OU SMART Radar Hurricane Winds
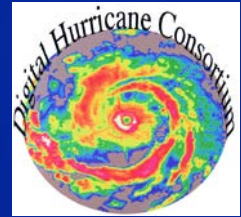
Dr. Michael Biggerstaff
School of Meteorology, University of Oklahoma
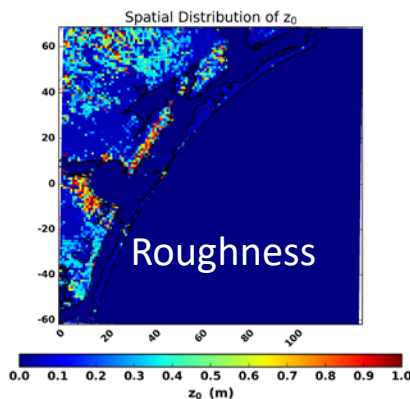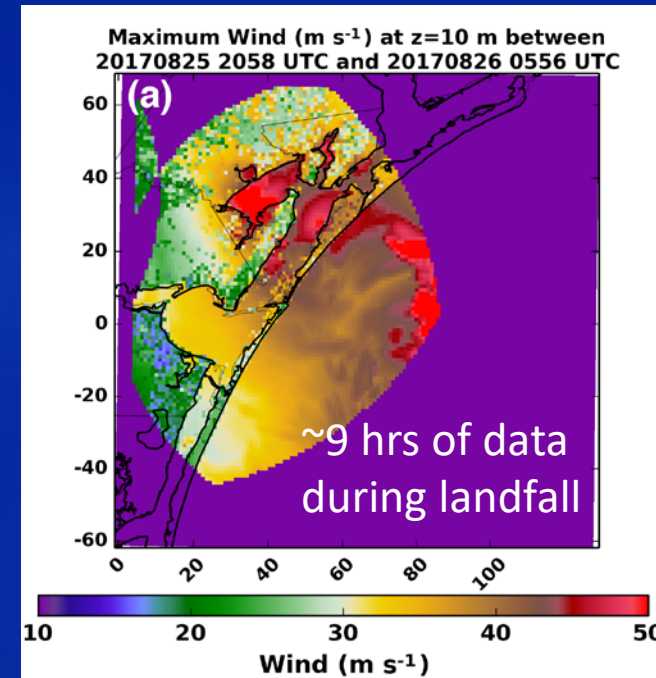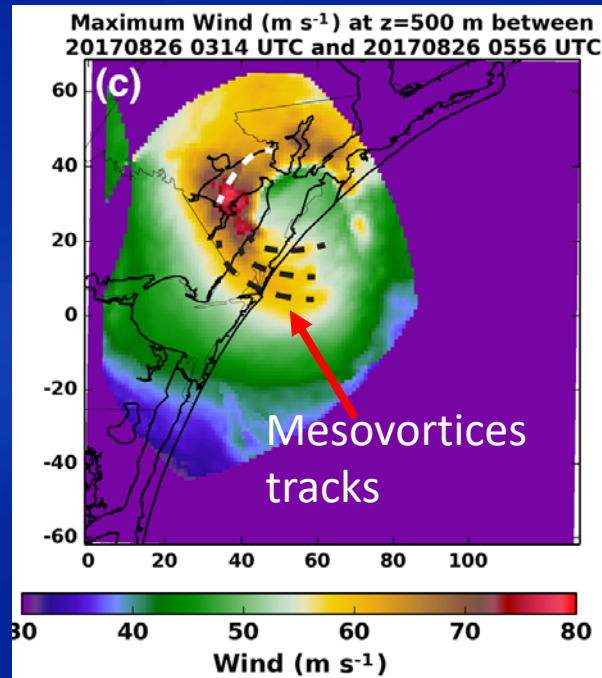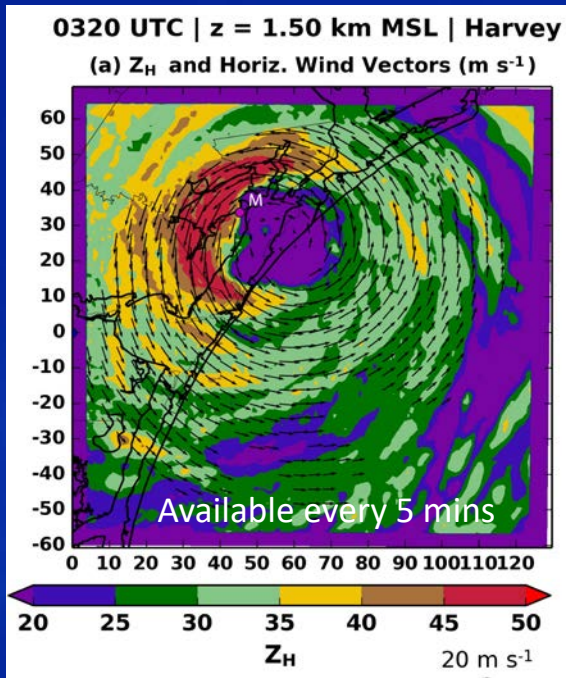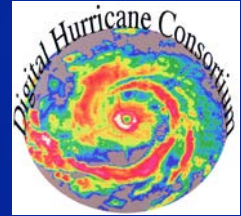

SR2- Ground-based Hurricane Hunter

SRs deployed in 11 landfalling TCs, most recently Harvey, Irma, and Florence

- **Two C-band polarimetric mobile radars**
  - **STaR dual-pol or linear H**
- **2.4 m diameter antenna (1.5° beam)**
- **300 kW magnetron transmitter**
- **10 kW diesel generator; 50-gal tank (60 hrs)**
- **Measures reflectivity, velocity, spectrum width, differential phase, specific differential phase, differential radar reflectivity, correlation coefficient**
- **FFT clutter filtering; staggered/dual PRT, random phase signal processing modes**
- **6 RPM az rotation rate; full/sector PPI, RHI, point**
- **$15K/yr internal funds to support SR program**
- **NSF RAPID grants for Harvey/Irma and Florence (well after the deployment)**

Hurricane Harvey (Cat 3 at landfall) Max Winds Mapping Method

0320 UTC | z = 1.50 km MSL | Harvey
(a) Z_H and Horiz. Wind Vectors (m s^{-1})

Available every 5 mins

Z_H 20 m s^{-1}

Maximum Wind (m s^{-1}) at z=500 m between
20170826 0314 UTC and 20170826 0556 UTC

Mesovortices tracks

Wind (m s^{-1})

Maximum Wind (m s^{-1}) at z=10 m between
20170825 2058 UTC and 20170826 0556 UTC

~9 hrs of data during landfall

Wind (m s^{-1})

Spatial Distribution of z_0

Roughness

z_0 (m)

Perform dual-Doppler analysis with SR2 and KCRP 88D; update max wind at each grid point; apply logarithmic wind profile with land-use-based surface roughness (Zo) to extrapolate to surface
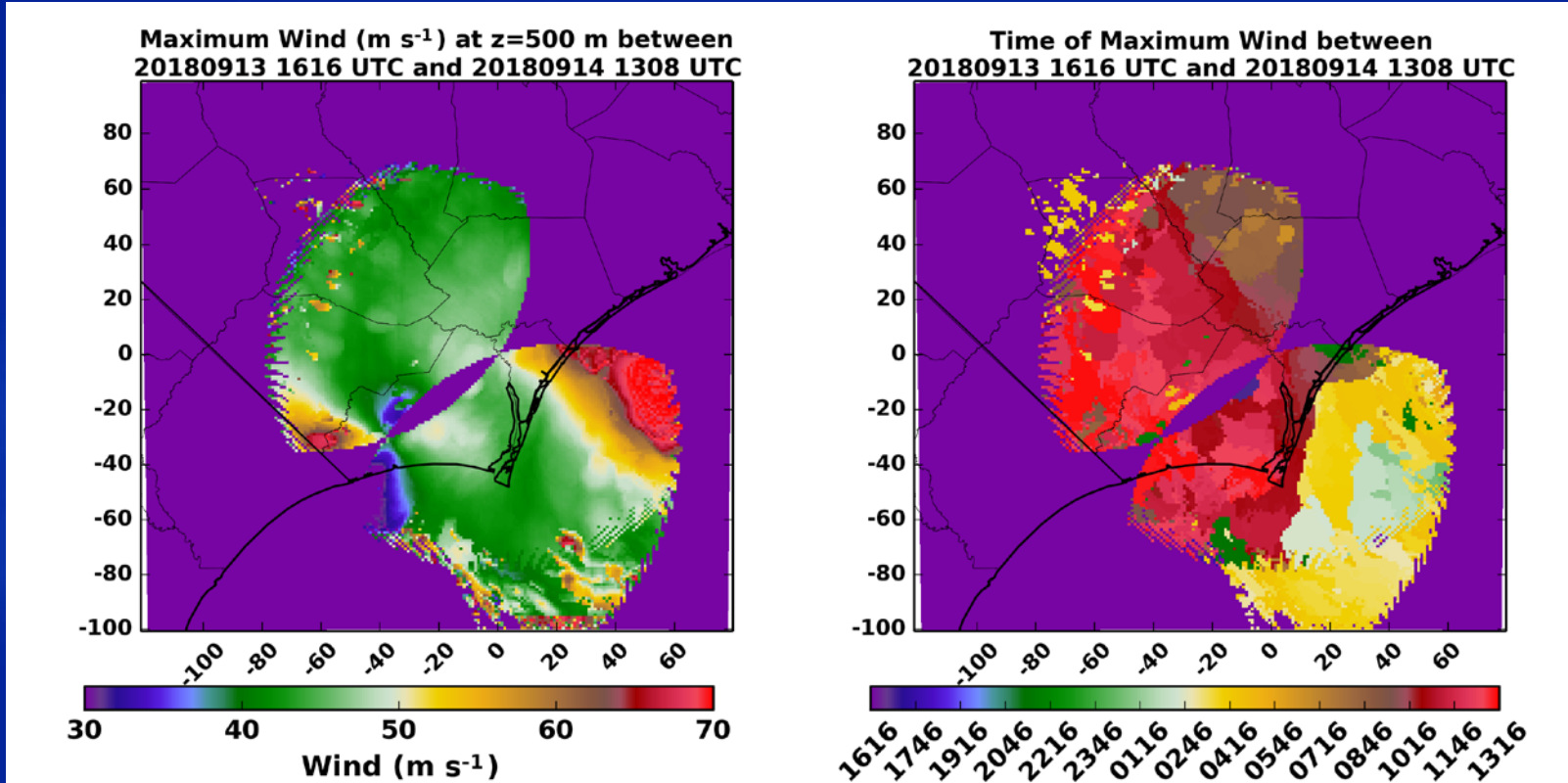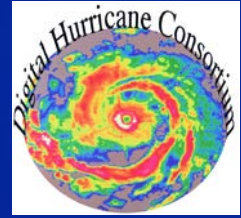
Validate against StickNets/Soundings/PIPS/other in situ obs
For Harvey, radar winds were high biased ~2 m/s; ~ 4m/s RMS error

2

Hurricane Florence
Initial Max Winds Aloft

Maximum Wind (m s⁻¹) at z=500 m between
20180913 1616 UTC and 20180914 1308 UTC

Time of Maximum Wind between
20180913 1616 UTC and 20180914 1308 UTC

SR3 and Wilmington 88D data collected every ~5 minutes analyzed over ~21 hours to show map of max winds and when they occurred at 500 m altitude. Need to determine surface roughness and extrapolate. Have 12 soundings, 14 StickNets, 4 PIPS, and 2 wind towers for validation.
NSF RAPID grant awarded to produce wind analyses.

WG/CAS-2018

SMART Radar
Future Hurricane Research Plans
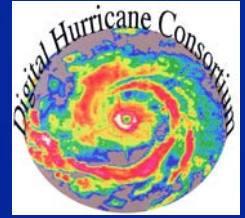
Current NSF RAPID grants
>   * Finish archive of Irma data
>   * Develop preliminary wind attribute maps (WAMs) for Irma
>   * QC and archive Florence
>   * Develop and publish WAMs for Florence

NIST Proposal (in review)
>   * Spatiotemporal maps of damaging winds from integrated remote and in situ observations
>   * Submitted in response to Disaster Resilience Research Grants Program
>   * Would fund SMART radars hurricane and severe wind intercepts/research for three years starting in August 2019 (if chosen)

NSF Proposal (in development)
>   * Focuses on inner core storm dynamics
>   * Will request support for one hurricane intercept during 3 year grant

External support essential if future hurricane deployments are going to be attempted. Internal OU funds were zeroed this last year.

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