HMT-Southeast Atmospheric River Observatory Training Webinar

9 July 2014

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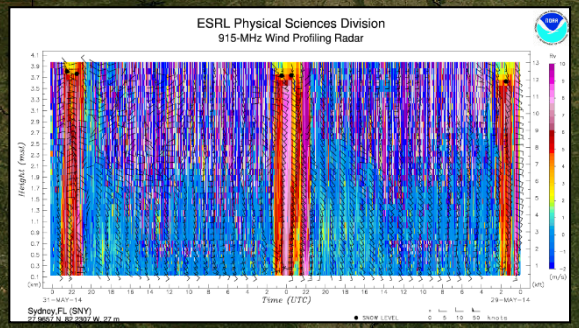
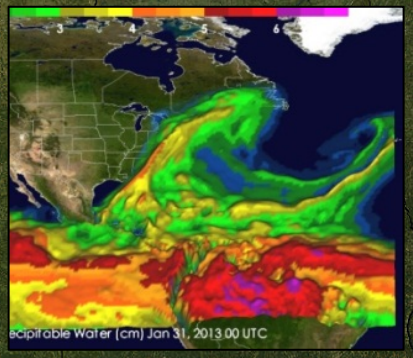
(NOAA ESRL, CIRES)





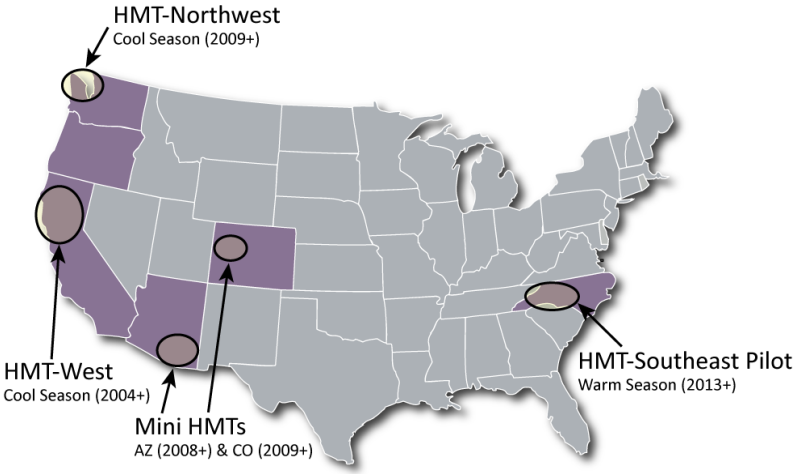
Outline

I. HMT-Southeast background (Rob Cifelli)
II. Three new AROs: What they are, where they are, data interpretation (Allen White)
III. Data access (Tim Coleman)
IV. HMT-SE research examples (Kelly Mahoney)
V. Questions, discussion (All)

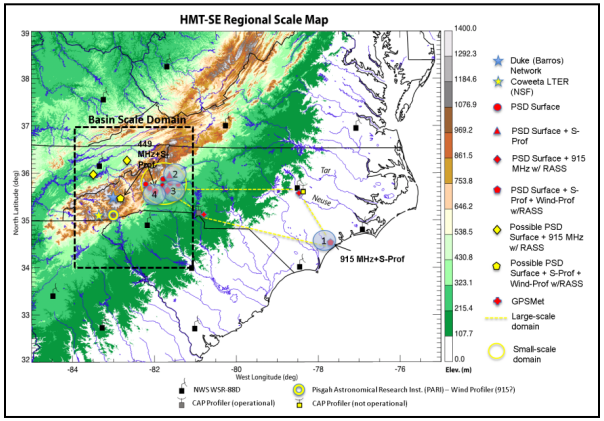
NOAA's Hydrometeorology Testbed (HMT)

- HMT conducts research on precipitation and weather conditions that can lead to flooding (dozens of research pubs available at hmt.noaa.gov)
- Aims to foster transition of scientific advances and new tools into forecasting operations (partnering with NOAA/WPC and locally with WFO's, RFC's)
- Accelerates development , prototyping of advanced hydrometeorological observations, models, and physical process understanding
- HMT-Southeast: 2 parts
  1. Pilot Study in western North Carolina (Spring 2013 – Fall 2014)
  2. Operationally-oriented research on extreme precipitation and forecast challenge identification

Mobile atmospheric river observatory (as used in HMT-West and HMT-Northwest)

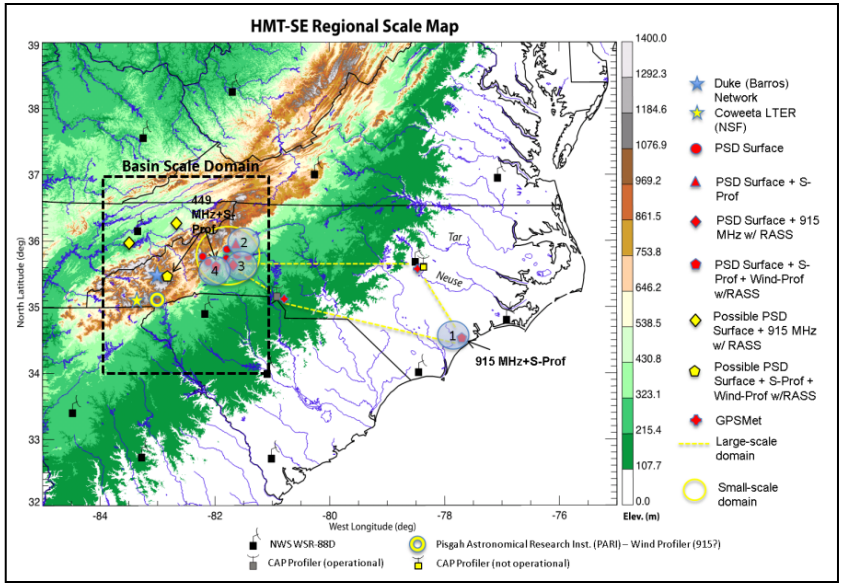


HMT-Southeast Pilot Study map



HMT-Southeast Pilot Study ("HMT-SEPS")

- May 2013 – September 2014: North Carolina
- Focus on QPE, NASA IPHeX collaboration in western NC, with some instrumentation in central and eastern NC
- NOAA providing most of instrumentation; leveraging additional assets from NASA IPHeX ground validation campaign

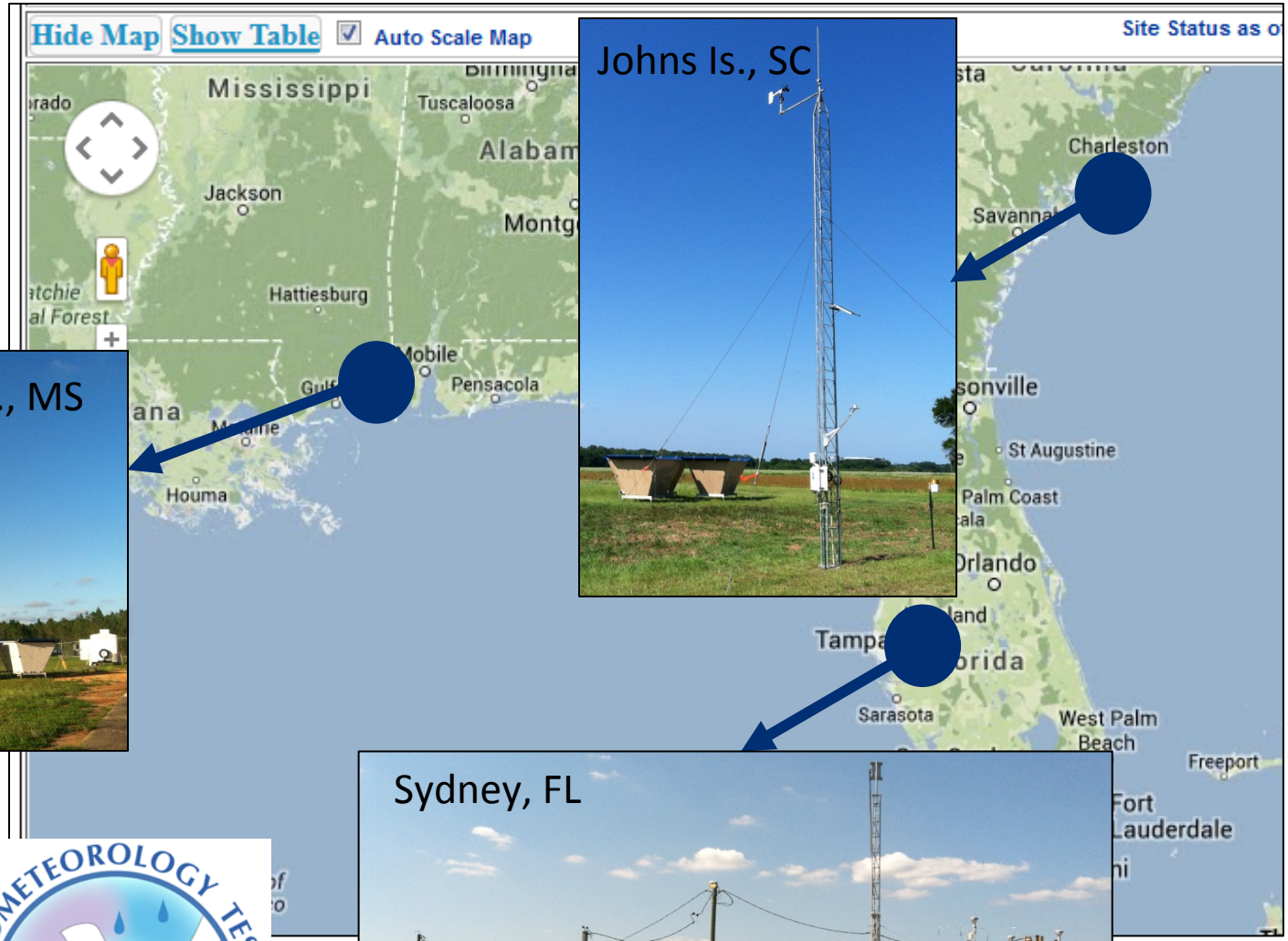


- "Pilot study": Long-term plan, vision unclear at this time; *if* value is demonstrated, could consider expanding, prolonging (provided external support could be garnered)
- Sandy Supplemental funding has allowed us to add instrumentation and prolong research into next FY

Asheville, NC Jan 2013

Asheville, NC 2004

NOAA Sandy Supplemental (Disaster Relief Act) adds three Atmospheric River Observatories to the Southeast U.S. to help monitor land-falling tropical storms and other high impact weather



What does an ARO measure?

- Hourly wind profiles from 120 m above surface to 4+ km, depending on atmospheric conditions
- Column-integrated total precipitable water, via the GPS satellite occultation technique and "bulk" water vapor flux
- The altitude where snow changes into rain (we call this the snow level) during precipitation
- 10-m tower surface meteorology (WS, WD, P, T, RH, rainfall)

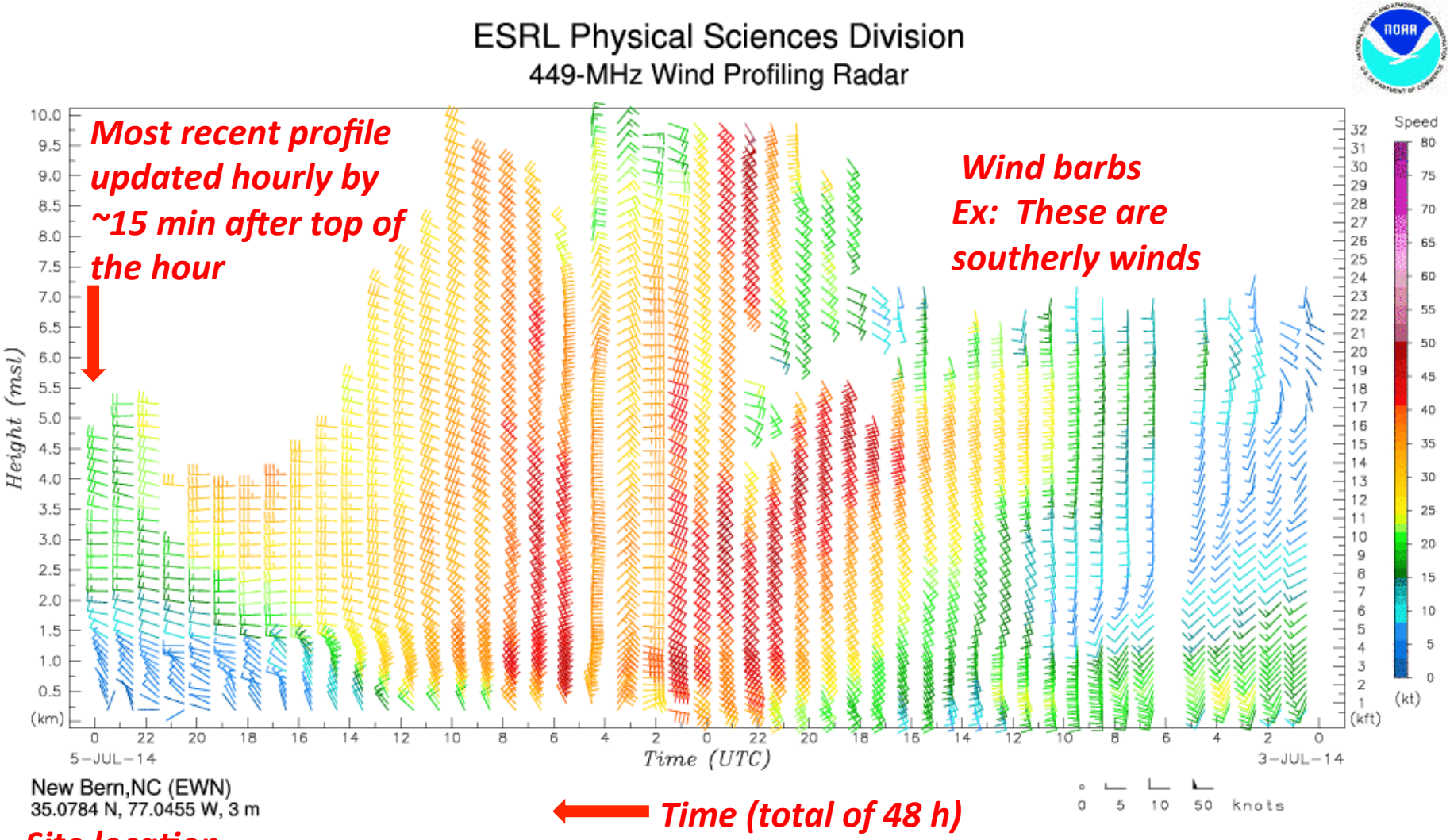
2 Types of Remote Sensing Radars

Scattering from clear-air turbulence in absence of precipitation

449-MHz Doppler Wind Profiler
Sites: New Bern and Old Fort, NC
Vertically pointing pulsed Doppler radar
Measures vertical profiles of radar backscatter (uncalibrated) and Doppler vertical velocity (reflectivity weighted) from which wind profiles are constructed.
Three beam directions steered electronically to allow composition of vector wind.

915-MHz Doppler Wind Profiler
Sites: Charlotte, Clayton, Marion, Research Triangle Park, NC; **Johns Is., SC; Sydney, FL; Moss Pt., MS**
Measures vertical profiles of radar backscatter (uncalibrated) and Doppler vertical velocity (reflectivity weighted) from which wind profiles are constructed.
Three beam directions steered electronically to allow composition of vector wind.

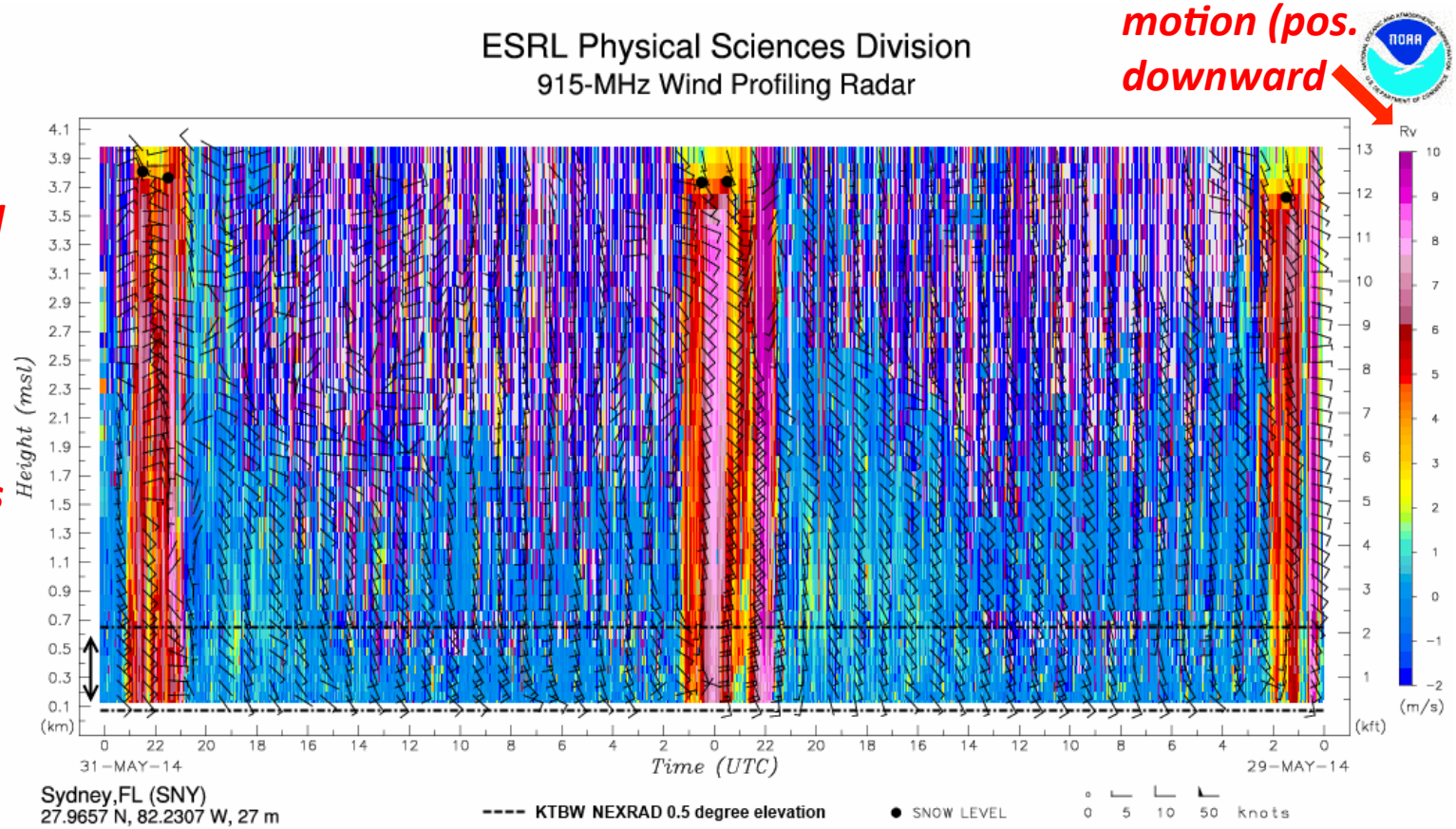
Wind Profiler – Time-height Display Wind Profiles



Wind Profiler – Time-height Display Winds and Snow Level

Vertical motion (pos. downward

Snow level is based on existence of a radar brightband during precipitation; also when measured vertical motion is dominated by fall speed of hydrometeors



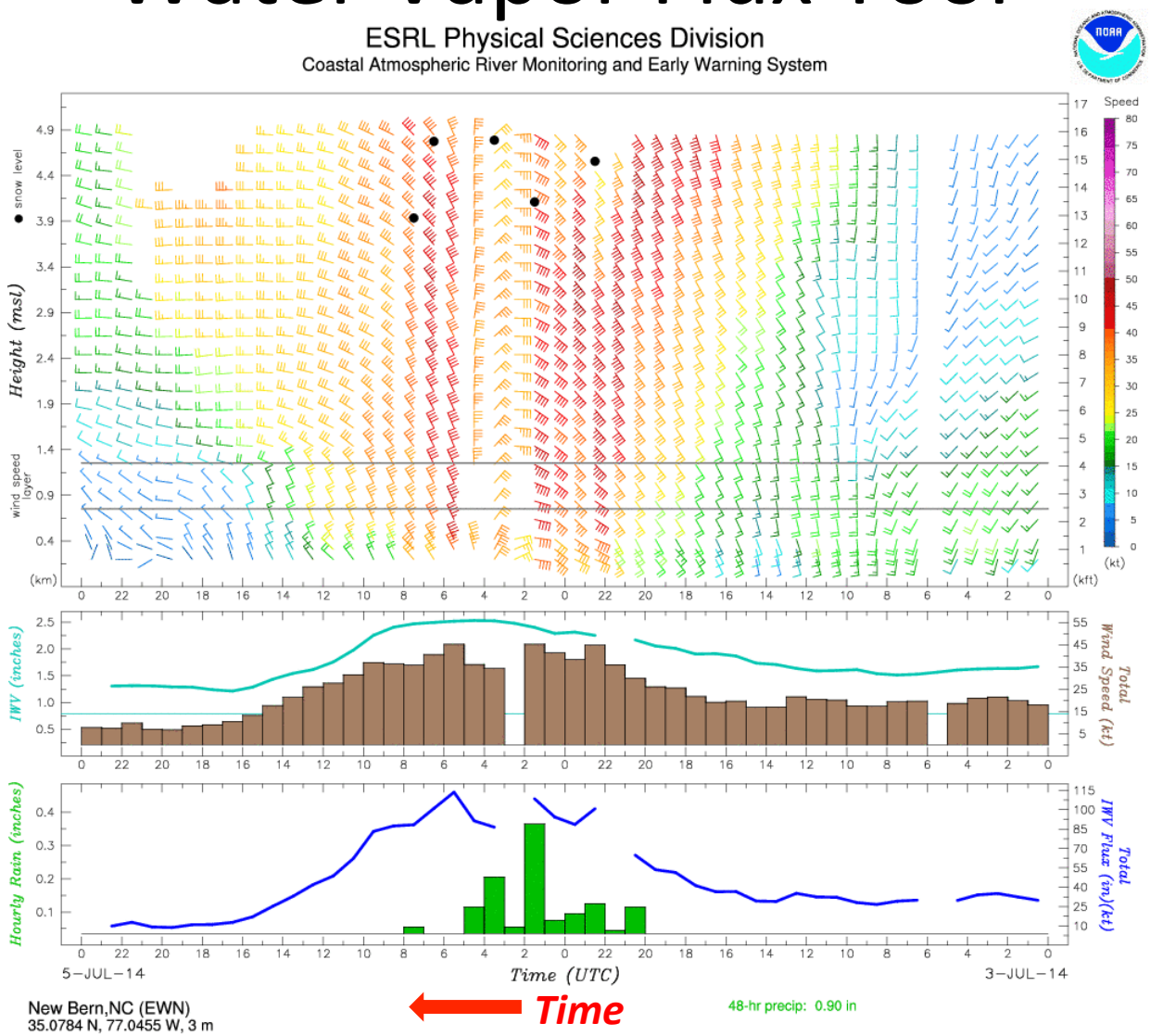
Sfc. Temp will be blue if below freezing

Time (UTC)	2330	2230	2130	2030	1930	1830	1730	1630	1530	1430	1330	1230	1130	1030	0930	0830	0730	0630	0530	0430	0330	0230	0130	0030
Snow Level (m)	none	3808	3765	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	3734
Snow Level (ft)	none	12490	12349	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	12247
Sfc Temp (C)	23.20	22.92	22.06	29.47	31.96	31.72	30.71	29.19	27.79	26.36	24.58	22.78	21.86	21.05	20.99	20.98	20.87	20.95	20.86	21.03	21.23	21.51	21.62	21.84

Time (UTC)	2330	2230	2130	2030	1930	1830	1730	1630	1530	1430	1330	1230	1130	1030	0930	0830	0730	0630	0530	0430	0330	0230	0130	0030
Snow Level (m)	3739	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	3630	none
Snow Level (ft)	12263	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	none	11906	none
Sfc Temp (C)	21.79	21.63	28.87	33.04	32.98	32.24	31.57	30.68	29.75	28.19	26.61	24.62	22.05	20.59	20.57	20.79	20.79	20.79	20.87	21.24	21.56	21.14	21.11	21.76

Start

Wind Profiler – Time-height Display Water Vapor Flux Tool



500-m layer used to calculate "bulk" water vapor flux

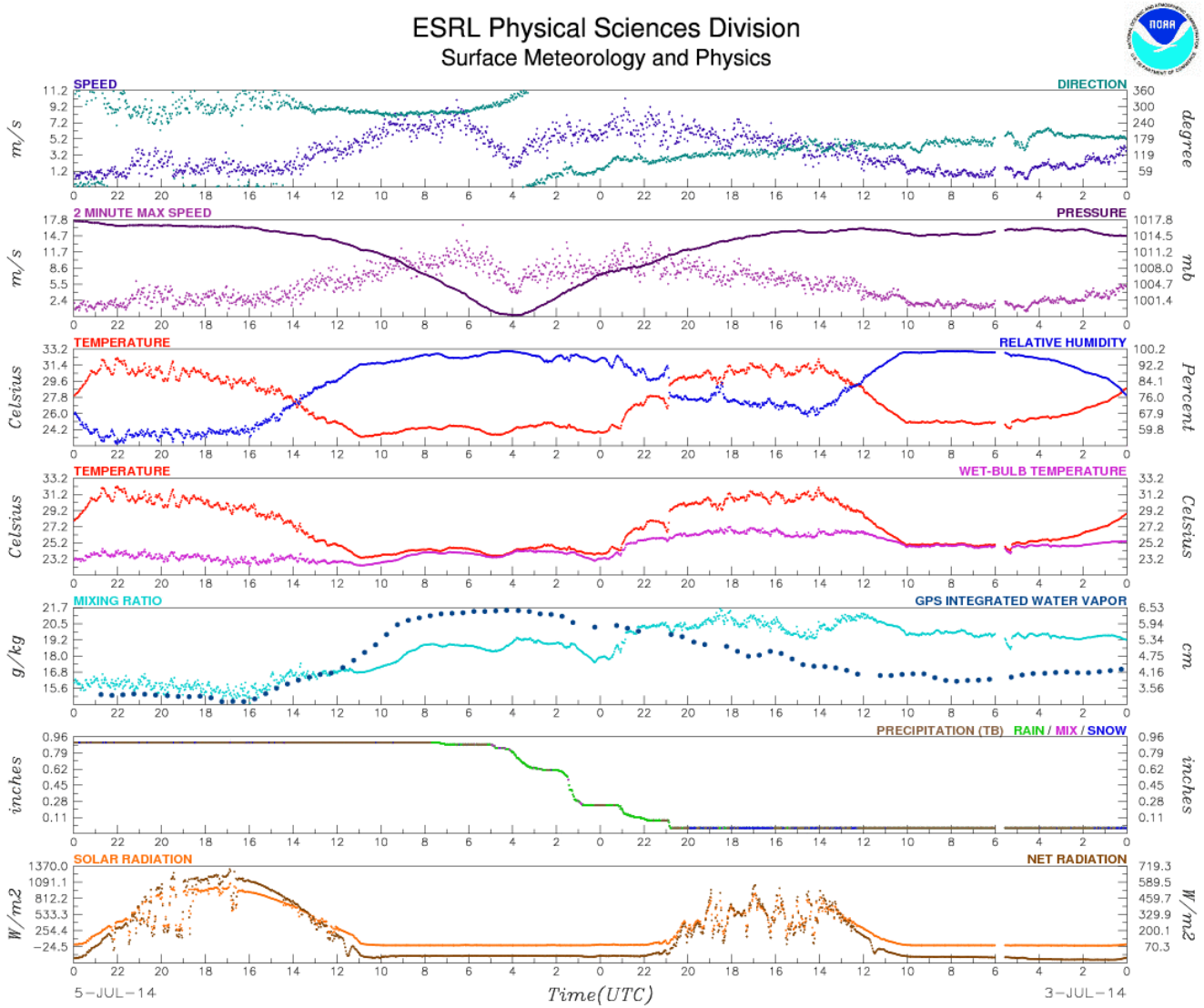
Time

Bulk flux = WS * IWV

Surface Meteorology – Time Series

Two variables per panel with variable identified by color at top of panel

Plotted are 2-min. averages for all variables except GPS integrated water vapor, which are 30-min. averages.



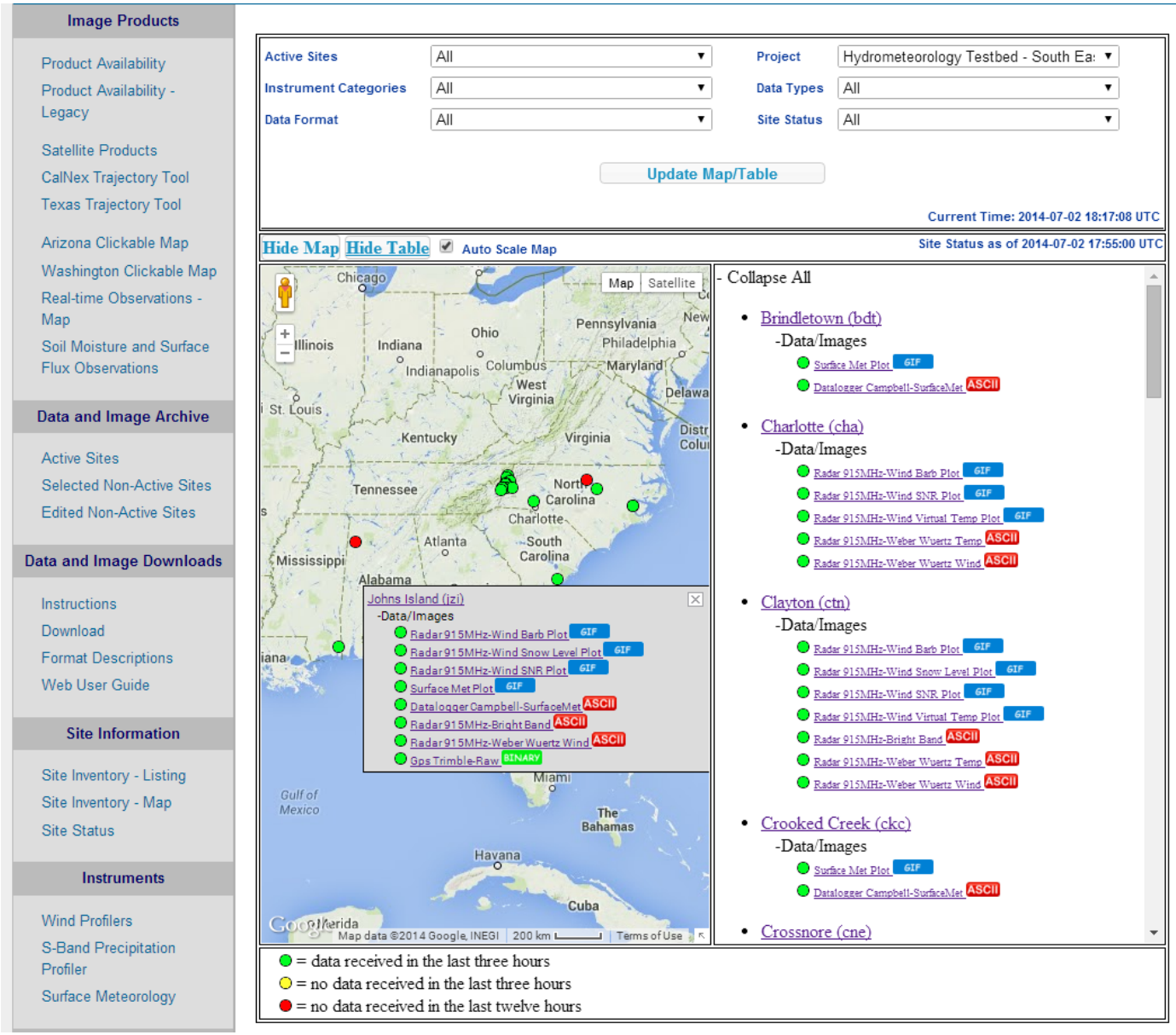
Time

Other Applications

- Land-sea breeze circulation
- Nocturnal low-level jets
- TAFs (wind shear, freezing level)
- Marine warnings (SCA, Gale)
- Frontal passages
- Fire wx.

And many more!

Data access (Tim Coleman)

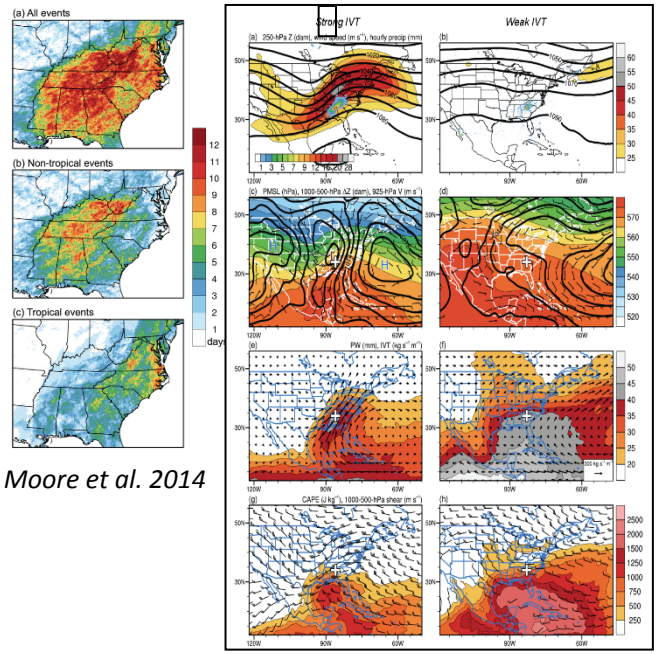


http://www.esrl.noaa.gov/psd/data/obs/datadisplay/index.php?ProjectID=7

HMT-SE extreme precipitation research

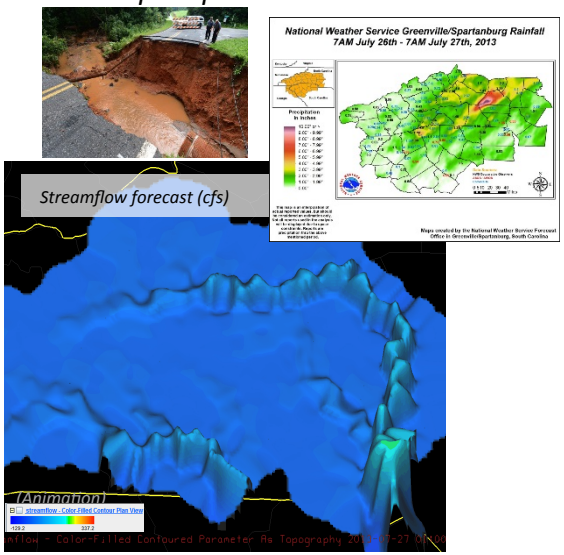
- Extreme precipitation work is not regionally-bound to where we have instrumentation
- Over the past year or two focus has been:
  1. Southeast US extreme precipitation climatology (Moore et al. 2014)
  2. Extreme event case studies, WRF, WRF-Hydro model sensitivity studies
  3. WPC QPF verification; linking forecast metrics to event types from climo

Extreme precipitation event climatology

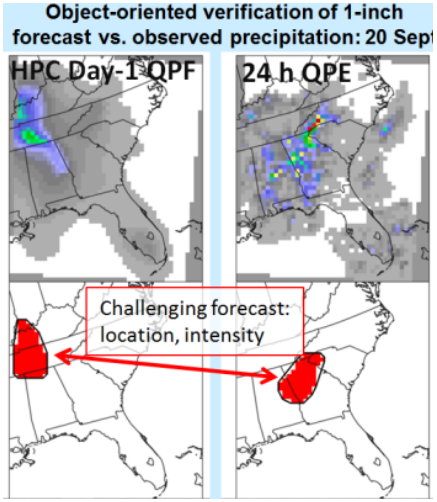


Moore et al. 2014

Extreme precipitation event case studies



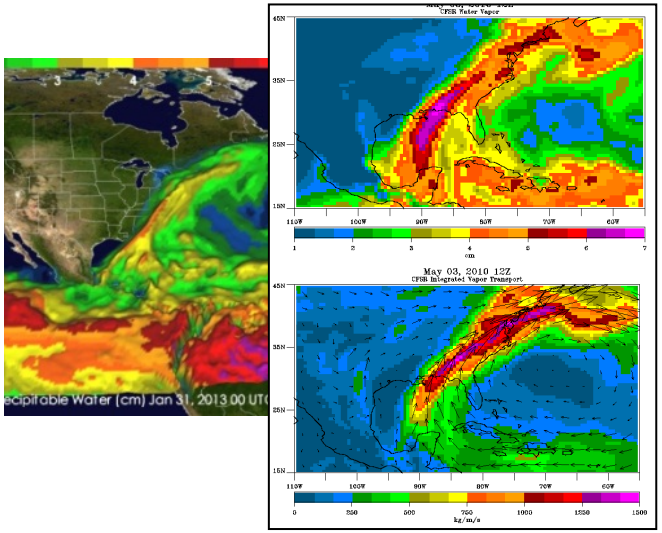
QPF verification



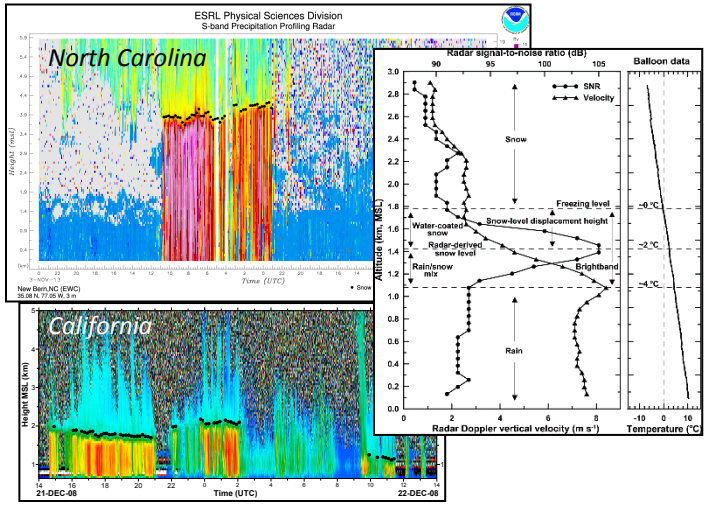
HMT-SE extreme precipitation research

- Ongoing projects include
  1. Defining/diagnosing/evaluating forecast utility of “atmospheric rivers” or similar phenomena in the southeast
  2. Use HMT-SE ARO observations to compare subsets of precipitation event types to west coast HMT research findings
  3. Evaluate forecast skill/errors for extreme events in GEFS reforecast dataset, NWS WFO gridded forecasts, other operational and experimental forecast models

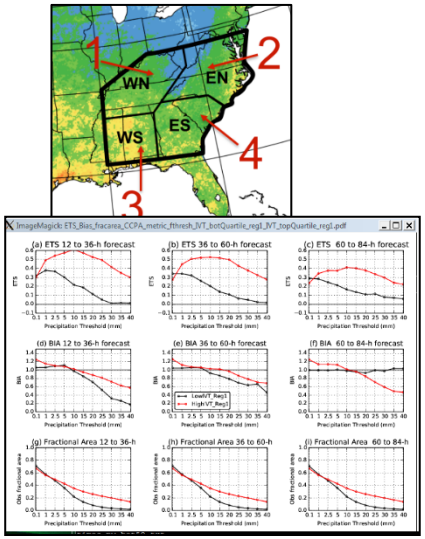
Atmospheric rivers in the east?



Comparison of west coast, SE precipitation characteristics



GEFS QPF verification



Questions/Discussion?

Contact information

- Facebook: https://www.facebook.com/NOAAHMTSoutheast (frequent updates, news, interactive sharing between community members)
- Webpage: http://hmt.noaa.gov/field_programs/hmt-se/ (background information, science plan, documentation)

- HMT-SEPS Project manager: Rob Cifelli (rob.cifelli@noaa.gov)
- Lead Scientist: Kelly Mahoney (kelly.mahoney@noaa.gov)
- Data, observations: Allen White (allen.b.white@noaa.gov)
- Displays, webpage, data access: Tim Coleman (timothy.coleman@noaa.gov)