# Windstorms in the Northeastern United States. S.C. Pryor, F. Letson, J. Sethunadh, & R.J. Barthelmie,
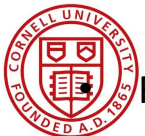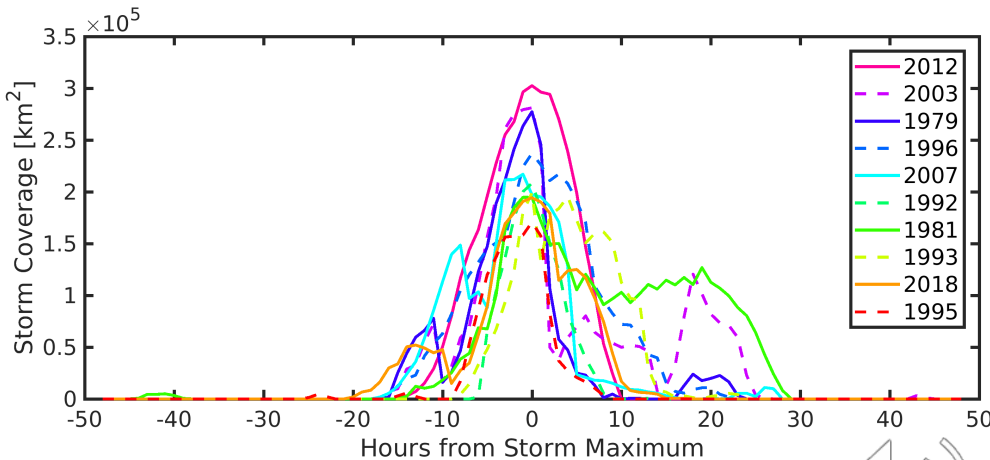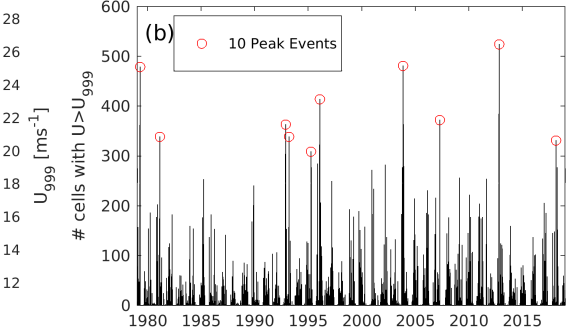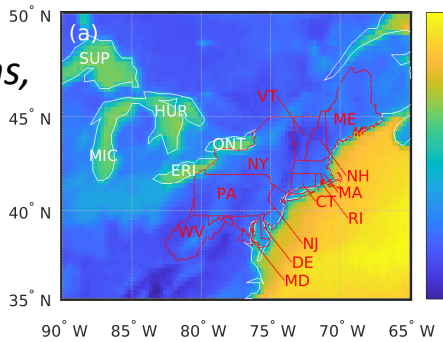
- Hazardous wind phenomena: 'Windstorms' (ETC), *downbursts/gust front (thunderstorms, MCS, derechos).*
  - Causes, Dynamics, Intensity
  - Climate sensitivity
- Method: 1979-2018 ERA5
  - Geophysical definition:
    - ERA5 hourly $U_{100m}$ > prctile(U,99.9)
    - Extent: # grid cells, Intensity: Umax & RP, Duration.
    - Composite: RR, hydrometeor type
  - Evaluation:
    - ASOS WS, RR. RADAR: RR. NOAA storm database
  - Cyclone characteristics. 3 hourly
    - $RV_{700}$ (T42 filtering), MSLP (T63 filtering)
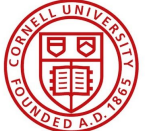  - Return Period: Gumbel annual max. U







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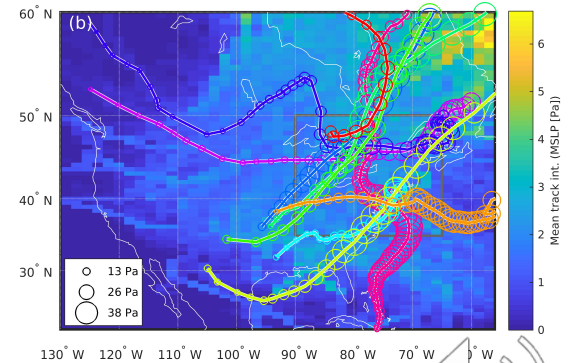A Framework for Improving Analysis and Modeling of Earth System and Intersectoral Dynamics at Regional Scales
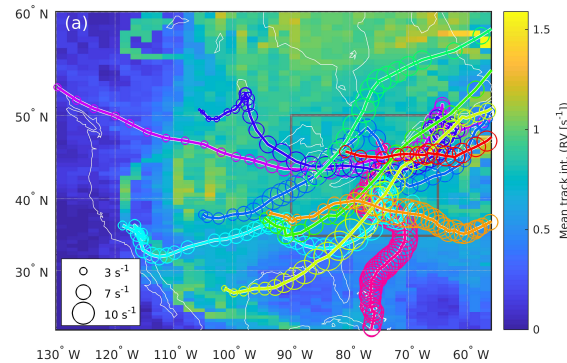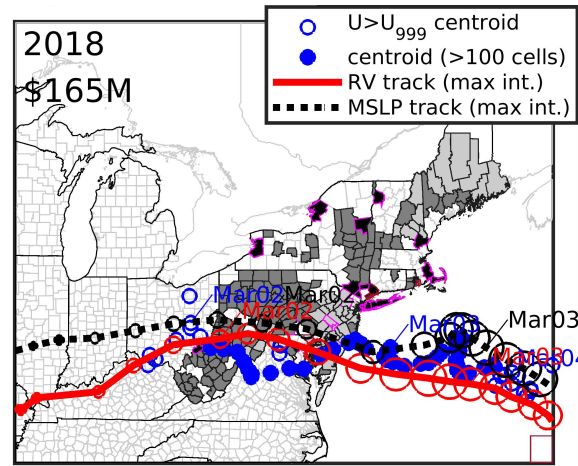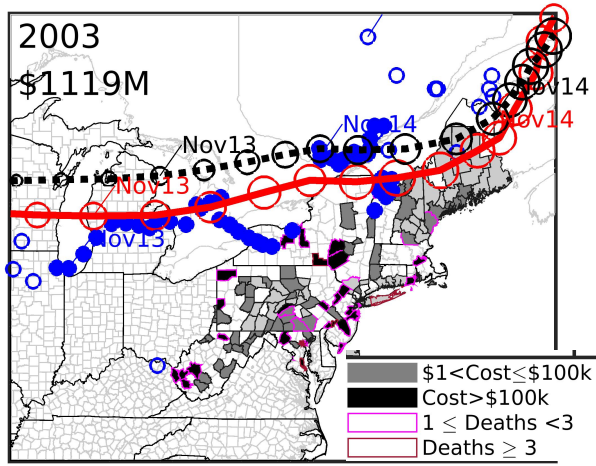
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- Historical events (storylines)

| | | Of 924 | [$] | p95th RP |
|---|---|---|---|---|
| TC | 10/30/2012 | 524 | 29B | 106 |
| AC | 11/13/2003 | 481 | 1.6B | 34.9 |
| AC | 04/06/1979 | 479 | 2.2B | 43.6 |
| CL | 01/27/1996 | 414 | 2.2B | 19.4 |
| CL/N | 04/16/2007 | 372 | 0.5B | 18.1 |
| CL | 11/13/1992 | 363 | 80M | 6.51 |
| CL | 02/11/1981 | 339 | 24M | 22.2 |
| TC/N | 03/13/1993 | 339 | 62M | 36.8 |
| CL | 03/02/2018 | 331 | 0.2B | 14.1 |
| AC | 04/05/1995 | 309 | 0.4B | 14.4 |

- # grid U > $U_{999}$ v storm damage r > 0.66 (p<0.05)

- Cyclone tracks 'typical' intensity 10* mean of tracks

- AC low ice cover. Inc.  intensity pass
  GL: +16% RV, 33% MSLP

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- WRF simulation of windstorm events
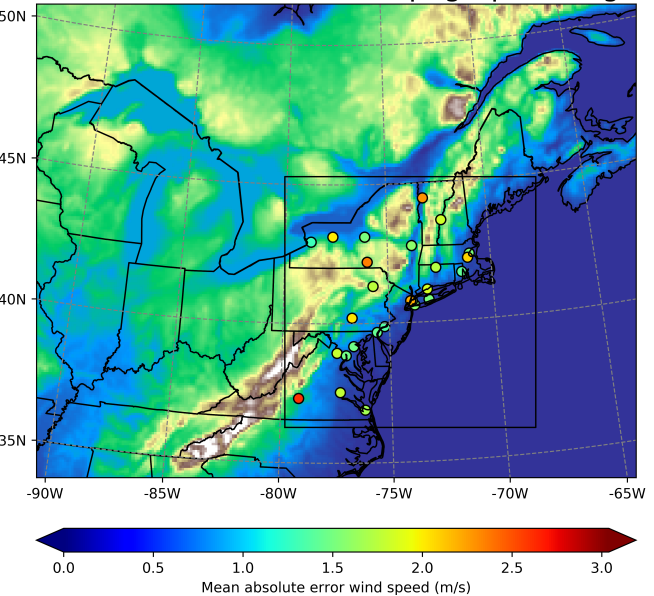  - Skill characterization. Cf.;
    - WS: ASOS, scatterometers/SAR
    - PPT: ASOS, RADAR
  - Value added of inc. resolution
    - 5 km v. 3.3 km v. 1.6 km
  - Dynamics. Causes of embedded maximum winds (cold front LLJ?)
  - Pseudo-global warming experiments
    - +T (mean(TC, CMIP6))
    - +Q ($f$(T))
    - Ice free GL
- Configuration as New European Wind Atlas (61 levels)
  - PBL: MYNN2.5
  - Surface layer: Eta, NOAH
  - Radiation: RRTMG
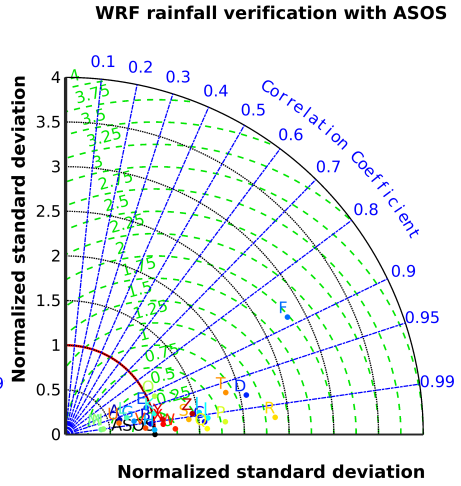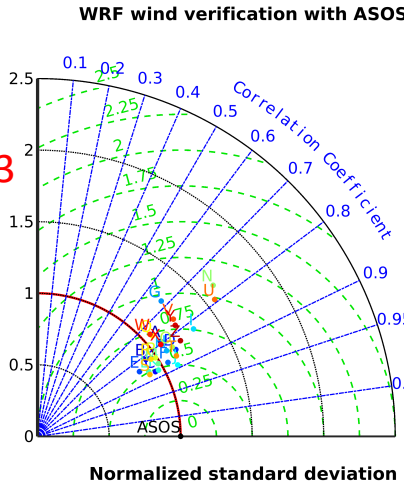  - Microphysics: WSM-5 class

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- WRF simulations
  - Domain 1: 10 km (240 by 190)
  - Domain 2: 3.3 km (300 by 300)

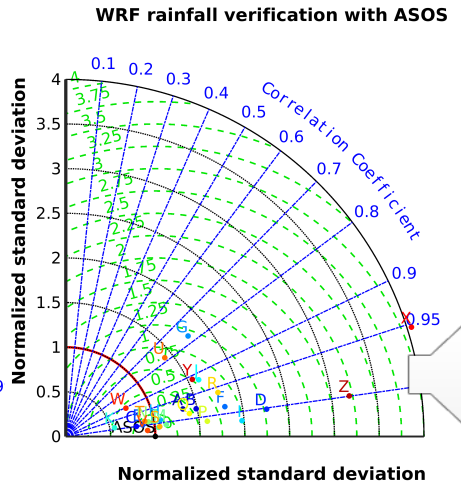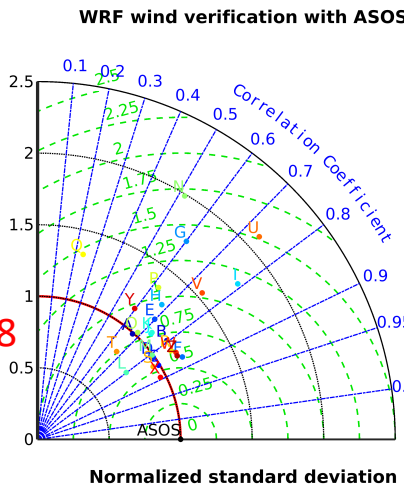Mean absolute error and topographic height



**WRF wind verification with ASOS**

AC
Nov 2003

**WRF rainfall verification with ASOS**

**WRF wind verification with ASOS**

CL
Mar 2018

**WRF rainfall verification with ASOS**

- ASOS
- A=KBDR
- B=KBDL
- C=KILG
- D=KBOS
- E=KMQE
- F=KBWI
- G=KLEB
- H=KALB
- I=KBGM
- J=KBUF
- K=KISP
- L=KJFK
- M=KLGA
- N=KNYC
- O=KROC
- P=KSYR
- Q=KAVP
- R=KMDT
- S=KPHL
- T=KPVD
- U=KLYH
- V=KORF
- W=KRIC
- X=KIAD
- Y=KBTV
- Z=KDCA