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

Improving Analyses, Numerical Models, and Situational Awareness of High-Impact Severe Convective and Mixed-Phase Precipitation Events in Complex Terrain

University: University at Albany

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National Oceanic and Atmospheric Administration (NOAA) Award #: NA19NWS4680006

Date: 18 December 2020

1. SUMMARY OF STUDENT RESEARCH ACTIVITIES

a) Near-freezing winter precipitation type in complex terrain

Graduate student: Matthew Seymour
PI and co-PIs: Justin Minder, Nick Bassill, Robert Fovell, Andrea Lang
NWS focal points: Michael Evans (ALY) and Frank Nocera (BOX)

Research summary:

During the reporting period, Mr. Seymour continued progress towards his M.S. degree. In Fall 2020, he once again took a full course load consisting of a graduate course and research credits. He continued to conduct and analyze WRF simulations, radar, sounding, and New York State Mesonet (NYSM) datasets.

This reporting period, he mainly focused on a case study of the 6–7 February 2020 winter precipitation event. This case involved a snow-to-ice transition, then a difficult rain vs. freezing rain (FZRA) precipitation type (p-type) setup, followed by a change to snow before the event ended. Simulations of this event thus far included sensitivity experiments involving two suites: one altering the planetary boundary layer (PBL) schemes and another altering the microphysics (MP) schemes. Results of the PBL suite were presented at the NWA Annual Meeting on 15 September 2020. A more complete analysis of the PBL suite was presented at the New York State Mesonet Forum on 30 October 2020 and the Northeast Regional Operational Workshop on 4 November 2020.

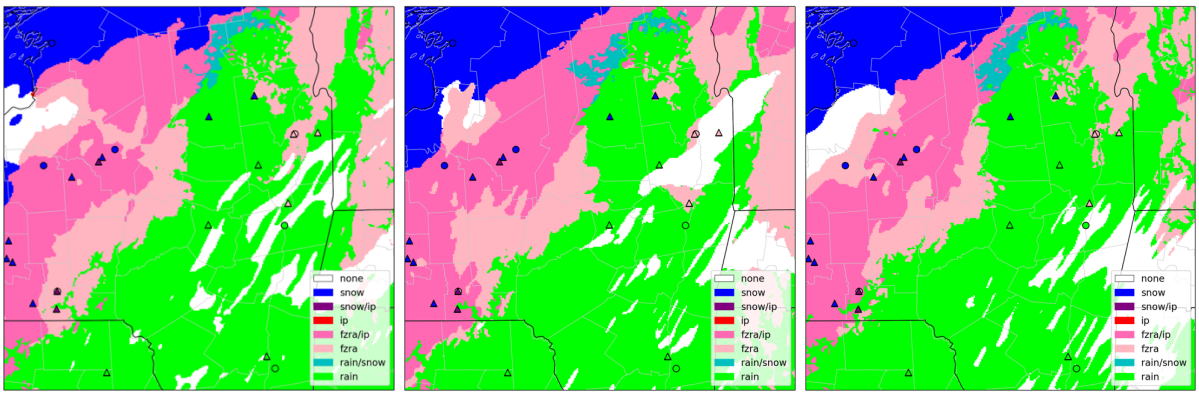

Figure 1: *Modeled p-type at 14 UTC 7 Feb 2020 for (left to right) MYNN, MYJ, and YSU PBL schemes. Circles indicate ASOS p-type, while triangles indicate crowd-sourced mPING p-type reports. Black lines represent state boundaries. Gray lines represent county boundaries.*

As shown in Figure 1, the case from 6–7 Feb 2020 featured a range of p-type errors. Over the western Mohawk Valley and central New York, a FZRA vs. snow error was noted, potentially indicating a quicker eastward progression of the rain/FZRA vs. snow line than modeled. Additionally, a rain vs. FZRA p-type error was noted in the upper Hudson Valley, just north of Albany, NY. So far, we have found this error to be mainly attributed to a model warm bias and wind direction bias, especially in the valley regions of eastern New York. Figure 2 provides an example of this at Albany, where the observed sounding indicates near-surface northerly winds, while the full suite of models portrays southerly winds in that same profile. Wind profiles measured by New York State Mesonet lidars reveal that this low-level wind bias is persistent and occurs during a time of particularly large positive temperature biases.

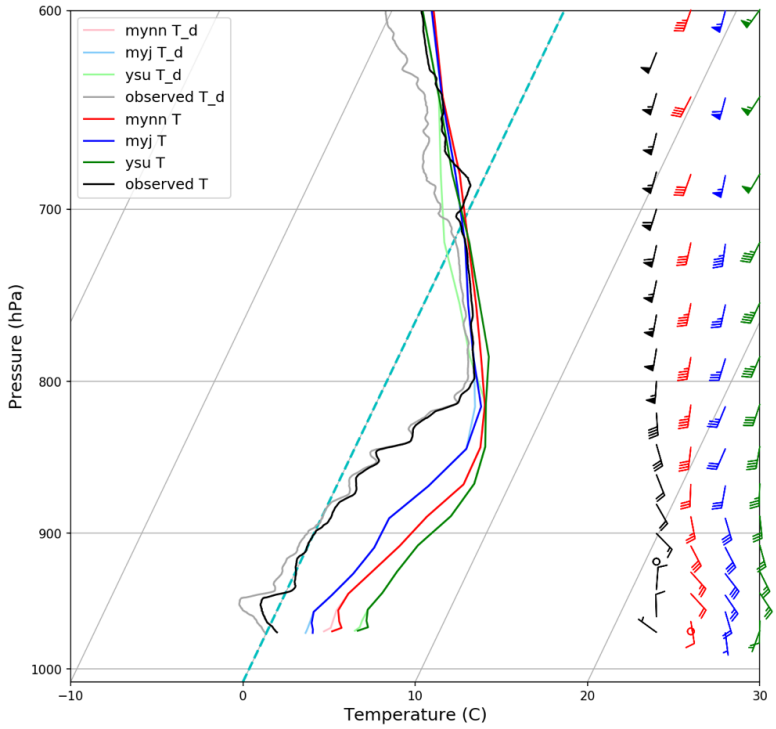

Figure 2: *Modeled and observed sounding at Albany, NY at 15 UTC 7 Feb 2020. Black lines/barbs indicate the observed sounding, while red/blue/green are from the MYNN/MYJ/YSU WRF simulations, respectively.*

Over the next six months, work will continue on this case; we will conduct initial and boundary condition (ICBC) experiments, as well as stochastic parameter perturbation (SPP) experiments. We will also run similar PBL, MP, ICBC, and SPP experiments on an additional one or two storms that involved inherently low precipitation type predictability. Results from these experiments will be presented at the next American Meteorological Society Weather Analysis and Forecasting/Numerical Weather Prediction (AMS WAF/NWP) Meeting (date TBD). Work on Mr. Seymour's master's thesis is tentatively planned to begin in May or June 2021, and conclude by August 2021.

NWS Interactions:

On 28 October, Mr. Seymour gave an update on his research progress at NWS Albany's Fall Meeting (virtually), which involved discussing the NWS's role in the project, as well as getting feedback on progress of the project so far and suggestions for future work.

b) Severe convection in complex terrain and across severe-weather environments

Graduate student: Brennan Stutsrim
PIs and co-PIs: Brian Tang and Robert Fovell
NWS focal points: Thomas Wasula (ALY) and Joe Dellicarpini (BOX)

Research summary:

Graduate student Brennan Stutsrim, co-PI Brian Tang, and co-PI Robert Fovell continued work on this portion of the CSTAR project. During this period, we have continued to focus, and expand, on examining environmental characteristics that are conducive for convective mode changes and back-building behavior. The goal of this investigation is to provide NWS forecasters with conceptual knowledge to better anticipate scenarios that might result in terrain-influenced, back-building convective events that result in heavy precipitation and potential flash flooding.

Brennan used the WRF model to simulate one such event on 21 August 2019, in which the convective mode changed from discrete to multicellular, as convection moved from the Catskill Mountains into the Hudson Valley. In the Hudson Valley, the convection back built, producing locally heavy rainfall and areas of flash flooding. These simulations were used to understand the mechanisms responsible for the back-building behavior observed in the Hudson Valley (see the previous six-month report for a summary of this simulation and findings). We then sought to identify more cases with qualitatively similar behavior.

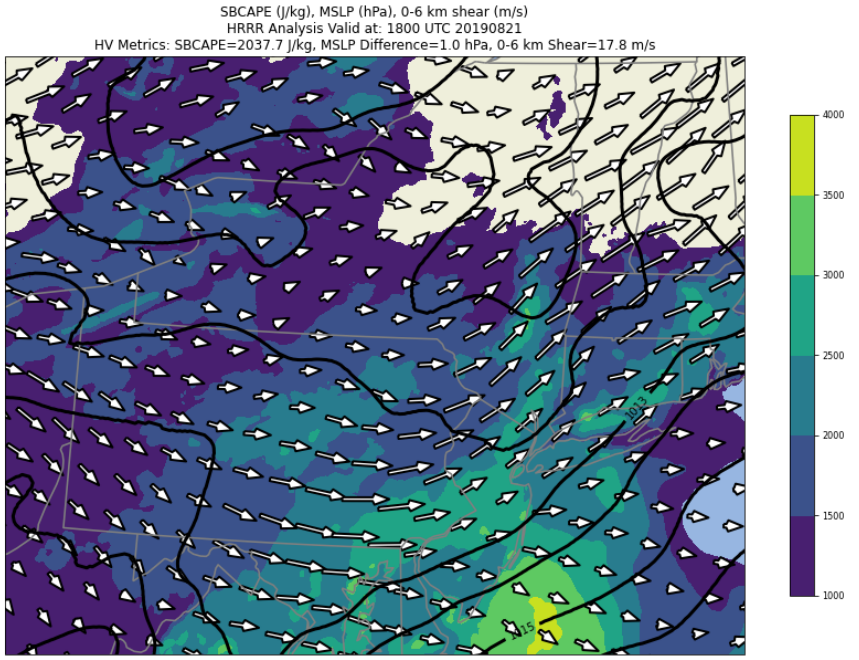

Figure 3: *Surface-based CAPE (shaded), MSLP (contoured) and 0–6-km vertical wind shear (vectors) at 1800 UTC 21 August 2019, from the HRRR analysis. There was locally higher CAPE and vertical wind shear within the Hudson Valley.*

In order to identify more cases, and then assess common characteristics of these cases, Brennan used archived NEXRAD radar and HRRR 1800 UTC analyses on each day in August, from 2016–2020. Using radar data, Brennan subjectively identified six cases that had convective mode changes and back-building behavior over this time period. Using the HRRR data, Brennan analyzed and calculated metrics that could be potentially important, motivated by the findings of the 21 August 2019 case. These metrics include the north-south mean sea level pressure (MSLP) difference in the Hudson Valley (from around Poughkeepsie to Albany), low-level wind velocity, convective available potential energy (CAPE), vertical wind shear, and water vapor mixing ratio. Maps of these variables were created for the identified cases (Fig. 3). Additionally, with the exception of the MSLP difference, these metrics were averaged in an area encompassing the Hudson Valley.

Brennan performed a statistical analysis of these valley-averaged metrics to evaluate two hypotheses. The first hypothesis is that back-building convection would most likely occur in environments with moderate-strong instability and weak-moderate vertical wind shear, under weak synoptic forcing. This type of environment allows terrain effects to have the most apparent influence on the mesoscale environment within the Hudson Valley to promote convective organization and back building within the Hudson Valley. The second hypothesis is that higher pressure in the lower Hudson Valley (and lower pressure in the upper Hudson Valley), combined with high surface moisture content, would result in increased southerly low-level water vapor flux

through terrain-channeled flow. This increased water vapor flux could feed back-building convection, as was found in the simulation of the 21 August 2019 case.

The initial results of this statistical analysis revealed some relevant patterns. We found that there was a strong relationship between the MSLP difference between the lower and upper Hudson Valley and southerly surface wind speed (Fig. 4). More interestingly, back-building events only occurred when the MSLP difference was $\gtrsim$ 1 hPa, promoting relatively strong southerly channeled flow ($\gtrsim$ 3 m s^{-1}). The average surface dew point in the Hudson Valley also tended to be higher when there were stronger southerly winds. Days with back-building convection had relatively high dew points ($\gtrsim$ 67°F) in the Hudson Valley compared to days with no back-building convection. Note that these thresholds may only be *necessary* conditions for back-building convection to occur.

Future work will continue the analysis of these events and metrics. Brennan also plans to extend the analysis to include events from June and July, and back to 2014, so that we can increase our sample size.

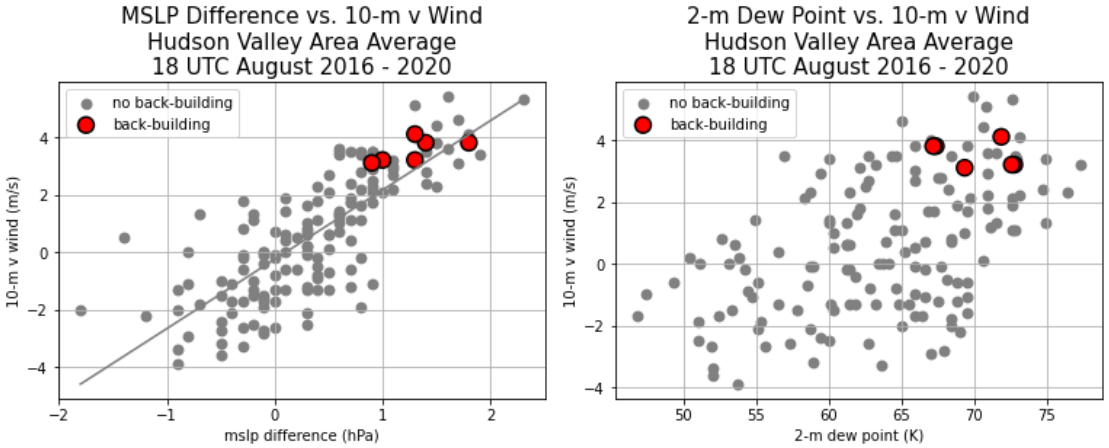

Figure 4. *Scatterplots of Hudson Valley area averages of MSLP difference versus 10-m meridional wind speed (left) and 2-m dew point temperature versus 10-m meridional wind speed (right) for all days in August 2016–2020. Non-back-building convection days are the smaller, gray dots, and back-building convection days are the larger, red dots.*

NWS Interactions:

Interactions occurred remotely due to the COVID-19 pandemic. Brennan emailed a research update and planned next steps to the NWS focal points in August 2020 to solicit their feedback. Tom Wasula and Joe Dellicarpini both suggested convective, heavy-rain events that Brennan could consider for this investigation. This interaction was helpful for expanding the geographic bounds to consider other events in the region that may have also had convective mode changes and back-building behavior. Brennan will meet with the NWS focal points in January 2021 to further discuss research plans.

c) Data fusion applications to assess forecast uncertainty and improve analyses

Graduate student: Brian Filipiak

PI and co-PIs: Kristen Corbosiero, Nick Bassill, Andrea Lang, and Ross Lazear

NWS focal points: Christina Speciale (ALY) and Neil Stuart (ALY)

Research summary:

In August 2020, graduate student Brian Filipiak began his work on this portion of the CSTAR project. Brian and Co-PIs Kristen Corbosiero, Nick Bassill, Andrea Lang, and Ross Lazear started discussing the goals and focuses of this project, and Brian began to conduct a literature review of applications utilizing the random forest machine learning algorithm to make probabilistic forecasts. He also met with NWS focal points, Christina Speciale and Neil Stuart, to begin identifying a case list of mixed precipitation events, as well as working to understand the needs of operational forecasters, which will end in developing the random forest. Based on suggestions from this meeting, Community Collaborative Rain, Hail and Snow Network (CoCoRaHs) data is being utilized to identify more cases to be used in conjunction with the NWS records (Figure 5). This will allow for smaller and more isolated events of mixed precipitation to be identified. The testing data for the random forest will be from the period of January 2017 to September 2020, corresponding with the New York State Mesonet being fully operational. Identifying as many cases as possible will improve the accuracy of the random forest.

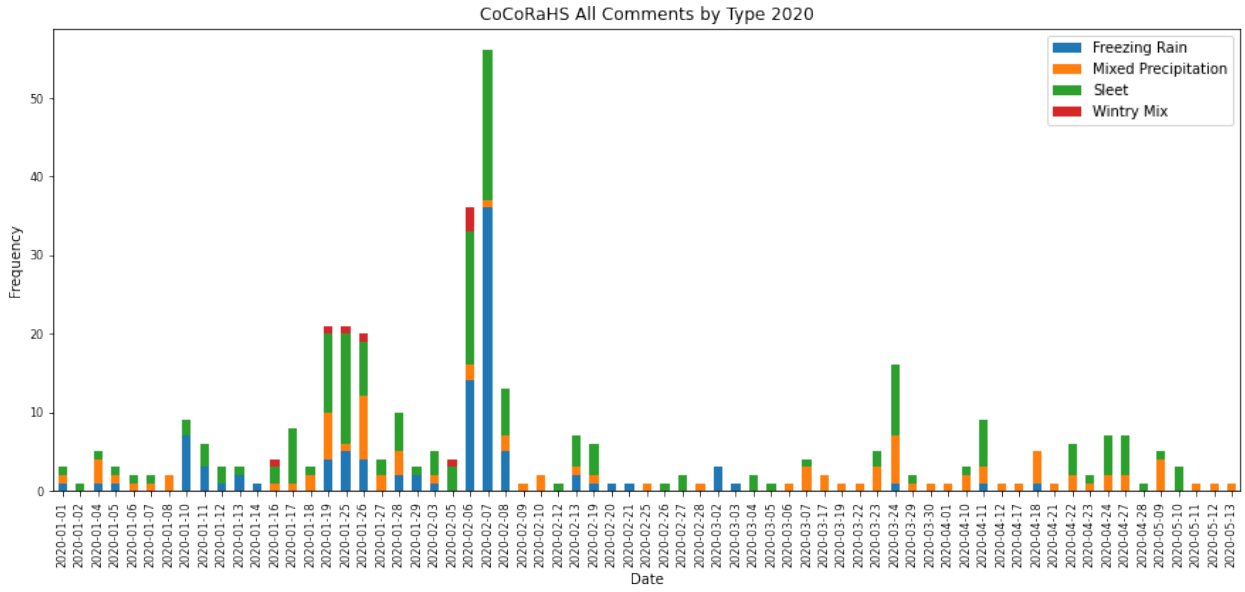

Figure 5: *CoCoRaHS comments mentioning freezing rain (blue), mixed precipitation (orange), sleet (green), and wintry mix (red) from 1 January to 13 May 2020.*

In the upcoming six months, Brian will continue to build upon his research. He will continue to identify and finalize a list of test cases for the random forest. Additionally, Brian is planning to learn more about building the random forest, including identifying data sources to be used for the project and how will they be incorporated into the random forest. Brian will continue to work with NWS focal points to make sure the research will be useful in operations.

2. CSTAR VII PROJECT THESES, PRESENTATIONS, AND PUBLICATIONS

(For a complete list of UAlbany–NWS Albany CSTAR project publications, please see *http://www.atmos.albany.edu/facstaff/kristen/CSTAR/CSTAR_CumulativePublications.pdf*.)

a) Theses completed

None

b) Presentations

Seymour, M., 2020: Sensitivity of forecast precipitation type to WRF parameterizations over complex terrain. *National Weather Association Annual Meeting*, 13–17 September, Tulsa, OK.

Seymour, M., 2020: Characterizing uncertainty in forecast precipitation type in eastern New York during the 6–7 Feb 2020 winter precipitation event. *New York State Mesonet Forum*, 30 October, Albany, NY. (Virtual)

Seymour, M., 2020: Sensitivity of forecast precipitation type to WRF parameterizations over complex terrain. *21st Annual Northeast Regional Operational Workshop*, 4–5 November, Albany, NY. (Virtual)

Stutsrim, B., 2020: Modeling convective mode changes in complex terrain in the Northeast U.S.. *21st Annual Northeast Regional Operational Workshop*, 4–5 November, Albany, NY. (Virtual)

c) Refereed publications

None

3. RESEARCH TO OPERATIONS

Updates to the Albany CSTAR Virtual Lab (VLab) community page are ongoing, with traffic to the page monitored using Google Analytics. Google Analytics shows that traffic to the page is higher in the cold season, perhaps owing to interest in recent cold season CSTAR project reference material, but also likely associated with major conferences like the Northeast Regional Operational Workshop (NROW) in November and the American Meteorological Society (AMS) Annual Meeting in January.

Agendas and preprints for NROW dating back to 2000 continue to be added to the VLab. Ross Lazear will be meeting with CSTAR students Matthew Seymour and Brennan Stutsrim along with their NWS focal points over the next six months to begin developing operationally relevant quick references of their major research results. As has been done with previous CSTAR research, these references will be linked to operations via the AWIPS Interactive Reference (AIR) tool.

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

The collaborative relationship between the NWS Albany and UAlbany remains strong, despite challenges associated with COVID-19. The collaboration associated with CSTAR VII continues to be one of the cornerstones of this relationship. From the NWS perspective, work on this and other projects with UAlbany remains critical for maintaining a strong culture of science-based forecasts, warnings and decision support at the Albany forecast office.

In regard to Major Project #1, Matt Seymour gave presentations updating his progress with the project titled "Uncertainty in near-freezing winter precipitation type in complex terrain" at the WFO Albany Winter Weather Workshop on 28 October and at the Northeast Regional Operational Workshop on 4 November. The presentations highlighted the performance of several different configurations of a high-resolution WRF model for a complex, mixed precipitation event that affected the Albany county warning on 6–7 February 2020. A low-level warm bias was noted for all configurations

There remain many forecast challenges associated with winter weather events associated with marginal, near freezing temperatures and the impacts of terrain on these types of events. We

have discussed some of these challenges with Matt. Some topics that could be explored related to the forecasting and modelling of these events include:

- Identifying and quantifying model errors and biases. Models are always changing but some problems with the models seem to persist, especially related to low-level temperature forecasts.
- Examining the utility of precipitation type algorithms and methods such as top down and Bourgouin.
- Evaluating the utility of blended and ensemble approaches for precipitation type forecasts, vs. single deterministic model approaches.
- Developing methods for identifying the potential for enhanced precipitation resulting in cooling and changes in precipitation type.
- Developing conceptual models for different types of topographic impacts: patterns associated with high elevation ice storms, large-elevation impacts on snow amounts ("elevation storms"), and patterns associated with "surprise" lower elevation heavy, wet snowstorms. Also, development of conceptual models for "front-end thump" storms associated with warm-air advection.

For Major Project #2, Brennan Stutsrim gave an update on his research with a talk at NROW XXI on the 4 November titled "Modeling convective mode changes in complex terrain in the Northeast U.S.". The presentation summarized modeling results from a case on 21 August 2019. Findings are: (1) Discrete convection moved into the Hudson River Valley, where it intensified and formed a cold pool; (2) channeled flow up the Hudson Valley increased low-level moisture flux upstream of the cold pool; (3) new cells formed into a squall line when high theta-e air was lifted over the gust front; (4) new cells formed along the squall line, reinforcing the cold pool with evaporatively cooled air; and, (5) the squall line produced localized maximum of precipitation with 1.8" in Saratoga County.

Brennan's current and future work is to address a few questions: (1) What combinations of environmental characteristics are conducive to this convective behavior?; and, (2) What threshold values would be useful for operational forecasters? He is compiling area averages of surface variables in the Hudson River Valley using HRRR analyses from August 2016–2020. He is making maps of severe weather indices using the HRRR analysis. He showed CAPE across eastern NY in the Hudson River Valley for the 21 August 2019 event. We have several cases to share from August 2020.

Tom, Joe, and Brennan exchanged several emails after a PowerPoint on his updated research was shared in mid-August. Brennan was looking for cases with any cell training resulting in localized flash flooding. He was looking for cases to compare to the 21 August 21 2019 case with similar synoptic features that do not result in the back-building and southward propagation. Joe shared a case from 28 June 2020 that resulted in over 4" of rain at his home in Norwood, MA. The outflow boundary from the thunderstorms that passed to the north focused training convection with significant urban flooding. Tom shared the Whitehall, NY flash flood case from 24 August 2020 where a COOP observer had 5.85" of rainfall from training cells, and also the 3 August 2018 case that featured back-building / training cells and flash flooding.

Tom put together a case study review of the "21 August 2019 Severe Weather and Tornado Event – Damage Assessment" for a Spring Emergency Managers Meeting on 3 June. Mike Evans gave the virtual presentation since Tom was on midnight shifts.

A major initiative for our office related to forecasts of severe convection continues to be the production of forecasts with enhanced temporal and spatial detail in short time ranges, from 0 to 6 h. The idea is to fill in the gap of forecast information available to our partners and the public during the time period between when watches are issued and when warnings are issued. Improvements in our ability to enhance these forecasts will result from an increased emphasis on meso-analysis as well as improvements in short-range, high-resolution modeling. One NWS-supported effort to improve high-resolution modeling of severe convection is the "Warn-on-Forecast" initiative, which is being developed at the National Severe Storms Lab. I see the work being done in this project as complementary to the broader NWS-supported Warn-on-Forecast initiative. Similar to the Warn-on-Forecast work, this project will focus on accurate, high-resolution modeling of short-term convective threats; this project, however, will concentrate on the modeling of events local to our area and, in particular, on the impact of our unique topography on the evolution of these events. Results from the modeling studies in this project should help us to develop some conceptual models on how our topography impacts the evolution of convection in our area, which will help us to produce more accurate short-term forecasts. In addition, access to output from model forecasts from the UAlbany system in real-time would also help us to produce more accurate forecasts and warnings.

Finally, for Major Project #3, NWS focal points Neil Stuart and Christina Speciale met with Brian Filipiak on 15 September to review plans for the project. The primary goal of the project will be to develop machine-learning based forecasts of probabilities of a variety of high-impact weather occurrences, based on the magnitude and patterns of several observational parameters. After the meeting, Neil and Christina supplied Brian with a long list of potential warm and cold season case studies associated with forecasting uncertainty. Our most recent, 7 October case may be added to the list.

Accurate predictions of high-impact weather in the short range requires that forecasters be well-versed in mesoscale analysis. A robust meso-analysis requires that forecasters have access to a wide-ranging suite of observational data and that forecasters understand which types of data are most important to evaluate in order to accurately assess high-impact weather potential. This project has the potential to help our operations by making a wide-range of observational data available to our forecasters. In addition, results from this study should help our forecasters learn which types of data are most important to evaluate, and how uncertainties in certain observational data sets could potentially translate into uncertainties in resulting weather outcomes and impacts. Ultimately, direct output from an application produced by UAlbany could help forecasters to not only assess which observational variables are most important, but to compare the values of those observed variables to values in models to help determine the likelihood of various model forecast outcomes. The result of this will be improved communication with weather-sensitive partners on the range of possible impacts that they may experience.

5. COLLABORATIVE AND ASSOCIATE PROJECTS *(Michael Evans and focal points)*

The eight collaborative projects associated with CSTAR VII are listed below, along with updates on progress from June through November 2020.

1. Improvement of tornado detection and lead time

Team lead: Joe Dellicarpini (BOX) and Christina Speciale (ALY)

Mike Evans and Christina Speciale evaluated QLCS tornado warning techniques identified by the NWS tornado warning improvement project for two tornadic QLCS events that occurred in the Albany county warning area during the spring of 2020. Based on this work, they developed a presentation for the NWS Warning Decision Training Division (WDTD) "Storm of the Month" titled, "Applying Concepts from the Tornado Warning Improvement Project for Quasi Linear Convective Systems to the Albany, NY County Warning Area". This presentation was made available virtually to all NWS forecasters with numerous attendees on 22 July. The presentation remains available on WDTD's public web site as a training resource for NWS and other meteorologists.

Mike Evans gave a presentation on applying tornado warning improvement project-based tornado diagnostic techniques to the 2 August tornadic severe weather event in western New England at NROW on 5 November.

WFO Albany has arranged for a Hollings Scholar to evaluate legacy and newer tornado diagnostic techniques during the summer of 2021. The student will start by evaluating events from the active 2020 season.

2. Warm season QPF challenges: identifying when model precipitation, areal coverage, location and maximum amounts will be skillful

Team lead: Justin Arnot (GYX)

Over the past six months, the research team has documented all warm season rain events (2015–2019) that resulted in a significant area (>=1000 square miles) of at least 1 in of rainfall. This compilation resulted in the finding of 137 events, of which 18 produced a significant area of 2 in or more of rainfall and two events produced over 3 in. Another group documented all National Weather Service flood headlines (Areal Flood Watch/Warning and Flash Flood Watch/Warning) that were issued during these warm seasons. Finally, a third group, in collaboration with SPC, accessed HREF data for all of the observed rainfall events and also retrieved data from the NCAR ensemble for the time period before the HREF became operational. This process was the most labor-intensive because of the extreme size of high-resolution ensemble data sets. We presented a summary of our results to date at the Northeast Regional Operational Workshop in November.

Now that the ensemble forecast information has been gathered, we are matching the ensemble forecast data with the observed events with our final task being to examine ensemble performance for these heavy rainfall events. We will examine fields including mean, max, and probability matched mean to determine the ability of the ensemble systems to provide forecasters with situational awareness as to the 1) occurrence, 2) location, and 3) magnitude of these events. Our goals include presenting additional results to forecasters in the spring with initial recommendations with a finalized set of forecaster tools/recommendations by the end of calendar year 2021.

3. Recent dual-polarization radar techniques to support severe weather operations

Team lead: Mike Jurewicz (CTP)

The main part of this project has been the evaluation of droplet size sorting magnitude and

orientation for tornadic vs. non-tornadic storms using data available from dual polarization radar. This work has been performed by Scott Loeffler and Matt Kumjian (at Penn State), and Mike Jurewicz at NWS State College. Since last spring, they have presented at an NWS multi-office severe weather webinar series conducted last April/May, the national NWA meeting in September, and NROW in November. They have also had several meetings with the National Weather Service's Tornado Warning Improvement Project (TWIP) team. The primary goal of the most recent meetings is to develop GR2 Analyst place files, as a first attempt to get objective visualization tools out to operations to help warning forecasters in real-time; this effort is ongoing. The group is also starting to hammer out a follow-up manuscript, which they will probably submit to WAF. This paper will be operationally focused, with a number of case studies included.

Other work related to dual-polarization techniques has included hosting a Hollings Scholar last summer from Oklahoma University, to work on downburst identification and associated techniques. Some of her results were complementary to recent work on Kdp columns and downbursts done by Brian Frugis (NWS Albany). These results have yet to be organized in a cohesive manner.

4. Using GLM lightning data in operations for severe weather forecasting and enhanced DSS

Team leads: Jared Klein (BGM) and Mike Jurewicz (CTP)

There has not been any significant progress on this project during the past 6 months.

5. Using GAZPACHO to verify high-resolution model snowfall forecasts from 2017–2019

Team leads: Joe Villani and Mike Evans (ALY)

Twelve snowfall events from the 2019–2020 winter season were evaluated using GAZPACHO software, which creates datasets of observed and forecast snowfall. NDFD, HRRR, and NAM Nest forecast snowfall was verified vs. observations for each event, based on a comparison of positive snow depth change vs. observed snowfall. A UAlbany student was utilized to calculate environmental parameters for each of these events.

A paper has been started that details this work. Once results are finalized, the paper will be submitted to the Scientific Services Division of the NWS ER, and then potentially submitted to a meteorological journal.

The final goal of this project will be to improve forecasts of topographic influence on snowfall. We will create error maps stratified by environmental parameter using GAZPACHO and ArcGIS for the 37 combined events from the 2017–2018, 2018–2019, and 2019–2020 winter seasons. Forecasters will use these maps to evaluate and potentially improve high-resolution model snowfall forecasts.

6. Examination of significant hail events: expand the project across the Northeast U.S.

Team lead: Tom Wasula (ALY)

Tom continued to work on the significant hail climatologies for New York (NY) and adjacent New England States, using the NCEI Storm Data database from 1950 to August 2020. Tom updated the climatologies for NY (132 reports), Massachusetts (43 reports), and Vermont (22 reports) from NCEI that were started in 2019. In November, Tom added Maine (34 reports), New Hampshire (15 reports), Rhode Island (2 reports), and Connecticut

(15 reports). Environmental data (i.e., CAPE, shear, lapse rates, etc.) are being added to the database. This analysis will involve observational soundings, and perhaps some model-based proximity soundings, as well as reanalysis data.

Tom gave a virtual oral presentation at NROW XXI on 4 November titled, "A Multi-Scale Analysis of the 29 August 2020 Tornadic Event across Eastern New York". The talk included application of the local V-R Shear and normalized rotation (Nrot) studies performed previously by Brian Frugis and Tom Wasula.

7. The role of the strength of large-scale low-level forcing on severe weather event magnitudes

Team leads: Neil Stuart (ALY) and Joe Cebulko (National Water Center)

The role of large-scale, low-level forcing on severe weather event magnitude is being evaluated as part of a COMET partners project with the New York State Mesonet. The strength of low-level forcing is being evaluated by looking at diagnostics of equivalent potential temperature gradients using data from the New York State Mesonet. An undergraduate student from UAlbany is working with Nick Bassill and Neil Stuart to develop and evaluate products that will be produced in real-time by the Mesonet and made available to NWS forecasters and other meteorologists.

8. Use of collapsing specific differential phase columns to predict significant severe thunderstorm wind damage across the Northeast United States

Team lead: Joe Cebulko (National Water Center)

Joe Cebulko has taken a position with the NWS Water Center and, as a result, this project will not be completed.

6. CSTAR PROJECT RESEARCH IN NWS AFDs

Tuesday 9 June 2020

CSTAR research on Northeast U.S. flash-flooding regimes was cited in the long-term section of the NWS ALY AFD.

FXUS61 KALY 100943
AFDALY

AREA FORECAST DISCUSSION
National Weather Service Albany NY
543 AM EDT Wed Jun 10 2020

.LONG TERM /SATURDAY THROUGH TUESDAY/...
A look at the global guidance and their associated dprog/dt analysis continue to suggest a blocking high across the north-central Atlantic Ocean with another ridge across either the Ohio Valley or western Great Lakes. This leaves the southern piece of the departing trough to linger/cut-off and keep a rather unsettled weather pattern across our region with variable cloud coverage and the threat for period of wet weather through early next week.

This pattern recognition looks somewhat similar to CSTAR work on flood/flash flood cases across the northeast. However, based on current instability parameters and surface dewpoints at or below 60F, seems values may fall short with respect to CAPE and the position of the upper jet to be further displaced from the region. Nevertheless, with light east-southeast steering flow expected with long moisture entrainment from the Atlantic, it is a none-zero probability that we could have some hydro-related issues through the long term.

LONG TERM...BGM

Saturday 1 August 2020

CSTAR research on predecessor rain events (PREs) was cited in the long-term section of the NWS ALY AFD.

FXUS61 KALY 010838
AFDALY

AREA FORECAST DISCUSSION
National Weather Service Albany NY
438 AM EDT Sat Aug 1 2020

.LONG TERM /MONDAY NIGHT THROUGH FRIDAY/...
The official NHC forecast has the storm making its closest approach by Tuesday evening in the vicinity of Long Island as a Tropical Storm. There is some guidance, such as the operational ECMWF, that continues to be about 12 hours slower than this. **But there is potential for rain in the local forecast area as early as Monday night. This setup has some characteristics of a Predecessor Rainfall Event (PRE) per CSTAR research, particularly the Southwest Jet conceptual model.** Some of these characteristics depicted by deterministic model guidance include poleward advection of moisture (PWATs increasing to 1.5-2.0 inches) downstream of the TC impinging upon a low-level boundary, and ascent being enhanced by the right entrance region of a southwesterly upper-level jet. There is enough confidence for likely to categorical PoPs Monday night into Tuesday morning with this setup.

LONG TERM...Thompson

Saturday 1 August 2020

CSTAR research on predecessor rain events (PREs) was cited in the short-term section of the NWS ALY AFD.

FXUS61 KALY 012014
AFDALY

AREA FORECAST DISCUSSION
National Weather Service Albany NY
414 PM EDT Sat Aug 1 2020

.SHORT TERM /6 AM SUNDAY MORNING THROUGH MONDAY NIGHT/...
Monday into Monday night...Relatively drier day Monday behind the cold front, however, can not rule out an isolated shower along with any differential heating boundaries. Sfc dewpts briefly lower into the upper 50s to mid 60s across the region. Max temps will be slightly above normal with lower to upper 80s in the valleys, and 70s to lower 80s over the higher terrain. Then as the upper trough across the Great Lakes approaches, upstream mid level jet magnitudes increase for increasing diffluence across the mid-Atlantic to the northeast overnight ahead of the tropical storm. **Seems the onset of a pre-event (CSTAR research) may unfold as we will increase PoPs from south to north overnight.** As Showalter values drop to below zero, we will continue with slight chance for thunder and could be some heavy rainfall potential. Lows generally into the 60s.

SHORT TERM...BGM/Wasula

Monday 3 August 2020

CSTAR research on predecessor rain events (PREs) was cited in the short-term section of the NWS ALY AFD.

FXUS61 KALY 030759
AFDALY

AREA FORECAST DISCUSSION
National Weather Service Albany NY
359 AM EDT Mon Aug 3 2020

.SHORT TERM /6 PM THIS EVENING THROUGH WEDNESDAY/...
Deep layer moisture will continue to gradually increase Monday night into Tuesday morning ahead of the storm, with PWATs forecast to reach 1.50-1.75 inches. **The pattern during this time period has been somewhat reminiscent of a southwesterly jet Predecessor Rainfall Event (PRE) per CSTAR research, where tropical moisture is advected poleward of the TC and interacts with ascent in the right entrance region of the upper level jet.** However, it appears to be lacking a well-defined low level boundary. So generally showers and isolated thunderstorms will increase in coverage through the night Monday night into Tuesday morning, but likely without much of a flood threat yet. Highs Tuesday may finally fail to reach 80 degrees over most of the area with clouds and showers around.

SHORT TERM...Thompson

Monday 6 October 2020

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

FXUS61 KALY 061930
AFDALY

AREA FORECAST DISCUSSION
National Weather Service Albany NY
330 PM EDT Tue Oct 6 2020

.SHORT TERM /WEDNESDAY THROUGH THURSDAY NIGHT/...
Even in the absence of convective cells, deep mixing along/behind the front into a layer of ~50 kt winds, along with strong cold advection promoting downward momentum transport, will support a strong synoptic wind threat. **Cross section analysis shows potential temperature decreasing with height along with a dry air intrusion at 700-500 mb, both of which have been shown by CSTAR research to enhance downward momentum transport, especially in the presence of convection.** Leafed-out trees will present more of a tree-fall hazard compared with a similar event in the winter. Some limiting factors to a more widespread/greater magnitude high wind event are potential for clouds to inhibit mixing depths behind the front over the high terrain, somewhat limited time behind the frontal boundary for diurnal heating to deepen the boundary layer, and weak convergence along the cold front. Advisory segmented in two to better delineate the wind threat along/behind the front.

SHORT TERM...Thompson