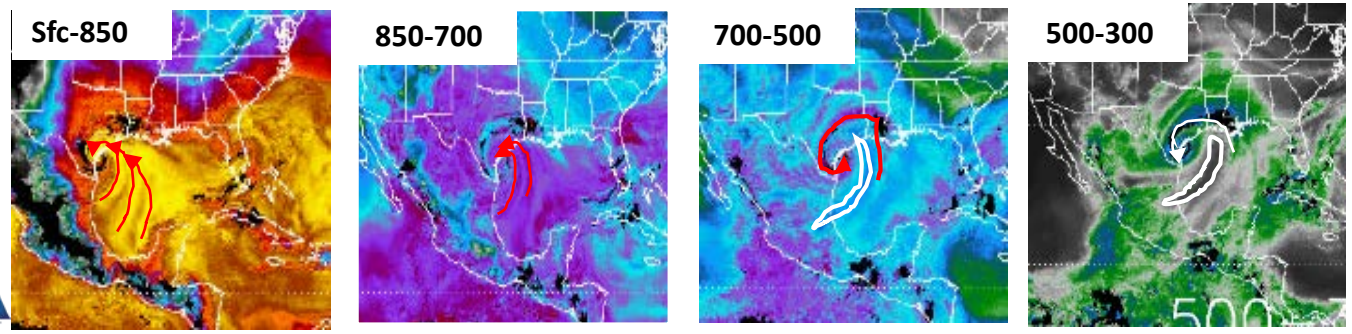
ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2017Aug2610Advect_LPW_ALT_anim.gif

2017 Harvey near time of SE TX Landfall

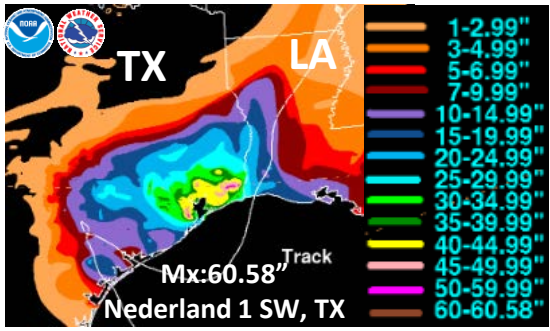
speed 6 to 2 kts

CIRA

Experimental CIRA Advected Layered Precipitable Water for 06 UTC 26 August 2017



25 August to 1 September 2017



avg wind flow at layer

Relative min of PW

Marshall Sheppard's photos

I-40 closed between Wilmington and Raleigh

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1412Advect_LPW_ALT_anim.gif

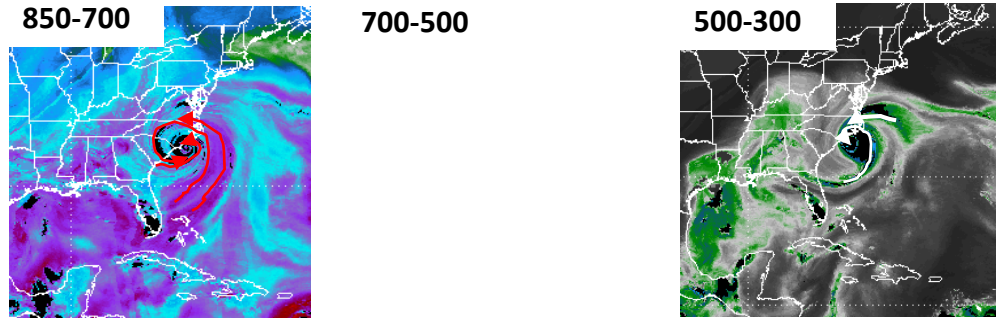
2018 Florence near time of SE NC Landfall

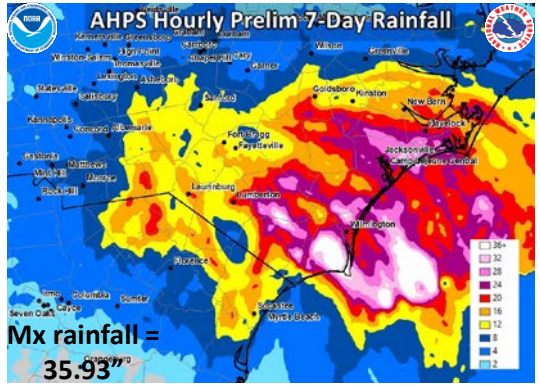
speed 5 to 3 kts

CIRA

Relative min of PW

Sfc-850





Experimental CIRA Advected Layered Precipitable Water for 09 UTC 14 Sept 2018

10 -17 September 2018

Experimental CIRA Advected Layered Precipitable Water for 09 UTC 20 Sept 2017

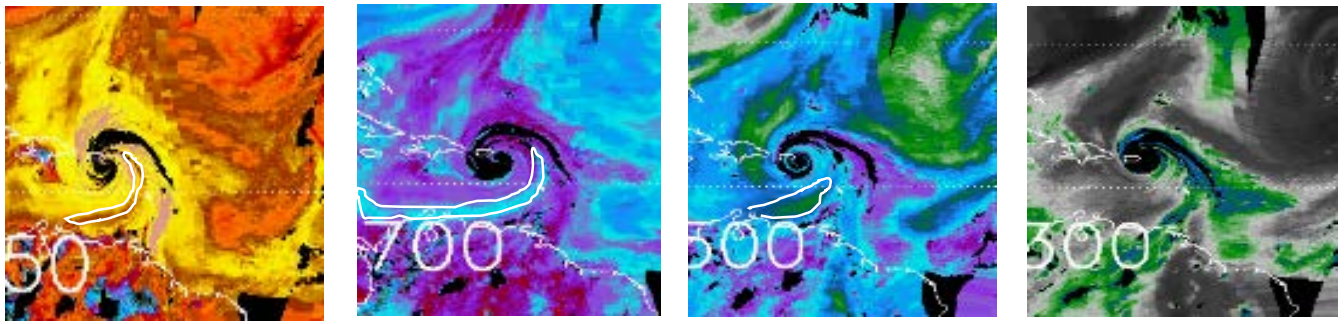
Photo: Hector Retamal, AFP/Getty Images

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2017Sep2100Advect_LPW_ALT_anim.gif

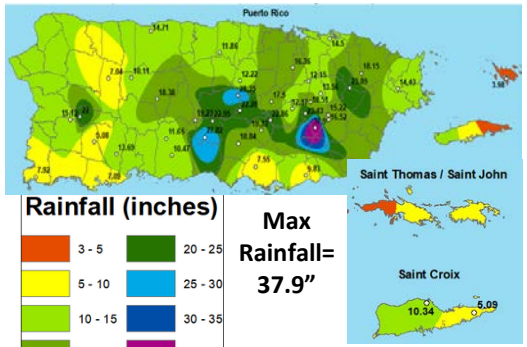
2017 Maria near time of SE PR Landfall

CIRA

Relative min of PW



48hr Rainfall Sep 19-21, 2017



Analysis by Sheldon Kusselson, CIRA Research Associate

The Severe Weather Angle

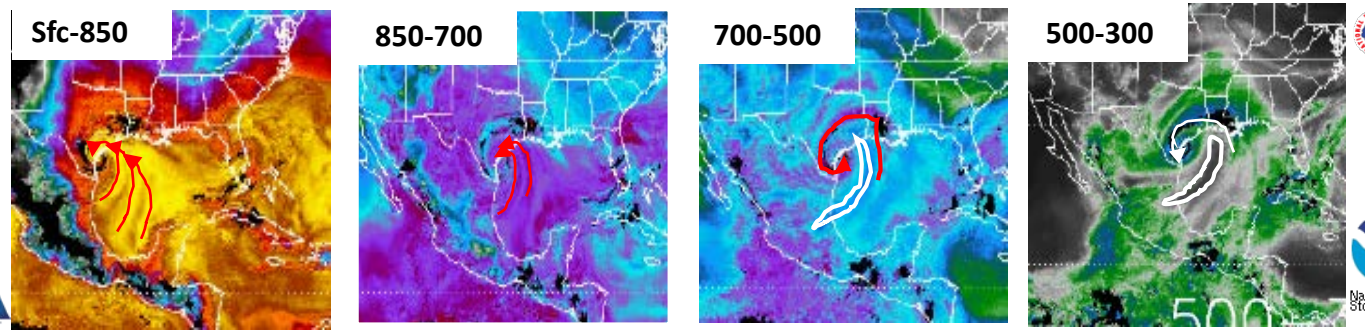
Advected Layered Precipitable Water Comparison Between Harvey (2017) and Florence (2018) – Severe Weather

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2017Aug2610Advect_LPW_ALT_anim.gif

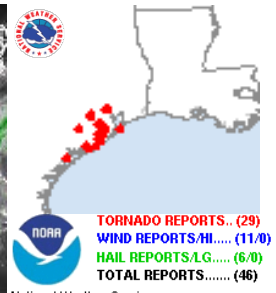
2017 Harvey near time of SE TX Landfall

speed 6 to 2 kts

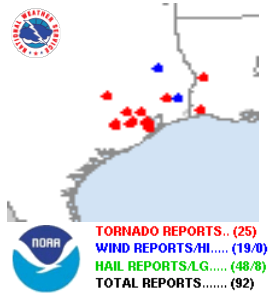
Experimental CIRA Advected Layered Precipitable Water for 06 UTC 26 August 2017



25 August 2017



26 August 2017



avg wind flow at layer

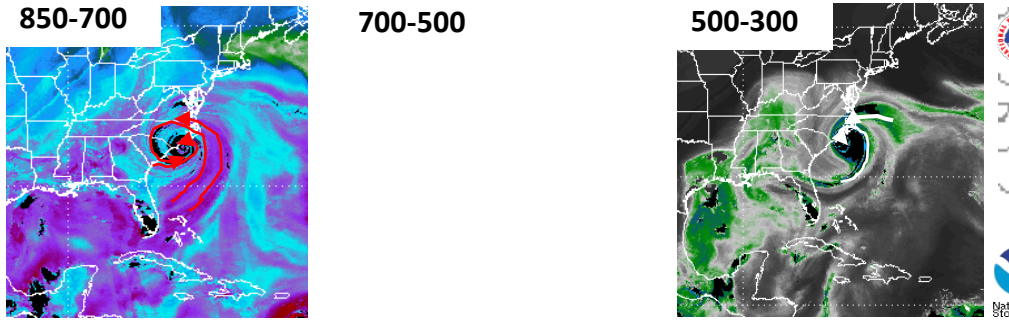
Relative min of PW

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1412Advect_LPW_ALT_anim.gif

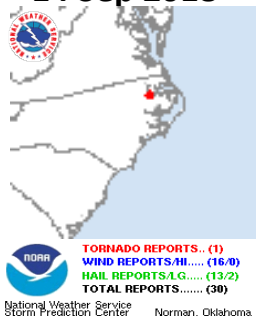
2018 Florence near time of SE NC Landfall

speed 5 to 3 kts

Experimental CIRA Advected Layered Precipitable Water for 09 UTC 14 Sept 2018



14 Sep 2018



Relative min of PW

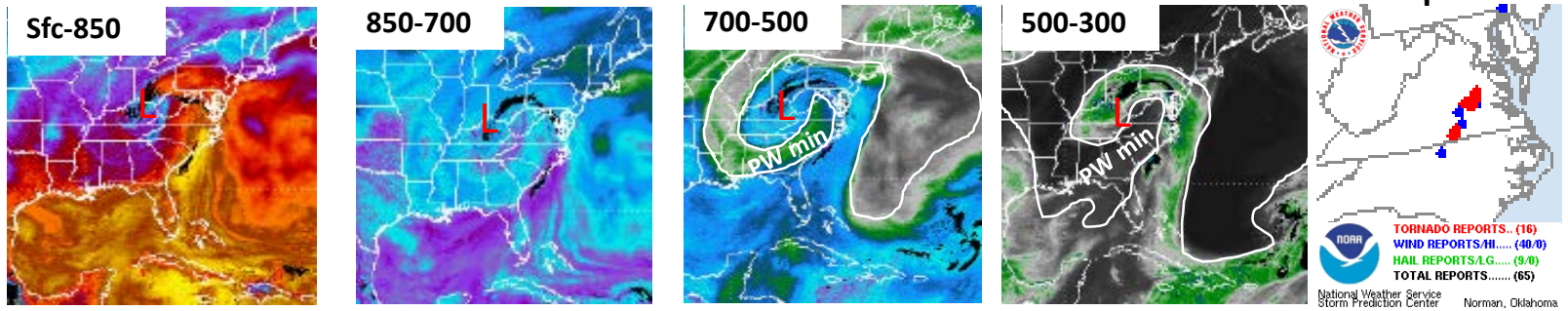
Note: Relative minimum of precipitable water (PW) at higher layers (700-500 and 500-300 hPa) over high moisture in lower layers (850-700 and Sfc-850 hPa) for a satellite signature of potential severe weather.

Analysis by Sheldon Kusselson, CIRA Research Associate

Advected Layered Precipitable Water (ALPW) on 17 September 2018...Three Days After Florence Landfall - Classic Severe Weather Signature of Relative Min of PW Aloft Over Relative Max PW

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1803Advect_LPW_ALT_anim.gif

2018 Florence
3 days after
SE NC Landfall



Relative min of PW

Experimental CIRA Advected Layered Precipitable Water for 15 UTC 17 Sept 2018

Analysis by
Sheldon Kusselson,
CIRA Research Associate

Note: Relative minimum of precipitable water (PW) at higher layers (700-500 and 500-300 hPa) over high moisture in lower layers (850-700 and Sfc-850 hPa) for a satellite signature of potential severe weather.

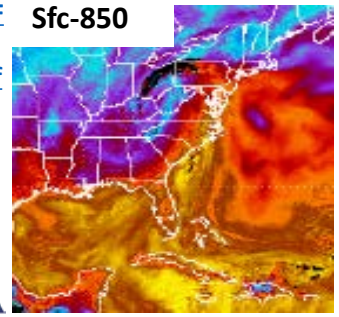
Advected Layered Precipitable Water (ALPW) on 17 September 2018...Three Days After Florence Landfall - Classic Severe Weather Signature of Relative Min of PW Aloft Over Relative Max PW

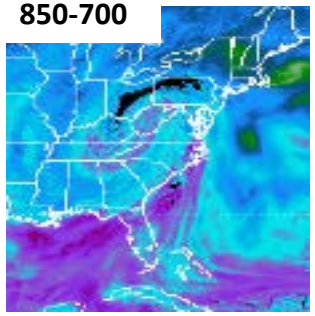
3hrs later,

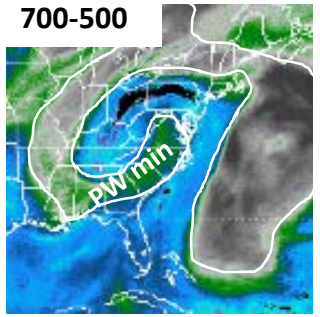
flip between
slides 9 and 10

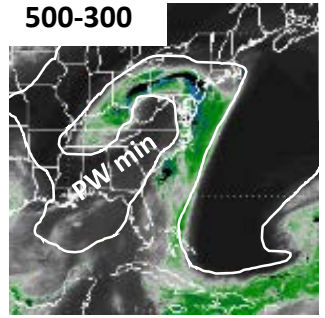
ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1803Advect_LPW_ALT_anim.gif

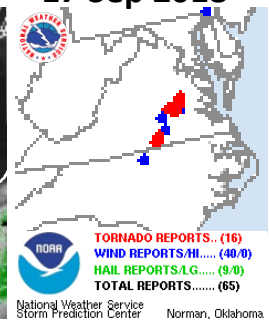
2018 Florence
3 days after
SE NC Landfall











Relative min of PW

Experimental CIRA Advected Layered Precipitable Water for 18 UTC 17 Sept 2018

Analysis by
Sheldon Kusselson,
CIRA Research Associate

Note: Relative minimum of precipitable water (PW) at higher layers (700-500 and 500-300 hPa) over high moisture in lower layers (850-700 and Sfc-850 hPa) for a satellite signature of potential severe weather.

Advected Layered Precipitable Water (ALPW) Comparison Between Harvey (2017) and Florence (2018) –

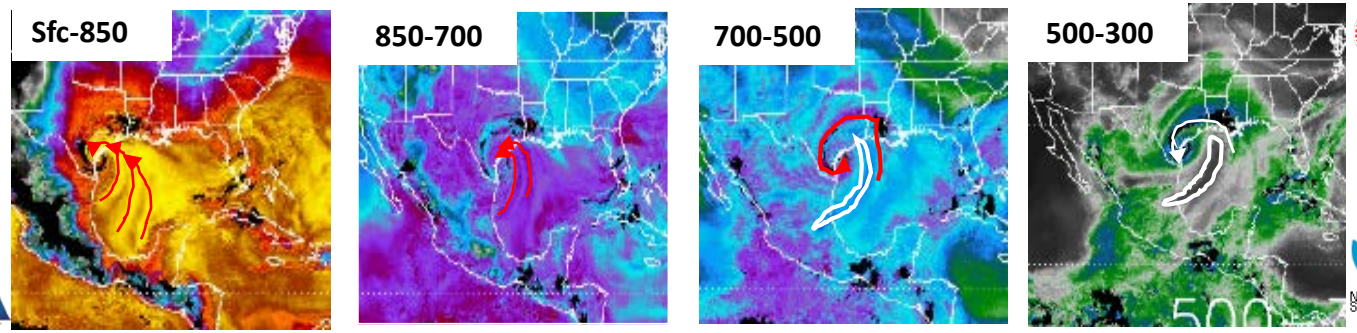
Severe Weather with Harvey, Day Before and After Landfall; Severe Weather With Florence, Three Days After Landfall - Classic Severe Weather Signature of Relative Min of PW Aloft Over Relative Max PW

Advected Layered Precipitable Water Comparison Between Harvey (2017) and Florence (2018) – Severe Weather

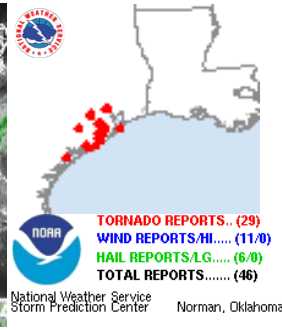
Experimental CIRA Advected Layered Precipitable Water for 06 UTC 26 August 2017

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2017Aug2610Advect_LPW_ALT_anim.gif

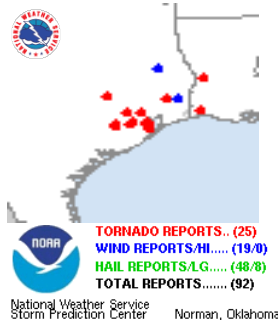
2017 Harvey near time of SE TX Landfall



25 August 2017



26 August 2017

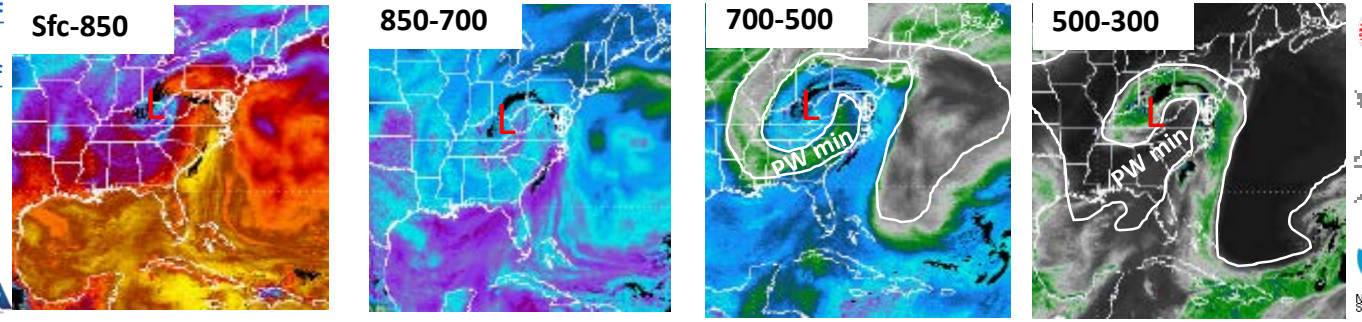


avg wind flow at layer 

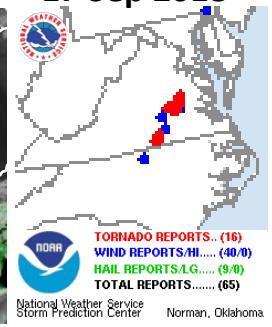
Relative min of PW 

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1803Advect_LPW_ALT_anim.gif

2018 Florence 3 days after SE NC Landfall



17 Sep 2018



Relative min of PW 

Experimental CIRA Advected Layered Precipitable Water for 15 UTC 17 Sept 2018

Analysis by Sheldon Kusselson, CIRA Research Associate

Advected Layered Precipitable Water (ALPW) Comparison Between Harvey (2017) and Florence (2018) –

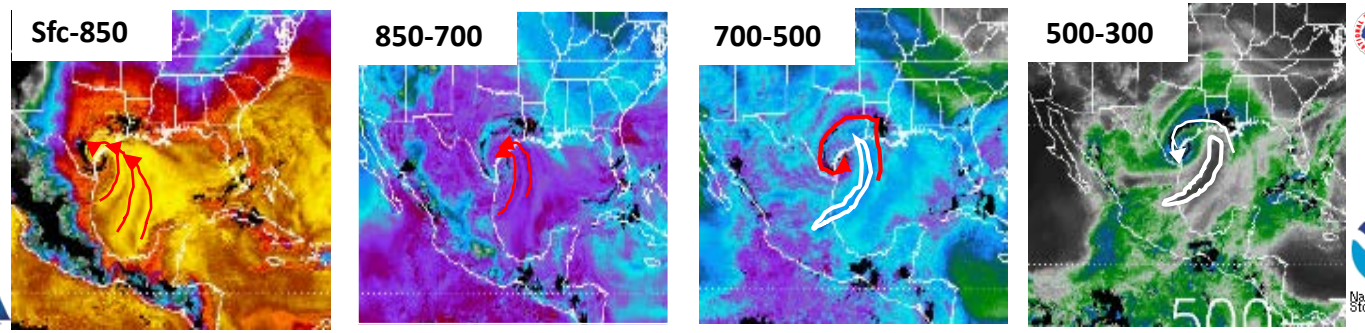
Severe Weather with Harvey, Day Before and After Landfall; Severe Weather With Florence, Three Days After Landfall - Classic Severe Weather Signature of Relative Min of PW Aloft Over Relative Max PW

Advected Layered Precipitable Water Comparison Between Harvey (2017) and Florence (2018) – Severe Weather

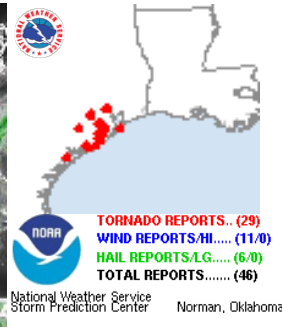
Experimental CIRA Advected Layered Precipitable Water for 06 UTC 26 August 2017

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2017Aug2610Advect_LPW_ALT_anim.gif

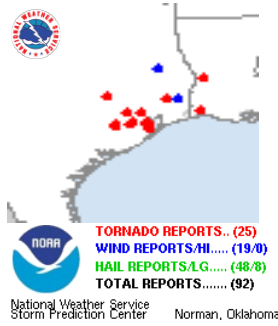
2017 Harvey near time of SE TX Landfall



25 August 2017



26 August 2017

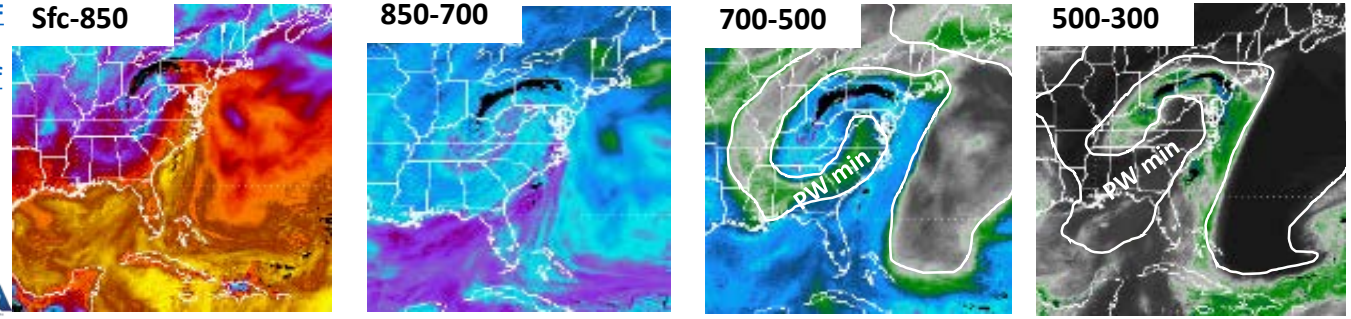


avg wind flow at layer 

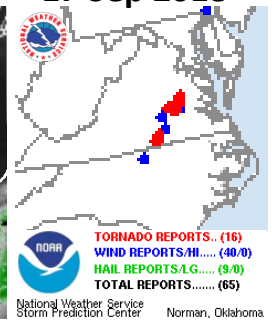
Relative min of PW 

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1803Advect_LPW_ALT_anim.gif

2018 Florence 3 days after SE NC Landfall



17 Sep 2018



Relative min of PW 

Experimental CIRA Advected Layered Precipitable Water for 18 UTC 17 Sept 2018

Analysis by Sheldon Kusselson, CIRA Research Associate

Advected Layered Precipitable Water Comparison Between Matthew (2016) and Florence (2018)

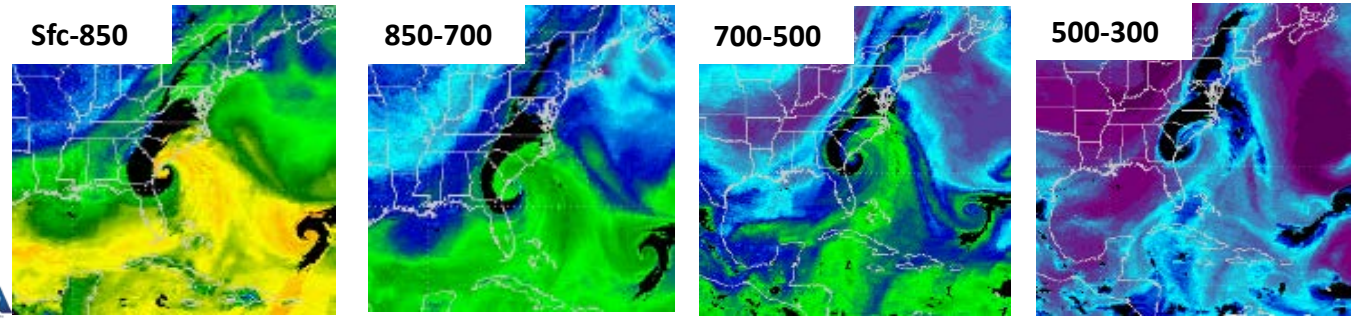
Experimental CIRA Advected Layered Precipitable Water for 12 UTC 8 October 2016

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2016Oct0916Advect_LPW_anim.gif

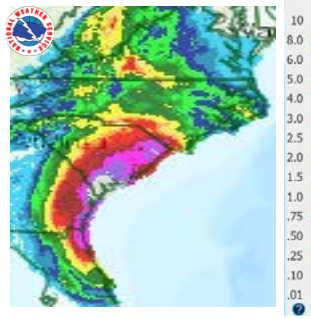
Charleston, SC
Blanco Getty images

2016 Matthew affecting Carolinas

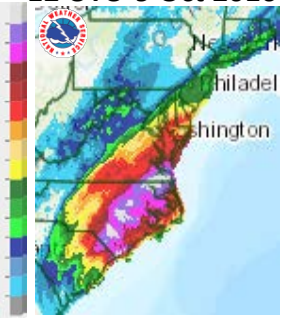
speed of storm
10 kts



24h Rainfall ending
12 UTC 8 Oct 2016



24h Rainfall ending
12 UTC 9 Oct 2016

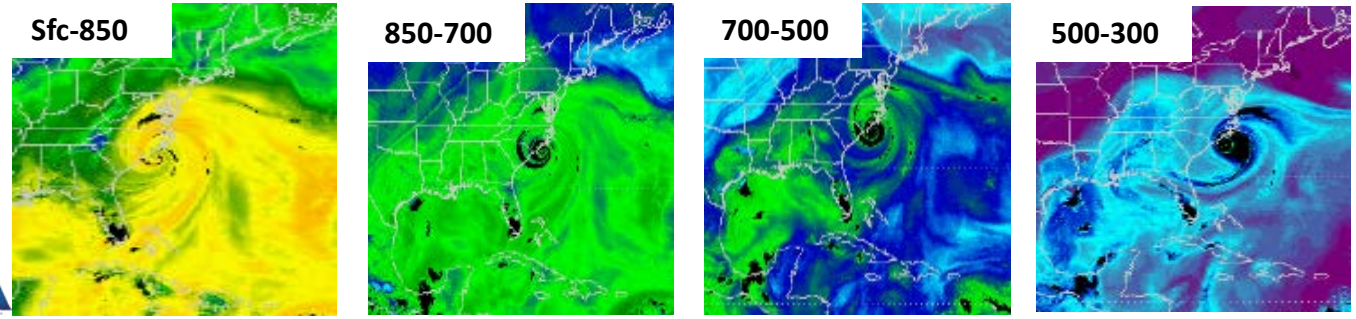


ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1512Advect_LPW_anim.gif

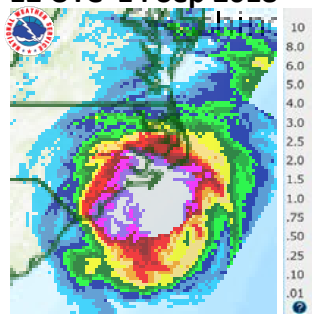
Hyde County, NC
Steve Helber, AP Photo

2018 Florence near time of SE NC Landfall

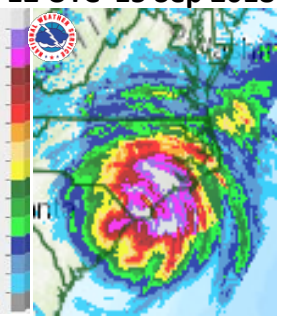
Speed of storm
7 kts



24h Rainfall ending
12 UTC 14 Sep 2018



24h Rainfall ending
12 UTC 15 Sep 2018



Experimental CIRA Advected Layered Precipitable Water for 09 UTC 14 Sept 2018

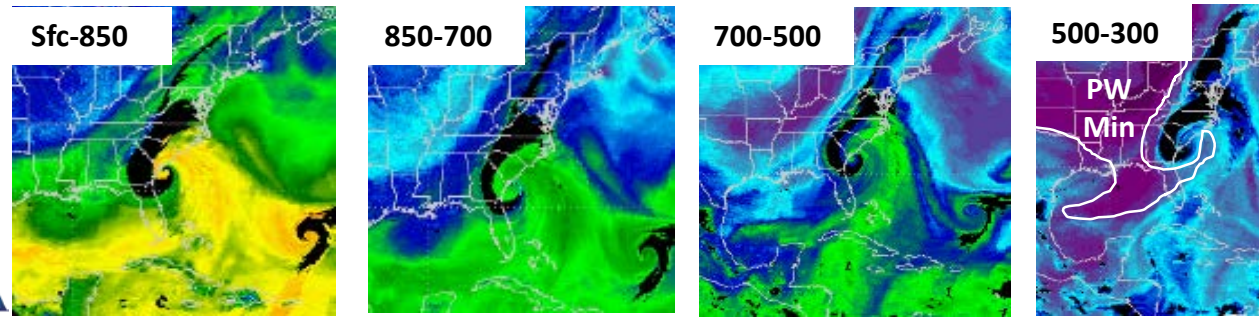
Produced by
Sheldon Kusselson,
CIRA Research Associate

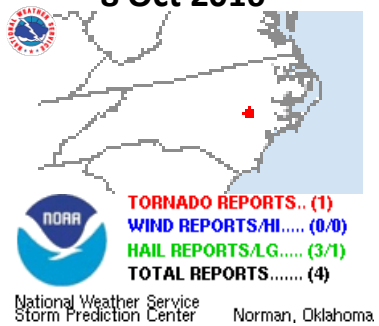
Advected Layered Precipitable Water Comparison Between Matthew (2016) and Florence (2018) – Severe Weather

Experimental CIRA Advected Layered Precipitable Water for 12 UTC 8 October 2016

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2016Oct0916Advect_LPW_anim.gif

2016 Matthew affecting Carolinas

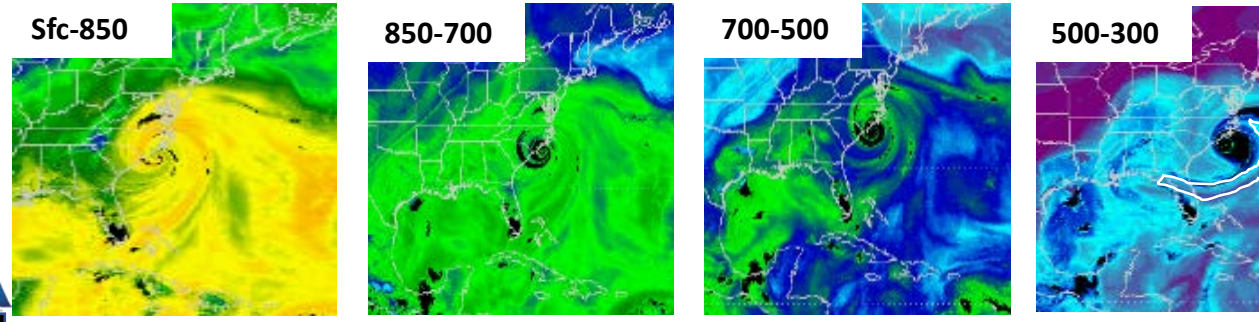


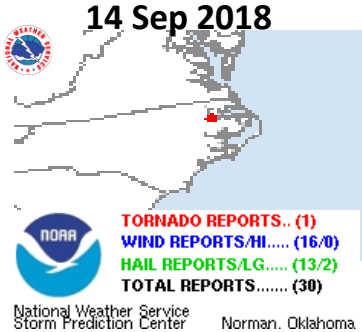


Relative min of PW

ftp://ftp.cira.colostate.edu/ftp/Forsythe/LPW/Anim_GIF/2018Sep1512Advect_LPW_anim.gif

2018 Florence near time of SE NC Landfall





Relative min of PW

Experimental CIRA Advected Layered Precipitable Water for 09 UTC 14 Sept 2018

Note: Relative minimum of precipitable water (PW) at higher layers (700-500 and 500-300 hPa) over high moisture in lower layers (850-700 and Sfc-850 hPa) for a satellite signature of potential severe weather. ***But in these cases, the areal extent of the relative min of PW/drier air at the two highest layers is less to the east of the hurricanes for less tornadoes.***

Produced by
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