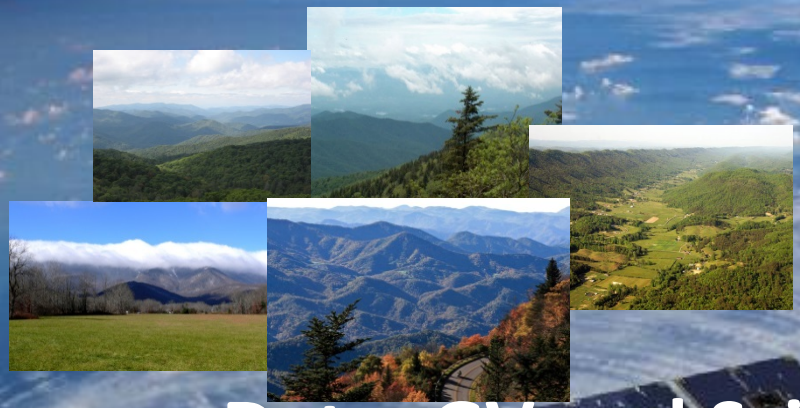
IPHEx2014
The Integrated Precipitation and Hydrology Experiment

A Global Precipitation Mission Measurement

Ground Validation Field Campaign in the Southern Appalachians



Data, GV and Science Updates

Ana P. Barros, Walt Petersen, Timothy Lang, Stephen Nesbitt, Rob Cifelli, Matt Schwaller, David Wolff, Douglas Miller, Christa Peters-Lidard, and Jonathan Gourley

Science Plan http://dx.doi.org/10.7924/G8CC0XMR

IPHEX Activities

1. Extended Observing Period : 9/2013 -12/2014

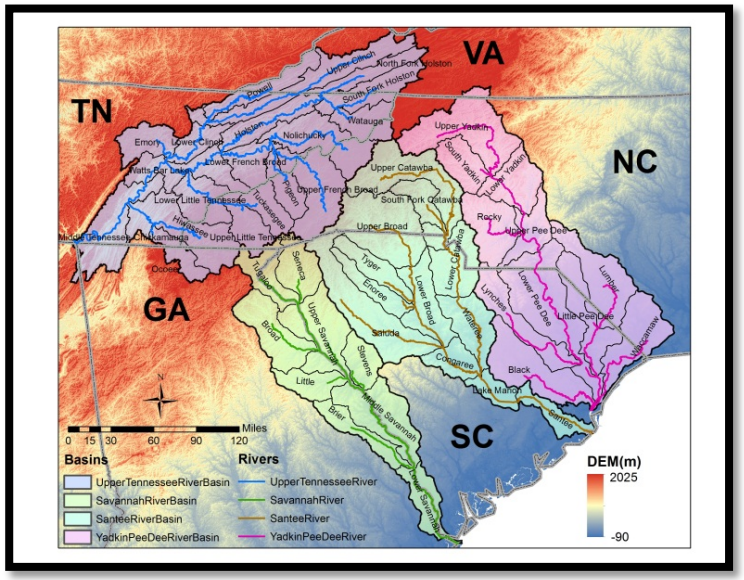
Raingauge Networks, MRRs, Disdrometers, ARM-MWRs, H2F2P, HMT-SEPS, *Snow*

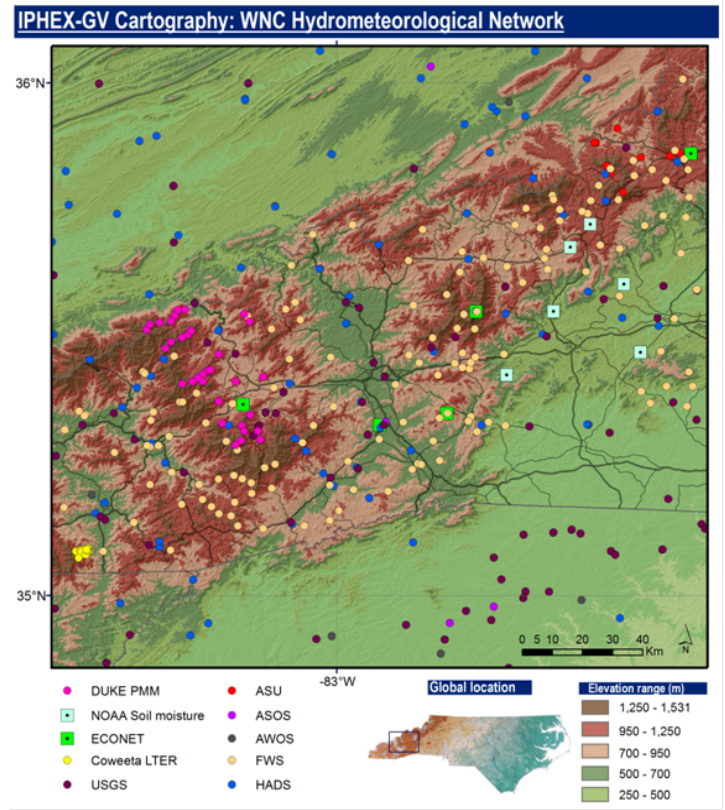
2. Intense Observing Period: 5/1/2014-6/15/2014

+ 3 Aircraft, Radars (NPOL, D3R, X-band, aerosols, *W-band, SLAP*)

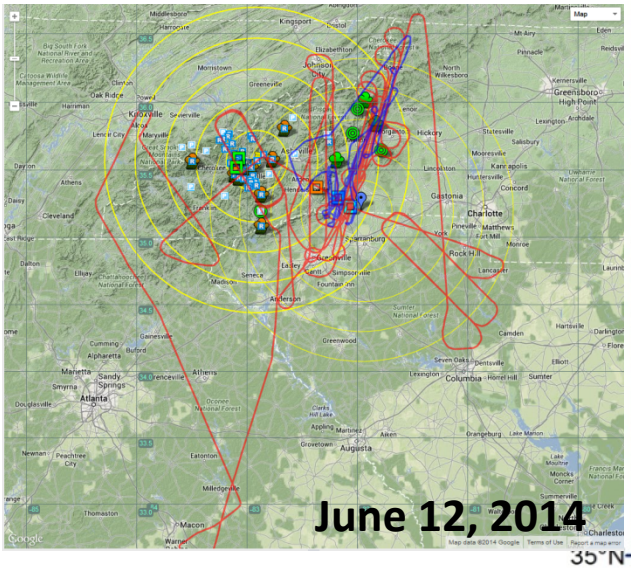
3. Hydrologic Modeling Modeling

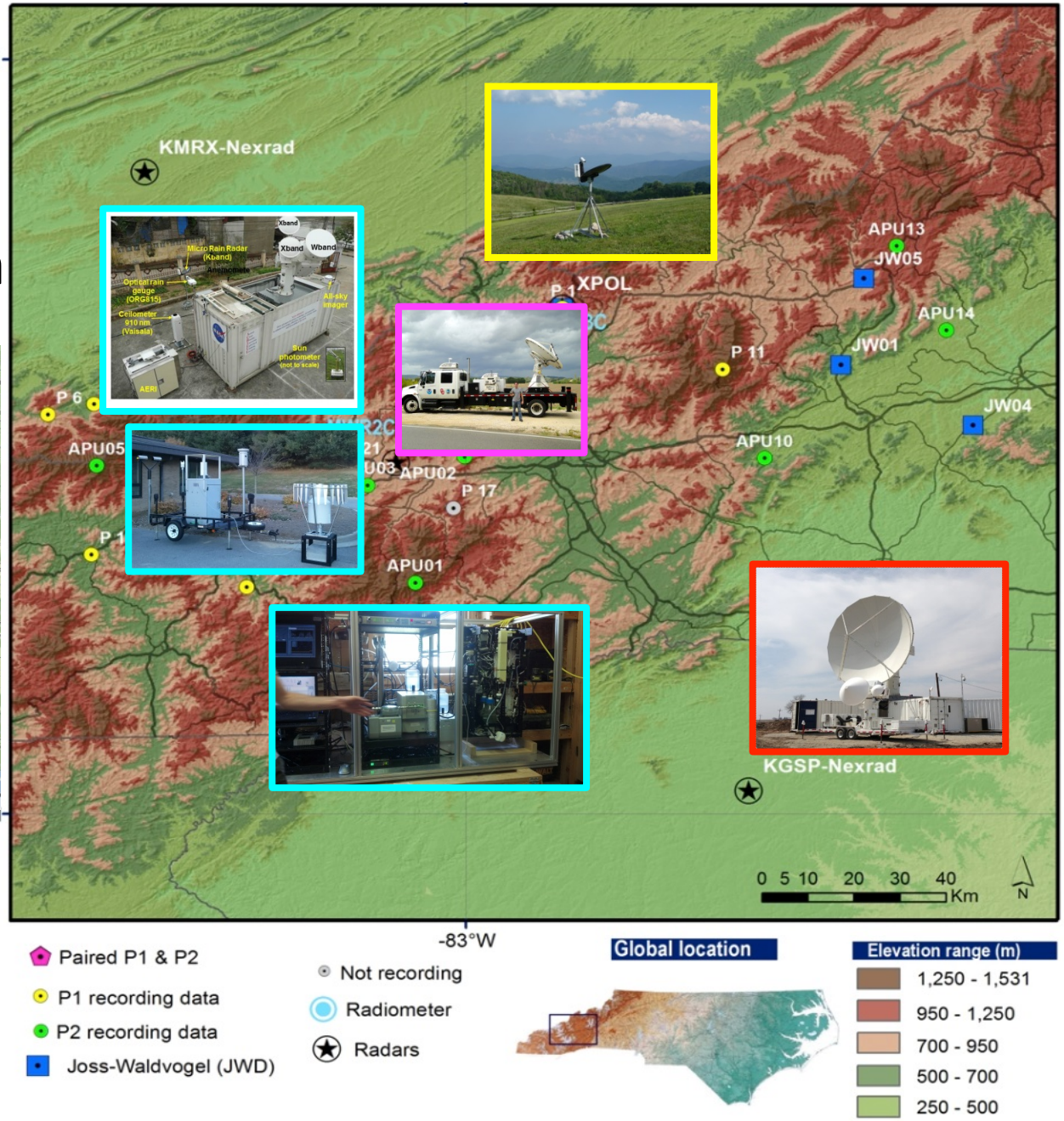
H4SE region QPE-to-OHF





Mapping Precipitation Processes in Complex Terrain





ER2 King Air

Citation

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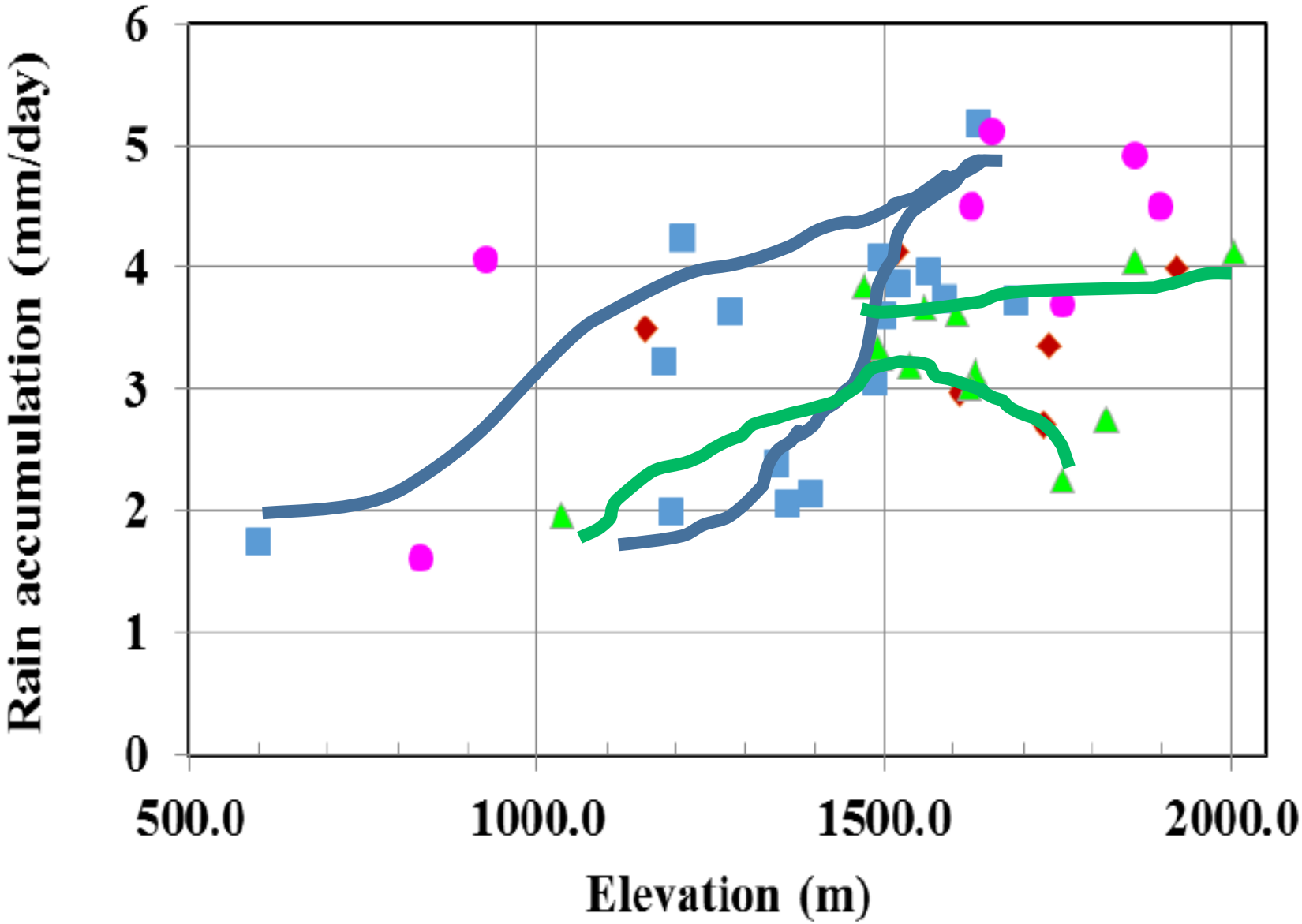
IPHEx IOP SCORECARD

Mission Targets	A	B	C	D	E	X
MCS Convection		5	1		5	4
MCS Stratiform	1	7	1		5	2
Non severe isolated/multi-cell	4	6		5	13	2
Anvil precipitation			1		4	1
Baroclinic/widespread stratiform	1	2	2	2	2	2
Orographic seeder-feeder					1	
Severe Thunderstorm	1	1		2	3	1
Ocean Cumuliform weak/non-precipitating			4	1		1
Ocean anvil, ice, Precipitating			1			1
Ocean MCS			1			1
Clear air land surface		2			17	1
Clear air calibration loop			2	2		3

A= aircraft coordinated and over watershed,
B= aircraft coordinated within NPOL domain,
C= aircraft ocean external domain;

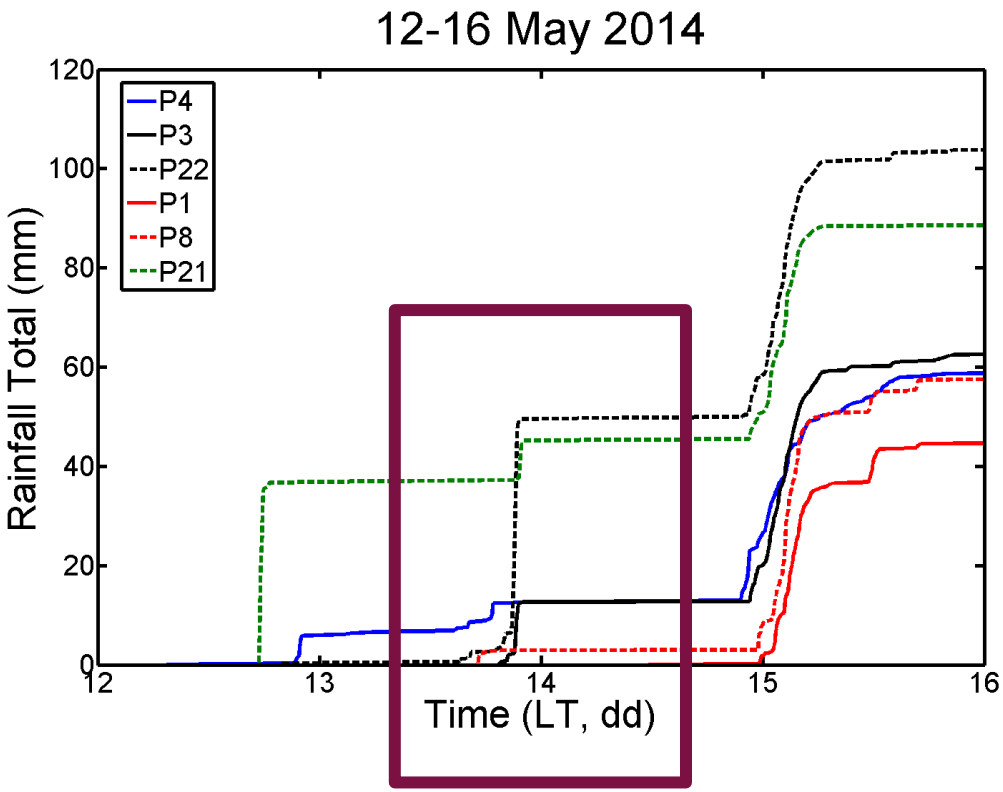
D= a,b,c with GPM overpass;
E= sampled by ground platform only
X=observed

“Qualified” Orographic Enhancement



8 years climatology

Local "Inverse" Orographic Effect in the Inner Mountain Region

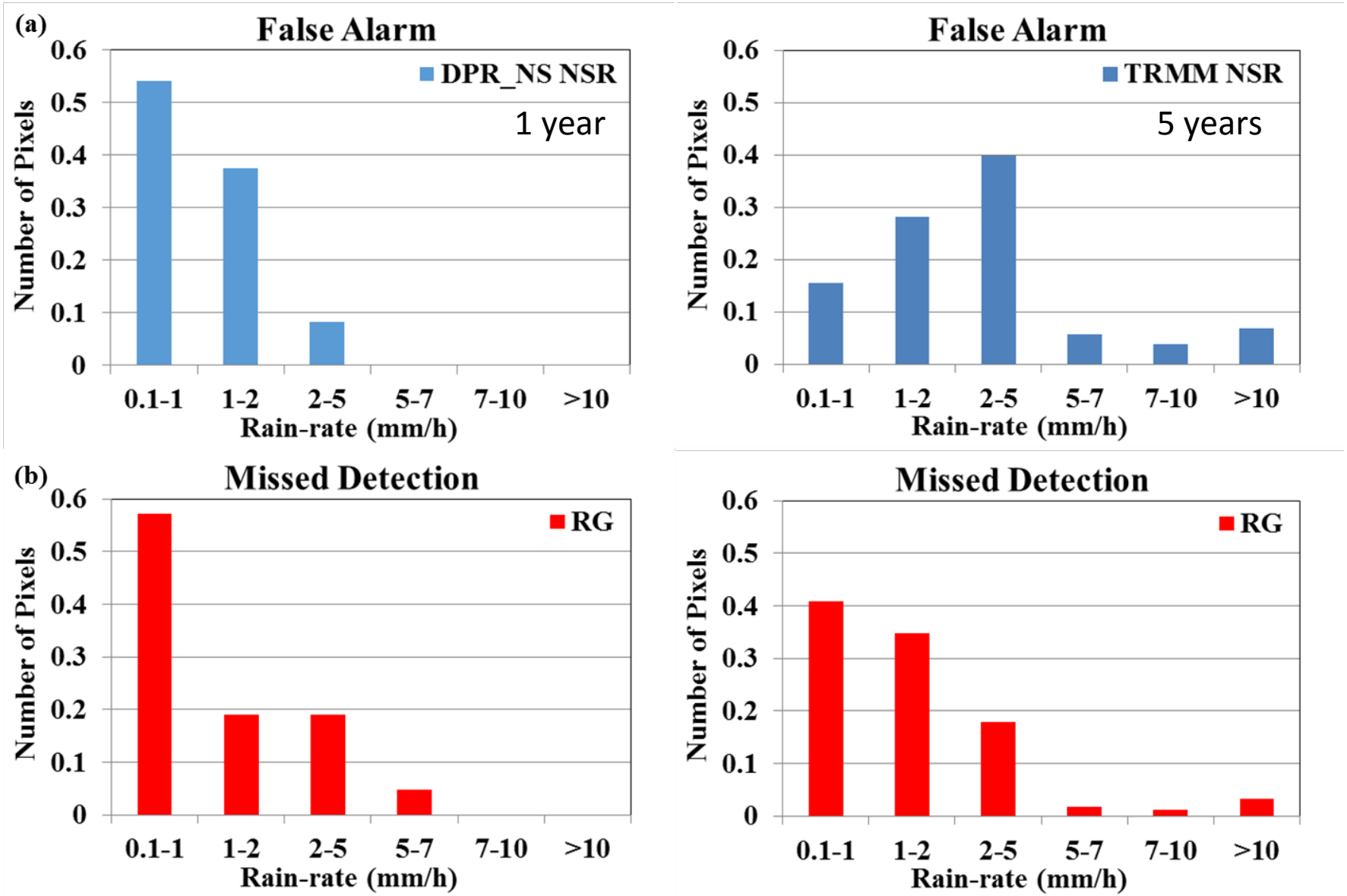


2X Rainfall in the valleys within the inner region over a 3-day period during IPHEx IOP

difference results from low level rainfall enhancement via seeder-feeder mechanisms prior to the May 15 event

Wilson

Error Climatology --- EOP



Spatial Organization?

Duan et al. 2015

Main Points

✓ The Importance of <u>Comprehensive</u>
<u>Colocated</u> Observations

IOP Maggie Valley Supersite

❑ Mapping the Space-Time Complexity of Microphysics

Homogenization and Integration of Observations

✓ Rainfall Fields and Hydrologic Simulations

Spatial and Temporal Scales, Geolocation,
"GroundTruth", Inverse Problem Solving

1. The Value Comprehensive Colocated Observations

Maggie Valley Supersite

- Process Studies (hydrometeor life-cycle)

  Interpretation of Observations

- Integration of Multisensor Observations

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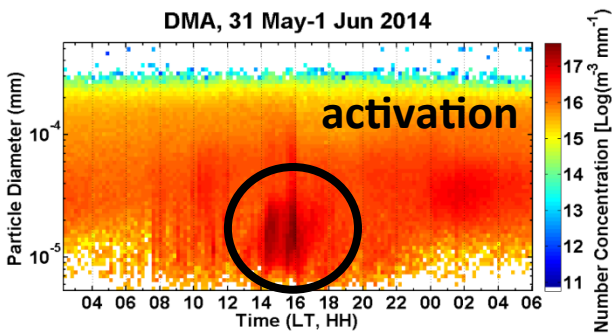

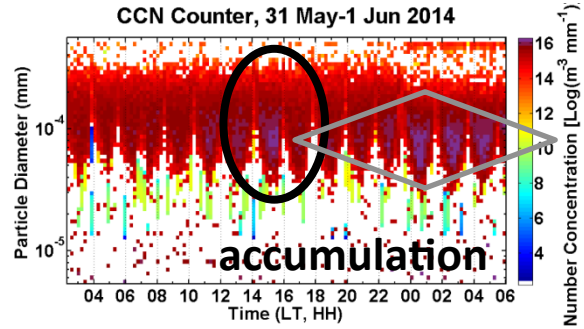

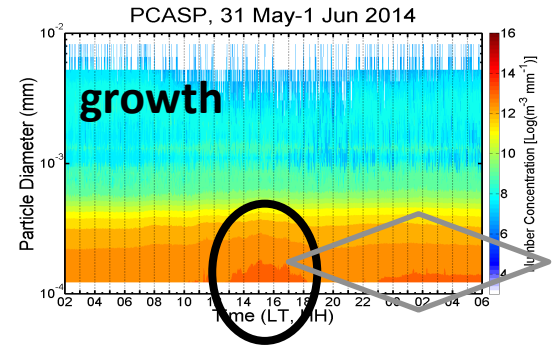

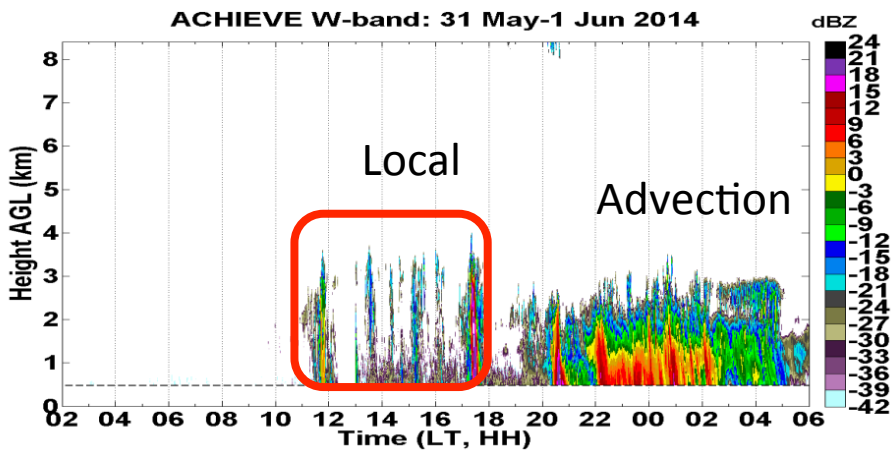

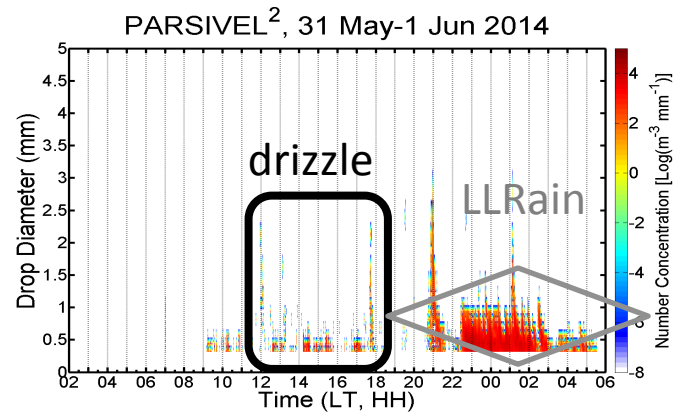

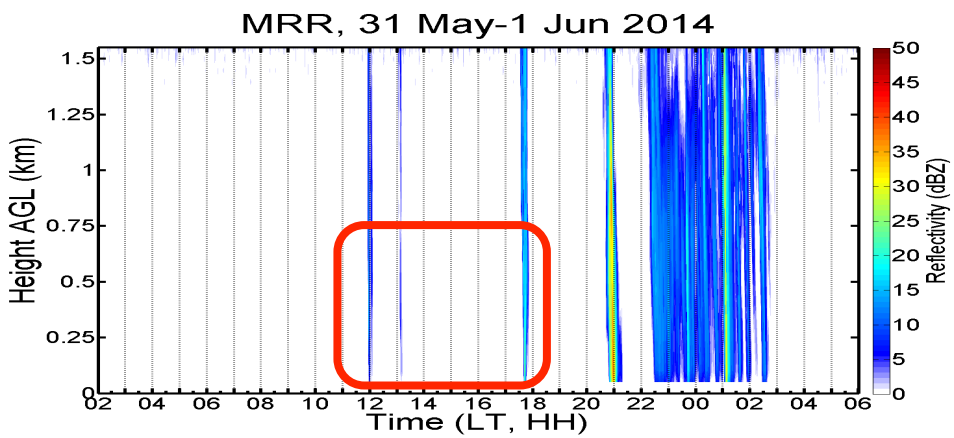

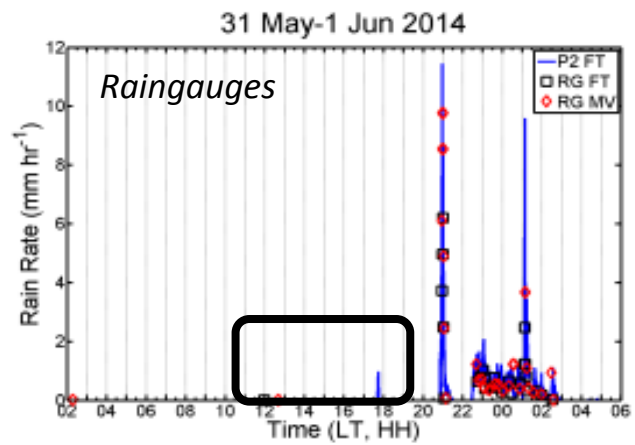

Wilson

Diurnal Life-Cycle of Hydrometeors

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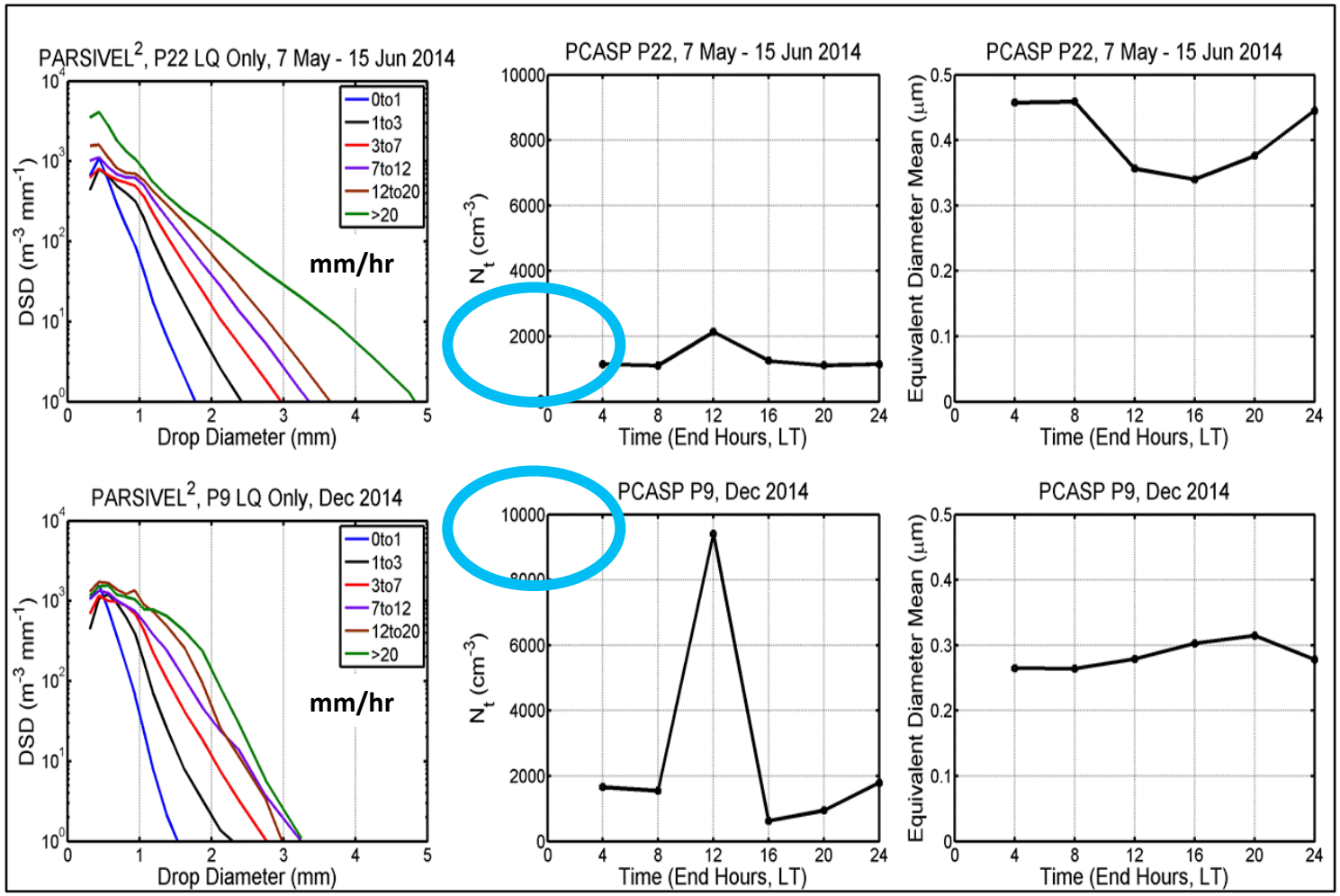
Inner Region Microphysics Diurnal Cycle + Seasonality

Summer

Winter



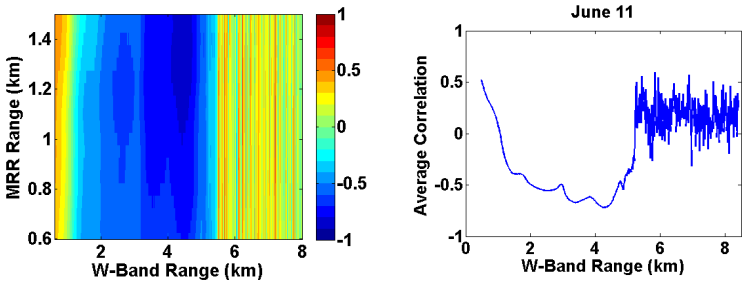
D_m-σ_m relationship

Wilson

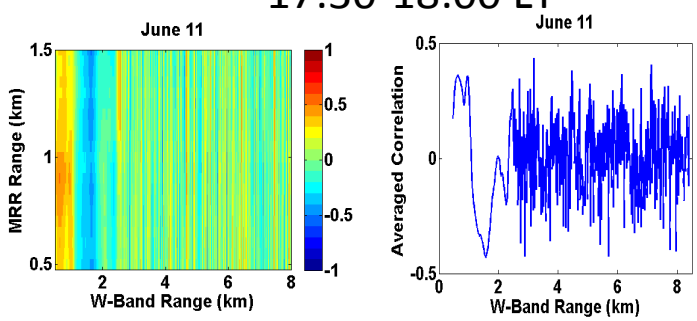
K-W Band Integration

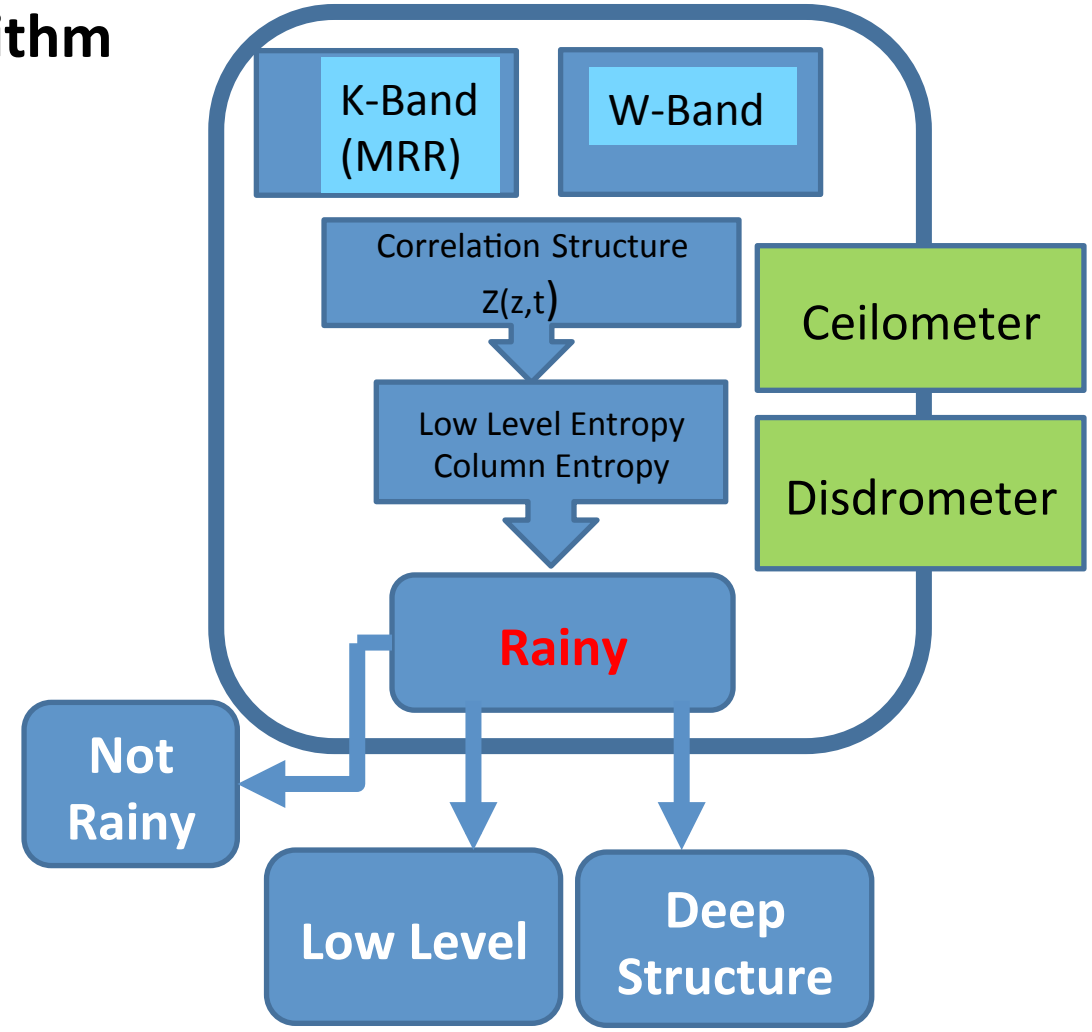
Rainfall Classification Algorithm

14:30-15:00 LT



17:30-18:00 LT

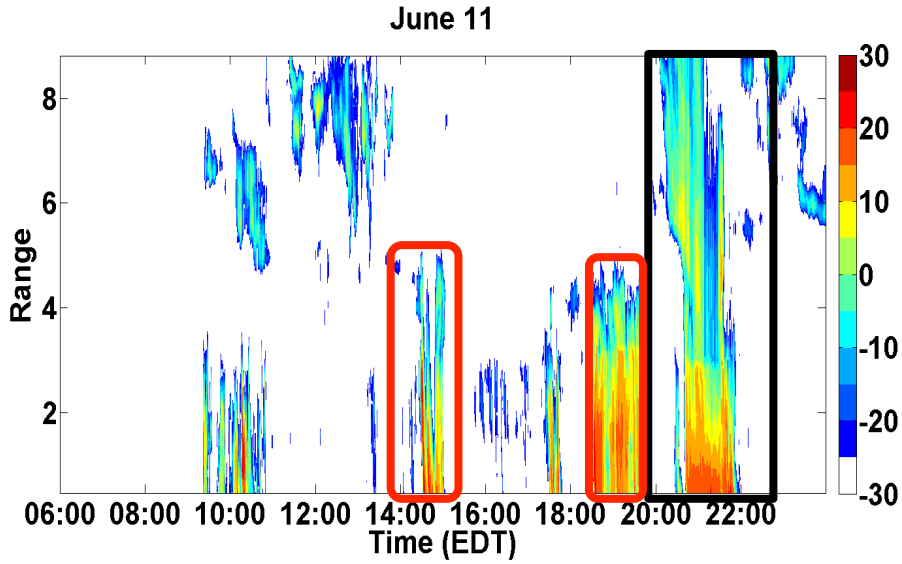




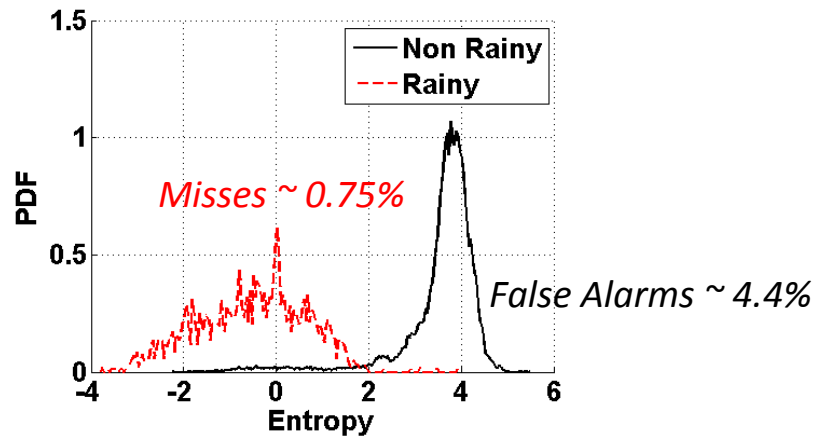
Arulraj

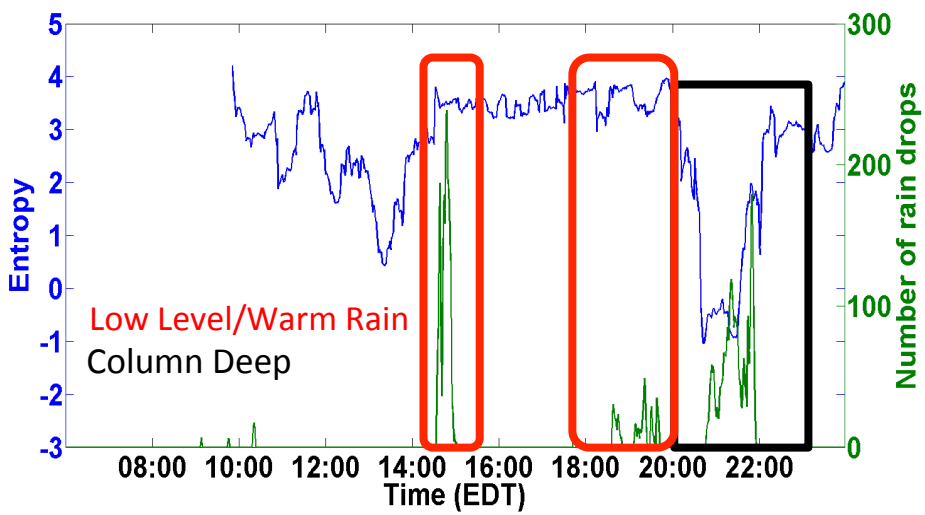
IPHEx IOP

W – BAND Reflectivity

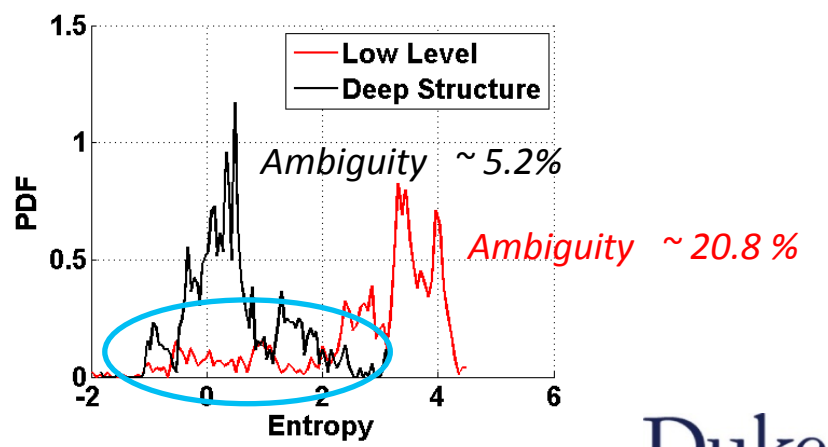


Rainfall Detection





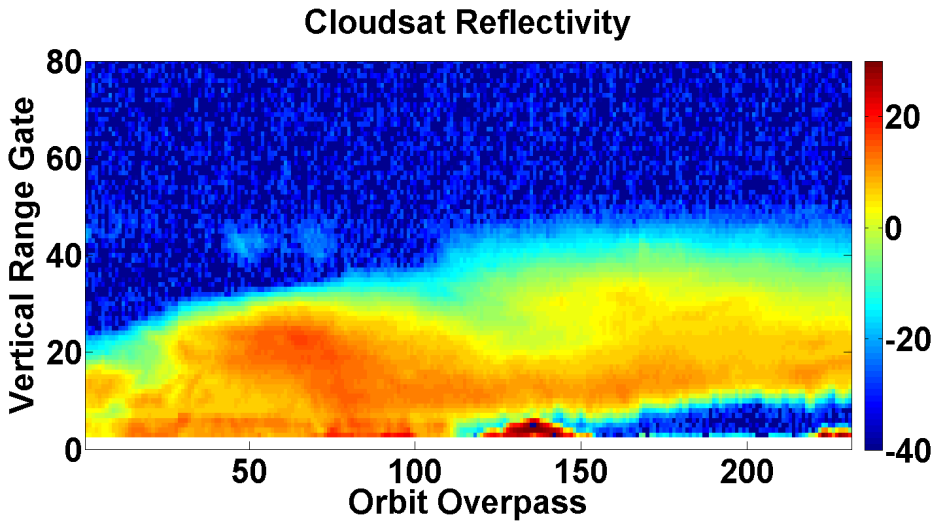
Rainy Conditions

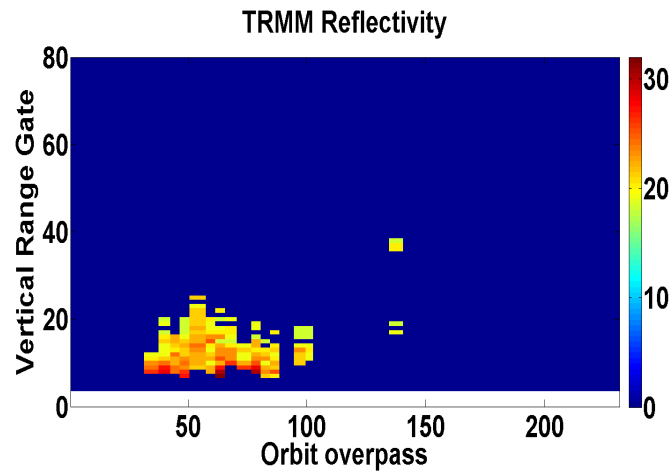


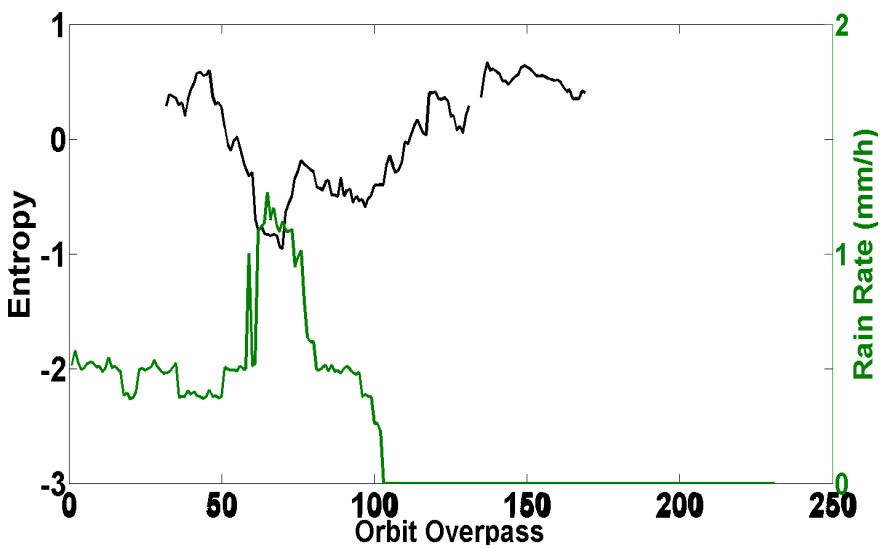
Arulraj

Application to "Concurrent" CloudSat and TRMM PR

February 4, 2010 14:58 LT







Implications
for future mission design

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4D microphysical grids

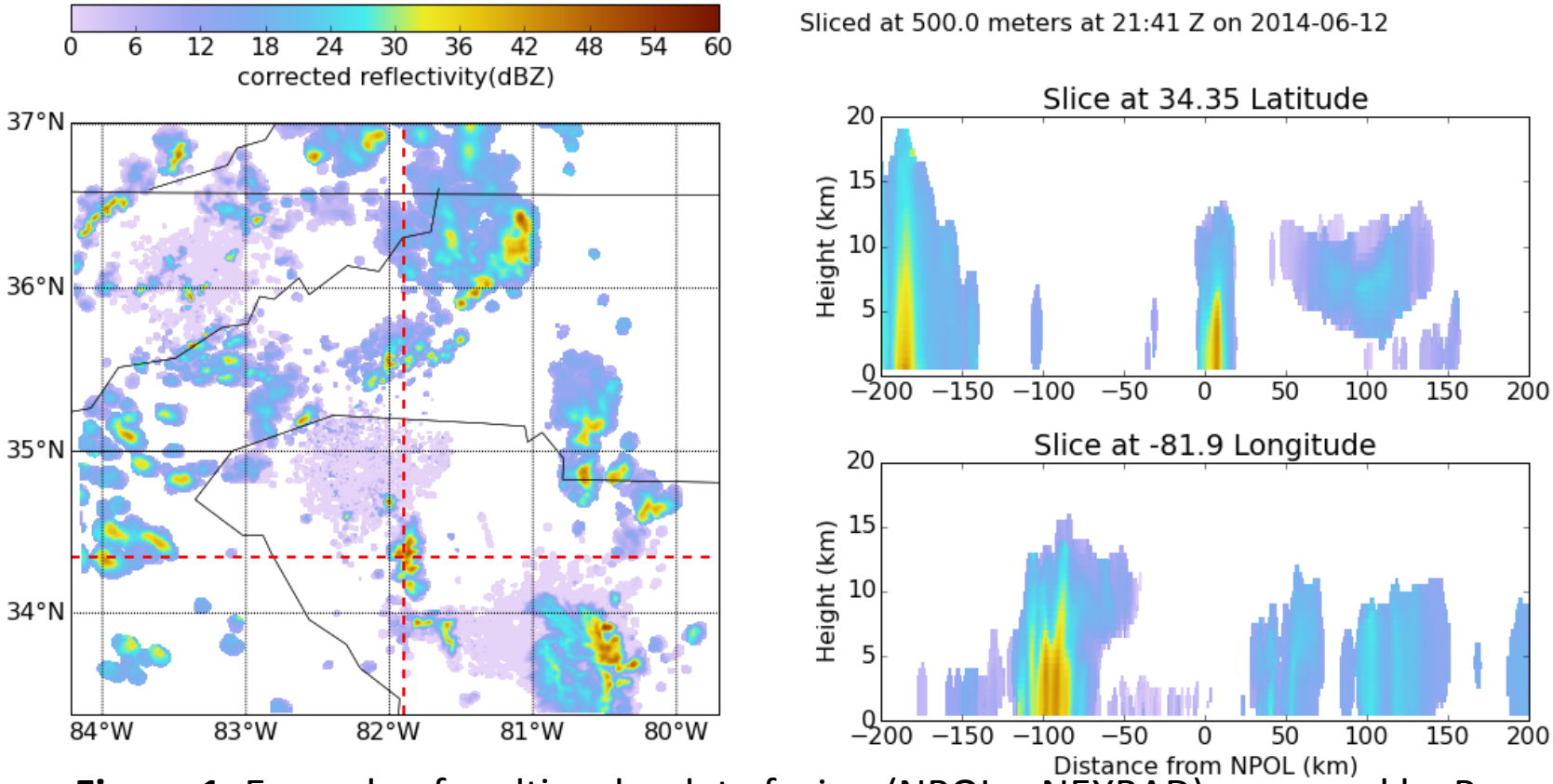


Figure 1. Example of multi-radar data fusion (NPOL + NEXRAD), powered by Py-ART. Precipitation retrievals are gridded along with standard variables like reflectivity.

Data Fusion

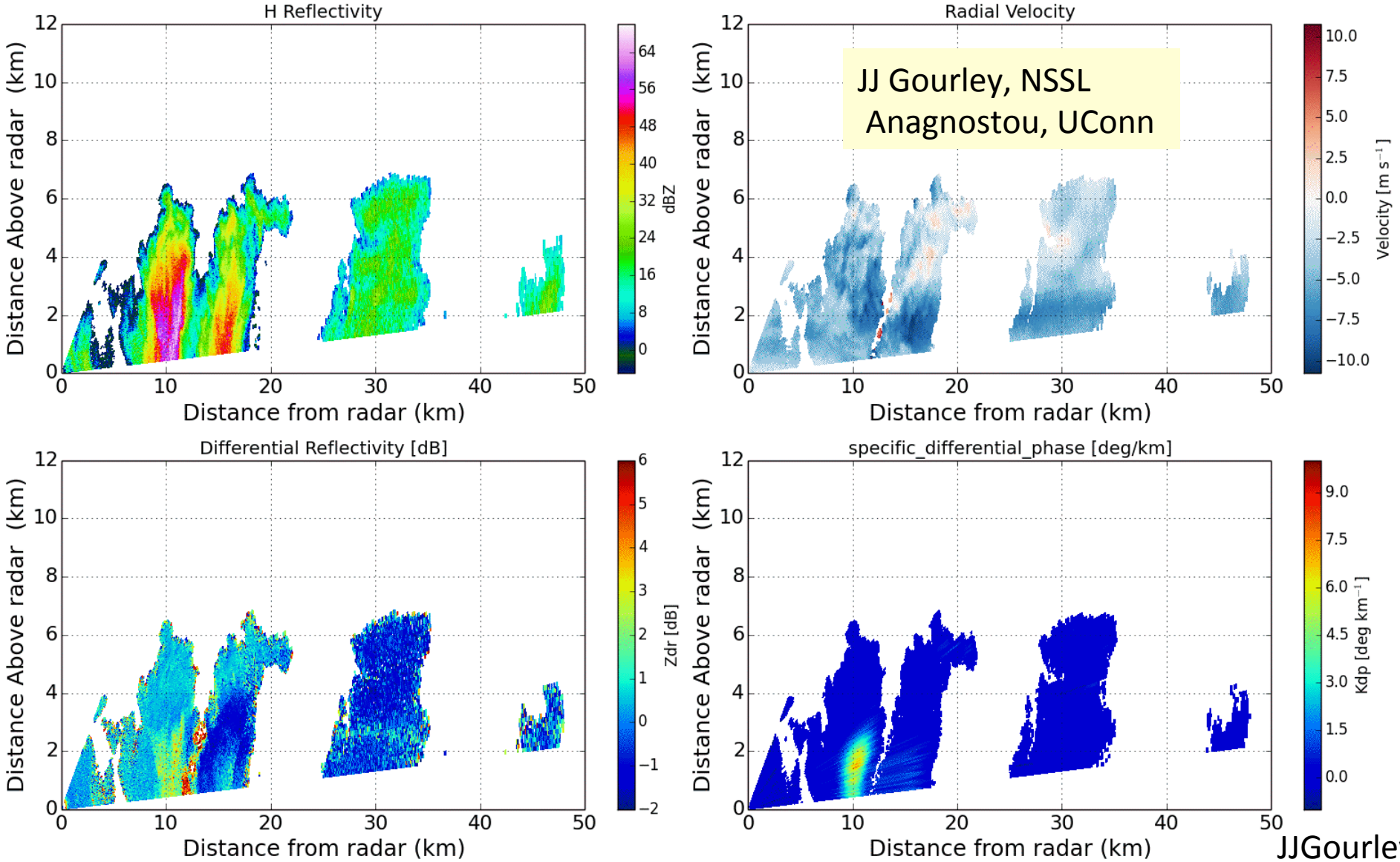
Ongoing work is seeking to merge precipitation information (e.g., Z, D0, R, etc.) from multiple platforms to create 4D microphysical grids for the 11-12 June 2014 significant hydrometeorological event.

T. Lang

NOXP Vertical Scans

Storm Cross-section Dynamics

RHI NOXPRVP 2014-06-12T16:43:54Z Azimuth=244.00 deg



JJ Gourley, NSSL
Anagnostou, UConn

JJGourley

2. Rainfall Fields and Hydrologic Simulations

- Intercomparison of Various Data Sets
- Space-Time Scale Effects
- The Elusive True Rainfall and Data-Assimilation Prospects

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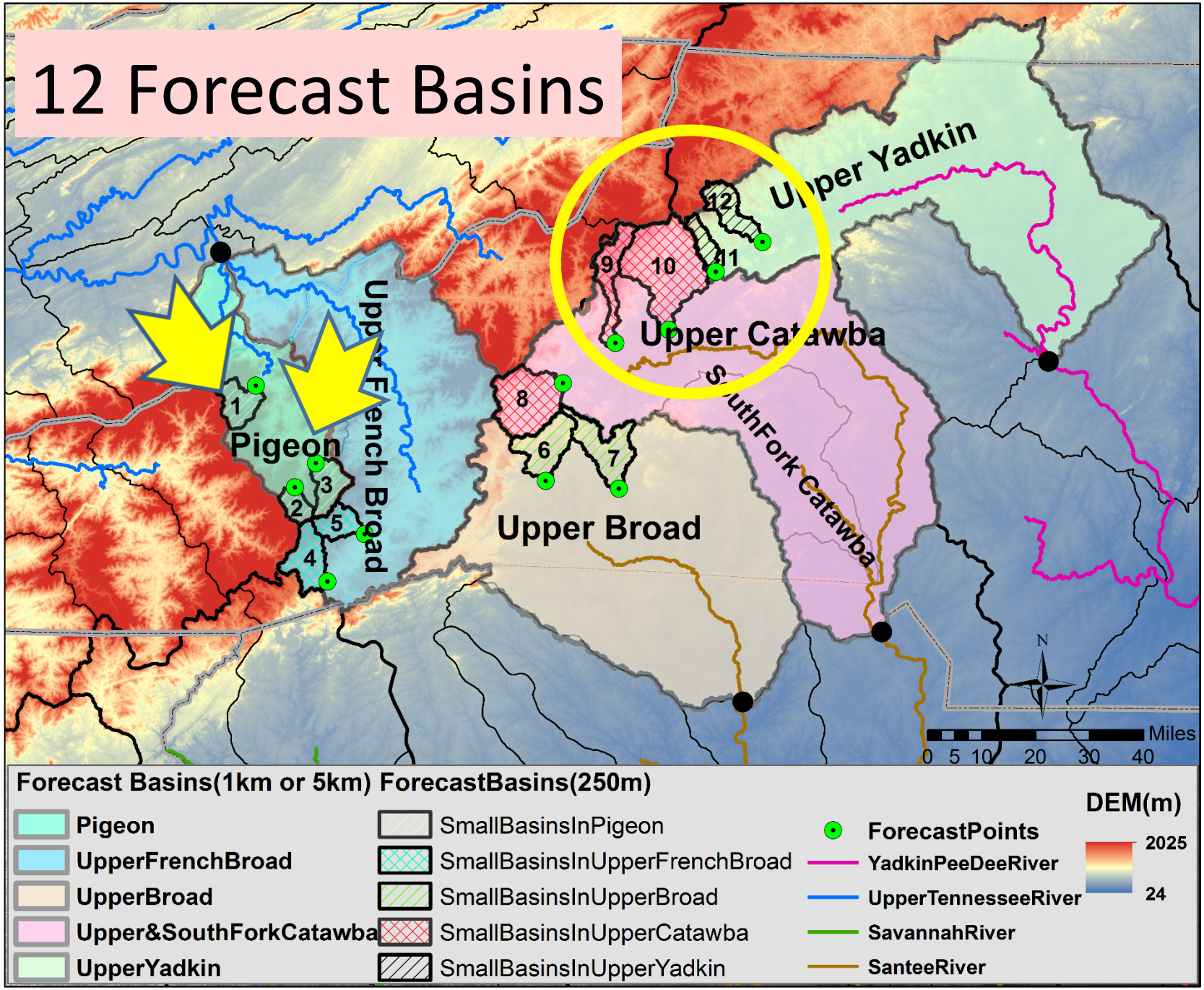
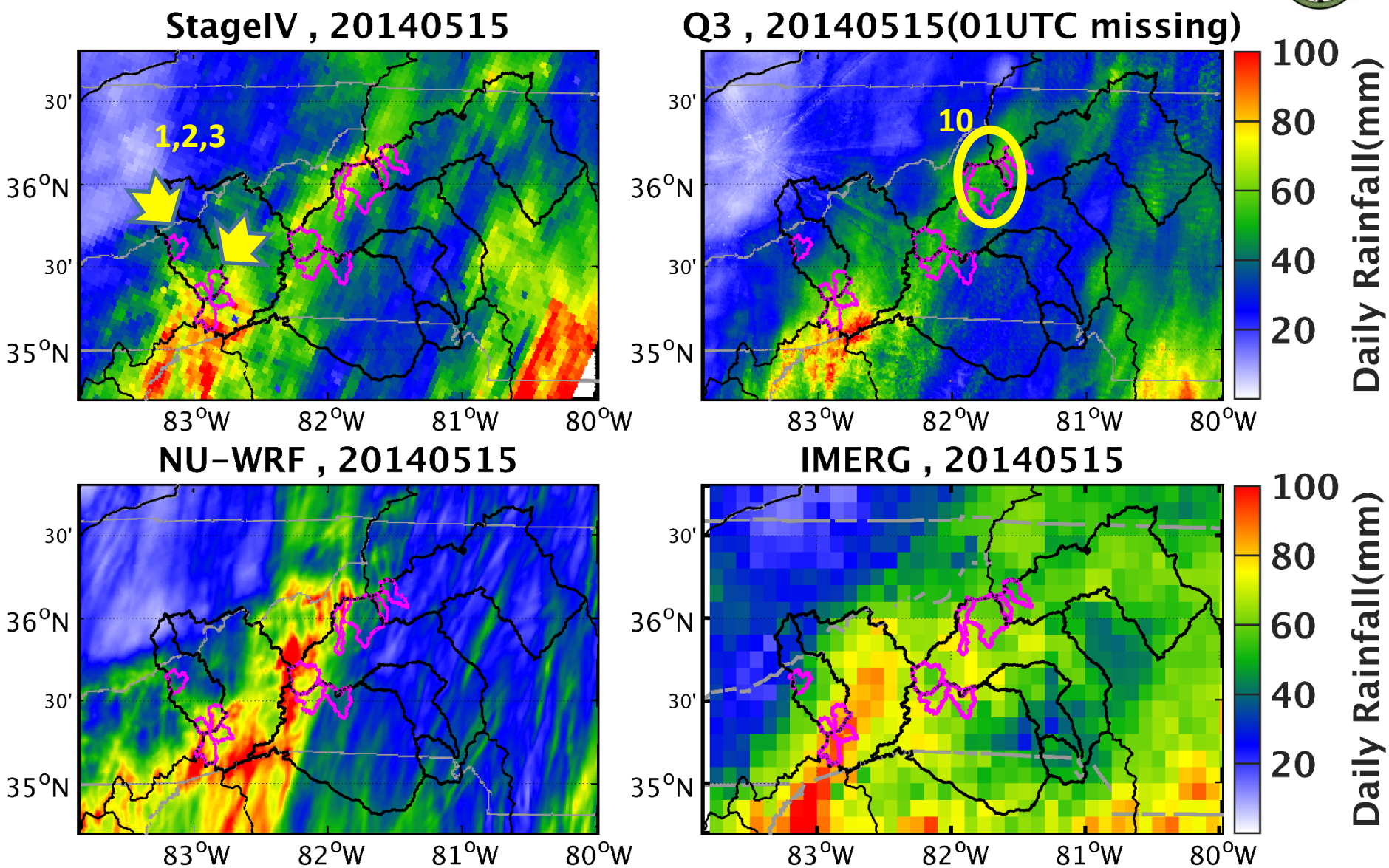
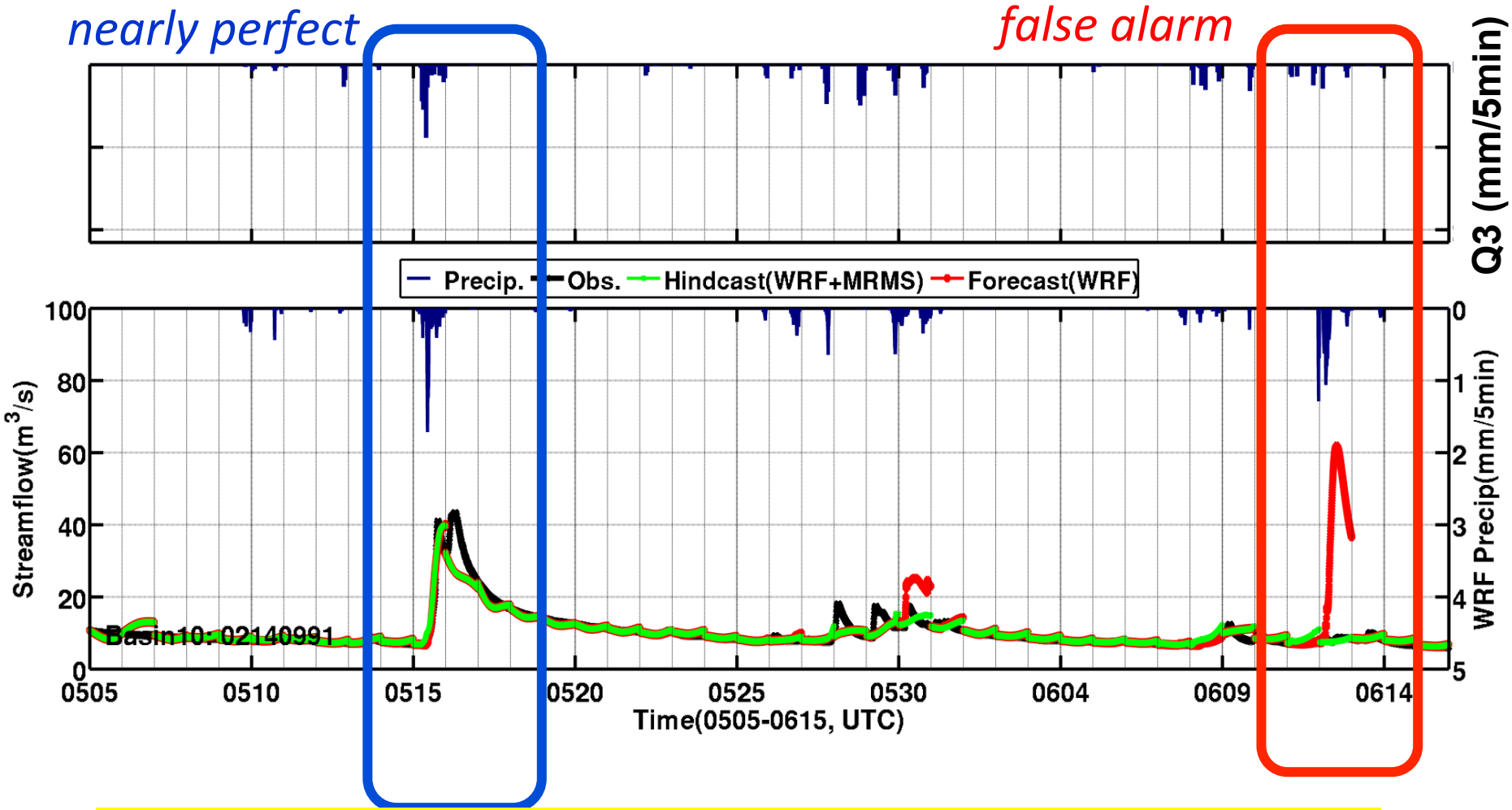

12 Forecast Basins
Upper Yadkin
Upper Catawba
SouthFork Catawba
Upper Broad
Upper French Broad
Pigeon
1
2
3
4
5
6
7
8
9
10
11
12
N
Miles
0 5 10 20 30 40
Forecast Basins(1km or 5km)
Pigeon
UpperFrenchBroad
UpperBroad
Upper&SouthForkCatawba
UpperYadkin
ForecastBasins(250m)
SmallBasinsInPigeon
SmallBasinsInUpperFrenchBroad
SmallBasinsInUpperBroad
SmallBasinsInUpperCatawba
SmallBasinsInUpperYadkin
ForecastPoints
YadkinPeeDeeRiver
UpperTennesseeRiver
SavannahRiver
SanteeRiver
DEM(m)
2025
24


StageIV , 20140515
Q3 , 20140515(01UTC missing)
NU-WRF , 20140515
IMERG , 20140515
1,2,3
10
30'
36°N
35°N
83°W
82°W
81°W
80°W
100
80
60
40
20
Daily Rainfall(mm)

Tao

Upper Catawba Operational Forecasting

Basin 10 ~ **515 km²**



Medium Size Catchment: Quantity and Duration are critical

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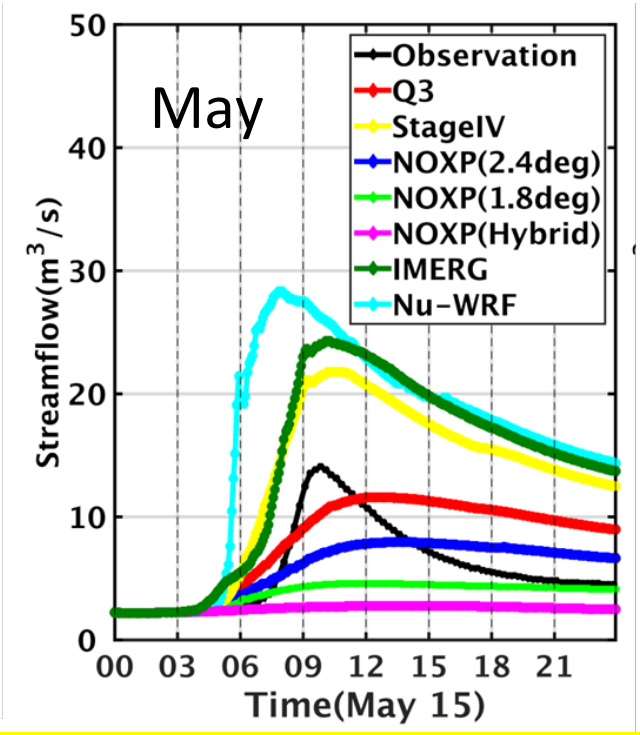
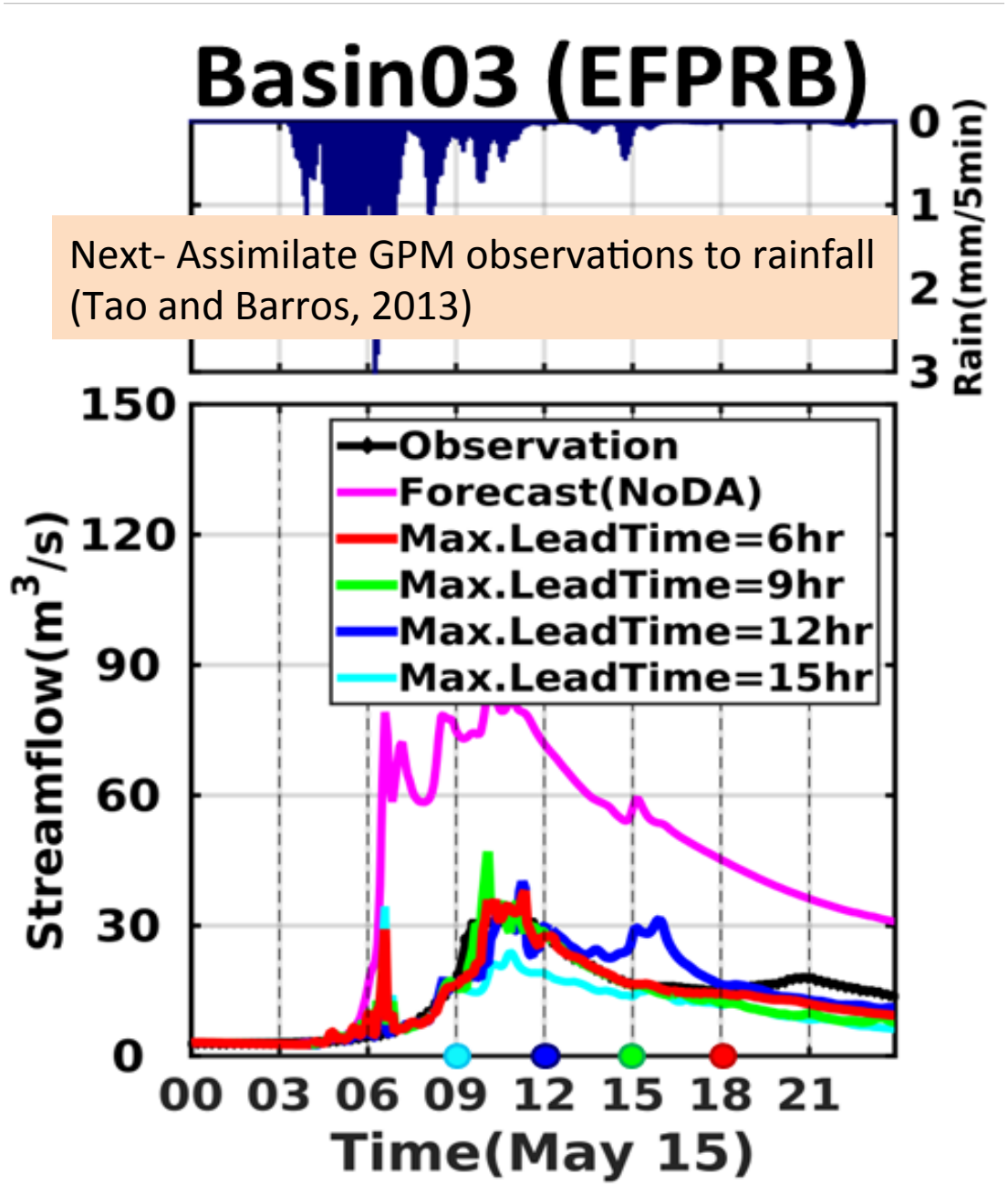


Preliminary Results with Data Assimilation suggest Reanalysis pathway to estimate initial Soil Moisture and bounds for True Rainfall…

Tao

EnKF vs. AEnKF (All States)



Next- Assimilate GPM observations to rainfall (Tao and Barros, 2013)

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Ongoing and Next….

- ❑EOP Wrap Up
- ❑4D Integration and Synthesis of Observations in the Inner Mountain Region + DA
- ❑Modeling of key events (May 15, June 12,…)
- ❑DPR, GMI, IMERG Evaluation - Uncertainty

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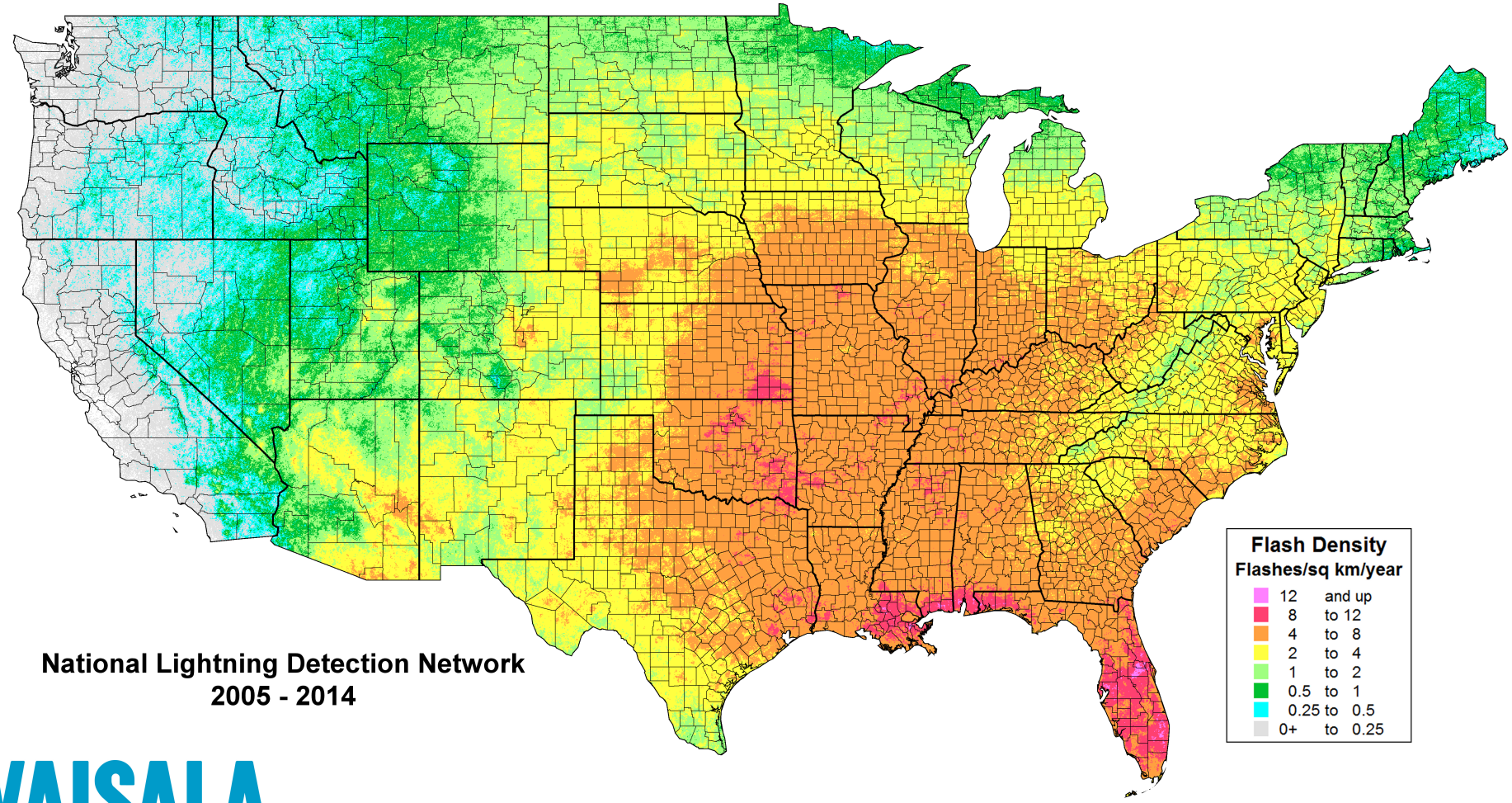

National Lightning Detection Network
2005 - 2014

VAISALA

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