The Collaborative Science, Technology, and Applied Research (CSTAR) Program

Development of Improved Diagnostics, Numerical Models, and Situational Awareness of High-Impact Cyclones and Convective Weather Events

University: University at Albany

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1. SUMMARY OF STUDENT RESEARCH ACTIVITIES

a) Forecast and model diagnostics for severe convective weather events in complex terrain

Graduate student: William Flamholtz
PI and co-PIs: Brian Tang, Lance Bosart, and Kristen Corbosiero
NWS focal points: Thomas Wasula (ALY), Michael Evans (ALY), and Matthew Kramar (PIT)

Research summary:

William Flamholtz examined how terrain perturbs convective environments using the WRF model with HRRR-like physics. A case-study analysis was conducted on the 13–14 August 2016 severe weather event in the Northeast U.S., which was a low predictive-skill event, using an updated database from a past CSTAR V project (Vaughan et al. 2017). Two simulations were conducted: one with realistic terrain (T simulation) and one without terrain (NT simulation).

There are interesting differences between the two simulations in the pre-convective environment. In the T simulation, there are local maxima of most-unstable CAPE in the Hudson and Connecticut River Valleys, upwards of 1500 J kg^{-1} at 1800 UTC 13 August 2016, compared to the surrounding higher terrain (Fig. 1). Also notable is the terrain channeling of warm, moist air up north–south oriented valleys, which may locally increase instability and vertical wind shear (Tang et al., 2016; Katona et al. 2016). There are local maxima in the surface–500-hPa wind shear in the valleys due to terrain channeling, resulting in a more southerly (versus southwesterly) flow in the boundary layer (Fig. 2). The subtle difference in wind direction increases the directional shear and the 0–1-km storm-relative helicity by 40 m^2 s^{-2} compared to the NT simulation (Fig. 3). Further examination of the importance of terrain channeling to the convective evolution is a topic of future work. In contrast, the NT simulation has a much more homogenous region of relatively higher CAPE. The NT simulation also does not produce significant west-to-east differences in shear magnitude or storm-relative helicity.

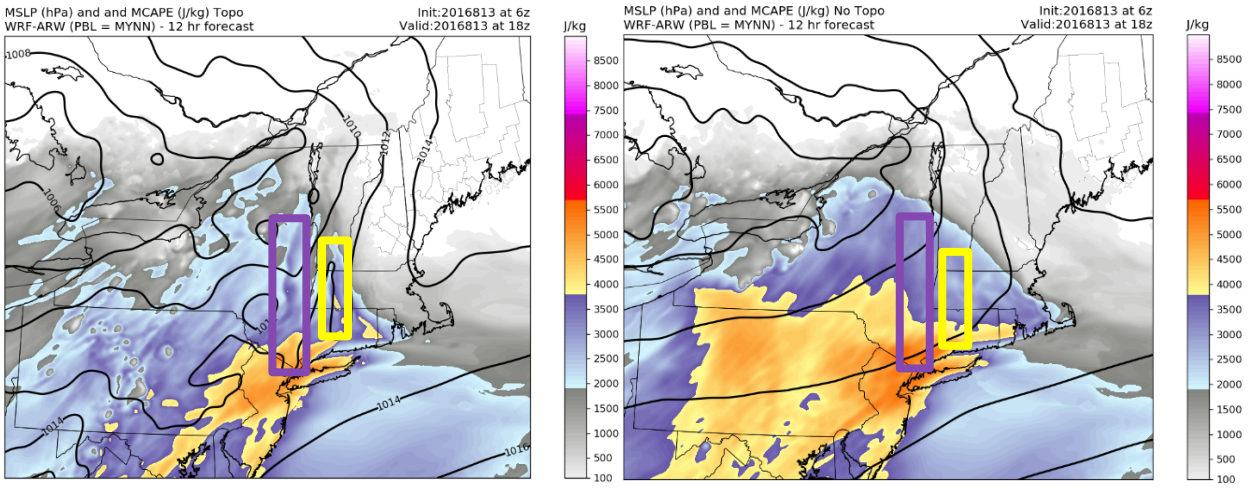


Figure 1: *Most-unstable CAPE and MSLP for T (left) and NT (right) simulations at 1800 UTC 13 August 2016. Purple and yellow boxes denote approximate locations of the Hudson and Connecticut River Valleys.*

During the next six months, we will evaluate the effects of these pre-convective environmental perturbations, particularly terrain-induced perturbations in the wind shear, on convective evolution. The plan is to follow the methodology of Parker (2017), using idealized WRF experiments with varying wind profiles from valley locations in the T and NT simulations. Different storm modes (e.g., supercell, multicell, and squall line) will also be examined.

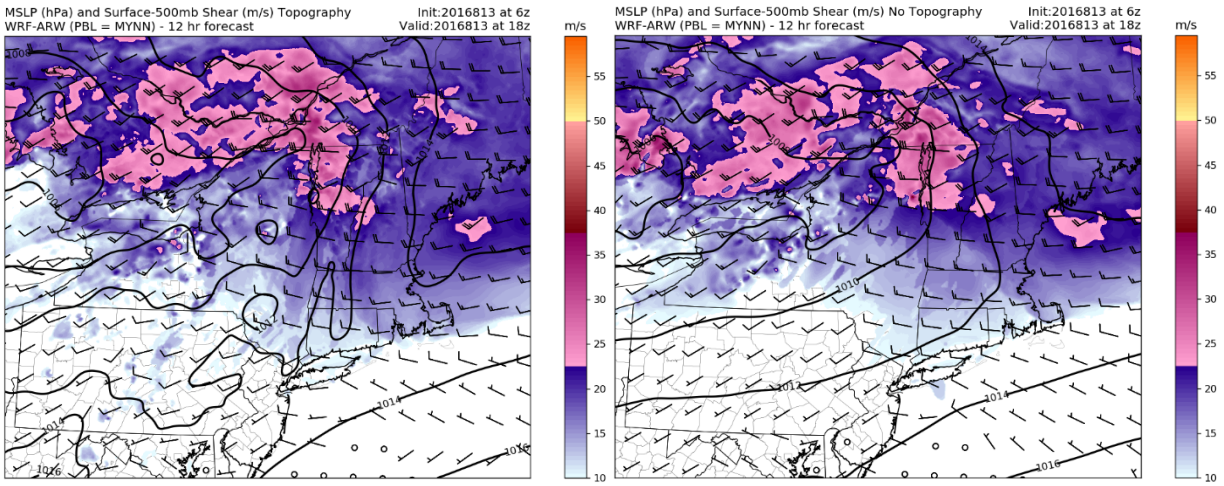


Figure 2: *Similar to Fig. 1, but for surface–500-hPa vertical wind shear.*

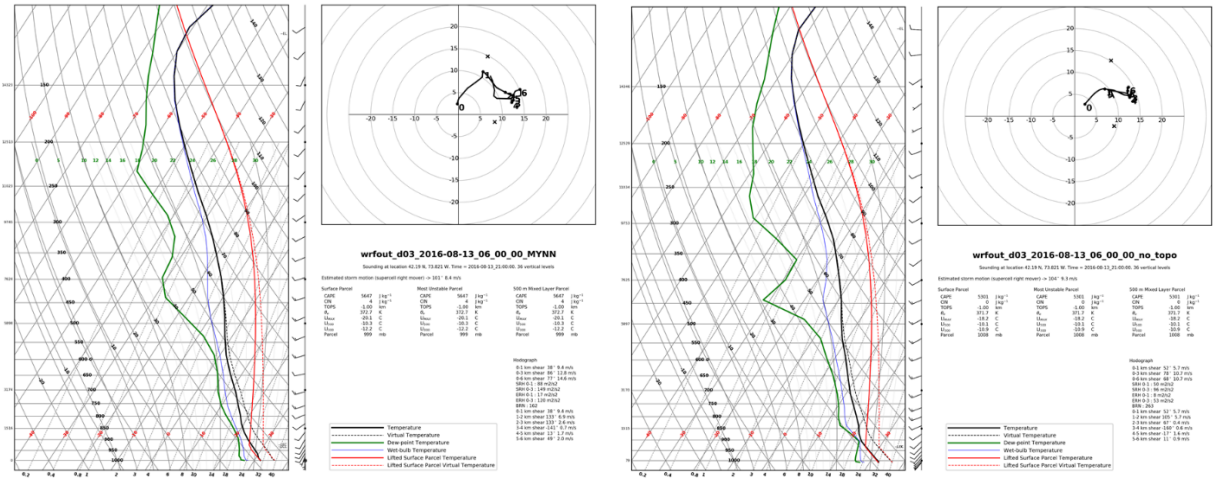


Figure 3: *Model sounding in the Hudson Valley from the T (left) and NT (right) simulations at 2100 UTC 13 August. Note the differences in the hodographs, particularly between 0 and 1 km.*

In a separate subproject, Ross Lazear and co-PI Brian Tang are working with an undergraduate student, Luke LeBel, to conduct WRF simulations on past high-impact weather events in the Northeast U.S.. We are focusing on the 31 May 1998 Mechanicville tornado (LaPenta et al. 2005). We have established a baseline simulation and will be working on studying the same aforementioned effects of terrain on the evolution of severe convection during this event.

NWS Interactions:

William Flamholtz, co-PIs Brian Tang and Lance Bosart, and PI Kristen Corbosiero, all attended the 18th Northeast Regional Operational Workshop (NROW) on 1–2 November 2017 and the 43rd Northeastern Storm Conference (NESC) on 9–11 March 2018. Co-PI Tang presented a talk at NROW on previous CSTAR research investigating the utility of lightning data and upslope flow in predicting severe weather in the Northeast U.S. using a machine learning algorithm. William presented a poster on differences between his T and NT simulations, as described above. At each of these meetings, we had discussions with National Weather Service forecasters who were in attendance.

William also presented a research update to NWS Focal Points at the Fall CSTAR Meeting on 3 November 2017. The NWS Focal Points provided feedback on directions for the research that may aid them in the prediction of severe weather in complex terrain. In particular, there were discussions on the simulation setup and past events that would be useful to examine.

Additionally, William sent out a research progress e-mail update to the NWS Focal Points on 24 January 2018. Michael Evans and Tom Wasula provided helpful feedback.

References:

Katona, B., P. Markowski, C. Alexander, and S. Benjamin, 2016: The Influence of topography on convective storm environments in the eastern United States as deduced from the HRRR. *Wea. Forecasting*, **31**, 1481–1490.

LaPenta, K., L. Bosart, T. Galarneau, and M. Dickinson, 2005: A multiscale examination of the 31 May 1998 Mechanicville, New York, tornado. *Wea. Forecasting*, **20**, 494–516.

Parker, M., 2017: How much does "backing aloft" actually impact a supercell?. *Wea. Forecasting*, **32**, 1937–1957.

Tang, B., M. Vaughan, R. Lazear, K. Corbosiero, L. Bosart, T. Wasula, I. Lee, and K. Lipton, 2016: Topographic and boundary influences on the 22 May 2014 Duanesburg, New York, tornadic supercell. *Wea. Forecasting*, **31**, 107–127.

Vaughan, M., B. Tang, and L. Bosart, 2017: Climatology and analysis of high-impact, low predictive skill severe weather events in the northeast United States. *Wea. Forecasting*, **32**, 1903–1919.

b) High-resolution numerical forecasts of lake-effect snowstorms: model performance, physics sensitivities, and synoptic predictability

Graduate student: Massey Bartolini
PIs and co-PIs: Justin Minder, Daniel Keyser, and Ryan Torn
NWS focal points: Joseph Villani (ALY) and David Zaff (BUF)

Research summary:

During the past six months, Massey Bartolini, the graduate student assigned to this project, has continued to make progress. To foster collaborations and gain experience, he visited NWS Buffalo in December 2017. During this visit he had productive discussions with David Zaff and several NWS Buffalo forecasters about this CSTAR research, their lake-effect forecasting techniques, and their current office research on lake-effect snow warning polygons. He completed additional coursework in mesoscale dynamics to continue building knowledge that will advance his research. Massey's research has continued to focus on suites of high-resolution,

convection permitting, numerical simulations of major, and well-observed, lake-effect storm that occurred downwind of Lake Ontario during the OWLeS field campaign.

As described in the previous report, one major focus of our research has been on analyzing experimental HRRR-like WRF simulation output from a series of model physics sensitivity experiments. This work has been largely focused on an OWLeS intensive observing (10–12 December 2013; IOP2b). We have been comparing an ensemble of microphysics sensitivity WRF experiments to each other and to several observational data sources from OWLeS. Our latest investigations focus on vertical profiles of radar reflectivity as well as cloud and precipitation properties, which exhibit large variations between schemes. Contoured-frequency-by-altitude diagrams (CFADs) are being used to compare modeled and radar-observed reflectivity. Representative vertical profiles have been constructed from NEXRAD data using the quasi-vertical profile (QVP) method, and are being used to identify biases in model-simulated reflectivity profiles. Additional comparisons between modeled and observed cloud liquid water path (CLWP) have been made, using data from a vertically pointing radiometer that was positioned within the snowband during OWLeS IOP2b. Observations indicate low CLWP values, consistent with small amounts of graupel observed by snow survey teams in the area. Among the schemes tested, several produce large values of CLWP indicating potentially important biases in how these schemes represent cloud microphysical processes (Fig. 4).

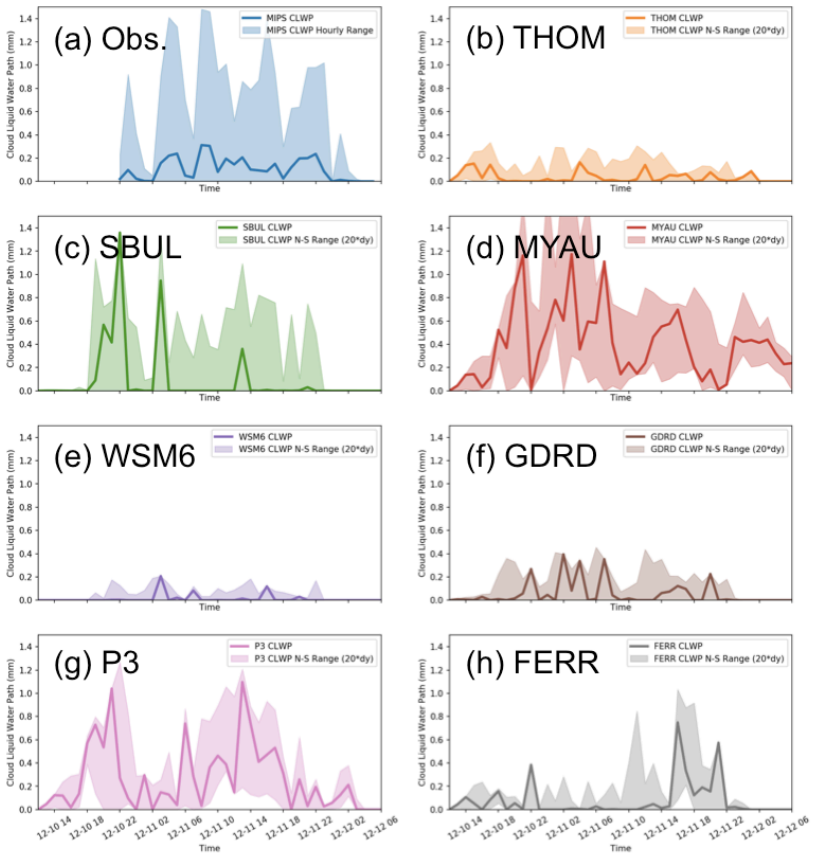
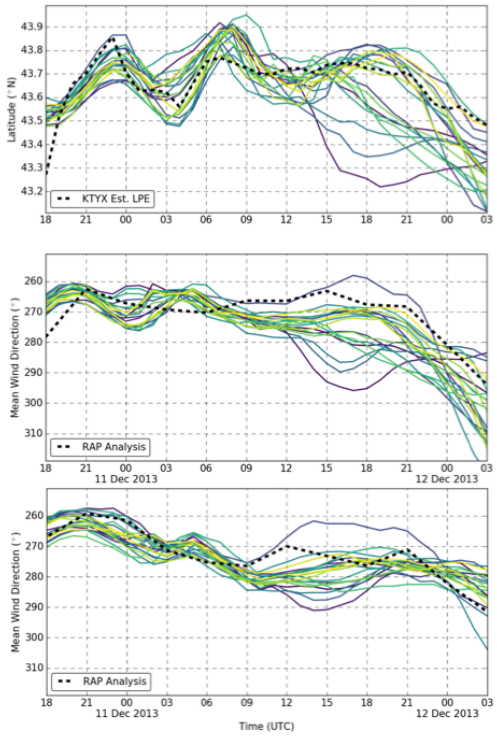


Figure 4: *Time series of integrated cloud liquid water path (CLWP) during OWLeS IOP2b. (a) Hourly mean CLWP from MIPS radiometer at Sandy Creek (solid line), with shaded range indicating hourly maximum and minimum CLWP values. (b)–(h) Hourly model CLWP predicted at the grid point nearest Sandy Creek (solid line), with shaded range indicating maximum and minimum CLWP within a 20-gridpoint (26.6 km) north–south range centered on Sandy Creek.*

Additional ensembles of WRF simulations have been run to explore the sensitivity of LeS forecasts to the choice of surface later (SL) and planetary boundary layer (PBL) parameterization scheme. Thus far, three schemes have been tested. An initial set of experiments for the OWLeS IOP2b case was described in our previous report. We have repeated similar experiments for two major LeS events downwind of lakes Erie and Superior. These experiments are used to evaluate the schemes against radar observations, surface snowfall, and in situ measurements of lake-air turbulent fluxes measured by eddy covariance instruments deployed atop lighthouses (*http://superiorwatersheds.org/GLEN/data.htm*). Initial comparisons against measured fluxes suggest that the operational MYNN scheme and the MYJ scheme produce fluxes consistent with observations, whereas the QNSE scheme produces unrealistically large fluxes that lead to excessive snowfall and errors in snow band morphology.

We have also been continuing to study forecast sensitivity to model initial and boundary conditions (IC/BC) uncertainty. Using the ensemble Kalman filter (EnKF) IC and Global Ensemble Forecast System (GEFS) BC ensembles introduced in the previous report, we have investigated the correlation of the low-level mean wind direction over Lake Ontario with the forecast hourly precipitation mass centroid latitude (hereafter abbreviated as "band latitude"; Fig.5a) downwind of the lake. A three-hour lag of the wind direction has the largest correlation to the forecast band latitude, since the LeS band latitude does not respond immediately to a change in wind direction. Using the EnKF IC / GEFS BC ensemble initialized at a 36-h lead time prior to IOP2b, the three-hour lagged 925-hPa wind direction explains about 82% of the temporal variance in the band latitude across all ensemble members (Fig. 5b), while the 850-hPa wind direction explains only about 15% of the variance (Fig. 5c). This suggests that the 925-hPa low-level winds have a much stronger influence on the near-term LeS band position than the 850-hPa winds in the upper part of the boundary layer during this case study. Work is underway using similar EnKF IC / GEFS BC ensembles for the 6–8 January 2014 case study to see if these preliminary conclusions are valid for another LeS event.



(a) Precip. Mass Centroid Latitude

(b) 925-hPa Mean Wind Direction

(c) 850-hPa Mean Wind Direction

Figure 5: *Time series of (a) hourly precipitation mass centroid latitude for each ensemble member (solid lines) and KTYX observations (dashed line), (b) 925-hPa mean wind direction in a 1° × 1° box over eastern Lake Ontario and the Tug Hill Plateau for each ensemble member (solid) and RAP analysis (dashed), and (c) same as Fig. 2b, but for 850 hPa.*

During the next six months, we will focus on completing the microphysics and PBL/SL scheme analyses. For the microphysics research, we intend to: (a) perform additional sensitivity experiments for the Thompson scheme used in the HRRR by adjusting parameters within the scheme and (b) compare model results with airborne in situ measurements. We anticipate submitting two manuscripts on our microphysics and PBL/SL results to AMS journals in Fall 2018. We also plan to continue the IC/BC research as time permits, potentially submitting a manuscript on these results in Winter 2018. During June 2018, Massey will be visiting Boulder, CO, for NCAR's ASP Summer Colloquium and has arranged meetings to update the ESRL–HRRR development team and Craig Schwartz (NCAR) on research progress and to continue research collaborations.

c) Applying forecast track and intensity diagnostics to high-impact Northeast winter storms

Graduate student: Tomer Burg
PI and co-PIs: Andrea Lang, Ryan Torn, and Kristen Corbosiero
NWS focal points: Neil Stuart (ALY), Joseph Dellicarpini (BOX), and Justin Arnott (GYX)

Research summary:

The goal of this project is to identify and quantify any systematic biases with forecasts of high-impact Northeast U.S. cyclones to improve situational awareness during the forecast process. Over the six-month reporting period, work on the project consisted of: (a) refining the objective cyclone identification and tracking algorithm, and (b) generating a climatology of cases. The cyclone-tracking algorithm was altered since the previous six-month report to track features in 850-hPa relative vorticity averaged over a 7˚ radius. The change to a vorticity-based tracking algorithm as opposed to an MSLP based algorithm was motivated by the consideration of a threshold for cyclone identification that is more objective, as an MSLP minimum depends on the background pressure. Area-averaging vorticity smooths smaller-scale features such as frontal boundaries and accounts for broad cyclones with multiple centers at similar intensity in a similar way, thus easing the process of tracking the large-scale cyclone. The next steps in the algorithm work will involve changing the area-averaging threshold from degree-based to kilometer-based, to be consistent with other forecast metrics. The consideration of km-based metrics is not expected to significantly alter the results as all of the cyclones identified tracked within a similar latitude band.

Additional analysis focused on creating a climatology of cyclones and their tracks that affected the East Coast of the U.S.. Cases were selected using an existing cyclone track database (Sprenger et al. 2017) which used the ERA-I reanalysis dataset. Cyclones that passed within a 750 km radius of the 40˚N 70˚W "benchmark" for 12 or more hours were retained and tracked using the previously described algorithm within the CFSR data. For each cyclone that was tracked in the CFSR, corresponding tracks were generated from the 11-member Global Forecast Ensemble System (GEFS) Reforecast Version 2 (Hamill et al. 2013), which has a 1˚ spatial resolution. For consistent methodology, the CFSR was regridded to 1˚ resolution for tracking purposes. Ensemble cyclone tracks were then matched to the CFSR track by searching for tracks surrounding the verification point within a search radius that increases with increasing lead-time. Figure 6 shows an example of the track output for the 1993 Superstorm for forecasts initialized at a 126-h forecast lead-time.

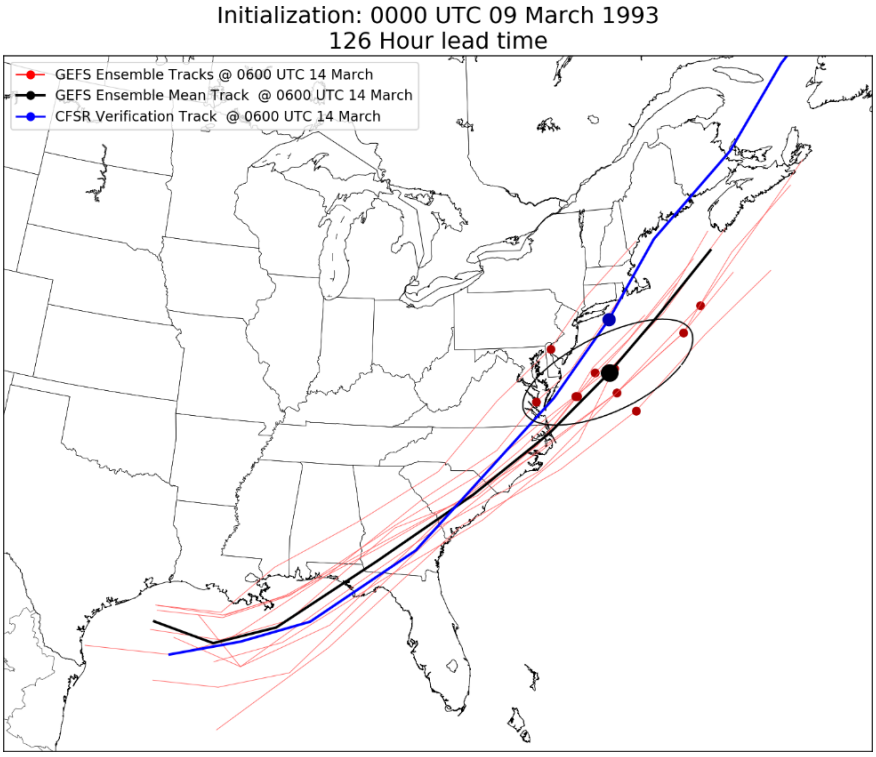


Figure 6: *Example of the tracking algorithm applied to the GEFS Reforecast ensembles initialized 0000 UTC 9 March 1993 for the 13–14 March 1993 cyclone. Ensemble tracks are in red, ensemble mean track is in black, and ERA-Interim verification is in blue, with positions valid at 0600 UTC 14 March. The ensemble spread ellipse following the methodology of Hamill et al. (2011) is denoted by the black ellipse.*

Using the 40˚N 70˚W benchmark as the verification location, preliminary analysis shows that leading up to verification, especially between 54-h and 18-h lead times, most ensembles tend to depict the cyclone slightly to the west of the verification point (Fig. 7). Currently ongoing and future work planned for the next six months includes further compositing and analyzing the subset of cases that produced significant snowfall in the Northeast U.S.. The proposed methodology will utilize daily snowfall reports from the Applied Climate Information System (ACIS) dataset, which consists of data obtained from an aggregate of sources. Additional work will be focused on quantifying errors and biases in the forecast climatology. The next steps will include partitioning cases to construct composites for ensemble members by track and intensity bias and attempt to identify any systematic biases originating in the short range or run initialization. This approach will be done via examining cyclone events into a phase space of intensity vs. track error and compositing cases from each quadrant to examine ensemble sensitivity and errors in the upstream flow.

References:

Hamill, T. M., J. S. Whitaker, M. Fiorino, and S. G. Benjamin, 2011: Global ensemble predictions of 2009's tropical cyclones initialized with an ensemble Kalman filter. *Mon. Wea. Rev.*, **139**, 668–688.

Hamill, T. M., G. T. Bates, J. S. Whitaker, D. R. Murray, M. Fiorino, T. J. Galarneau, Y. Zhu, and W. Lapenta, 2013: NOAA's second-generation global medium-range ensemble reforecast dataset. *Bull. Amer. Meteor. Soc.*, **94**, 1553–1565.

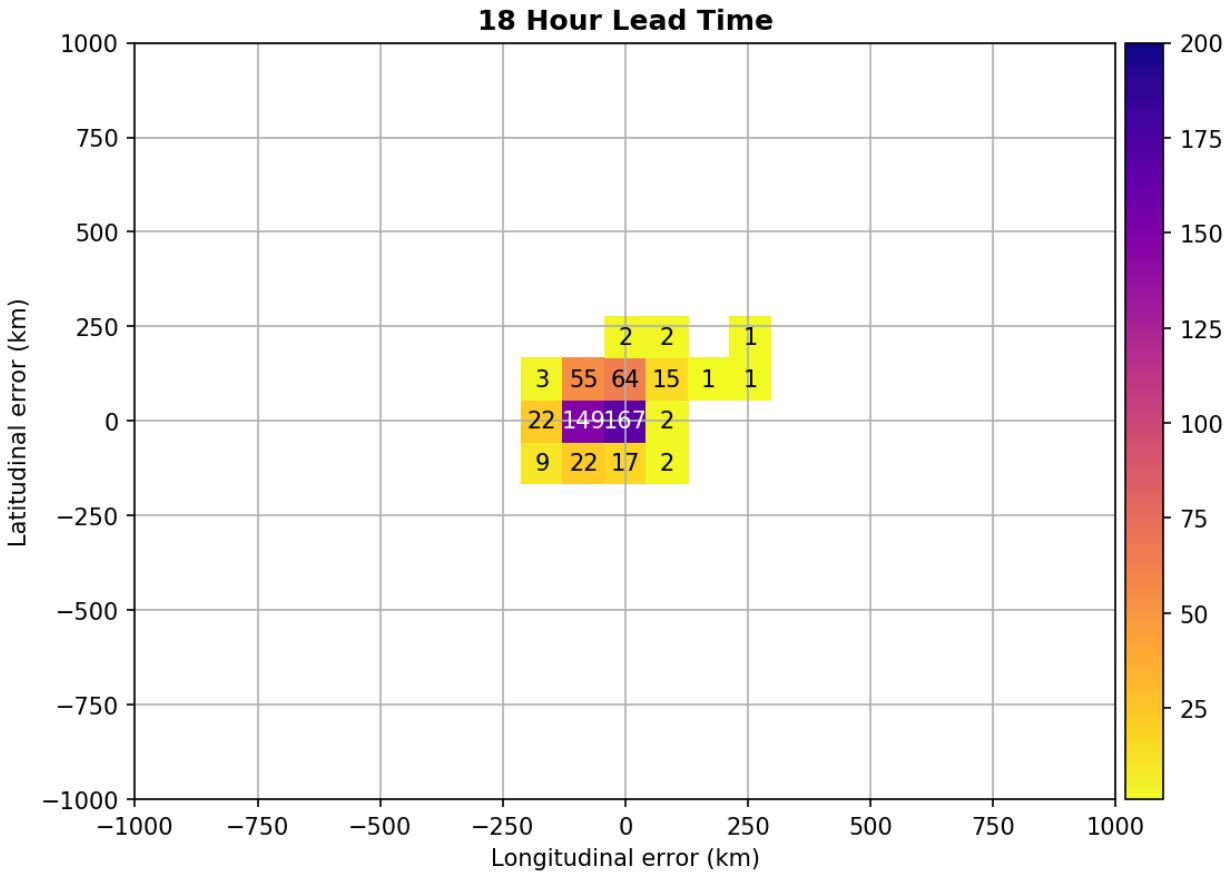


Figure 7: *A two-dimensional histogram of the count of error location occurrence, longitudinal error (km), and latitudinal error (km), for all ensemble forecasts of all cyclones with an 18-h lead-time verification near the 40˚N 70˚W benchmark. The origin point is the location of verification. Even at short lead times, there was a slight displacement to the west of the observed cyclone position.*

2. CSTAR VI PROJECT THESES, PRESENTATIONS, AND PUBLICATIONS

a) Theses completed

None

b) Presentations

Burg, T., A. L. Lang, K. L. Corbosiero, and R. D. Torn, 2017: Applying forecast track diagnostics in high-impact Northeast winter storms: Climatology and case analysis. Oral presentation at the *18th Northeast Regional Operational Workshop*, 1 November, Albany, NY.

Eck, P., B. Tang, and L. Bosart, 2017: Total lightning and upslope flow as predictors of severe weather in the Northeast. Oral presentation at the *18th Northeast Regional Operational Workshop*, 1 November, Albany, NY.

Wasula, T. A., and B. J. Frugis, 2017: A multi-scale analysis of the 18 May 2017 severe weather event across eastern New York and western New England. Oral presentation at the 18th Northeast Regional Operational Workshop, 1 November, Albany, NY.

Bartolini, W. M., J. R. Minder, R. D. Torn, and D. Keyser, 2017: Convection-permitting ensemble forecasts of the 10–12 December 2013 lake-effect snow event: Sensitivity to initial and boundary conditions. Oral presentation at the *18th Northeast Regional Operational Workshop,* 2 November, Albany, NY.

Minder, J. R., W. M. Bartolini, R. D. Torn, and D. Keyser, 2017: Convection-permitting ensemble forecasts of the 10–12 December 2013 lake-effect snow event: Sensitivity to microphysical and surface-layer parameterizations. Oral presentation at the *18th Northeast Regional Operational Workshop*, 2 November, Albany, NY.

Villani, J. P., 2017: Using GAZPACHO to create forecast snowfall bias/error maps stratified by flow regime. Oral presentation at the *18th Northeast Regional Operational Workshop*, 2 November, Albany, NY.

Burg, T., A. L. Lang, K. L. Corbosiero, and R. D. Torn, 2018: Applying forecast track diagnostics in high-impact Northeast winter storms: Climatology and case analysis. Oral presentation at the *43rd Northeastern Storm Conference*, 10 March, Saratoga Springs, NY.

Flamholtz, W., B. Tang, and L. Bosart, 2018: Terrain effects on the convective environment of the 13–14 August 2016 northeastern U.S. severe weather event. Poster presentation at the *43rd Northeastern Storm Conference*, 10 March, Saratoga Springs, NY.

Main, M. E., R. A. Lazear, and L. F. Bosart, 2018: Differences between high-shear/low-CAPE environments favoring tornadoes versus straight-line damaging winds in the Northeast U. S.. Oral presentation at the *43rd Northeastern Storm Conference*, 10 March, Saratoga Springs, NY.

Rocque, M., and J. Minder, 2018: Understanding variations in WSR-88D dual-polarization radar parameters from the Ontario Winter Lake-Effect Systems Field Campaign. Poster presentation at the *43rd Northeastern Storm Conference*, 10 March, Saratoga Springs, NY.

Bartolini, W. M., J. R. Minder, C. S. Schwartz, R. D. Torn, and D. Keyser, 2018: Convection-permitting ensemble forecasts of the 10–12 December 2013 lake-effect snow event: Snowband and land-breeze front predictability. Oral presentation at the *43rd Northeastern Storm Conference*, 11 March, Saratoga Springs, NY.

c) Refereed publications

None

3. RESEARCH TO OPERATIONS

Updates to the Albany CSTAR Virtual Lab (VLab) community page have been ongoing over the past six months. Conceptual models from Rebecca Steeves' research (CSTAR V) on transition season Northeast U.S. snowstorms were added to the VLab. Keywords matching AWIPS search terms were added, so that Rebecca's work can be easily accessed by operational meteorologists through the AWIPS Interactive Reference (AIR) tool. The following additional edits were made to the VLab page:

- A list of ongoing projects, graduate students, the PI, co-PIs, and NWS Focal Points was added to the homepage.
- Six-month and final CSTAR reports dating back to October 2005 were added to a new *Reports* subpage.
- Links to M.S. theses under a new *M.S. theses* subpage were added.
- *Cold Season* and *Warm Season CSTAR Results* were changed to *Quick References*, which more accurately describes the concise, operationally relevant conceptual models placed on these subpages.
- The *Wiki* and *Forums* subpages were removed, but may be added at a later date.

In the coming months, we will be phasing out the current CSTAR website, housed currently at UAlbany, since all of the material will be housed on the VLab. In preparation for this change, the CSTAR VLab was made public, so that those without VLab accounts can access theses and research results, thereby enabling easy access to both operational and research meteorologists.

4. NWS PERSPECTIVE ON CSTAR VI PROGRESS *(Michael Evans, SOO WFO ALY)*

Progress continues on the initiative to migrate Albany CSTAR training materials and research findings to NOAA's VLAB in order to facilitate increased research to operations for our projects. Ross Lazear is working with our information technology officer Vasil Koleci on the CSTAR VLAB page. They have been bringing more CSTAR work to VLAB and incorporating the AWIPS Interactive Reference Tool. This tool will allow operational forecasters to access VLAB material with a mouse click on a product legend. They are also working on bringing all of the completed student thesis work over to VLAB as well.

From the NWS perspective, perhaps the most exciting result of moving our data to the VLAB will be the availability of reference material from the projects on AWIPS workstations via the AWIPS interactive reference tool. The tool will link reference material to many of the diagnostics fields that can be accessed in AWIPS, allowing forecasters to better understand and utilize these fields. In addition, a Virtual Lab page has been set up that gives users access to highly informative, concise graphics that highlight results from our cold and warm season research results, along with access to the graduate student Master' thesis's.

Research continues on the three Major Projects of CSTAR VI, including Tomer Burg's work on track and intensity errors in major Northeast U.S. winter storms. NWS Focal Points for this project are Neil Stuart from NWS Albany, Joe Dellicarpini from NWS Taunton, and Justin Arnott from NWS Grey. The goal of this research is to compare observed low pressure tracks to GEFS forecast tracks for a large number of storms, in an effort to identify patterns that may help forecasters to better utilize the ensemble data to determine the most likely storm tracks within ensemble track envelopes. Tomer is working on a diagnostic tool that will aid forecasters with this effort.

Tomer met with Neil Stuart on 1 May to discuss the latest progress with his research. Instead of using MSLP centroids, he is using 850-hPa average vorticity centroids, based on some research by another graduate student at UAlbany that just received her PhD. From the examples Tomer showed Neil, the 850-hPa average vorticity was just as good, if not a better, method of tracking the low level center of the storm. Tomer showed Neil histograms of track errors in

ensemble members at various forecast times, showing the decreasing E–W and N–S errors as the storm got closer to t=0 h. He also showed Neil a plot of percent of members within 1° of the observed track and it reflected what the histograms showed. One interesting feature was a slight increase in spread at the 48–72-h time frame, with slightly less spread at longer ranges and, as expected, shorter ranges. Once the analyses are complete, Tomer will be consulting with Neil, Joe Dellicarpini, Justin Arnott and other NWS personnel on what results would be useful for operational forecasters.

The second Major Project is work by Massey Bartolini on the predictability and variability of lake-effect snow bands. Massey is looking at how well high-resolution models simulate severe lake-effect storms. In particular, he is investigating model physics sensitivity, multi-scale predictability, and ultimately model performance. He is using the extensive observational datasets gathered during OWLeS.

Massey and Joe Villani had planned on meeting at the NWS office in Albany so he could observe our methodology when forecasting a lake-effect snow event. The day in December they were supposed to meet, however, Joe had to cancel due to busy workload from a synoptic storm. They intended on re-scheduling during the school break in mid-January. Unfortunately, the opportunity never materialized again, as there were no significant lake-effect events that occurred while Joe was on shift the rest of the winter. Joe is still planning to try to meet with Massey soon to at least show him the methodology of how we would hypothetically forecast for a lake-effect snow event.

As part of Massey's CSTAR project, Joe is planning on conducting a local study with regards to hi-resolution model output and inland extent of LES bands. This project would be an extension of his prior work: *https://member.nwas.org/sites/default/files/nwa_pubs/2017-JOM5.pdf*. Joe plans on utilizing a new capability in a future GAZPACHO (Gridded Automated Zonal Precipitation and Complete High Resolution Output) program build that will allow for comparison of positive snow depth change from hi-resolution model data (HRRR and NAMNest) and observed snowfall. This subset of the project will likely begin during the upcoming 2018–2019 snowfall season.

The final Major Project of CSTAR VI is work examining severe convection in complex terrain, started by Pamela Eck and continued by William Flamholtz. The NWS Focal Points are Tom Wasula, Michael Evans, and Matt Kramar. Kat Hawley from NESDIS is also working with William on the project and supplied some satellite imagery to William for a case that he is working on. William presented some initial research results at the Fall CSTAR 2018 meeting in November. He has applied a high-resolution model to a previous convective case, running the model with and without terrain to see the effects of terrain on the meso-scale environment, including effects on convection. In this case, the differences between the no terrain and terrain runs of the model were included differences in the patterns of convective initiation over the mountains of central Pennsylvania, and the no-terrain run of the model appearing to have slightly more robust convection, possibly due to more instability moving farther north into New York state.

Mike and Tom have met with William to discuss potential operational benefits and applications to his research. Mike submitted a review of William's work to William and his advisors, from an operational perspective, including some thoughts on how the work could apply to operations. Mike's thoughts were that a good outcome of this research would be if conceptual models or synoptic patterns could be identified that are favorable vs. unfavorable for strong topographic influences on convection. If the cases examined in the research could ultimately be

divided into a large terrain-effect case data set and a small terrain-effect data set, synoptic pattern differences between these data sets could be examined to give forecasters an idea of what to look for when trying to identify cases that will be particularly susceptible to topographic influences.

Kat has also been in contact with William a few times to discuss the project. Kat was unable to attend the CSTAR meeting; however she was able to review William's presentation. She noted that both the NT and T runs of the WRF did a poor job simulating the convection that developed over New England for his case, which was possibly in association with a back-door cold front. She wondered whether that had an impact on the rest of the simulation. Kat also believes that expanding the study to several cases to compare and contrast terrain effects will ultimately be required for this study to be useful operationally.

5. STATUS OF "SNYDER PLAN V" PROJECTS *(Michael Evans and focal points)*

Work is underway on several Collaborative and Associate Projects in CSTAR VI. Details are presented below. Six NWS offices are participating in this work.

CSTAR VI Collaborating and Associate Projects

1. Assessment of polygon-based lake effect warnings

Team lead: Jon Hitchcock (BUF)

General forecaster David Church gave a presentation at the Spring 2018 CSTAR meeting on the latest progress on WFO BUF's project to implement and verify lake effect snow polygon warnings. His presentation indicated that polygons show slightly better skill in defining areas of impact compared to legacy, county-based warnings. The probability of detection declines, but the false alarm rate declines more and overall CSI is improved. These statistics were based only on first-issuance of the polygon, so once verification is done on subsequent issuances, closer to or during events, verification statistics for the polygons should improve. Results also indicated that polygons correctly reduce the number of people in a warning, and correctly reduce the time that people are under warnings.

2. Expansion of Buffalo high wind study and decision aide to other offices

Team lead: Shawn Smith (BUF)

Shawn Smith gave a presentation at the 2018 Spring CSTAR meeting that summarized results from his study on developing a methodology for predicting damaging synoptic-scale wind events. Shawn has examined correlations between three key parameters and occurrence of damaging winds in western New York associated with strengthening low-pressure areas moving up the Saint Lawrence Valley. His components are 850-hPa wind speed, three-hour pressure rises and 850-hPa temperature advection. Shawn has developed an index that is a function of those three parameters. He showed examples of index values for a few recent events that covered large areas of the Northeast U.S., and it appears that values of his index greater than one are typically associated with severe wind reports for areas beyond western New York.

3. Improving forecasts of snow along the west-facing slopes of the Appalachians

Team lead: Matt Kramer (PIT)

Work has not yet begun on this project.

4. Integrating advanced boundary layer physics and theory into operations

Team lead: Ian Lee (DTX)

Nothing new to report.

5. Heat waves/extreme heat events in the Northeast United States

Team leads: Neil Stuart and Kevin Lipton (ALY)

a. On 19 December, Neil, Steve DiRienzo, and Kevin met with the NYS DOH. They discussed the conclusions of the study into heat index thresholds for NY State. The NYS DOH presented their findings and we all agreed that their PowerPoint presentation would be the basis for recommending the heat advisory threshold in NY State to be lowered to 95°F for two consecutive days. Steve has been coordinating the change with surrounding offices and NWS Eastern Region Headquarters. The change will take effect during the summer of 2018.
b. The paper, "Estimating policy relevant health effects of ambient heat exposures using spatially contiguous remote sensing reanalysis data", coauthored by the NYS DOH, Steve, Neil, and Kevin, has been reviewed by NWS Albany and will be submitted to Eastern Region Headquarters for their review before submitting it to a health journal of the NYS DOH's preference. This paper summarizes the processes and results that justified the change in criterion for heat advisories in NY State.
c. Neil and/or Kevin plan to attend and present at a 4 June 2018 meeting of the partners involved in the NASA grant project that analyzed high-resolution satellite temperature data and resulted in the changes in the NY state heat advisory criterion.
d. On 19 April, Steve and Neil participated in a conference call with the UAlbany School of Public Health and other partners included on a research grant studying the health effects of power outages. The conference call was conducted to discuss what effects should be included in the study. There are weather-related and non-weather-related factors. Some of the weather related factors include, but are not limited to, temperatures during the power outage such as cold weather after an ice storm, and hot weather after thunderstorms or a hurricane. Some non-meteorological factors include, but are not limited to, food spoilage and injury while cleaning up after a disaster.
e. The paper, "Are the current thresholds, indicators, and time window for cold warning effective enough to protect cardiovascular health?" has been accepted for publication in Science of the Total Environment. Steve, Neil, and Kevin are coauthors on this paper with the UAlbany School of Public Health.
f. Kevin Lipton has proposed a workshop or seminar on extreme heat in 2019 or 2020. This would be a collaboration with the UAlbany Department of Atmospheric Science, School of Public Health, and Public Policy. Local media and other NWS offices in the region would also participate. This possible workshop or seminar is in the very early planning stages.

6. Develop methods/best practices for development of conceptualized models for (parameter) use by operational forecasters using previous event analysis/reanalysis

Team lead: Alan Cope (PHL)

Two of our forecast staff, along with a student volunteer last summer, worked on a project to develop conceptual models for parameters associated with flash flood events in

the WFO Mount Holly, NJ area. They first used the NCEI storm event database to identify 96 cases (days) with three or more flash flood events, during the months May through September 1999 to 2016. These cases were grouped according to three types: synoptic, convective, or tropical, and NARR and NCEP/ NCAR reanalyses were used to create daily composite maps of relevant parameters such as meridional wind anomalies, moisture convergence, CAPE, etc., for each of the three types.

This work was presented at our recent office Spring Workshop, including a table, which highlighted the main characteristics of the different types of flash flood days. The ultimate goal is to develop conceptual models for each of the three types, i.e., illustrations showing how the various parameters fit together. This work could serve as an example of how to develop such models, and could be used for many other types of significant weather events, such as severe weather, heavy snow, high winds, etc.

7. Development of IFR climatologies for inland TAF sites

Team lead: Joseph Dellicarpini (BOX)

Nothing new to report.

8. Development of improved WSR-88D warning criteria using dual polarization datasets

Team leads: Tom Wasula and Brain Frugis (ALY)

a. Tom gave a summary presentation at the Fall CSTAR meeting based on Brian Frugis's 42nd National Weather Association poster entitled, "Examining methods to accurately predict significant severe thunderstorm wind damage across the Northeastern United States".
b. Tom gave an oral presentation at the 43nd Northeastern Storms Conference in Saratoga Springs, NY entitled, "Albany forecast area significant hail climatology and case studies". Brian Frugis was a co-author.
c. Tom gave two WFO BOX station meeting webinar presentations on 11 April 2018 entitled, "Eastern NY and western New England widespread severe event: May 18th 2017" and "A brief review of Albany forecast area significant hail climatology".
d. Tom has submitted two abstracts on the 18 May 2017 Severe Weather Event, and the WFO Albany significant hail climatology for the 24–29 October 2018 AMS Severe Local Storms Conference.

9. Assessing the relationship between flash flooding verification and values of instantaneous precipitation rate (DPR)

Team lead: Ian Lee (DTX)

Due to time constraints, this project has been discontinued.

10. Explore and assess use of MRMS in warning operations

Team lead: Ian Lee (DTX)

Research was conducted during the summer of 2017 at NWS Miami–South Florida with the assistance of a NOAA Hollings Scholar. The main goals of the research were to explore the applicability of MRMS data with respect to thunderstorm severity as measured in lightning severity, as well as assessing the time to first lightning strike.

Over 50 thunderstorm cases across South Florida were analyzed, with the focus on the MRMS variable Vertically Integrated Ice (VII). A statistically significant relationship was found in correlating a wide variety of MRMS variables (particularly max VII value and VII value areal extent) to the number of lightning strikes observed in a thunderstorm. A predictive equation was developed from this work that has been shown to accurately predict the number of lightning strikes at each MRMS time step to within +/- 10 strikes compared to observed lightning. A decision aid is currently in development to assist NWS forecasters during warning operations to identify thunderstorms that have a better chance at producing lightning.

An expansion of this research is currently underway at NWS Detroit–Pontiac to test the applicability of our results in different geographical regimes. The Hollings Student wrote an undergraduate thesis based on the work, and will be working closely with NLDN developers to expand our results as a grad student at the University of Oklahoma. We are also in the process of writing a journal article to formally present our results.

11. Verification of gridded ceiling and visibility forecasts at Taunton, MA

Team lead: Joseph Dellicarpini (BOX)

Nothing new to report.

12. Expanding Decision Support Services

Team lead: Brian Montgomery (ALY)

The main accomplishment in this area was the roll-out of national IDSS training in September. The plan moving forward is to continue to evolve our decision support services independently from the CSTAR program.

13. A climatology of damaging QLCS storms that produce mesovortices

Team lead: Matt Kramer (PIT)

Nothing to report at this time.

14. Expressing uncertainty with lake-effect snow in the ER probabilistic snow project

Team lead: Matt Kramer (PIT)

Work has not yet begun on this project.

15. An expanded analysis of BUFKIT methodologies to forecast wind and wind gust speed for the upper Ohio River Valley

Team lead: Matt Kramer (PIT)

Nothing new to report at this time.

16. R2O and CSTAR project support by UAlbany undergraduate interns

Team lead: Vasil Koleci and Michael Evans (ALY)

Ross Lazear and Vasil are working on the CSTAR VLAB page. They would like to bring more CSTAR work to VLAB and incorporate the AWIPS Interactive Reference Tool.

This tool will allow operational forecasters to access VLAB material with a mouse click on a product legend. They are also working on bringing all the completed student Thesis work over to VLAB as well.

6. COMPUTER AND TECHNOLOGY TRANSFER ISSUES *(David Knight)*

The results described herein would not have been possible without appropriate computing infrastructure, which continues to play an important part in this collaborative effort. Students are exposed to NWS facilities and software, and NWS staff has access to capabilities not available in the local office. Both groups benefit from this interaction and sharing of facilities. Several Linux workstations and PCs are available for use by CSTAR participants. Approximately 9 TB of disk space on the UAlbany Department of Atmospheric and Environmental Sciences (DAES) servers is dedicated to storing CSTAR related data and software. This disk space is available on all DAES workstations and provides a central location where both UAlbany and NWS personnel can store, process, and exchange large datasets. Each CSTAR student has a PC or Mac laptop, which enables them to take familiar computers with them when visiting NWS staff, and provides them ready access to the DAES UNIX machines. CSTAR Email lists originally created on the DAES computers at the beginning of the project have been superseded by the "map" list (*map@listserv.albany.edu*). The "map" list reaches a much larger audience (out of 849 members, more than ¼ are from NOAA), allowing discussion of CSTAR related research among many more people.

NWS Albany staff took the lead in maintaining content for the CSTAR webpage at *http://cstar.cestm.albany.edu*. The web page provides an additional mechanism for exchanging information and ideas. The NWS also runs a CSTAR forum and discussion group at *http://infolist.nws.noaa.gov/read/?forum=cstar_ne*. The DAES web server (*http://www.albany.edu/atmos*) and ftp server (*ftp://ftp.atmos.albany.edu*) are being used to facilitate exchange of large datasets between CSTAR collaborators. The DAES computing resources are available for CSTAR related research including a Linux server (with 32 CPUs and 256 GB RAM) and two large network attached disk storage arrays (85 TB total usable space). While CSTAR money was not used for this, and the machines were not bought specifically for CSTAR use, they nonetheless directly benefit the CSTAR research by providing much faster servers for computation and storage space for commonly used datasets. A Linux server (Peebles) with 48 cores, and 128 GB RAM, dedicated to CSTAR computations was recently purchased. This computer will facilitate increasingly complicated computations.

In addition to DAES, and NWS computing facilities, the formal CSTAR collaborative grant effort has allowed access to University Research Information Technology (RIT) services. In particular, NWS ALY is using the RIT 144 CPU Linux cluster for WRF model simulations. This computing facility allows them to perform computations not possible at the local office. The facility is used to generate additional members for the collaborative ensemble, and to generate higher resolution runs for research purposes. So far this facility has been made available at no cost to the CSTAR project. The RIT group has also made an additional 10 TB of disk space available for CSTAR data storage.

7. CSTAR PROJECT RESEARCH IN NWS AFDs

Saturday 18 November 2017

CSTAR research on cool-season, high-wind events was cited in the short-term section of the NWS ALY AFD.

FXUS61 KALY 180950
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
450 AM EST Sat Nov 18 2017

.SHORT TERM /SUNDAY THROUGH SUNDAY NIGHT/...
Fairly good consensus among deterministic models and GEFS members in tracking the strengthening surface low up the St. Lawrence Valley, with sea level pressures in the upper 970s by the time it`s in southeastern Quebec by 00Z Monday. The low will drag a sharp cold front across the forecast area Sunday morning, with the frontal position roughly situated across the Hudson Valley at 12Z Sunday. H850 temps are forecast to drop from roughly 7C at 09Z Sunday to -6C by 18Z Sunday. The strong cold advection and strong pressure gradient in the southwest quadrant of the low leads to the concern for strong winds Sunday. **CSTAR research has shown this particular low track to be favorable for strong winds over portions of the forecast area.** However, H850 winds are not terribly strong at around 45 kt, and it is questionable how deeply the boundary layer will mix given what is likely to be a fairly generous coverage of clouds. In coordination with neighboring offices, will forego any wind headlines attm, given the uncertainty and the timing which will still be in the 3rd forecast period (post 12Z Sunday). Favored locations for strong wind gusts exceeding 40 mph are higher terrain above 1500 feet along with the Mohawk Valley and Capital District.

SHORT TERM...Thompson

Saturday 9 December 2017

CSTAR research on mesoscale snowbands was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 100100
AFDALY

Area Forecast Discussion
National Weather Service Albany NY

800 PM EST Sat Dec 9 2017

.NEAR TERM /UNTIL 6 AM SUNDAY MORNING/...
As of 800 PM EST...**As shown in recent CSTAR research, a narrow laterally quasi-stationary mesoscale snow band continues to extend from the eastern Catskills northeast through Columbia/Rensselaer Counties and southern Vermont.** Although this band was initially weakening, it has appeared to strengthened over the last 30-45 minutes based on KENX radar imagery. It may slowly start to translate eastward towards the Taconics and Berkshires as well.

NEAR TERM...IAA/Frugis

Saturday 13 January 2018

CSTAR research on Mohawk–Hudson Convergence was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 132053
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
353 PM EST Sat Jan 13 2018

.NEAR TERM /UNTIL 6 AM SUNDAY MORNING/...
As of 345 PM EST, a persistent area of snow showers continues across the northeast/east portions of the Capital District, extending north into the Saratoga/Glens Falls area, and southeast through the central Taconics and Berkshires. **This seems to be associated with an area of enhanced low level convergence, noted in surface wind observations, including those from the NYS Mesonet, with a more north/northeast wind across the upper Hudson River Valley through the Saratoga region, and west/northwest closer to and within the Mohawk Valley (likely a form of Mohawk-Hudson Convergence noted from CSTAR research).** Some moisture contribution from Lake Champlain also appears to be involved. Localized snowfall amounts of 1-3 inches have been associated with this feature this afternoon, and an additional inch could occur through 5 PM.

NEAR TERM...KL

Monday 15 January 2018

CSTAR research on mesoscale snowbands was cited in the short-term section of the NWS ALY AFD.

FXUS61 KALY 150926
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
426 AM EST Mon Jan 15 2018

.SHORT TERM /TUESDAY THROUGH WEDNESDAY NIGHT/...
Then, the weak area of low pressure is expected to stall along a strengthening baroclinic zone across western New England Tuesday night. At the same time, a secondary area of low pressure is forecast to emerge off the Delmarva and track northeast along the edge of the baroclinic zone. A positive tilt trough aloft will be advancing eastward across the lower Great Lakes and Ohio Valley region. **This set up looks to be conducive for some mesoscale banding to develop, and resembles a potential quasi-stationary band pattern from noted CSTAR research.** Deterministic and ensemble model QPF has also increased from previous runs, which lends more confidence to a moderate snowfall event, especially for much of the area from the foothills of the southern Adirondacks south and east. **Due to the best forecast 850-700mb F-Gen across SE NY and the southern New England coast, the most likely area for potential mesoscale banding looks to be across the southern Green Mountains of Vermont and the Berkshires based on the CSTAR research.** So we have issued a Winter Storm Watch for this area due to at least 50 percent confidence of greater than 6 inches of snow. Elsewhere, it appears an Advisory will eventually be needed with snowfall forecast of generally 3-6 inches outside of the Watch area, and lighter 1-3 amounts in the west-central Adirondacks.

SHORT TERM...JPV

Tuesday 16 January 2018

CSTAR research on mesoscale snowbands was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 162329
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
629 PM EST Tue Jan 16 2018

.NEAR TERM /THROUGH WEDNESDAY/...

With the approaching upper level trough and a strong jet-streak nearby, Northeast CSTAR research would suggest the potential for a quasi-stationary mesoscale band of snowfall on the northwestern side of this developing low pressure area. Mesoscale models, including the 3km HRRR and NAM do suggest some heavier snowfall amounts extending from the Poconos northeast across the Catskills, mid Hudson Valley and into NW CT/Berkshires.

NEAR TERM...Frugis/Wasula

Tuesday 30 January 2018

CSTAR research on Mohawk–Hudson Convergence was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 302126
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
426 PM EST Tue Jan 30 2018

.NEAR TERM /THROUGH WEDNESDAY/...
As of 1230 PM EST, As main coastal low is east of the Gulf of Maine, broad upper trough remains across the region as it slowly migrates east. **Per mesoscale models and local CSTAR research, seems we are setting up the increased potential for MHC (Mohawk-Hudson Convergence).** North-northeast wind coming down the Hudson into the Capital Region with a developing westerly flow down the Mohawk along with fairly moist profiles to warrant the continued high chance for additional snow showers through the evening hours.

NEAR TERM...IAA/BGM

Wednesday 31 January 2018

CSTAR research on snowfall bias based on flow regime was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 312052
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
352 PM EST Wed Jan 31 2018

.NEAR TERM /UNTIL 6 AM THURSDAY MORNING/...
After this initial band moves through, expect persistent but weaker isentropic lift to prevail overnight. However, orographic enhancement combined with this isentropic lift will likely lead to some pockets of additional steadier snowfall overnight, especially for areas near and just north of the Mohawk River Valley into the southwest Adirondacks, as well as across northern Berkshire CO and southern Bennington/southwest Windham Cos. In some of these areas, snowfall accums by daybreak Thursday could reach 1-3 inches, with isolated locations possibly receiving up to 4 inches. **These areas are indicated by higher res CAMS, and also local CSTAR research with similar low level wind flow regimes from the south/southwest.**

NEAR TERM...KL/Thompson

Wednesday 28 February 2018

CSTAR research on mesoscale snowbands was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 282025
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
325 PM EST Wed Feb 28 2018

.NEAR TERM /UNTIL 00Z FRIDAY/
Bands of heavy precipitation will develop over eastern NY and western New England by early Friday as the cyclone rapidly develops and a highly anomalous 70 to 80 kt easterly 850 jet develops over central and southern New England. **Bands of frontogenetically induced heavy precipitation will develop, with the pattern strongly suggesting the potential for pivoting bands and associated persistent areas of heavy precipitation per recent CSTAR research.**

NEAR TERM...KL/JVM

Thursday 1 March 2018

CSTAR research on mesoscale snowbands was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 012138
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
438 PM EST Thu Mar 1 2018

.NEAR TERM /THROUGH FRIDAY NIGHT/...

Per WPC guidance, a blend of the 12Z GFS/ECMWF was preferred for the synoptic features, with the NAM perhaps a bit too far north/west. The composite trough cuts off over western PA tonight and drifts offshore of the Delaware Bay Friday morning. Strongly diffluent midlevel flow develops resulting in a precipitation shield spreading SW-NE across the forecast area likely 03-06Z. The system entrains tropical moisture per theta-e progs, resulting in a period of moderate to heavy precipitation before tapering off Friday evening and overnight (see hydro discussion below for details on QPF and flood potential). **Strong frontogenesis develops in the 850-500 mb layer, with deep tropospheric lift noted on forecast soundings and cross sections. The pattern is very reminiscent of the pivoting band composite per recent CSTAR research.** Cross sections also reveal an area of negative EPV with steeply sloped midlevel moist isentropes, suggesting thunder cannot be ruled out.

NEAR TERM...Thompson

Friday 2 March 2018

CSTAR research on mesoscale snowbands was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 022325
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
625 PM EST Fri Mar 2 2018

.NEAR TERM /UNTIL 6 AM SATURDAY MORNING/...
Major winter storm is beginning to wind down...

Looking back earlier today, the Capital District and Hudson Valley areas got into the heavy snow likely because of diabatic cooling effects with intense precipitation cooling the column and the intersection of strong midlevel frontogenesis and maximum vertical motion through the dendritic growth zone over eastern NY. **This contributed to an intense and large, nearly stationary mesoscale snowband (pivoting band per CSTAR research), set up across the eastern Mohawk Valley, Schoharie County, Helderbergs and eastern Catskills well above the boundary layer and above any low level downslope effects that could have limited snow amounts but did not.** There is a lot more to be studied and discovered about this storm, too.

NEAR TERM...NAS/JPV

Tuesday 6 March 2018

CSTAR research on mesoscale snowbands was cited in the short-term section of the NWS ALY AFD.

FXUS61 KALY 060915
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
415 AM EST Tue Mar 6 2018

.SHORT TERM /6 PM THIS EVENING THROUGH THURSDAY/...

...Winter Storm Warnings for areas excluding Herkimer/Hamilton
Cos...where a Winter Storm Watch remains in effect for
Wednesday-Wednesday night...

Wednesday-Wednesday night, deterministic models and their ensembles continue to tighten the range of solutions regarding the track of the developing storm system, which is closer to the coast compared to what some were depicting 24+ hours ago. There remains some question as to how fast the H500 low closes off, with a quicker/farther south closing off process potentially allowing a pivoting snowband to extend farther N and W into the forecast area. **At this time, confidence is highest that areas from the Capital Region and points south and east should experience the strongest/most persistent mid level frontogenesis and greatest potential for pivoting snowbands, per CSTAR research.** This should allow for a swath of 6-12 inches of snow in these areas, except even higher, 12-18 inches across NW CT, western MA and southern VT, and possibly portions of the SE Catskills.

SHORT TERM...KL/Thompson

Wednesday 7 March 2018

CSTAR research on mesoscale snowbands was cited in the short-term section of the NWS ALY AFD.

FXUS61 KALY 070522
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
1222 AM EST Wed Mar 7 2018

.SHORT TERM /6 AM THIS MORNING THROUGH 6 PM THURSDAY/...
Winter Storm Warnings now in effect for the entire forecast area from 7 am Wednesday through 7 am Thursday, except through 7 pm Thursday for the southern Adirondacks, Taconics, Washington County, and western New England.

A lull in the precipitation is likely Wednesday morning before forcing for ascent rapidly increases during the afternoon and evening. Strongly diffluent flow will spread south to north across the forecast area, with forcing for ascent enhanced by the poleward exit region of the strong upper jet. Easterly wind anomalies of 3 to 5 SD at H850/H925 in the warm conveyor belt per the GEFS will result in good moisture transport into the area, similar to Friday`s event. Strong frontogenetical forcing in the 850 to 500 mb layer will be a major factor in enhancing snowfall rates during the afternoon and evening. Cross sections reveal very weak static stability above the layer of frontogenesis with moist isentropes nearly vertical for a time. **This all leads to high confidence in intense banding, with this event also being reminiscent of the pivoting band composite in recent CSTAR research. Snowfall rates of 1 to 3 inches per hour will be possible during the afternoon and evening. Where exactly the most intense banding sets up is always difficult to pinpoint, with CSTAR research indicating that it tends to form a bit removed from the impinging dry slot.** The dry slot may tend to punch into portions of the mid Hudson Valley and northwest Connecticut during the evening hours, but will likely have greater impacts in cutting down snowfall totals to our south and east. Latest thinking is that the heaviest snowfall rates will spread south to north across the forecast area roughly 17-01Z (noon to 8 pm). The best chance for pivoting bands to set up is expected to be south of the southern Adirondacks and north of the mid Hudson Valley/NW CT. Heavy snowfall rates may linger to around 06Z especially for the Greens and Berkshires. We may see some upslope enhancement for their eastern slopes early on with easterly winds at 925 mb, but as they turn more northeasterly, orographic enhancement will become increasingly likely across the northern Catskills.

SHORT TERM...Thompson

Sunday 11 March 2018

CSTAR research on mesoscale snowbands was cited in the short-term section of the NWS ALY AFD.

FXUS61 KALY 112042
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
442 PM EDT Sun Mar 11 2018

.SHORT TERM /6 AM MONDAY MORNING THROUGH TUESDAY NIGHT/...
...Winter Storm Watch posted from 8 pm MON to 6 pm TUE for western New England...

Tuesday...The low-level GEFS -U component of the winds or easterlies crank up to 3 to 5 standard deviations above over eastern NY and New England. Strong synoptic QG lift continues with the H500 upper level low over the eastern Great Lakes Region and western NY trying to capture the ocean cyclone going through rapid cyclogenesis. **The best H850-700 FGEN or deeper H850-500 FGEN stays south and east of western New England, but a pivoting band may nudge into western New England in the late morning into the early afternoon with snow rates increasing to an inch or so in an hour /conceptual model form Kenyon CSTAR research.** The best chance of potentially 6-10" of snow will be across western New England, with perhaps 4-8" total further west by the early evening TUE. Again, we may need advisories for a chunk of eastern NY if these totals hold /6-8" in 12-hrs/. Highs TUE will be in the mid 20s to lower 30s over the higher terrain, and 30s in the valleys.

SHORT TERM...Wasula

Monday 12 March 2018

CSTAR research on mesoscale snowbands was cited in the short-term section of the NWS ALY AFD.

FXUS61 KALY 122114
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
514 PM EDT Mon Mar 12 2018

.SHORT TERM /6 AM TUESDAY MORNING THROUGH WEDNESDAY/...

Tomorrow....The coastal low slowly chugs northeast towards Nova Scotia during the afternoon and evening and deepens and intensifies to around 965 hPa on the latest ECMWF. The H850-500 FGEN strengthens especially east of western New England. Some of the bands emanating westward from the coastal bomb may yield snow rates close to an inch or two and hours scraping the Berkshires, southern Greens and Litchfield Hills. **We believe the pivoting band /based on Kenyons CSTAR research/ or two may stay east of most of the forecast area.** However, we can not rule out 6-10" with around a foot in a few spots in the warning area. The better pcpn efficiency looks like it will be just west to northwest of the best FGEN zone. Nonetheless, decent upward vertical motion in the northwest quadrant of the cyclone near\ the mid and upper deformation axis will continue light to moderate snow over the forecast during the morning and into the afternoon. A dry slot ahead of the H500 closed circulation over western NY and PA may poke into the west to southwest zones in the late pm or early evening. We sided with the colder guidance. Highs will only be in the mid 20s to lower 30s over the hilltowns and mtns, and lower to mid 30s in the valleys. Additional snow accums will be in the 3-6" range from the Taconics eastward into western New England, and 2 to 5" westward with the lowest amounts over the Mid Hudson Valley.

SHORT TERM...Wasula

Tuesday 13 March 2018

CSTAR research on cold season NAO regime changes was cited in the long-term section of the NWS BGM AFD.

FXUS61 KBGM 140003
AFDBGM

Area Forecast Discussion
National Weather Service Binghamton NY
803 PM EDT Tue Mar 13 2018

.LONG TERM /THURSDAY THROUGH TUESDAY/...

A strong storm signal is present around Tuesday of next week with the various models and ensembles. Model consensus now is for this to track through the Central plains and Ohio Valley eastward into Mid-Atlantic. Given this is still seven days away, we expect quite a bit of model waffles and flips to be served up as we get closer to the event. **What we do know now is that the NAO looks to remain negative but trend toward positive during this timeframe giving us a potential Archambault setup.** This strength of the NAO block will impact the storm track, if the block is too strong the storm may track south of the entire region (GFS, EC operational). On the other hand, a weaker block would result in a much farther northward track and even mixed precipitation issues (CMC). For now will start with snow chances on Tuesday across the region.

LONG TERM...MWG

Tuesday 13 March 2018

CSTAR research on Mohawk–Hudson Convergence was cited in the near-term section of the NWS ALY AFD.

FXUS61 KALY 140101
AFDALY

Area Forecast Discussion
National Weather Service Albany NY
901 PM EDT Tue Mar 13 2018

.NEAR TERM /UNTIL 6 AM WEDNESDAY MORNING/...
Winter Storm Warnings now for Herkimer, Hamilton, Bennington, and western Windham Counties until 8 pm EDT WED...

Winter Weather Advisories now in effect continue for the Berkshires, the northern and central Taconics including all of Washington County, the central and eastern Mohawk Valley, Schoharie Valley, eastern Catskills, and Helderbergs until 8 PM EDT WED...

Winter Weather Advisories now in effect until 2 am EDT Wednesday for the Capital Region, Glens Falls Saratoga Region, eastern Greene and western Columbia Counties...

This mesoscale band has had incredible low-level convergence in the confluent corridor of the Mohawk and Hudson River Valleys, and was initially focused along and inverted sfc trough with coastal bomb east of Cape Cod at around 967 hPa. **It has now evolved into a more Mohawk Hudson Valley Convergent zone signature /documented in the CSTAR research/.** Snow rates an inch an hour over the next couple hours are possible, as good pcpn efficiency is expected. Elsewhere, upslope snows, and synoptic deformation snow will persist.

NEAR TERM...Wasula