Evolution in identifying High Impact Weather Events since 18-19 February 1979

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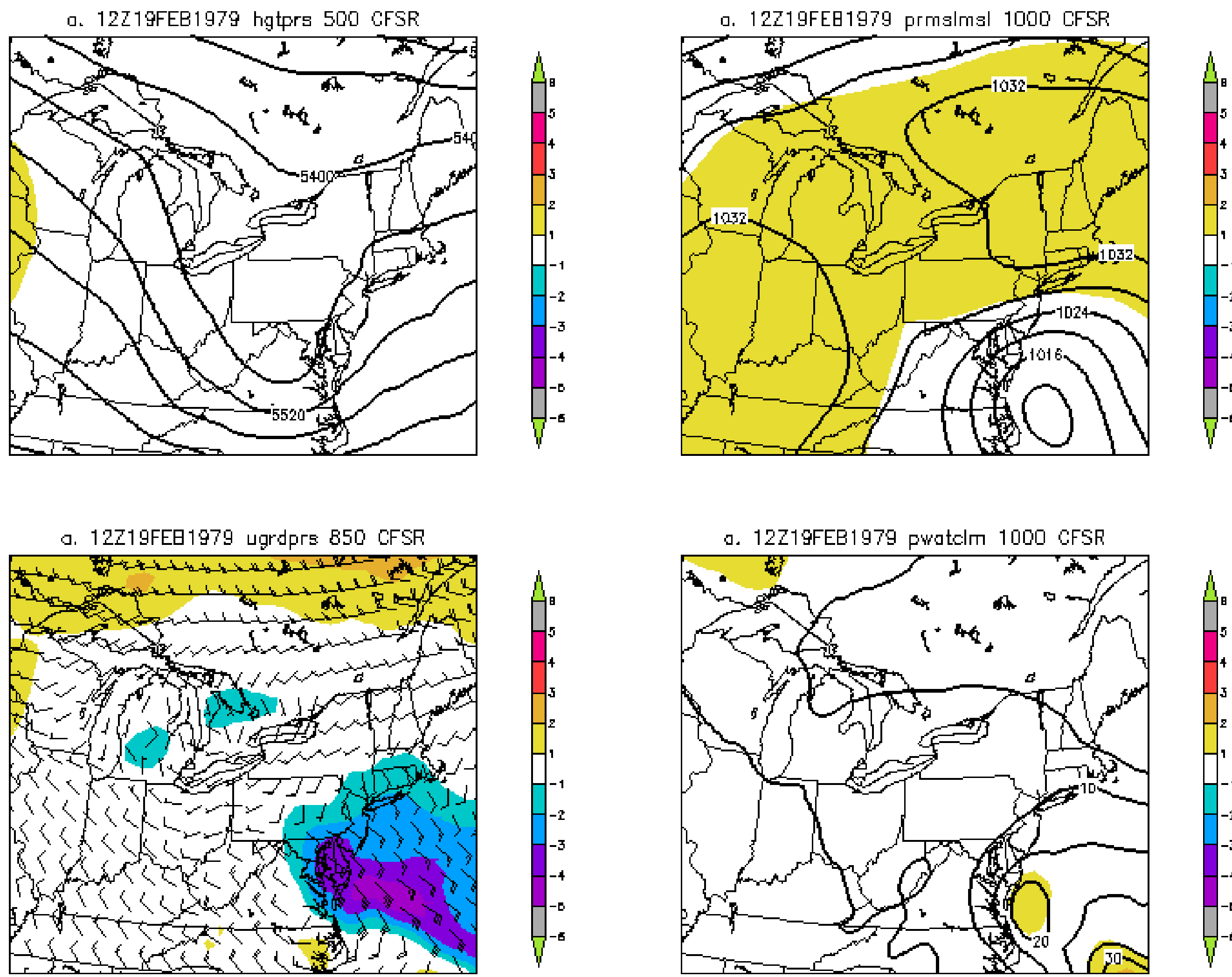
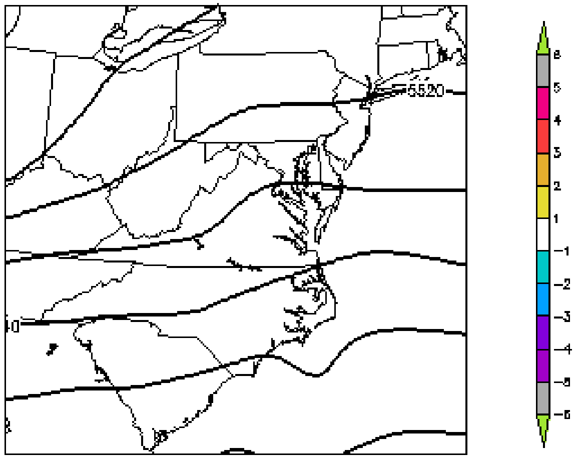
“The greatest snowstorm in more than half a century left the Washington area smothered under at most two feet of snow yesterday — a magnificent white menace that virtually imprisoned the city and sent road crews battling to reopen streets for this morning’s commuters.” Wash. Post 1979

1970s Traditional view

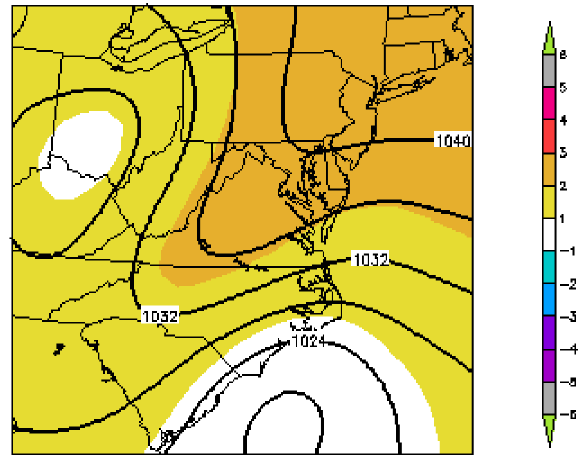
Using R-Analysis



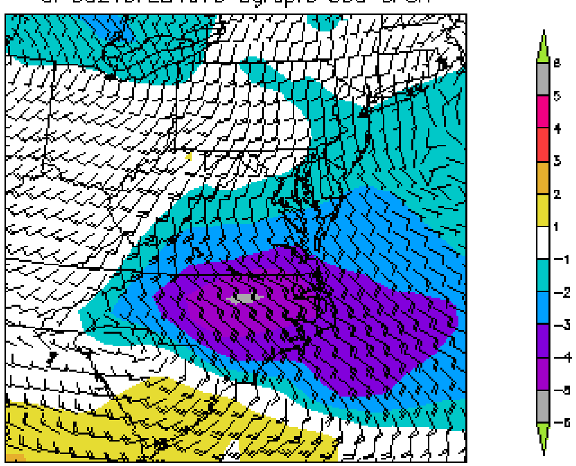
HIWE: Snow Storms over 30 years



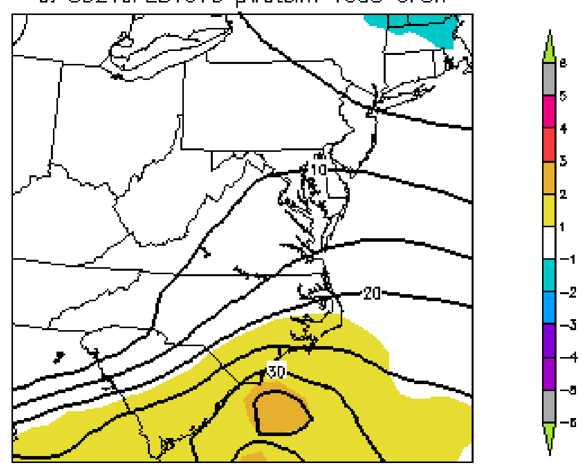
a. 00Z19FEB1979 hgtprs 500 CFSR



a. 00Z19FEB1979 prmslmsl 1000 CFSR



a. 00Z19FEB1979 ugrdprs 850 CFSR



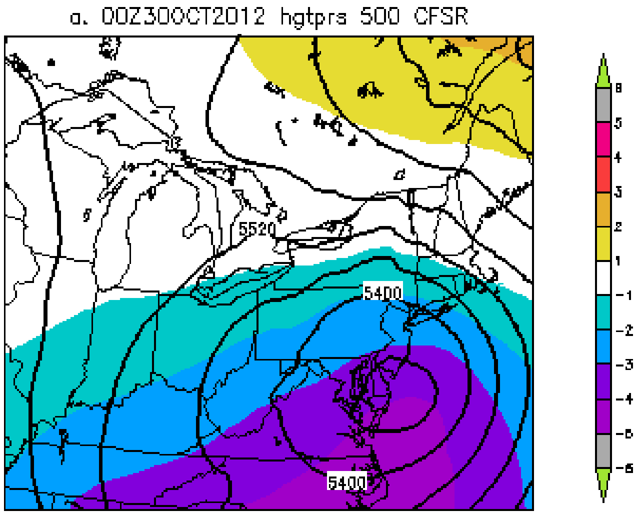
a. 00Z19FEB1979 pwatclm 1000 CFSR

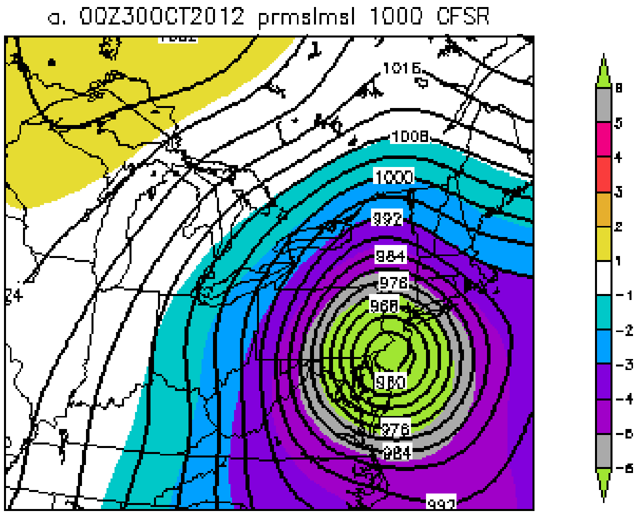
R-Climate and HIWE

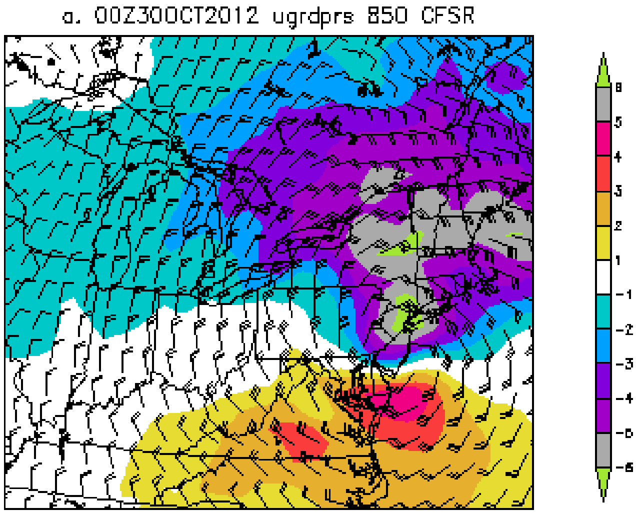
- *Traditional Standardized* anomalies facilitate identifying features associated with significant high impact weather events

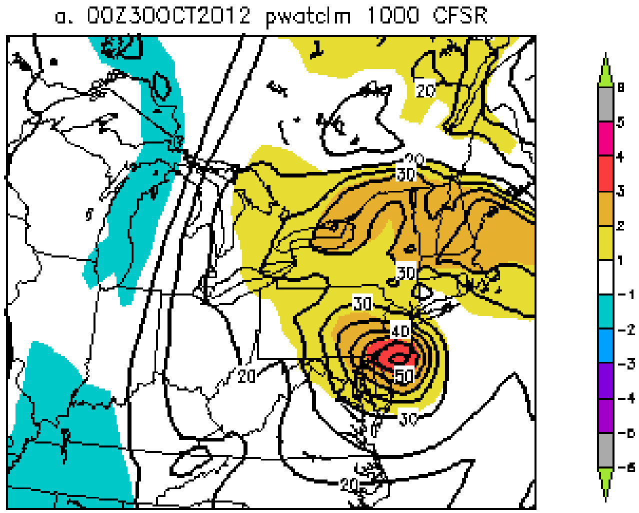
- Remove the guessing improving identification of larger scale ***high impact weather events*** (HIWE)

Sandy was a dandy









R-Climate and HIWE

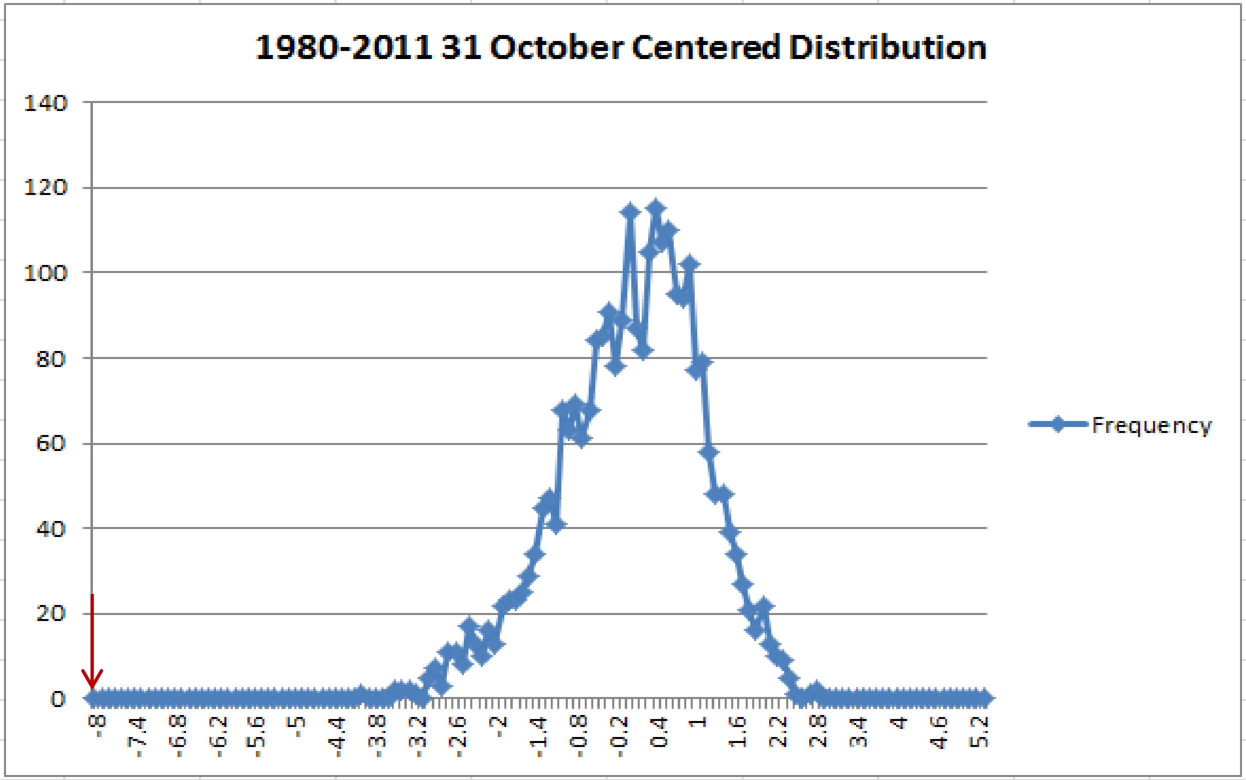
- Traditional Standardized anomalies facilitate identifying features associated with significant high impact weather events

- Remove the guessing improving identification of larger ***scale high impact weather events*** (HIWE)

- Now we can leverage the full PDF→ find extreme outliers

The Mean Sea-level Sandy

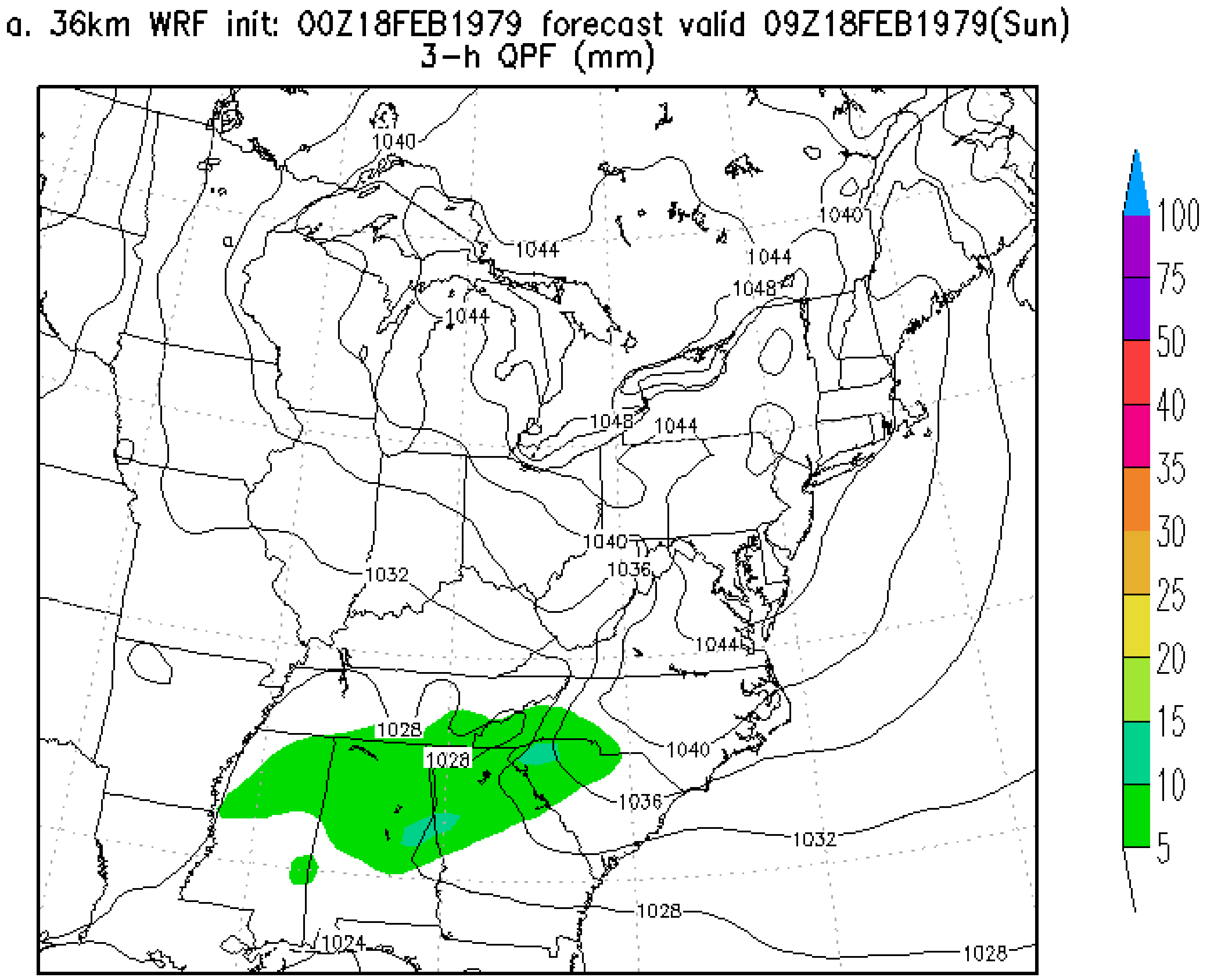
if we know the PDF and the forecast automation can provide alerts to extreme events in tails of any distribution



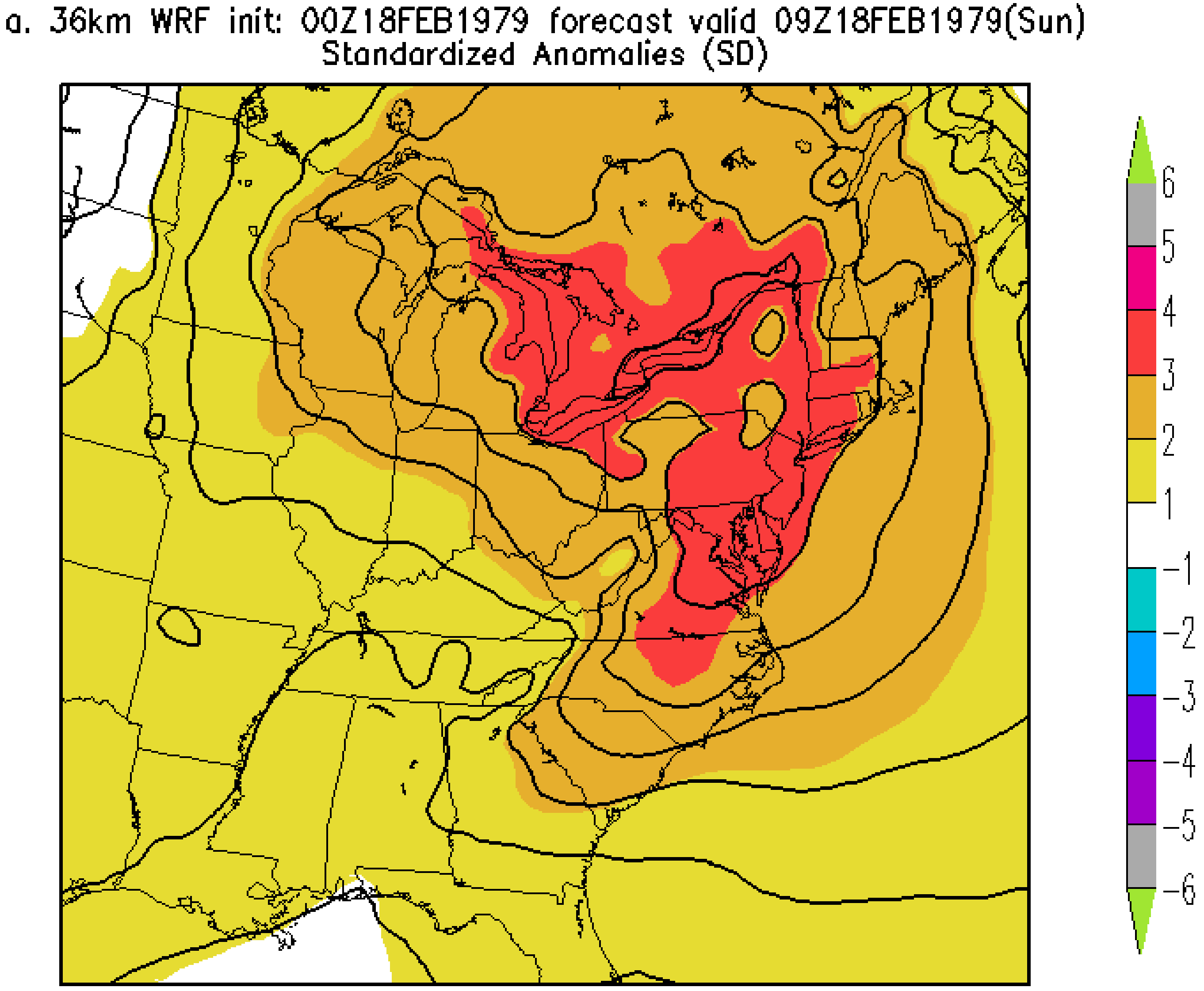
R-Climate and Forecasts Simulation 0000 UTC 17 February 1979

- Use 3-4 images from WRF-EMS runs for brevity (runs completed in grib2)
  - Traditional MSLP and QPF
  - MSLP with Standardized anomalies
- Surface cyclone was not so impressive→ anticyclone was!
- Show GEFS traditional "Superstorm" images

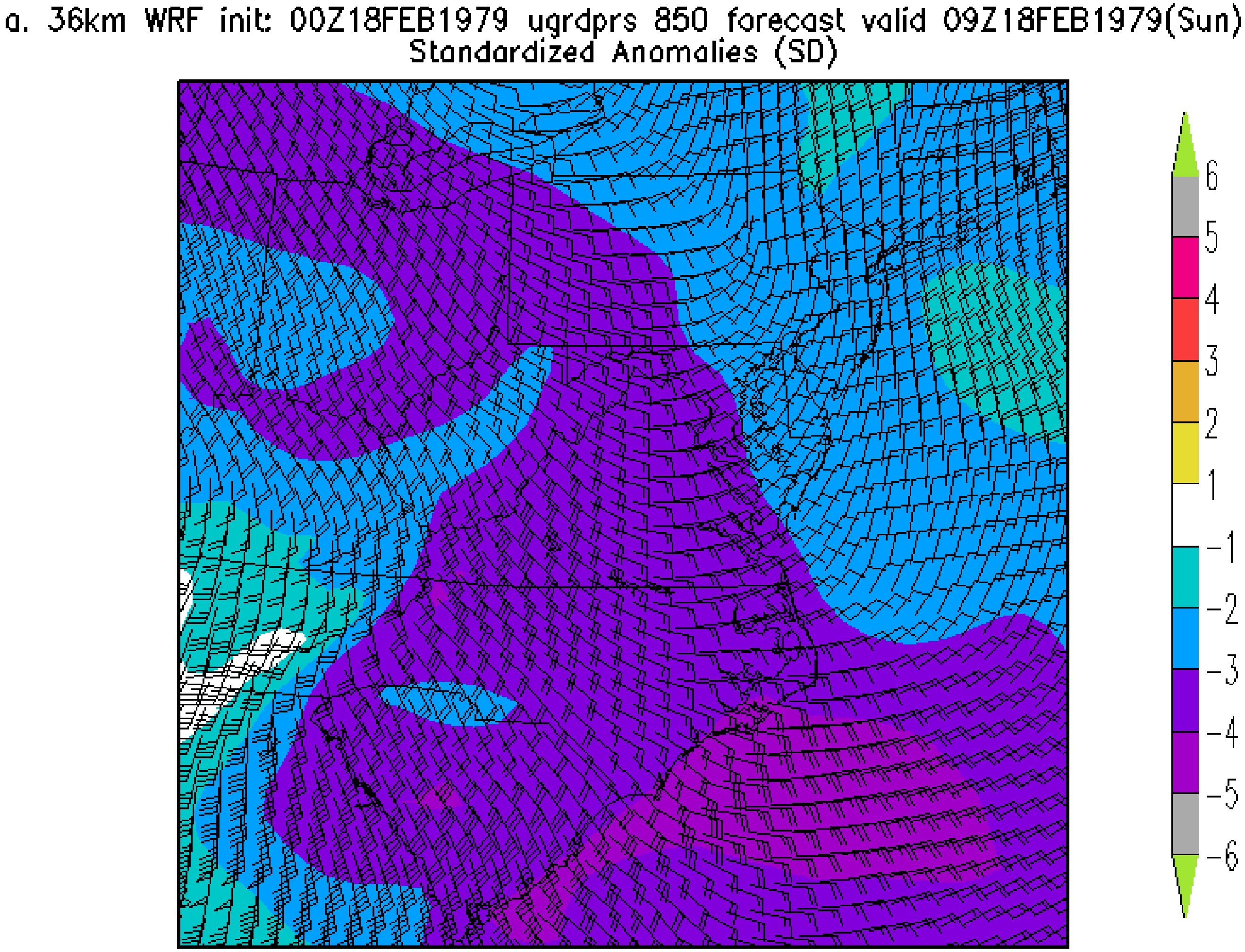
Traditional MSLP/3-hour QPF



MSLP and Standardized Anomalies



Magnificent 850 hPa wind anomalies



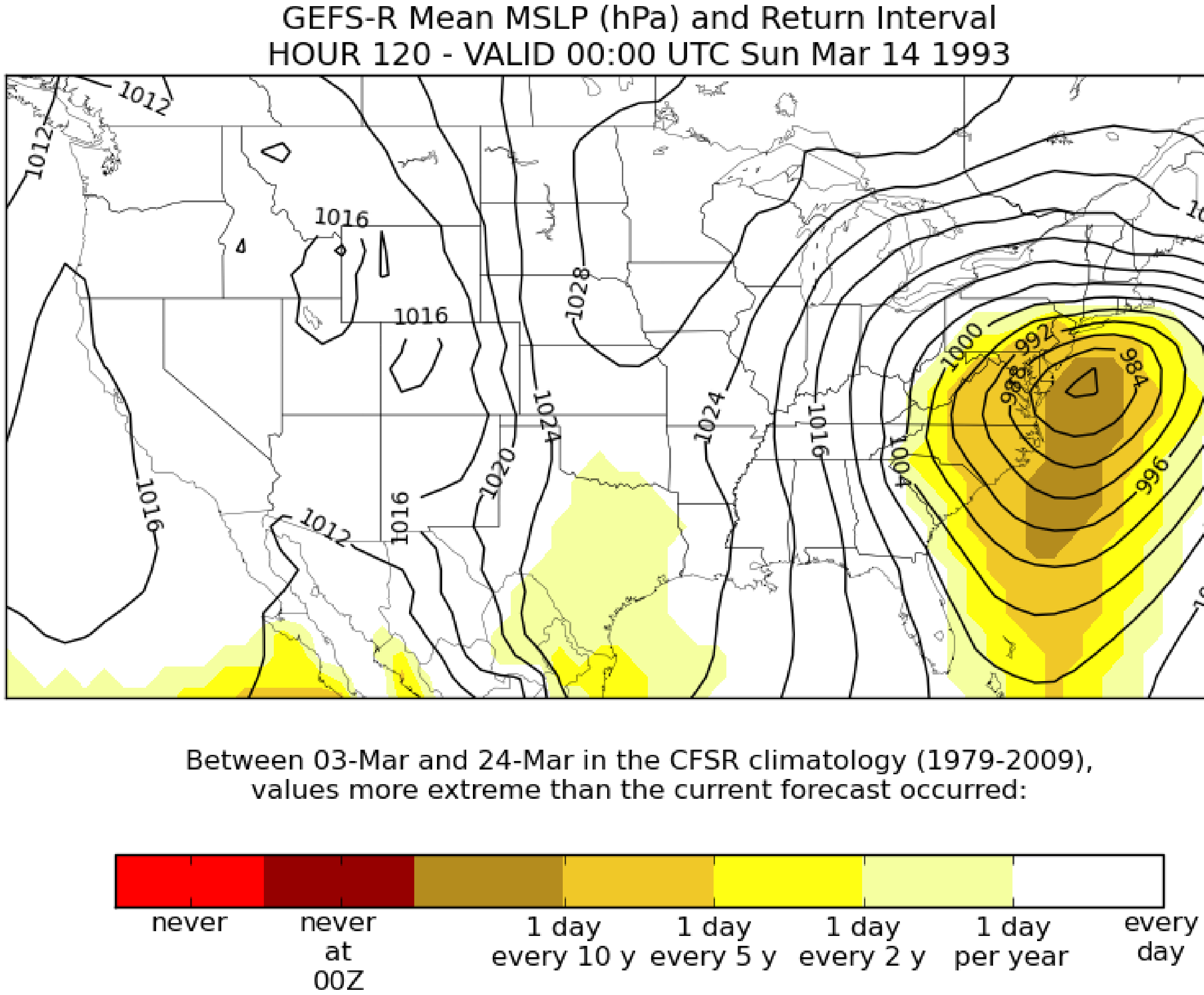
R-Climate

- The WRF simulations nailed the -6σ LLJ
  - Critical feature with historic East Coast winter storms
- WRF nailed the massive anticyclone
  - Nailed snow too but not enough time to show
- *Standardized anomalies analysis had proven to be of great use in identifying high impact weather events in recent years*. **They would have been of Great Value in 1979 too!**

GEFS-R

- For another case
- No good data available for this event
- But have a proxy event→ 13-14 March 1993

R-Climate Anomalies



GEFS-R *Proxy case March 1993*

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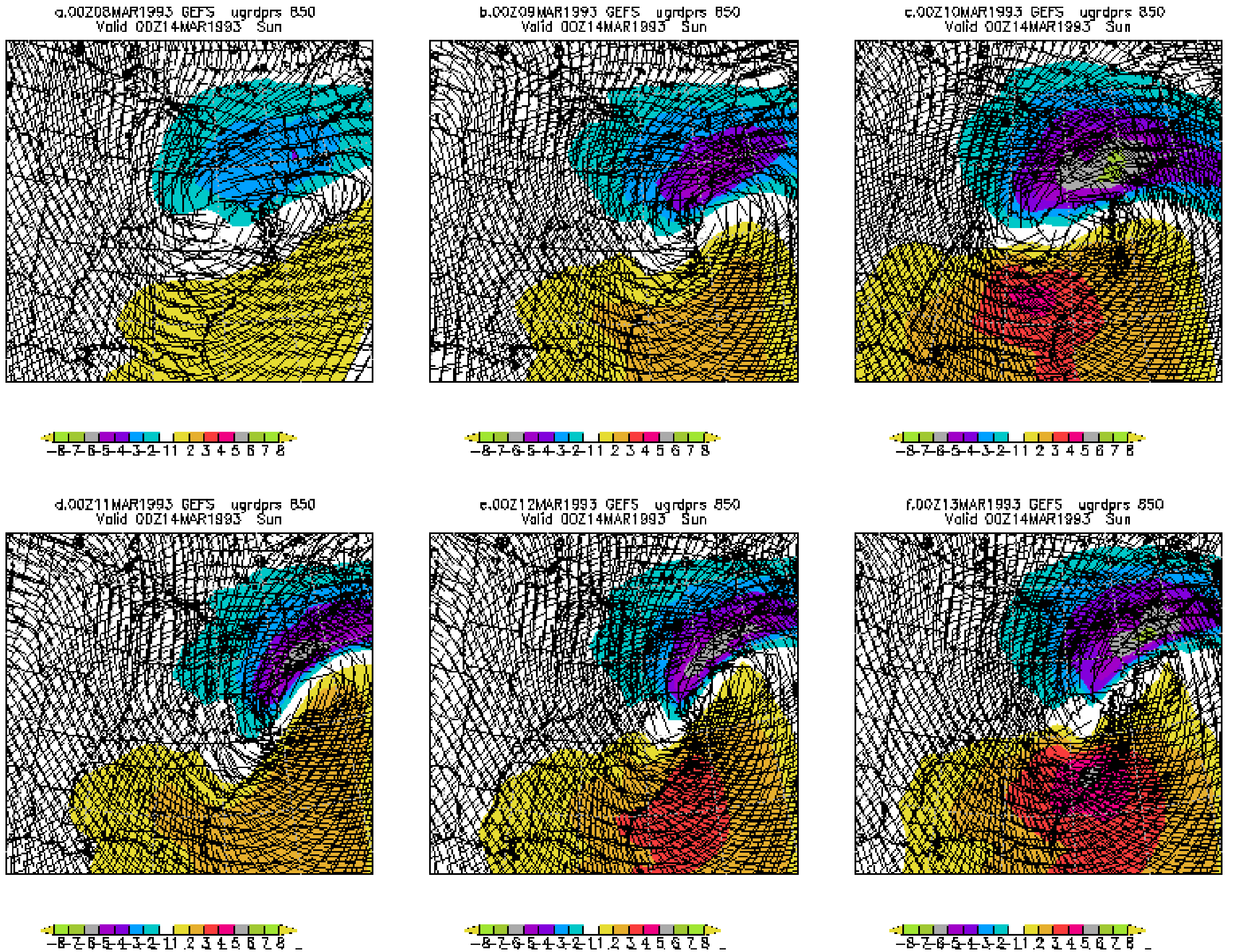
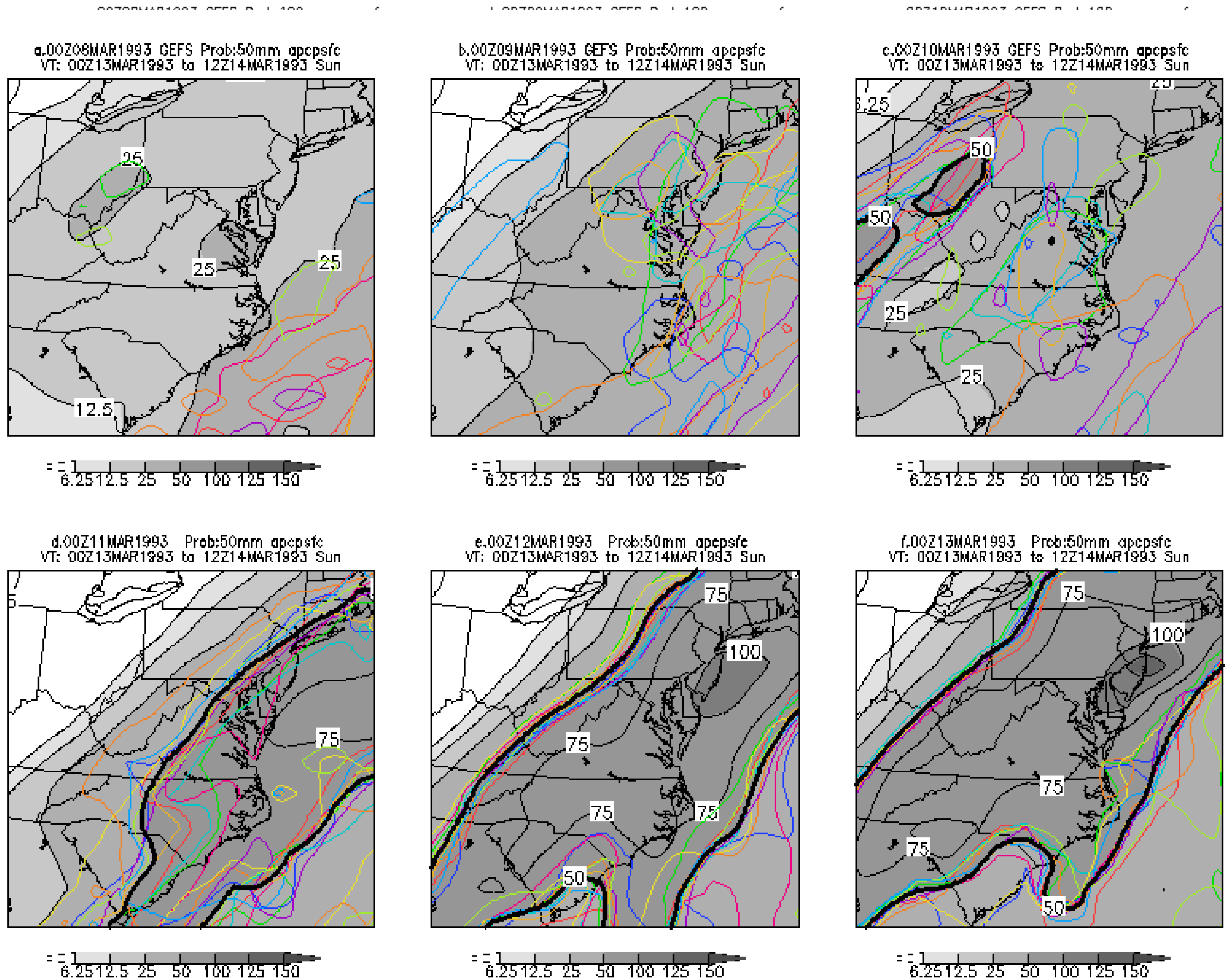


Big QPF amounts shorter lead-times



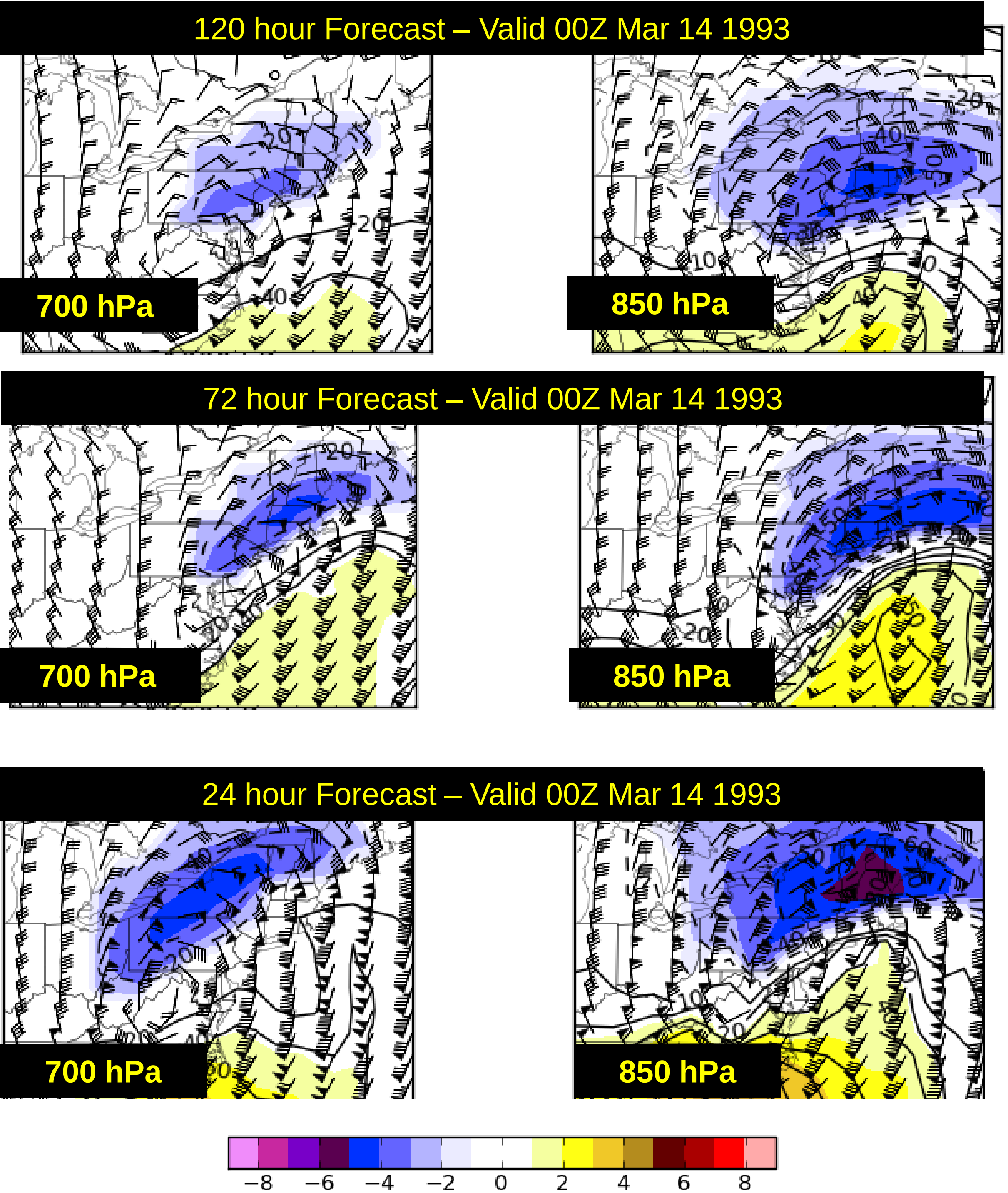
Leveraging the full R-Climate PDF

works with automation/bots

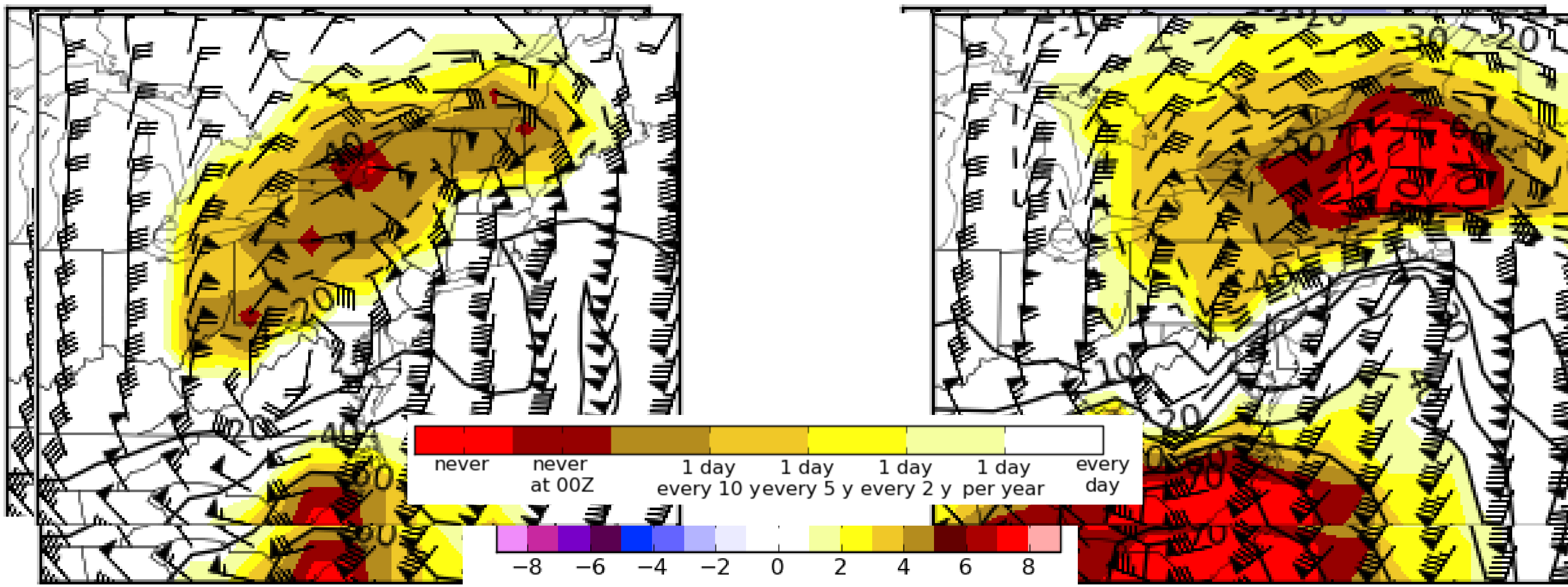
- Current NWS has WR-Situational Awareness
  - *Identifies strongly forced high impact events*
  - *IDSS for significant large scale events*

- Could provide inputs for Algorithms
  - *Extreme forecast indices →* ***R-Climate*** *based*
  - *Extreme weather alerts regional and locally*
    - *Exploitable PDF EFS and EFS PDF verse R-Climate*

Zonal Wind Anomalies



- 120 hour forecast
  - 700 hPa: -3 to -4 σ
  - 850 hPa: -4 to -5 σ
  - Significant values at 120 hours
- 72 hour forecast
  - -4 to -5 σ at both 700 & 850 hPa
- 24 hour forecast
  - 700 hPa: -4 to -5 σ
  - 850 hPa: 5 to -6 σ
  - Displaced to the northwest


never
never
at 00Z
1 day
every 10 y
1 day
every 5 y
1 day
every 2 y
1 day
per year
every
day
−8
−6
−4
−2
0
2
4
6
8

Model Climate (M-Climate)

- Probability distribution functions from EFS or single model
  - *EFS and M-Climate based EFI*

- When is model predicting a record or near record event
  - *Another means to add value to the forecast*
  - *Another HIWE alert opportunity*
  - *QPF is the best starting point for this activity*

As we move foreword

- Leveraging seemingly disparate datasets
  - *We can improve identification of high impact weather events and thus decision support activities*
  - *Tools but the forecaster over the process*
- Lends well to automation and automated alerts
  - *Where to focus activities and resources*
  - *Few surprises*

BOTS will be watching it like a hawk…

Mesoscale Predictability of the "Surprise" Snowstorm of 24–25 January 2000

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(Manuscript received 24 May 2001, in final form 11 December 2001)

ABSTRACT

A mesoscale model is used here to investigate the possible sources of forecast error for the 2000 snowstorm along the east coast of the United States. The primary focus is the quantitati forecast out to lead times of 36 h. The success of the present high-resolution control forecast storm could have been well forecasted with conventional data in real time. Various experime insufficient model grid resolution and errors in the initial conditions both contributed significan in the forecast. Other experiments, motivated by the possibility that the forecast errors arose from analysis poorly fitting one or two key soundings, test the effects of withholding single soundings initial conditions. While no single sounding results in forecast changes that are more than a s the error in the operational forecast, these experiments do reveal that the detailed mesoscale precipitation in the 24- or 36-h forecast can be significantly altered even by such small chang conditions. The experiments also reveal that the forecast changes arise from the rapid growth o below 500 km in association with moist processes. The results presented emphasize the difficult precipitation relative to, say, surface pressure and suggest that the predictability of mesosca features in cases of the type studied here may be limited to less than 2–3 days.