An Analysis of BUFKIT Methodologies to Forecast Wind and Wind Gust Speed for the Southern Appalachians

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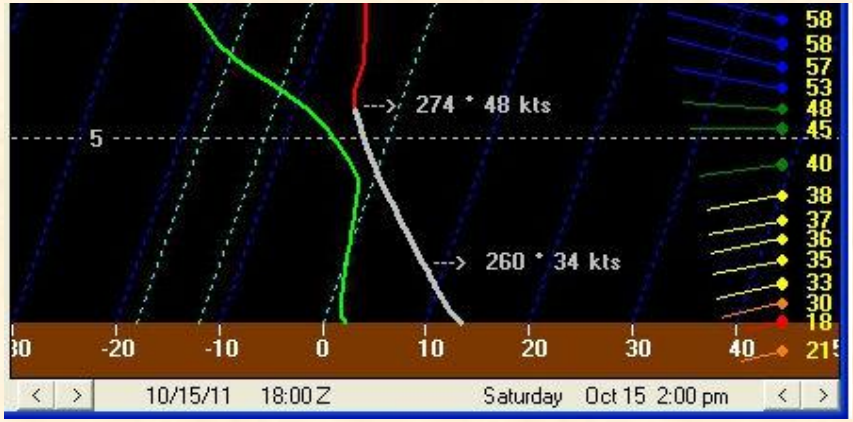
Wichita wind project methodology

- Ken Cook (NWS Wichita) looked at 20+ wind headline events in first half of 2006 for 6 sites in Wichita County Warning Area (CWA)
- Compared observations of wind and wind gust to two BUFKIT momentum transfer values
- Most recent model run was used (if highest wind observation occurred at 22Z, forecast was from 18Z model)

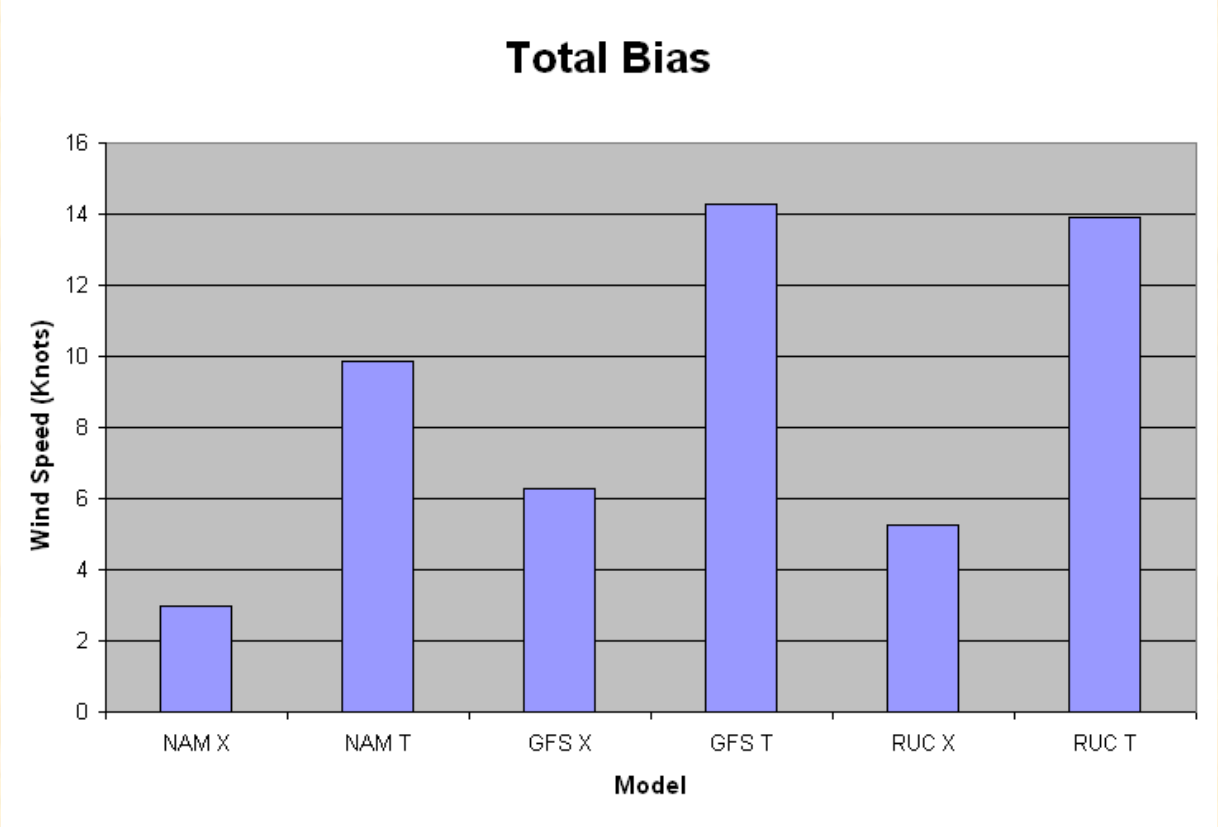
Which BUFKIT number is which?

- Wind speed at top of boundary layer (**top**, not **maximum**) (“NAM T” – top number in BUFKIT)
- Mean/average boundary layer wind speed (transport wind) (“NAM X” – bottom number in BUFKIT)



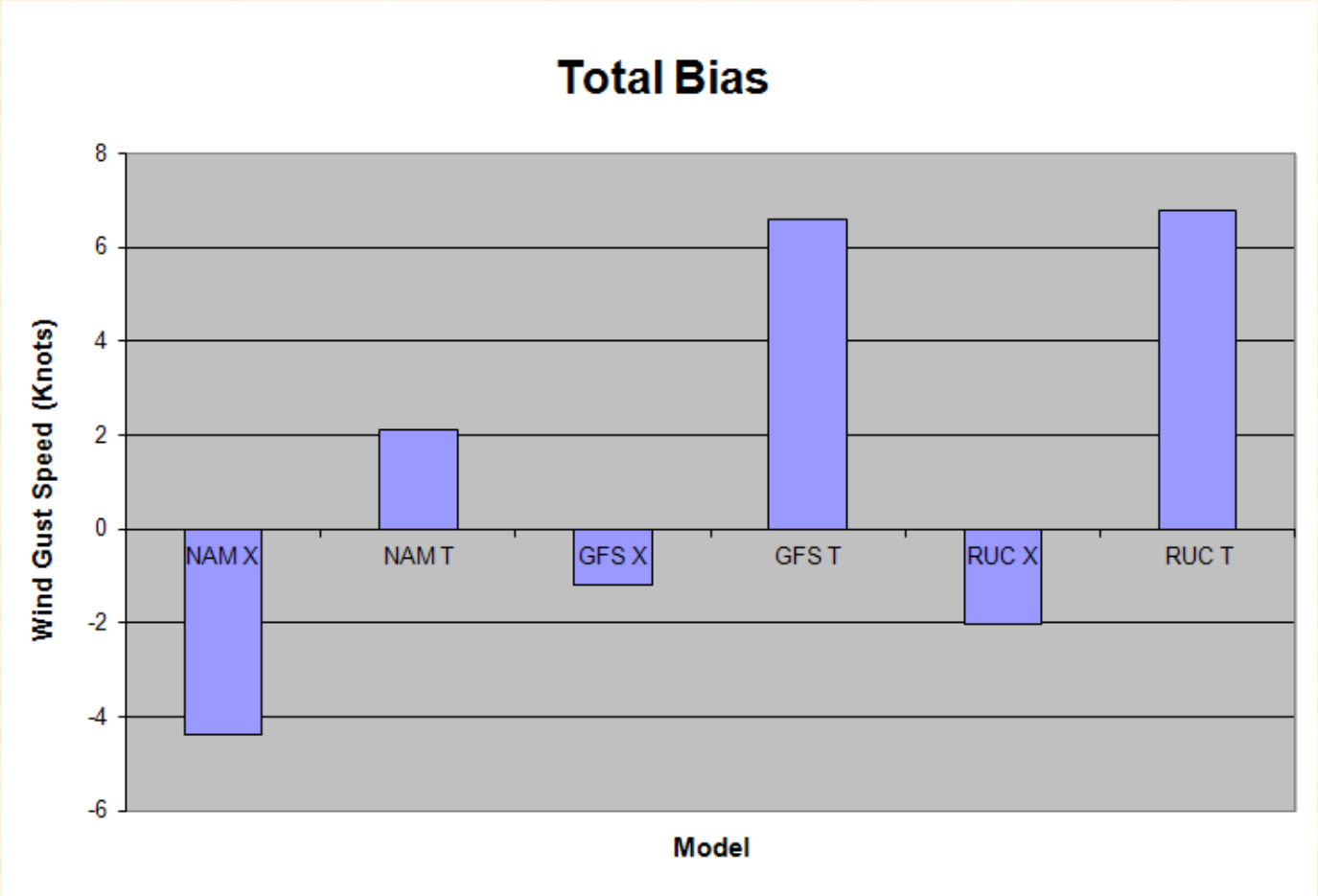
Wichita wind project results

- Both BUFKIT forecast methodologies had a high bias compared to sustained wind
- NAM X had the least bias for forecasting sustained wind



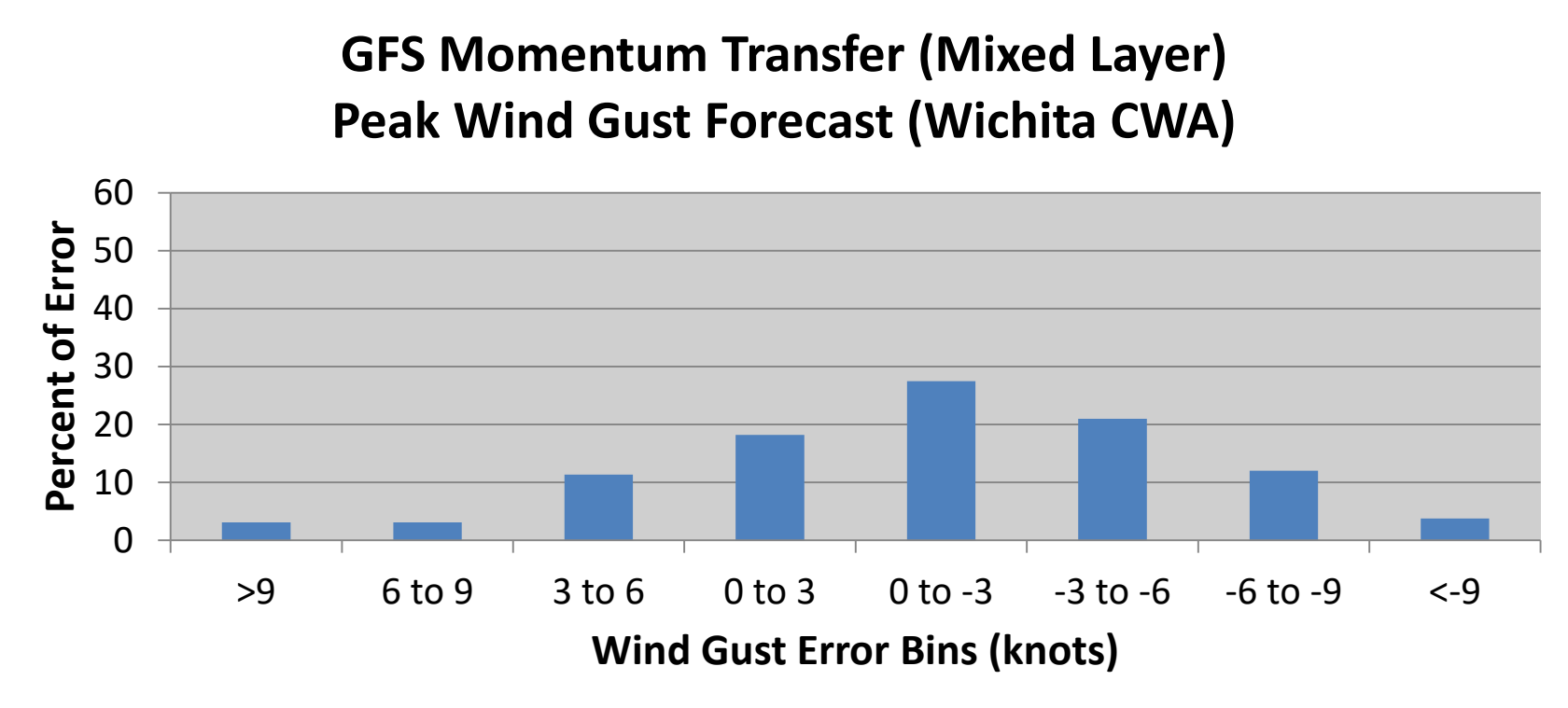
Wichita wind project results (cont.)

- Mean mixed layer wind worked very well for GFS and RUC



Wichita wind project results (cont.)

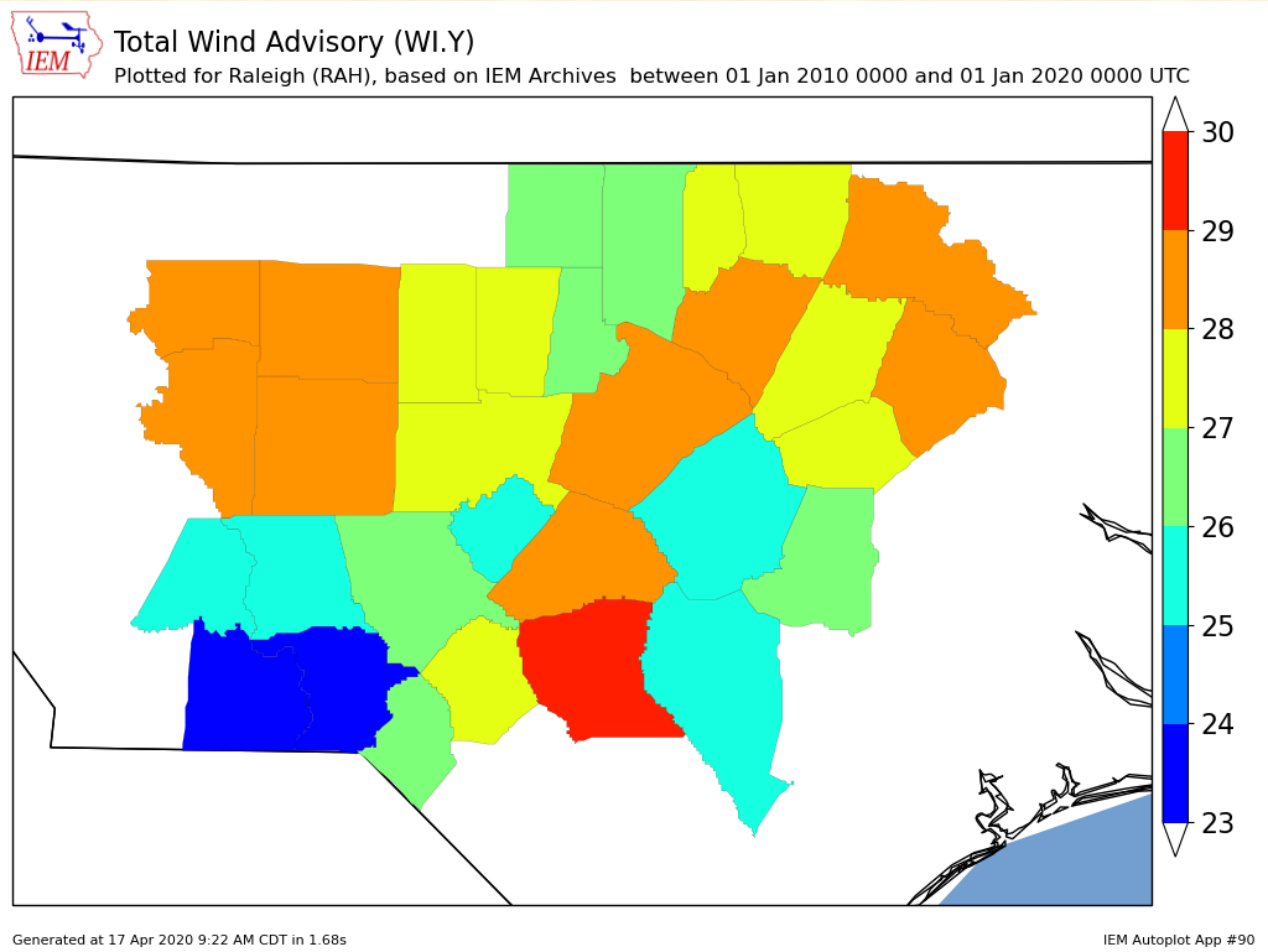
- Not only did the GFS X forecast have very low error, the bias was centered around zero



My methodology for Raleigh

- I looked at 33 headline events from 2010-2019
- Observations came from Raleigh's 5 ASOS aviation (TAF) sites (map will be shown on a later slide)
- Looked at observations from every site for every headline, even if the headline was valid for a different portion of the CWA

Raleigh wind headlines

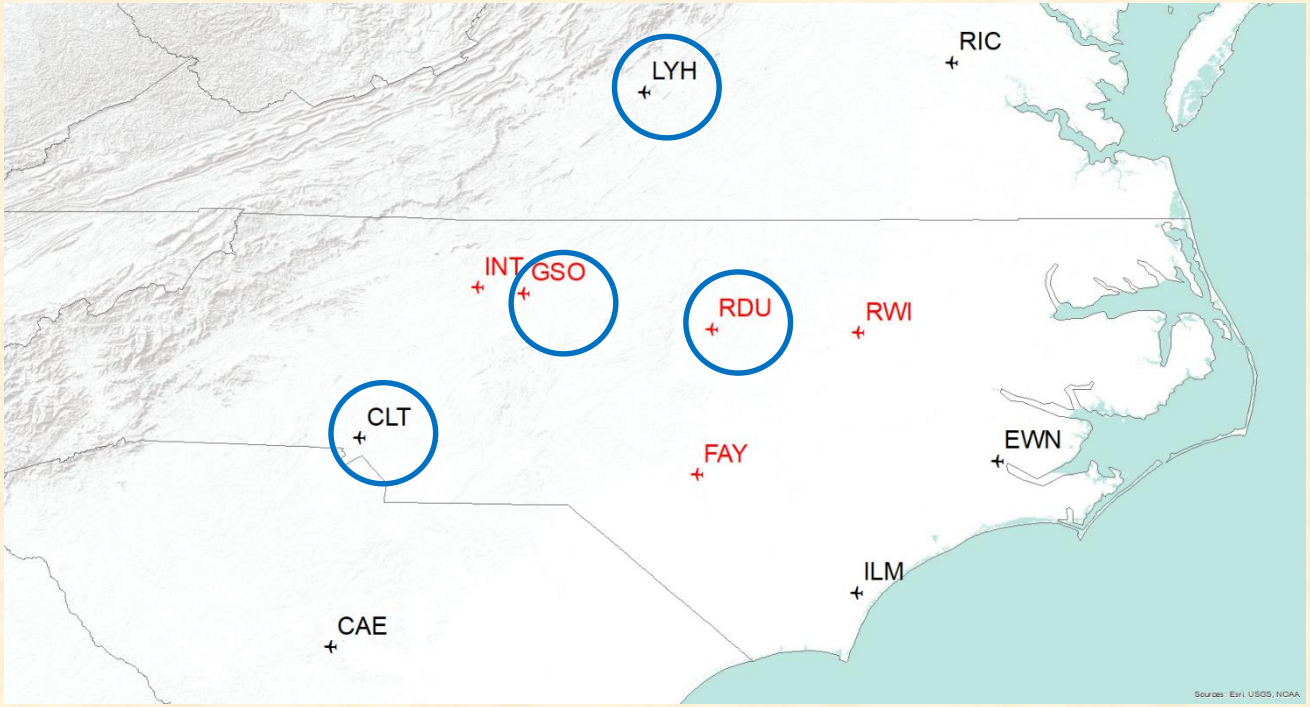


My methodology for Raleigh

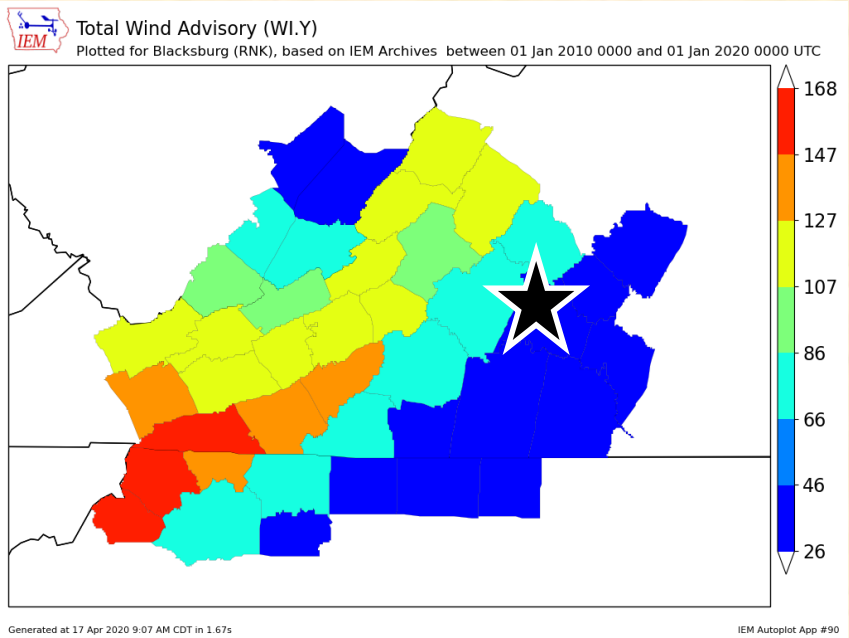
- I also added observed cases without headlines (advisory criteria is 40 kt, included events when ob was > 35 kt)
  - For observed cases without headlines, I only looked at the site with the observation, I didn't check all other sites as well
- Eliminated headline OR observed cases if convection was close to the observing site (this is a non-convective wind study)

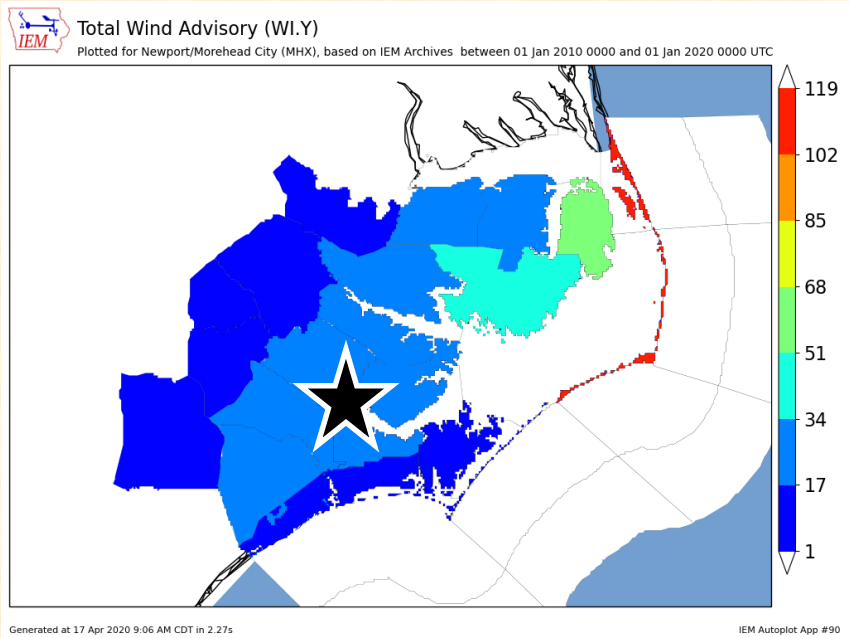
Non-Raleigh sites

- Didn't want the study to be completely Raleigh-centric
- For each of 6 bordering CWAs, added the TAF site with highest number of daily flight operations according to AirNav.com
- Primary difference in methodology for other sites – didn't study EVERY headline event from CWA
  - Didn't want terrain events near LYH, coastal storms for EWN

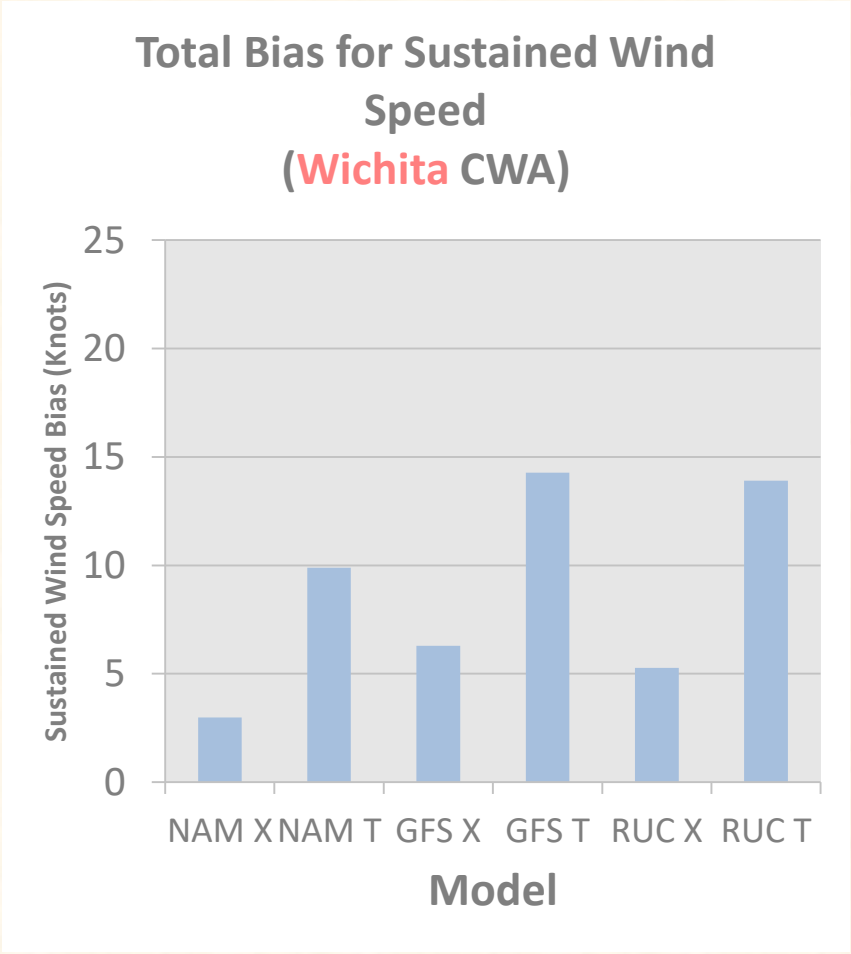


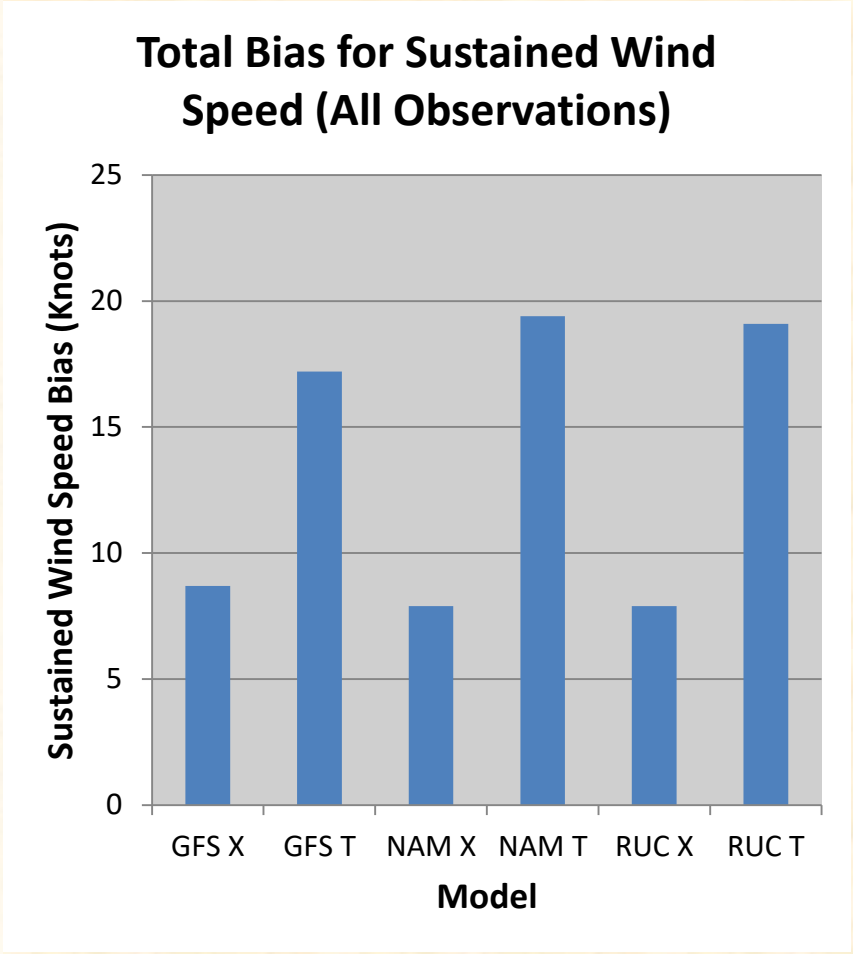
Eliminating some headlines





Local results worse than ICT results





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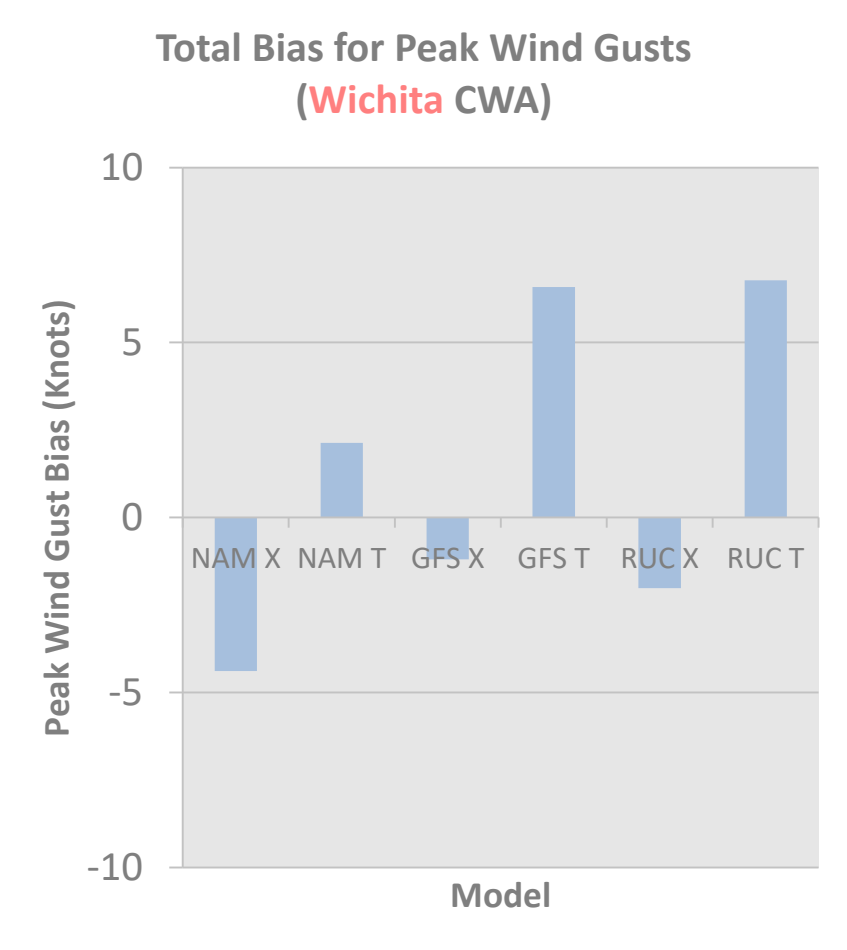
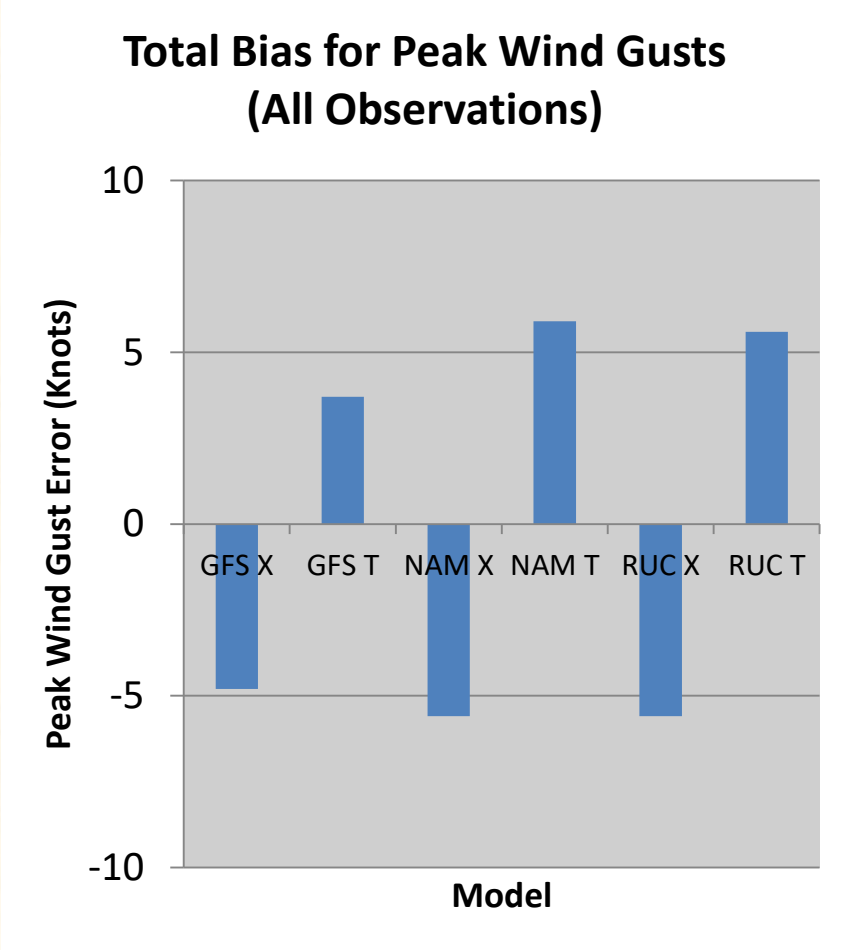
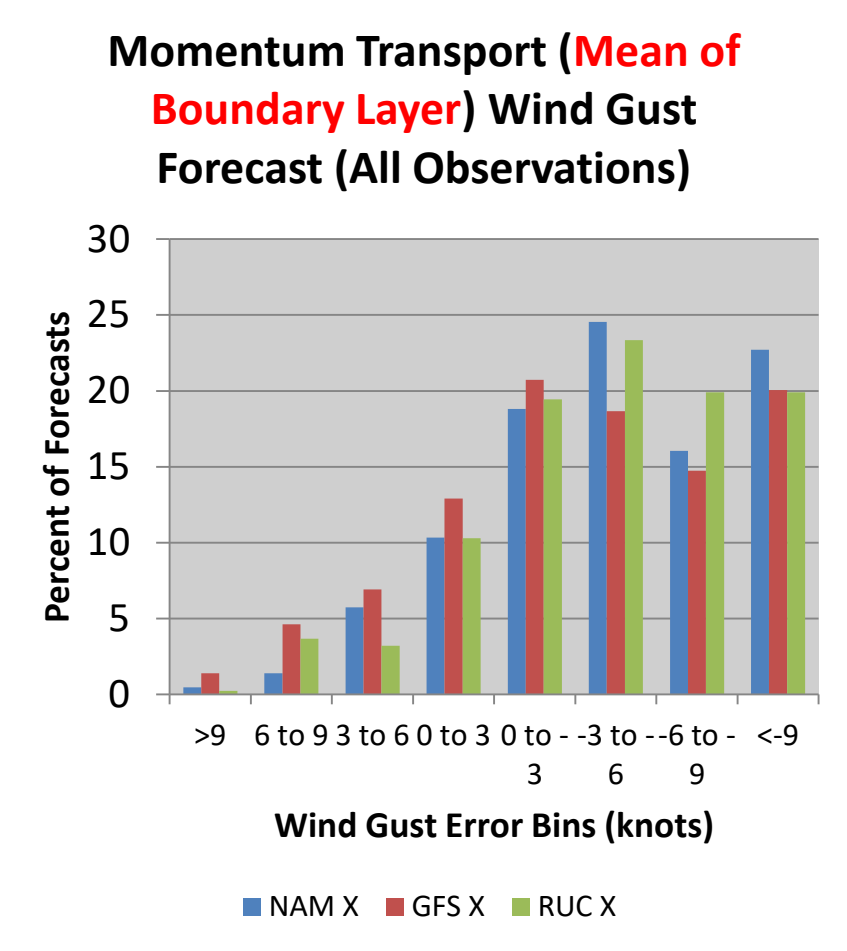
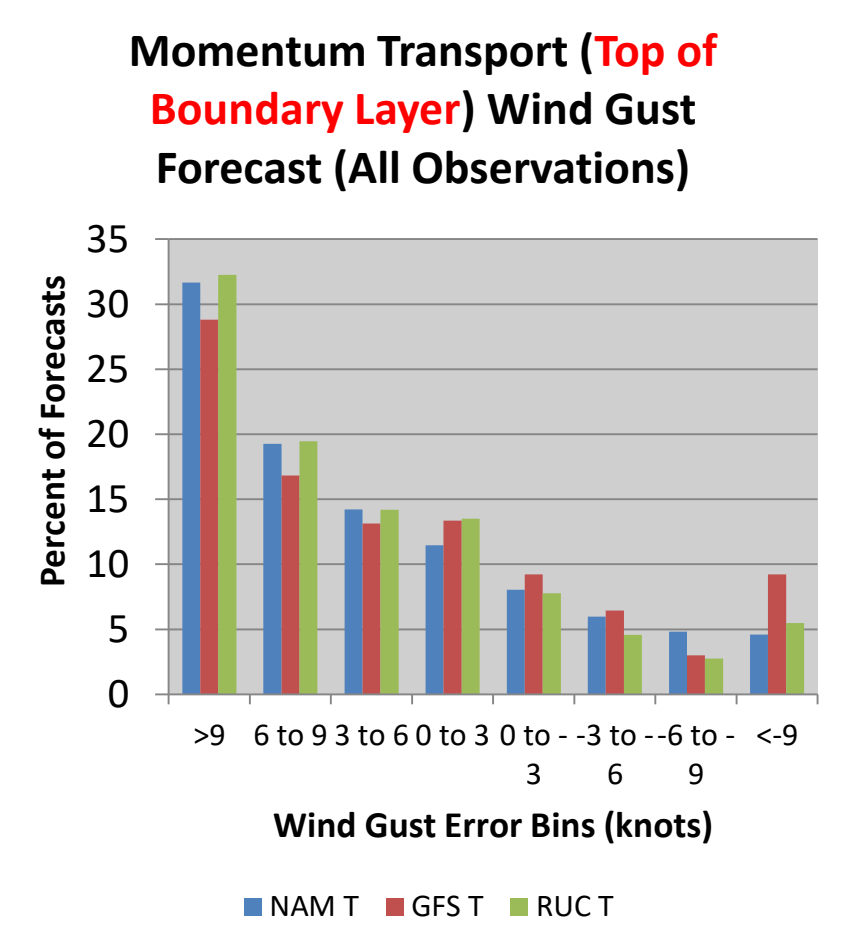


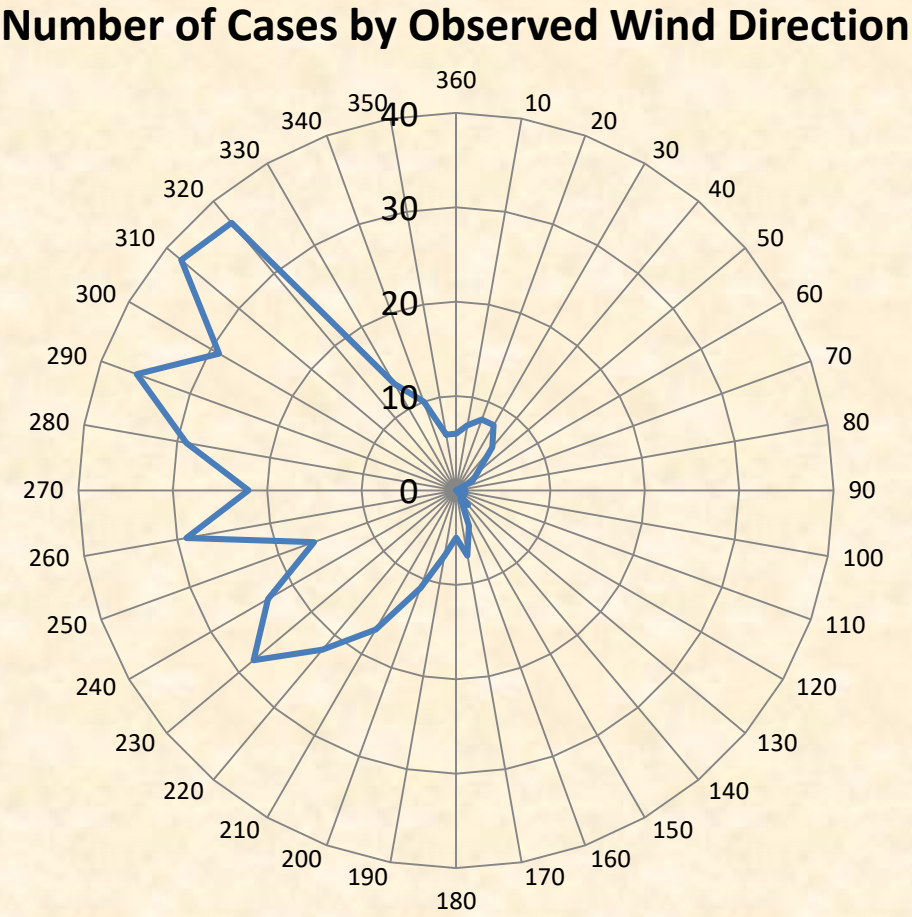


Local data not centered near zero





Westerly component favored during high wind events

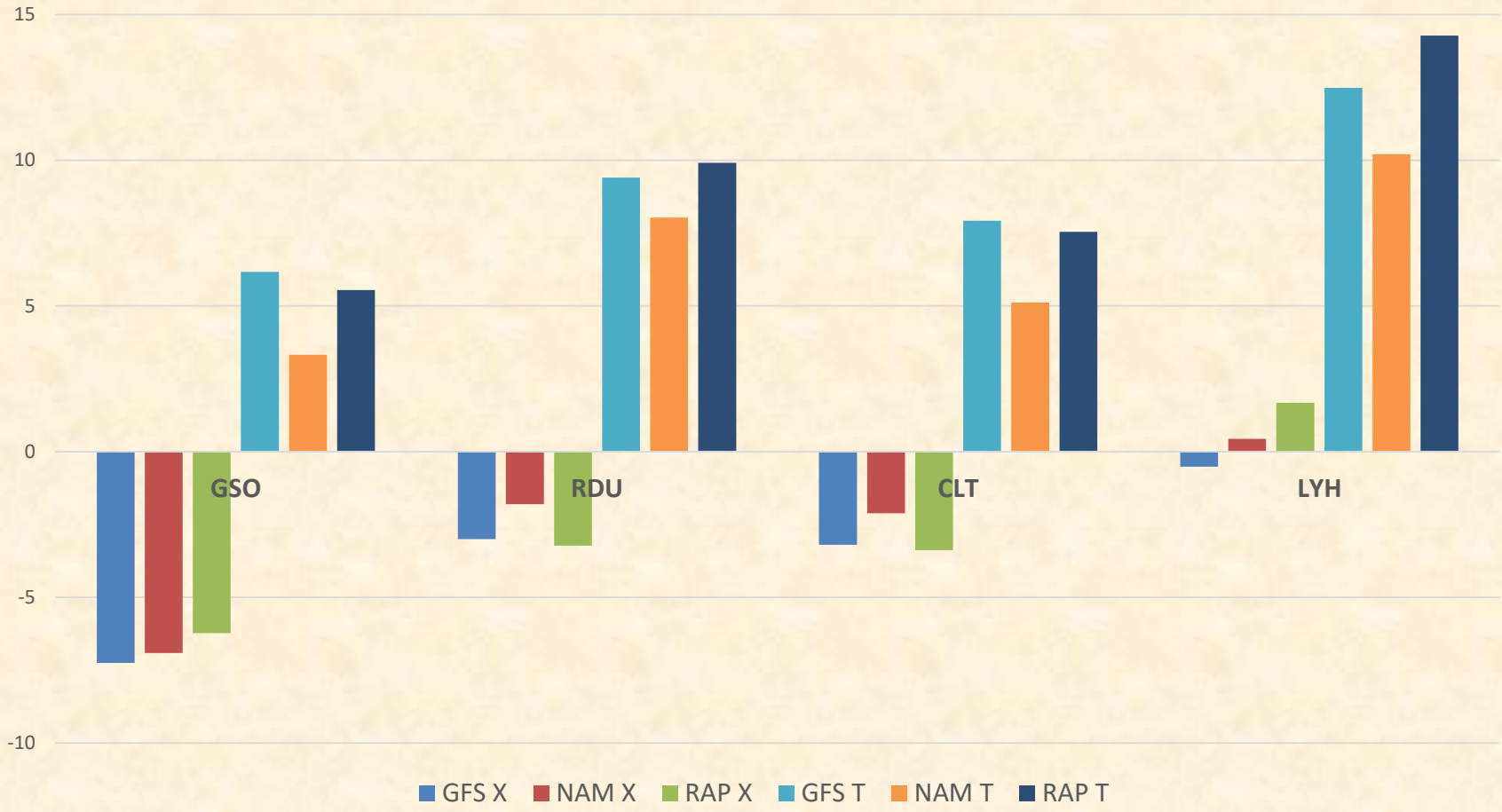


Site	Favored Direction
CLT	230°
RDU	230°
LYH	270°-290°
GSO	310°

Out of 435 events, at least 10 cases for each wind direction between 200°-340°

Error is consistently low (3-7 kt) in favored wind directions (not shown)

Mean Error for Peak Wind Gusts by Station



What if we AVERAGED the mean wind and top of the boundary layer wind … ?

Mean Error for Peak Wind Gusts by Station (again)

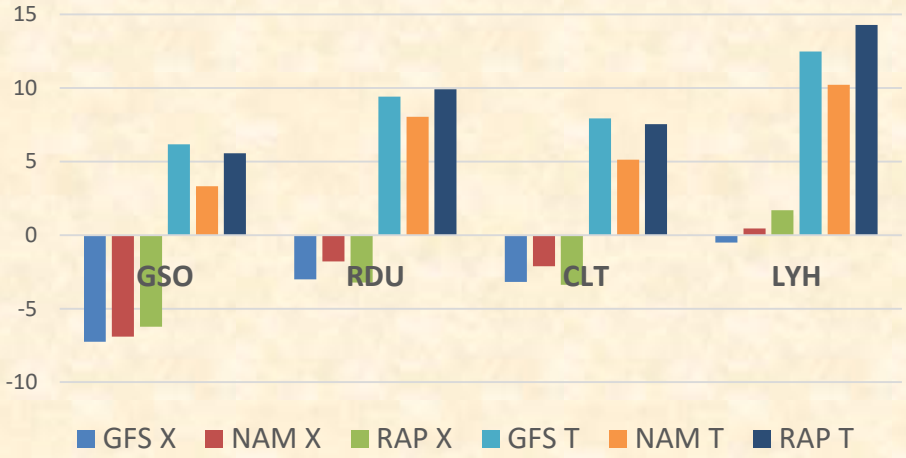
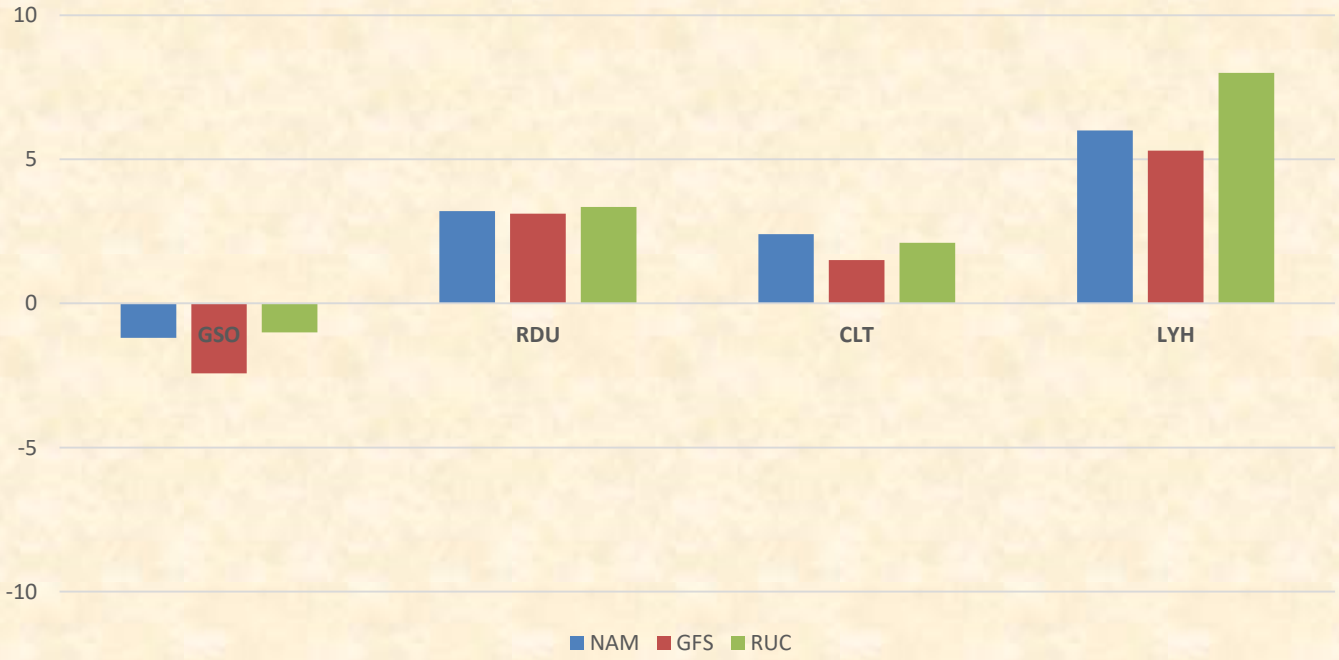


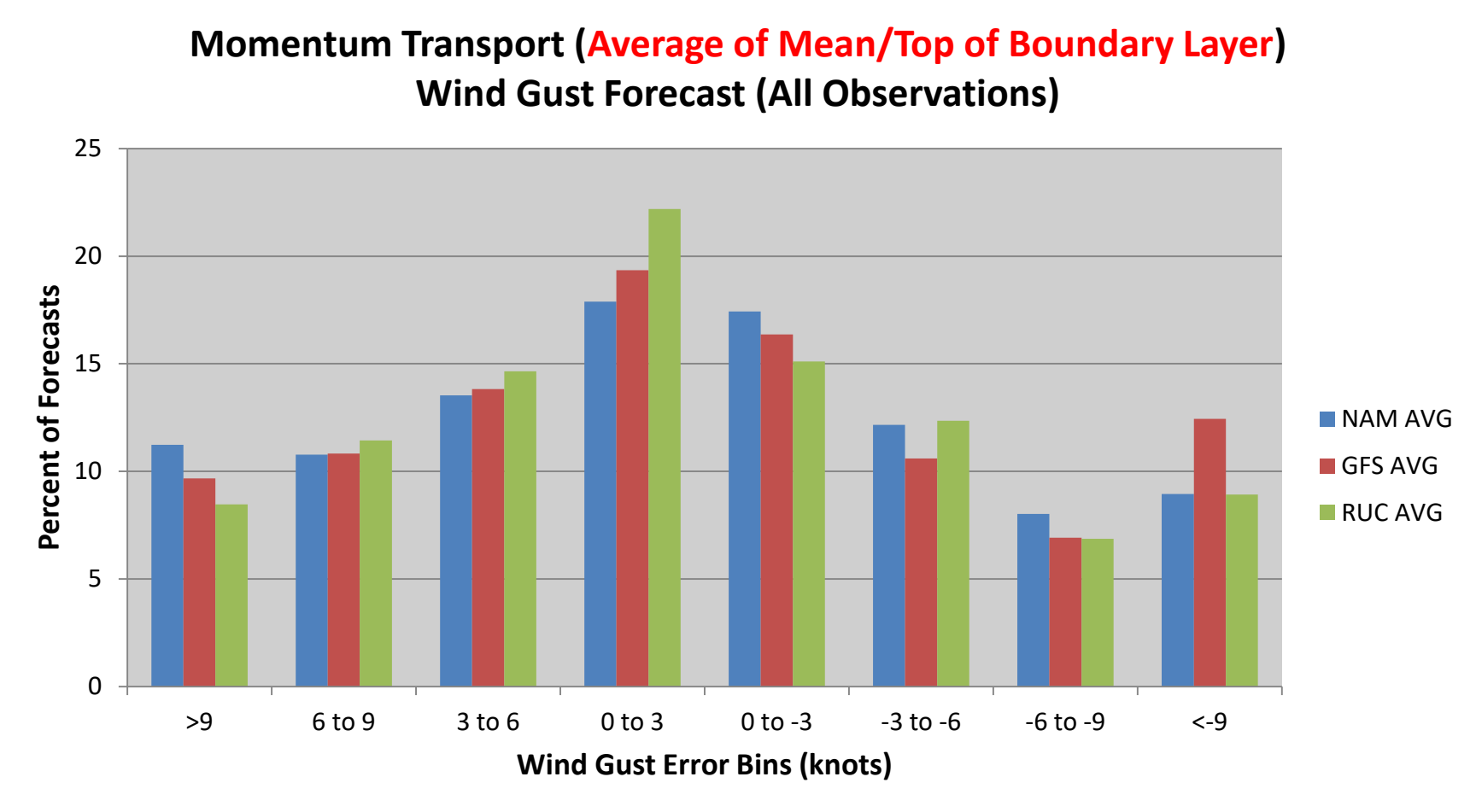
Image from previous slide



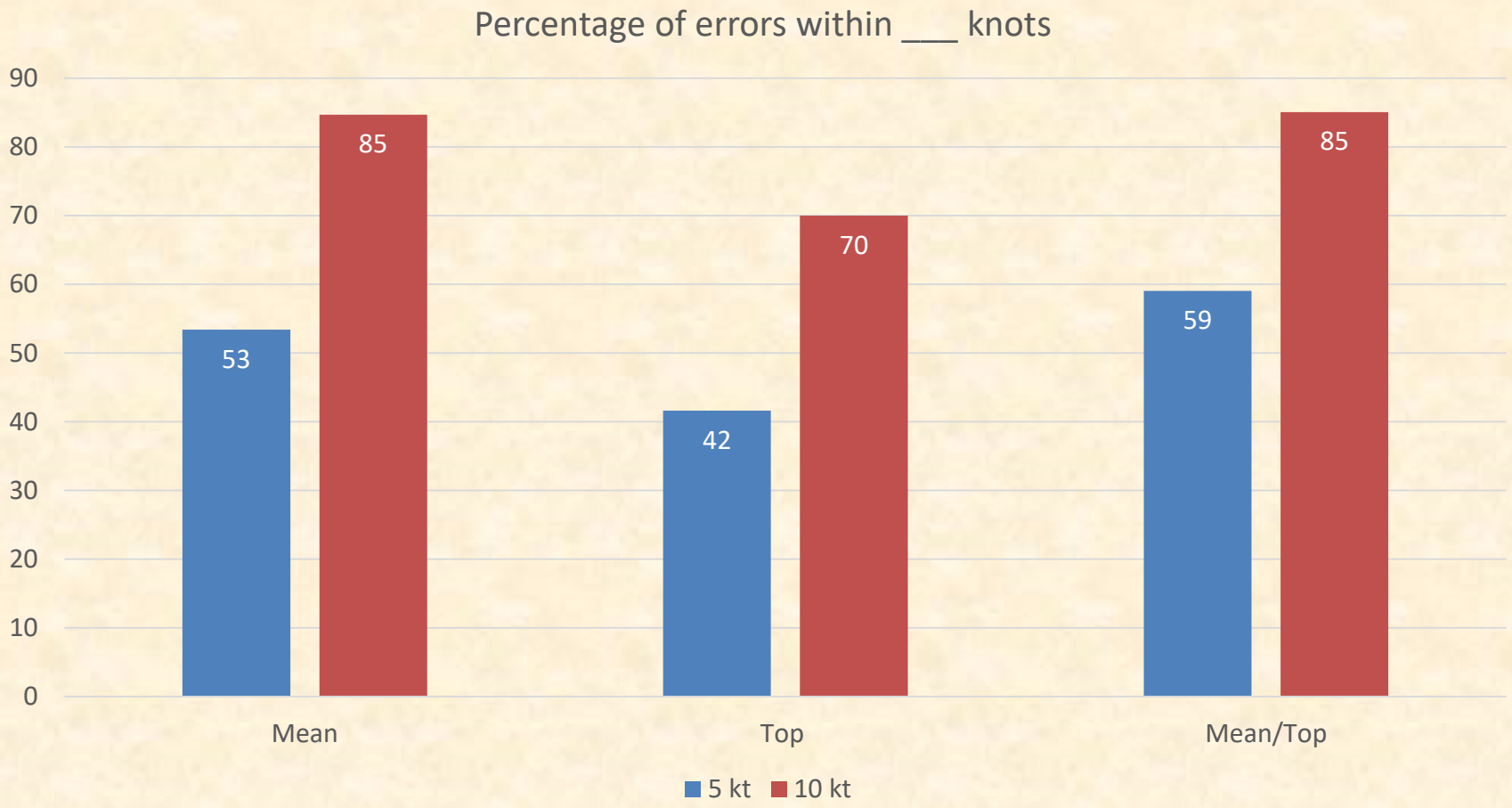
Which method has smallest bias?

- Average of mean/top of boundary layer:
  - GSO, CLT, all sites combined
- Mean wind of boundary layer:
  - RDU, LYH

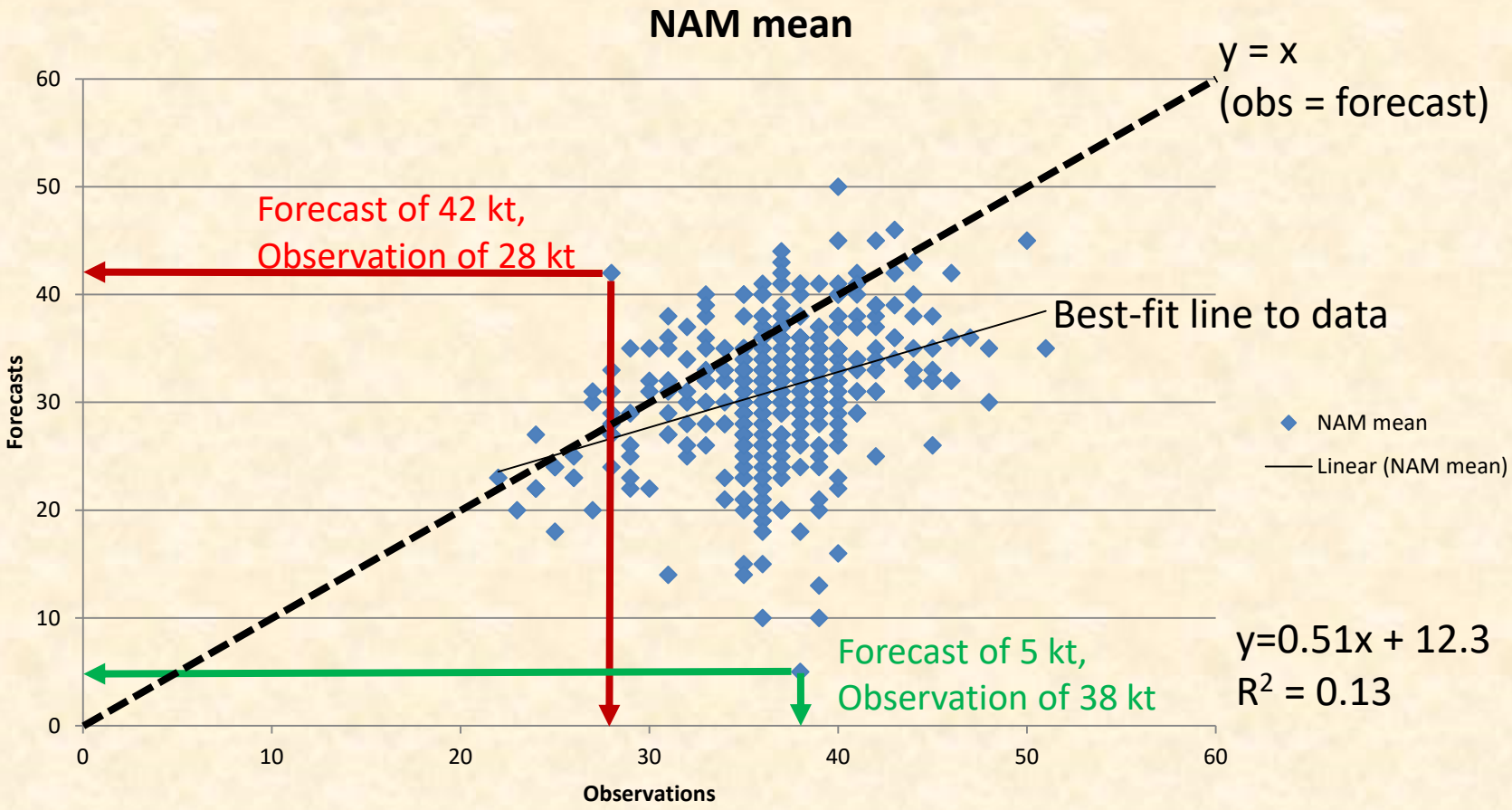
Averaged data centered near zero



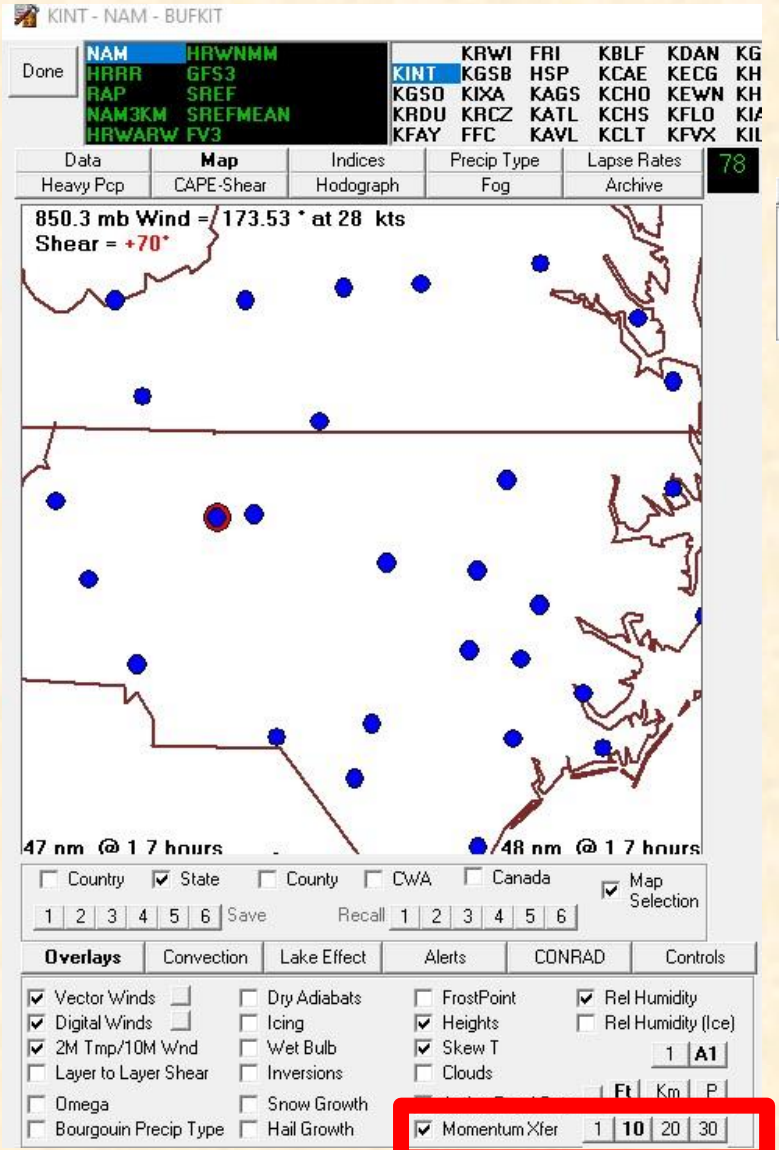
How consistent are the methodologies?



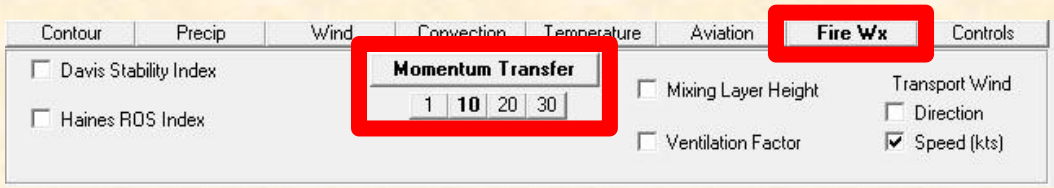
Scatter plot also shows plenty of spread



How do I view this data in BUFKIT?



Overview Window



KINT - NAM - BUFKIT Overview

Close | Reset

Relative Humidity
Relative Humidity (Ice)

Save F1 F2 F3 F4 F5 F6
Recall F1 F2 F3 F4 F5 F6

Contour Interval: 1 2 5 10

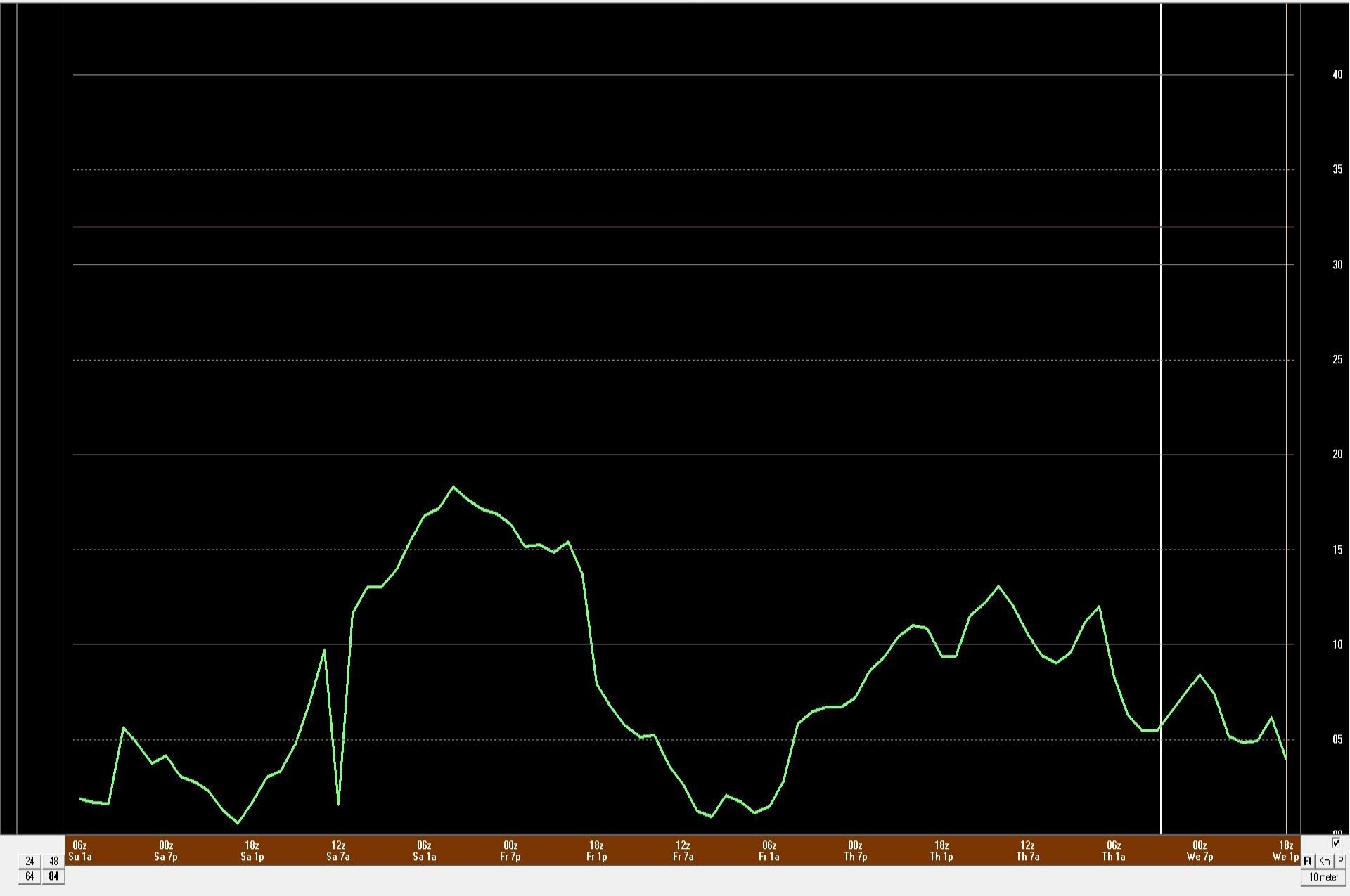
Contour | Precip | Wind | Convection | Temperature | Aviation | **Fire Wx** | Controls

Davis Stability Index
Haines RDS Index

Momentum Transfer: 1 **10** 20 30

Mixing Layer Height
Ventilation Factor

Transport Wind
Direction
Speed (kts)



24 48
64 **84**

Ft | Km | P
10 meter

Conclusions

- The BUFKIT momentum transfer algorithm has some skill for predicting high wind events in the southern Appalachians, using the mean boundary layer wind (additional benefit comes from using the top of the boundary layer wind as well)

- Combining the mean boundary layer wind and top of the boundary layer wind eliminates much of the bias

- Despite the lack of bias, the error that is present is an average of both overestimates and underestimates

Post-Workshop edit

- What happened with the wind advisory the day of the workshop?

Model Run	X value	T value
3/25 18Z NAM	34	54
3/25 18Z GFS	38	49
3/26 12Z NAM	30	51
3/26 12Z GFS	37	50
3/26 12Z RAP	27	37
VERIFICATION: 35 kt		

  - Thanks to Jimmy Danco for 18Z data, Nick Luchetti for 12Z data, and Andrew Kren for his computer to edit the presentation Friday night!

Previous Research

- Cook and Williams (2007) - https://www.weather.gov/ict/bufwind2