# Partners Project Title Page
# Proposal for a Partners Project

Title: Verifying the Three-Ingredients Method for Nowcasting QLCS Tornadoes

Date: 8/12/20; Expected Project Dates: 10/1/20 – 9/30/21

Signatures for University
University Name: University of Louisiana Monroe
Address: 700 University Ave
Monroe, LA 71209

Principal Investigator
Name (typed): Dr. Todd Murphy
Telephone number: 318.342.3428
FAX number: N/A
Address: 700 University Ave
Monroe, LA 71209; Hanna Hall 324
Email: murphy@ulm.edu

University Official (usually dept. chair)
Name (typed): Dr. Anne Case Hanks
Title: Director, School of Sciences
Telephone number: 318.342.1822
FAX number: N/A

University Official (contract sent to)
Name (typed): Dr. Alberto Ruiz
Title: VP for Academic Affairs
Address: 700 University Ave
Monroe, LA 71209; Sandel Hall 213
Telephone number: 318.342.1039
FAX number: 318.342.1479
Email: ospr@ulm.edu

Signatures for NWS
NWS Office: Shreveport, LA
Address: 5655 Hollywood Ave
Shreveport, LA 71109

8/18/2020

Principal Investigator
Name (typed): Mr. Brad Bryant
Telephone number: 318.636.3669 ext. 224
FAX number: 318.636.9620
Email: brad.bryant@noaa.gov

8/18/2020

MIC/HIC
Name (typed): Mr. Mario Valverde
Telephone number: 318.636.3669 ext. 222
FAX number: 318.636.9620

Gregory Patrick Date: 2020.08.25 08:09:12 -05'00'

SSD Chief
Name (typed): Greg Patrick

COOPER.STEVEN.G.1365850930 Digitally signed by COOPER.STEVEN.G.1365850930 Date: 2020.08.25 13:45:52 -05'00'

Regional Director
Name (typed): Steven Cooper

SUMMARY OF BUDGET REQUEST:

COMET FUNDS: Year 1 $14,971

NWS FUNDS: FY 1 $4,450 FY 2 $0

**Verifying the Three-Ingredients Method for Nowcasting QLCS Tornadoes**

PI: Dr. Todd A. Murphy, University of Louisiana Monroe (ULM)
PI: Mr. Brad Bryant, National Weather Service (NWS) Shreveport
Outside Collaborator: Mr. Ryan Wade, University of Alabama in Huntsville (UAH)

## Project Summary

The Southeastern United States (hereafter abbreviated "SE") represents a geographic maximum in tornado frequency that may locally approach the well-known maximum in the U.S. Great Plains. A significant fraction of these tornadoes are produced by quasi-linear convective systems (QLCSs). However, QLCS tornadoes tend to have much worse tornado warning skill scores compared to supercellular tornadoes, due in part to these tornadoes often being shorter lived and weaker, and not fully understanding the QLCS tornadogenesis process. Understanding the tornadic environment and tornadoes in this region is critical to improve tornado warning performance and thus advancing the NWS mission of protecting life and property.

Refined understanding of QLCS tornadoes, and specifically the nowcasting of these tornadoes, offers one of the best opportunities to strengthen the NWS tornado warning program. Leveraging and expanding upon existing collaborations between NWS-Shreveport, ULM, and other outside collaborators, this study seeks to better understand how NWS meteorologists forecast and nowcast tornadic QLCSs. To advance our understanding, we propose to statistically evaluate a technique commonly used to nowcast QLCS tornadoes called the "three-ingredients method". We also plan to compare this technique to other commonly used tornado forecasting/nowcasting parameters to identify opportunities to further enhance nowcasting QLCS tornadoes.

The outcomes of the proposed project will include results that have the potential to improve NWS warning performance of tornadic QLCSs. The project will also strengthen collaborative ties between NWS Weather Forecast Office (WFO) Shreveport and the ULM Atmospheric Science program. Such relationships between academia and WFOs have shown time and again to yield results which advance the NWS mission, leading to a more Weather Ready Nation. Finally, the project will engage a ULM undergraduate student in an authentic research experience, with both university and NWS project personnel providing mentorship and training.

## 1. PROJECT OBJECTIVES

The three-ingredients method (TIM) for anticipating QLCS mesovortex potential, originally developed by Schaumann and Przybylinski (2012), is commonly used in the NWS to improve nowcasting performance in QLCS tornado events and is included as part of forecaster training (e.g., Guseman et al. 2017; Williams et al. 2018; NWS Central Region 2020; Warning Decision Training Division 2020). The TIM includes an environmental and radar analysis to identify:

1. QLCS regions where the cold pool and ambient low-level wind shear are nearly balanced or slightly shear dominant,
2. QLCS regions where the 0-3 km line-normal bulk shear magnitudes are $\geq 15$ m $s^{-1}$ (30 kts), and
3. surges or bowing line segments due to a rear-inflow jet (RIJ) or local outflow enhancements.

When all three ingredients are co-located in a QLCS, there is an increased chance for mesovortexgenesis, which has been linked to tornado potential (Funk et al. 1999; Weisman and Trapp 2003a,b; Wheatley and Trapp 2008; Atkins and Laurent 2009a,b; Schenkman et al. 2012). Additionally, the NWS Central Region's "Tornado Warning Improvement Project" has identified a set of "confidence builders" and "nudgers" to be used when the three-ingredients are met, which may further increase tornado warning confidence (NWS Central Region 2020). However, *this technique has never been statistically evaluated by peer review across a large dataset of both non-tornadic and tornadic QLCSs.* Additionally, discussions with NWS forecasters at some southeast offices indicate uncertainty in the robustness of this technique for evaluating tornado potential, including anecdotal observations of no change in QLCS tornado warning false-alarm rate (FAR) or probability of detection (POD) for events when the TIM was used versus events when it was not used.

During a Summer 2020 Research Experiences for Undergraduates (REU) project at UAH, ULM student Jacob Zeringue developed a database of approximately 200 QLCS cases across the SE US. These cases were primarily for QLCSs in environments supportive of tornadoes based on Storm Prediction Center (SPC) Convective Outlooks and tornado watches. Approximately half of the QLCSs in this database produced tornadoes. Using this database, we propose to *statistically quantify* the effectiveness of the TIM for evaluating QLCS tornado potential. Both tornadic and non-tornadic QLCS events will be included for hypothesis testing. To simulate similar QLCS interrogation used in NWS WFOs, focus will be given to datasets forecasters commonly use during nowcasting and short-range forecasting: local environmental observations, high-resolution convective allowing model guidance (e.g., RUC/RAP and HRRR), and the SPC Mesoanalysis products. The project will use freely available datasets, such as those provided by the National Centers for Environmental Information (NCEI). Additional free datasets may come from the University of Utah's HRRR archive

(http://home.chpc.utah.edu/~u0553130/Brian_Blaylock/hrrr_FAQ.html) and the Iowa Environmental Mesonet (IEM) data archive (https://mesonet.agron.iastate.edu/). The interrogation method outlined in NWS training will be followed:

1. Determine the shear/cold pool balance by first finding the location of the updraft-downdraft convergence zone (UDCZ; Fig. 1a). The UDCZ is located using Doppler radar products at the lowest elevation angle (e.g., reflectivity, velocity, and spectrum width). The UDCZ is typically coincident with the gust front. The UDCZ is then compared to radar identified updraft towers:
    a. if the UDCZ is out ahead of updraft towers, then the QLCS is cold pool dominant,
    b. if the UDCZ is within/near updraft towers, then the QLCS is balanced, or
    c. if the UDCZ is behind updraft towers, then the QLCS is shear dominant.
2. Calculate the 0-3 km line normal bulk shear (Fig. 1b) by first obtaining or estimating the 0-3 km bulk shear ahead of the QLCS using model data, SPC Mesoanalysis data, upper-air data, and/or radar velocity azimuth display (VAD) wind profile (VWP) data. Determine the approximate direction the QLCS is moving and calculate the component of the 0-3 km bulk shear that is perpendicular to QLCS motion.
3. Examine Doppler radar products for surges or bowing segments in the QLCS (Fig. 1c).

Cases will be binned using the following guidelines: (1) tornadic or non-tornadic, (2) 0-3 km line-normal bulk shear $\geq$ 30 kts or $<$ 30 kts, (3) cold-pool dominant, balanced, or shear dominant, (4) radar identifiable surges/bowing segments (yes or no), and (5) all three ingredients met (yes or no). We will further evaluate if the confidence builders and nudgers identified by NWS Central Region are present, and if specific confidence builders/nudgers should be given more weight during nowcasting. Finally, we will evaluate the threshold magnitude of the 0-3 km line-normal bulk shear, while also comparing these results to other commonly used tornado parameters (e.g., 0-1 km shear magnitude, 0-1 km storm-relative helicity adjusted for line segment storm motion, low-level lapse rates, and low-level instability).

This analysis will allow an evaluation to determine if other parameter relationships are as or more important than the TIM for examining QLCS tornado potential. The statistical analysis will also be compared to event specific tornado warning FAR and POD to determine how the TIM affects warning performance. Parameter relationships will be provided to NWS forecasters for testing in the operational environment, and feedback will be used for further statistical testing. We believe this iterative process between researchers and operational forecasters is the key toward making real advances in the QLCS tornado forecasting and warning problems. NWS WFO Shreveport's Weather Event Simulator (WES) will be utilized to determine if the revised nowcasting relationships lead to improvements in tornado warning FAR and POD for past cases.

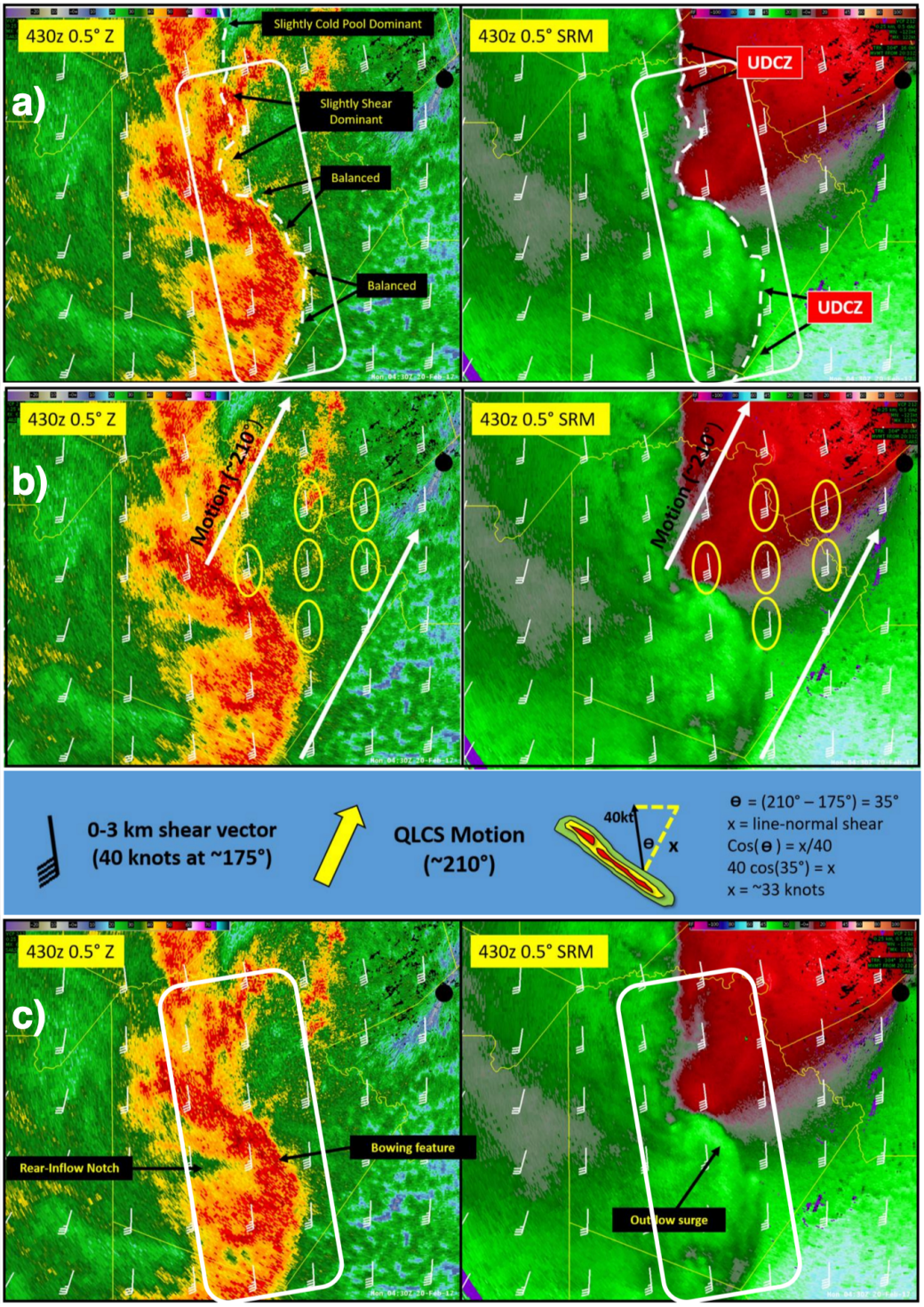


***Figure 1:*** *An example of the TIM interrogation method adapted from Williams et al. 2018: (a) locating the UDCZ to determine cold pool-shear balance; (b) determining 0-3 km line-normal bulk shear for line segments nearly balanced; (c) examining for bowing segments in radar reflectivity or outflow surges in Doppler velocity.*

In total, this project aims to develop best practice guidelines for the interrogation method(s) that yield the best warning performance in fast evolving QLCS tornado events. While this work will initially be completed for QLCSs just within the SE US region, we hope to be able to expand the dataset in the future. However, we expect the results would be applicable to all NWS WFOs which experience QLCS tornadoes.

## 2. PROJECT TASKS & TIMELINE

Listed below are descriptions of specific tasks (T) and deliverables (D) that we propose to accomplish during the 1-year grant period. Furthermore, a timeline for the proposed tasks and deliverables are summarized in Table 1. Contributions are listed as: ULM (PI Murphy and/or undergraduate student Jacob Zeringue) and NWS (PI Bryant and/or NWS Shreveport forecaster Matt Hemingway).

***Table 1****: Proposed schedule of activities to be completed during the grant period.*

| **Year** | **I** | | | |
|---|---|---|---|---|
| **Quarter** | **1** | **2** | **3** | **4** |
| T1 | **NWS** | | | |
| T2 | **ULM** | **ULM** | **ULM** | |
| T3 | **NWS** | **NWS** | **NWS** | |
| T4 | | | **NWS** | **NWS** |
| T5 | **ULM, NWS** | **ULM, NWS** | **ULM, NWS** | **ULM, NWS** |
| D1 | | | | **ULM, NWS** |
| D2 | | | | **ULM, NWS** |

***T1:*** Aggregate local NWS Shreveport knowledge on commonly used forecasting & nowcasting patterns and parameters for tornadic QLCSs; share with ULM researchers to be incorporated into TIM evaluation.

***T2:*** Evaluate the TIM (including confidence builders and nudgers) using the previously developed SE US QLCS dataset. Integrate other parameters and local NWS Shreveport knowledge to determine the best method for nowcasting QLCS tornadoes.

***T3:*** Determine event specific tornado warning FAR and POD. Evaluate possible changes to FAR/POD by incorporating findings into event re-analysis using NWS Shreveport's WES.

***T4:*** NWS Shreveport incorporates preliminary project findings into warning operations.

***T5:*** Hold regular conference calls or digital meetings to discuss project direction and results.

***D1:*** Present project results at a national conference (e.g., NWA annual meeting).

***D2:*** Submit project results as an article to NWA's Journal of Operational Meteorology.

## 3. KEY CONTRIBUTIONS

**University Contributions:** Dr. Murphy and an undergraduate researcher, Mr. Jacob Zeringue, will contribute effort to this project on the tasks outlined above. Dr. Murphy will donate approximately 10% of his time for the project duration. In addition to the tasks above, Dr. Murphy will provide project guidance, coordination between all personnel, and mentorship to Mr. Zeringue. Mr. Zeringue will work approximately 20 hrs/week for the project duration. Additionally, Mr. Ryan Wade from UAH will serve as an outside faculty collaborator on this project at no additional cost. Mr. Wade served as Mr. Zeringue's co-mentor during the summer REU, so he is intimately familiar with the QLCS dataset. Mr. Wade will ensure Jacob maintains access to any datasets created during the summer REU and stored on UAH computing facilities, while also providing further mentorship and project guidance.

**NWS Contributions:** Mr. Brad Bryant and Matt Hemingway will primarily contribute effort to this project on the tasks outlined above. Other NWS Shreveport forecasters may also provide input and more limited assistance at times. NWS Shreveport will provide computing facilities, including use of their WES machine, to support the project. They will also help to mentor Mr. Zeringue during the project.

Due to near-term uncertainty surrounding COVID-19 related travel, project meetings will be held digitally using Google Meet. All project personnel will meet at least once a week to discuss project status, share findings, and discuss next steps.

## 4. PRINCIPAL INVESTIGATORS

**ULM PI:** Dr. Todd Murphy is an associate professor of atmospheric science at ULM. Dr. Murphy also currently serves as the ULM atmospheric science program coordinator, and faculty advisor to the ULM student AMS chapter. He has extensive experience with meso- and storm-scale analysis using radar and other in-situ instrumentation, and is actively involved in NOAA's VORTEX-SE research program. Dr. Murphy is the lead science PI for ULM's S-band polarimetric Doppler weather radar, and a new integrated mobile instrument platform that includes a Doppler wind lidar.

He is well published in AMS and NWA journals and has presented at numerous conferences. Dr. Murphy is actively involved in promoting undergraduate research, having mentored 30 students on authentic research projects, and supervising > 50 students for funded field work.

**NWS Shreveport PI:** Mr. Brad Bryant is the Science and Operations Officer (SOO) at NWS Shreveport. He has 17 years' experience in meso- and storm-scale analysis in NWS convective warning operations in the Lower Mississippi Valley region (working at both NWS Jackson, MS, and NWS Shreveport). He has presented at numerous conferences in his NWS career, including locally, regionally, and nationally, and has gained considerable expertise in severe weather climatology and convective warning philosophy in "Dixie Alley". As Science and Operations Officer, he is responsible for making sure the ~15 meteorologists at NWS Shreveport are trained to make use of the latest scientific, technological, and operational advancements in the fulfillment of mission-critical warning operations. He also has a working relationship with the ULM Atmospheric Science program and has mentored many students in this program, both at NWS Shreveport and NWS Jackson.

## 5. BUDGET REQUEST

### University Personnel + Fringe Benefits

Dr. Todd Murphy will serve as the university PI on this project. He is committed for approximately 10% of his time, which he will donate to the project. Mr. Jacob Zeringue will serve as an undergraduate student researcher on this project. He will devote 20 hours/week for 31 weeks to the project at $12.00/hr. Fringe benefits are not charged on student support. The total request for university personnel is $7,440.

### NWS Personnel

Mr. Brad Bryant will serve as the NWS PI on this project and Mr. Matt Hemingway will also contribute to the project. They are both committed for approximately 5% of their time, or ~160 combined total hours.

### Travel

ULM requests $3,178 for domestic travel costs related to presenting results on project activities at a scientific conference. The 2021 National Weather Association's annual meeting in Tulsa, OK will be targeted. State of Louisiana travel guidelines for out-of-state, domestic travel are followed. These funds will allow both Dr. Murphy and Mr. Zeringue to participate. Travel costs are itemized below.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| DESTINATION: | | Tulsa, OK (2021 NWA Annual Meeting) | | | | | LENGTH OF TRIP: | | 5 | Days | |
| | | | | | | | | | | | |
| PURPOSE: | | Conference Presentation | | | | | NUMBER OF TRAVELERS: | | 2 | | |
| | | | | | | | | | | | |
| NUMBER OF TRIPS: | 1 | per year | | | | | | | | | |
| | | Hotel | | $ 150 | /Night x | 4 | | | | | $ 600 |
| | | Per Diem | | $ 61 | /Day x | 5 | | | | | $ 305 |
| | | Rental Car | | $ 150 | | | | | | | $ 150 |
| | | Fuel / Parking | | $ 200 | | | | | | | $ 200 |
| | | Conference Registration | | $ 334 | | | | | | | $ 334 |
| | | | | | | | | Subtotal Per Person: | | | $ 1,589 |
| | | | | | | | **Total Per Trip (1 trip x 2 travelers):** | | | | **$ 3,178** |

Similarly, NWS Shreveport requests $4,000 for domestic travel costs related to traveling to the 2021 NWA meeting. These funds will allow both Mr. Bryant and Hemingway participate.

**Other Direct Costs**

NWS Shreveport requests $450 to cover page charges associated with publishing project results in the NWA Journal of Operational Meteorology.

**Indirect Costs**

ULM requests indirect charges totaling $4,353 at the predetermined rate of 41% for the project. Indirect costs are charged on the university personnel and ULM's travel costs ($10,618) and not on the NWS requests. ULM's Facilities & Administrative (indirect) costs are calculated according to ULM's current negotiated rate agreement with the Federal government. The Department of Health and Human Services is ULM's cognizant federal agency. A copy of ULM's approved rate agreement is attached.

## 6. REFERENCES


Atkins, N. T., and M. S. Laurent, 2009a: Bow Echo Mesovortices. Part I: Processes That Influence Their Damaging Potential. *Mon. Wea. Rev.*, **137**, 1497–1513.

Atkins, N. T. and M. St. Laurent, 2009b: Bow Echo Mesovortices. Part II: Their Genesis. *Mon. Wea. Rev.*, **137**, 1514– 1532.

Funk, T.W., K.E. Darmofal, J.D. Kirkpatrick, V. L. Dewald, R. W. Przybylinski, G. K. Schmocker, and Y.-J Lin, 1999: Storm reflectivity and mesocyclone evolution associated with the 15 April 1994 squall line over Kentucky and southern Indiana. *Wea. Forecasting*, **14**, 976-–-993.

Guseman, J.C., B.T. Goudeau, and E.C. Ray, 2017: Quasi-Linear Convective System (QLCS) and Non-Supercell (Landspout) Tornadoes Across Eastern Kentucky. *3rd Midwest Bowecho Workshop*, St. Louis, MO, Saint Louis University.

NWS Central Region, 2020: *QLCS Mesovortex Warning System Reference Sheets*, https://www.weather.gov/media/lsx/QLCS%20Reference%20Sheets.pdf.

Schaumann, J. S., and R. W. Przybylinski, 2012: Operational Application of 0-3 km Bulk Shear Vectors in Assessing QLCS Mesovortex and Tornado Potential. Preprints, *26th Conf. on Severe Local Storms*, Nashville, TN, Amer. Meteor. Soc., 9.10.

Schenkman, A. D., M. Zue, and A. Shapiro, 2012: Tornadogenesis in a Simulated Mesovortex within a Mesoscale Convective System. *J. Atmos. Sci.*, **69**, 3372–3390.

Warning Decision Training Division, 2020: *Three Ingredients Method*, https://training.weather.gov/wdtd/courses/woc/documentation/severe/three-ingredients-timebudget.pdf

Weisman, M. L., and R. J. Trapp, 2003a: Low level vortices within squall line and Bow Echoes: Part I. Overview and dependence on environmental shear. *Mon. Wea. Rev.*, **131**, 2804-2823.

Weisman, M. L., and R. J. Trapp, 2003b: Low level vortices within squall line and Bow Echoes: Part II. Their genesis and implications. *Mon. Wea. Rev.*, **131**, 2804-2823.

Wheatley, D. M., and R. J. Trapp, 2008: The Effect of Mesoscale Heterogeneity on the Genesis and Structure of Mesovortices within Quasi-Linear Convective Systems. *Mon. Wea. Rev.*, **136**, 4220–4241.

Williams, B.M, J.S. Allen, and J.W. Zeitler, 2018: Anticipating QLCS Tornadogenesis: The Three-Ingredient Method during the 19-20 February 2017 South-Central Texas Tornadic QLCS Event. *98th American Meteorological Society Annual Meeting*, Austin, TX, Amer. Meteor. Soc. P375.

# Project Budget Page

| | COMET Funds | NWS Contributions |
|---|---|---|
| **University Senior Personnel** | | |
| 1. Dr. Todd Murphy, faculty PI | **$0** | **NA** |
| 2. | | **NA** |
| | | |
| **Other University Personnel** | | |
| 1. Mr. Jacob Zeringue, student researcher | **$7,440** | **NA** |
| 2. | | **NA** |
| | | |
| **Fringe Benefits on University Personnel** | **$0** | **NA** |
| | | |
| **Total Salaries + Fringe Benefits** | **$7,440** | **NA** |
| | | |
| **NWS Personnel** | | |
| 1. Mr. Brad Bryant, SHV SOO | **NA** | 80 (# of hours) |
| 2. Mr. Matt Hemingway, SHV Forecaster | **NA** | 80 (# of hours) |
| | | |
| **Travel** | | |
| 1. Research Trips | **$0** | $0 |
| 2. Conference Trips | **$3,178** | $4,000 |
| 3. Other | **$0** | $0 |
| **Total Travel** | **$3,178** | $4,000 |
| | | |
| **Other Direct Costs** | | |
| 1. Materials & Supplies | **$0** | **NA** |
| 2. Publication Costs (put in the NWS column if a co-author will be an NWS employee) | **$0** | $450 |
| 3. Other Data | **$0** | $0 |
| 4. NWS Computers & Related Hardware | **NA** | $0 |
| 5. Other (specify) | **$0** | $0 |
| **Total Other Direct Costs** | **$0** | $450 |
| | | |
| **Indirect Costs** | | **NA** |
| 1. Indirect Cost Rate | **41%** | |
| 2. Applied to which items? | **All of the above** | |
| **Total Indirect Costs** | **$4,353** | **NA** |
| | | |
| **Total Costs (Direct + Indirect)** | $14,971 | $4,450 |

**Todd A. Murphy**

## Professional Preparation

| | | |
|---|---|---|
| Univ. of South Alabama, Mobile, AL | Meteorology | B.S., 2008 |
| Univ. of Alabama in Huntsville, Huntsville, AL | Atmospheric Science | M.S., 2010 |
| Univ. of Alabama in Huntsville, Huntsville, AL | Atmospheric Science | Ph.D., 2015 |

## Appointments

| | |
|---|---|
| 2020-present | Associate Professor, Atmospheric Science, University of Louisiana Monroe |
| 2018-present | Program Coordinator, Atmospheric Science, University of Louisiana Monroe |
| 2017-2020 | Geosciences Endowed Professor, Atmospheric Science, University of Louisiana Monroe |
| 2014-2020 | Assistant Professor, Atmospheric Science, University of Louisiana Monroe |
| 2012-2014 | Instructor, Atmospheric Science, University of Alabama in Huntsville |
| 2008-2014 | Graduate Research Assistant, Atmospheric Science, University of Alabama in Huntsville |

## Publications


Lyza, A.W., T.A. Murphy, B.T. Goudeau, P.T. Pangle, K.R. Knupp, and R.A. Wade, 2020: Observed Near-Storm Environment Variations across the Southern Cumberland Plateau System in Northeastern Alabama. *Mon. Wea. Rev.*, **148**, 1465-1482.

Murphy, T.A., C. Palmer, C. Entremont, and J.D. Lamb, 2019: Early Operational Succeses of the University of Louisiana Monroe's Polarimetric S-band Doppler Radar. *J. Operational Meteor.*, **7** (8), 105-116.

Murphy, T. A., R. A. Wade, and B. C. Carcione, 2016: Observations and operational considerations of the 4 June 2013 chaff event in north Alabama. *J. Operational Meteor.*, **4** (3), 34-45.

Knupp K. R., T. A. Murphy, T. A. Coleman, R. A. Wade, S. Mullins, C. J. Schultz, E. V. Schultz, L. Carey, A. Sherrer, E. W. McCaul, B. Carcione, S. Latimer, A. Kula, K. Laws, P. T. Marsh, and K. Klockow, 2014: Meteorological overview of the devastating 27 April 2011 tornado outbreak. *Bull. Amer. Meteor. Soc.*, **95**, 1041–1062.

Coleman, T. A., T. A. Murphy, K. R. Knupp, L. D. Carey, and M. E. Anderson, 2014: Extensive observations of the transition region of a winter storm. *J. Operational Meteor.*, **2** (1) 1–12.

Murphy, T. A., and K. R. Knupp, 2012: An analysis of cold season supercell storms using the synthetic dual-Doppler technique. *Mon. Wea. Rev.*, **141**, 602–624.


## Other Significant Products


Lyza, A.W., T.A. Murphy, B.T. Goudeau, P. Pangle, K.R. Knupp, and R.A. Wade, 2020: Observational Summary of the Effects of the Northeastern Alabama Plateaus on the Near-Storm Environment of Tornadic Storms during VORTEX-SE. *30th Conf. on Weather Analysis and Forecasting*, Boston, MA, Amer. Meteor. Soc., 3B.4.

Murphy, T.A., M.I. Biggerstaff, E.N. Rasmussen, and C.L. Ziegler, 2019: An overview of Spring 2018 VORTEX-SE observations in northern Louisiana. *National Weather Association 44th Annual Meeting*, Huntsville, AL, Nat. Wea. Assoc.

Ziegler, C.L., T.A. Murphy, K.L Elmore, M.I. Biggerstaff, Z. Wang, E.N. Rasmussen, D.P. Jorgensen, and A.A. Alford, 2018: Kinematics, Thermodynamics, and Microphysics of the Tornadic 13-14 April 2018 Calhoun, LA Supercell during VORTEX-SE. *29th Conference on Severe Local Storms*, Stowe, VT, Amer. Meteor. Soc., 8.4.

Wade, R. A., T. A. Murphy, D. D. Turner, T. R. Lee, M. Buban, P. Pangle, A. W. Lyza, and K. R. Knupp, 2017: A Comparison of Atmospheric Profilers and Environmental Soundings in Complex Terrain during the 2017 VORTEX-SE Field Campaign. *38th Conference on Radar Meteorology*, Chicago, IL, Amer. Meteor. Soc., P288.

Murphy, T. A., C. Entremont, B. Hughes, D. Lamb, and M. Mayeaux, 2017: Early Operational Successes of the University of Louisiana at Monroe's S-band Polarimetric Doppler Radar. *38th Conference on Radar Meteorology*, Chicago, IL, Amer. Meteor. Soc., P223

Murphy, T. A., R. A. Wade, A. W. Lyza, and K. R. Knupp, 2017: An Examination of Convective Enhancement within Complex Terrain on 5 April 2017 during VORTEX-SE. *38th Conference on Radar Meteorology*, Chicago, IL, Amer. Meteor. Soc., P150.

Murphy, T. A., T. Aydell, I. Bordelon, S. Kreller, A. Melancon, H. M. Mallinson, and E. M. Murillo, 2016: An Overview of ULM Participation in the VORTEX-SE Field Program. *28th Conference on Severe Local Storms*, Portland, OR, Amer. Meteor. Soc., P78.

**Synergistic Activities**

- Member, PEiRLS Science and Planning Team (2019-present)
- Science-PI, ULM polarimetric S-band Doppler radar (2014-present)
- Member, American Meteorological Society (2008-present) & National Weather Association (2011-present)
- Research participant, VORTEX-SE Steering Workshop and Planning Meeting (2015-2019)
- Local K-12 & summer camp weather balloon launches and STEM outreach in northeast Louisiana (2014-present)
- ULM member representative, UCAR (2015-present)
- Field Experience:
    - Verification of the Origins of Rotation in Tornadoes Experiment-Southeast (VORTEX-SE; 2016-2019; Funding Source: NOAA)
    - Ontario Winter Lake-effect Systems (OWLeS; 2013-2014; Funding Source: NSF)
    - Atmospheric Boundary Identification and Delineation Experiment III (ABIDE-III; 2011-2013; Funding Source: NSF)
    - UAH Tornadoes & Hurricanes, Observations, & Research (THOR; 2008-2012; Funding Source: NOAA & NSF)
- Reviewer for: *NSF, NOAA, Journal of Applied Meteorology and Climatology, Journal of Operational Meteorology, Monthly Weather Review*

**Recent External Collaborators**

| | |
|---|---|
| Biggerstaff, Mike | University of Oklahoma |
| Brown, Mike | Mississippi State University |
| Buban, Michael | NOAA/OAR/ARL Atmospheric Turbulence and Diffusion Division |
| Kimball, Sytske | University of South Alabama |
| Knupp, Kevin | University of Alabama in Huntsville |
| Lee, Temple | NOAA/OAR/ARL Atmospheric Turbulence and Diffusion Division |
| Lyza, Tony | University of Oklahoma/CIMMS/NSSL |
| Parker, Matthew | North Carolina State University |
| Rasmussen, Erik | University of Oklahoma/CIMMS/NSSL |
| Terwey, Wesley | University of South Alabama |
| Turner, Dave | NOAA Earth System Research Laboratory |
| Wade, Ryan | University of Alabama in Huntsville |

**Graduate Advisor**

| | |
|---|---|
| Knupp, Kevin | University of Alabama in Huntsville |

**Graduate Students Advised**

None

**UNITED STATES DEPARTMENT OF COMMERCE**
**National Oceanic and Atmospheric Administration**
National Weather Service Southern Region Headquarters
819 Taylor Street, Room 10E09
Fort Worth TX 76102

August 31, 2020

MEMORANDUM FOR: Ms. Lorrie Alberta
COMET Outreach Program Administrator
3085 Center Green Drive
Boulder CO 80301

FROM: Steven Cooper, Director
NWS Southern Region Headquarters

COOPER.STEVEN.G.1365850930 Digitally signed by COOPER.STEVEN.G.1365850930 Date: 2020.08.31 11:16:56 -05'00'

SUBJECT: Letter of Support for COMET Partners Proposal

National Weather Service, Southern Region Headquarters, fully supports the COMET Partners Proposal titled "Verifying the Three-Ingredients Method for Nowcasting QLCS Tornadoes."

SRH and our Science and Technology Services Division are pleased to endorse this joint University of Louisiana Monroe (ULM) and WFO Shreveport COMET Partner's Proposal. In addition to the potential science and service improvement benefits, this proposal, if funded, will continue to support a growing professional relationship between NWS and the Atmospheric Science Program at ULM. A healthy and robust relationship would help future meteorologists at ULM understand operational meteorology and the ULM Atmospheric Science Program would provide opportunities for SHV to keep a solid footing in academia and research.

NWS Southern Region Forecast Offices, particularly those from TX/LA east into MS/AL/GA, are often impacted by the effects of quasi-linear convective systems (QLCS). Anticipating and warning for QLCS tornadoes is one of the most difficult and stressful issues facing operational meteorologists at these offices. The proposed project aims to assess the "Three-Ingredients Method" to discover whether or not the method is a valid decision aid for tornado warnings. The project has the potential to improve warning lead times for QLCS tornadoes, improve short-term Impact-Based Decision Support Services, and lead to better understanding of the strengths and weakness of the associated warning methodology.

## COLLEGES AND UNIVERSITIES RATE AGREEMENT

EIN: 1726001695

DATE:06/19/2017

ORGANIZATION:

University of Louisiana - Monroe
(Formerly Northeast Louisiana University)
700 University Avenue
Monroe, LA 71209-2200

FILING REF.: The preceding agreement was dated 05/30/2013

The rates approved in this agreement are for use on grants, contracts and other agreements with the Federal Government, subject to the conditions in Section III.

### SECTION I: Facilities And Administrative Cost Rates

RATE TYPES: FIXED FINAL PROV. (PROVISIONAL) PRED. (PREDETERMINED)

| | EFFECTIVE PERIOD | | | | |
|---|---|---|---|---|---|
| **TYPE** | **FROM** | **TO** | **RATE(%)** | **LOCATION** | **APPLICABLE TO** |
| PRED. | 07/01/2013 | 06/30/2017 | 41.00 | On Campus | All Programs |
| PRED. | 07/01/2017 | 06/30/2021 | 41.00 | On Campus | All Programs |
| PROV. | 07/01/2021 | Until Amended | | | Use same rates and conditions as those cited for fiscal year ending June 30, 2021. |

*BASE

Modified total direct costs, consisting of all direct salaries and wages, applicable fringe benefits, materials and supplies, services, travel and up to the first $25,000 of each subaward (regardless of the period of performance of the subawards under the award). Modified total direct costs shall exclude equipment, capital expenditures, charges for patient care, rental costs, tuition remission, scholarships and fellowships, participant support costs and the portion of each subaward in excess of $25,000. Other items may only be excluded when necessary to avoid a serious inequity in the distribution of indirect costs, and with the approval of the cognizant agency for indirect costs.

ORGANIZATION: University of Louisiana - Monroe (Formerly Northeast Louisiana University)

AGREEMENT DATE: 6/19/2017

## SECTION II: SPECIAL REMARKS

TREATMENT OF FRINGE BENEFITS:

The fringe benefits are charged using a rate(s) which are not shown in the Rate Agreement. Over/under recoveries from actual costs are adjusted in current or future periods. The directly claimed fringe benefits are listed below.

TREATMENT OF PAID ABSENCES

Vacation, holiday, sick leave pay and other paid absences are included in salaries and wages and are claimed on grants, contracts and other agreements as part of the normal cost for salaries and wages. Separate claims are not made for the cost of these paid absences.

EQUIPMENT DEFINITION:

Equipment means an article of nonexpendaable, tangible personal property having a useful life of more than one year and an acquisition cost of $5,000 or more per unit.

FRINGE BENEFITS:

FICA
Retirement
Worker's Compensation
Life Insurance
Unemployment Insurance
Health Insurance

Per 2 CFR 200.414(g) - A rate extension has been granted.

NEXT PROPOSAL DUE:

Your next proposal based on actual costs for the fiscal year ending 06/30/2020 is due in our office by 12/31/2020.

ORGANIZATION: University of Louisiana - Monroe (Formerly Northeast Louisiana University)

AGREEMENT DATE: 6/19/2017

## SECTION III: GENERAL

A. LIMITATIONS:

The rates in this Agreement are subject to any statutory or administrative limitations and apply to a given grant, contract or other agreement only to the extent that funds are available. Acceptance of the rates is subject to the following conditions: (1) Only costs incurred by the organization were included in its facilities and administrative cost pools as finally accepted: such costs are legal obligations of the organization and are allowable under the governing cost principles; (2) The same costs that have been treated as facilities and administrative costs are not claimed as direct costs; (3) Similar types of costs have been accorded consistent accounting treatment; and (4) The information provided by the organization which was used to establish the rates is not later found to be materially incomplete or inaccurate by the Federal Government. In such situations the rate(s) would be subject to renegotiation at the discretion of the Federal Government.

B. ACCOUNTING CHANGES:

This Agreement is based on the accounting system purported by the organization to be in effect during the Agreement period. Changes to the method of accounting for costs which affect the amount of reimbursement resulting from the use of this Agreement require prior approval of the authorized representative of the cognizant agency. Such changes include, but are not limited to, changes in the charging of a particular type of cost from facilities and administrative to direct. Failure to obtain approval may result in cost disallowances.

C. FIXED RATES:

If a fixed rate is in this Agreement, it is based on an estimate of the costs for the period covered by the rate. When the actual costs for this period are determined, an adjustment will be made to a rate of a future year(s) to compensate for the difference between the costs used to establish the fixed rate and actual costs.

D. USE BY OTHER FEDERAL AGENCIES:

The rates in this Agreement were approved in accordance with the authority in Title 2 of the Code of Federal Regulations, Part 200 (2 CFR 200), and should be applied to grants, contracts and other agreements covered by 2 CFR 200, subject to any limitations in A above. The organization may provide copies of the Agreement to other Federal Agencies to give them early notification of the Agreement.

E. OTHER:

If any Federal contract, grant or other agreement is reimbursing facilities and administrative costs by a means other than the approved rate(s) in this Agreement, the organization should (1) credit such costs to the affected programs, and (2) apply the approved rate(s) to the appropriate base to identify the proper amount of facilities and administrative costs allocable to these programs.

BY THE INSTITUTION:

University of Louisiana - Monroe (Formerly Northeast Louisiana University)

(INSTITUTION)

(SIGNATURE)

Eric Pani, Ph.D.

(NAME)

VP for Academic Affairs

(TITLE)

06/28/2017

(DATE)

ON BEHALF OF THE FEDERAL GOVERNMENT:

DEPARTMENT OF HEALTH AND HUMAN SERVICES

(AGENCY)

Arif M. Karim -A

Digitally signed by Arif M. Karim -A
DN: c=US, o=U.S. Government, ou=HHS, ou=PSC, ou=People, cn=Arif M. Karim -A, 0.9.2342.19200300.100.1.1=2000212895
Date: 2017.06.27 11:29:32 -05'00'

(SIGNATURE)

Arif Karim

(NAME)

Director, Cost Allocation Services

(TITLE)

6/19/2017

(DATE) 0495

HHS REPRESENTATIVE: Matthew Dito

Telephone: (214) 767-3261

# NWS Checklist for Submitting a COMET Outreach Proposal

| Actions Before Proposal is Submitted to COMET | YES | NO | DATE |
|---|---|---|---|
| 1. Did NWS office staff and university staff meet to discuss and form outline and scope of project? | Y | | 7/29/20 |
| 2. Did NWS office consult Scientific Services Division (SSD) staff? | Y | | 8/6/20 |
| 3. Was Statement of Work and budget formulated as a team effort between university and NWS staffs? | Y | | 8/10/20 |
| 4. Was proposal submitted to SSD for review? | Y | | 8/19/20 |
| 5. Did SSD forward copies of proposals dealing with WSR-88D data to Radar Operations Center (ROC), Applications Branch Chief for review? | N/A | N/A | N/A |
| 6. Did SSD forward copies of proposals dealing with hydrometeorology to the Senior Scientist of OHD for review? | N/A | N/A | N/A |
| 7. Did SSD review the data request for project to ensure its scope and criticality for proposal? | Y | | 8/25/20 |
| 8. Is all data for the project being ordered by NWS offices through the National Climatic Data Center's (NCDC) Research Customer Service Group free of charge? | Y | | 8/25/20 |
| 9. Does budget include publication charges and travel costs for NWS employees to present results at scientific conferences? | Y | | 8/25/20 |
| 10.Does budget separate NWS costs into fiscal year costs and university costs into calendar year costs? | Y | | 8/25/20 |
| 11.Does proposal include a separate justification for university hardware purchases which are usually not funded by the COMET Outreach Program? | N/A | N/A | N/A |
| 12. Have the following people signed off on the proposal cover sheet:<br>- MIC/HIC?<br>- SSD Chief?<br>- Regional Director? | Y | | 8/18/20<br>8/25/20 |
| 13. Is a letter of endorsement signed by regional director attached? | Y | | 8/31/20 |

# NWS Checklist for Submitting a COMET Outreach Proposal

| Actions after Endorsement by NWS | YES | NO | DATE |
|---|---|---|---|
| 1. University submits proposal to the COMET Program. | | | |
| 2. Proposal acknowledgment letter sent by the COMET Program to submitting university with copies to SSDs and NWS office. | | | |
| 3. COMET review of proposal (internal review for Partners Project proposals and formal review for Cooperative Project proposals). | | | |
| 4. The COMET Program sends acceptance, rejection, or modification letters to university with copies to SSD, NWS office, and OST12. | | | |
| 5. The COMET Program allocates funds for university. | | | |
| 6. OST12 obligates funds for NWS offices. | | | |
| 7. SSD/NWS office orders data from NCDC. | | | |
| 8. NWS office or SSD calls OST12 for accounting code for expenses. | | | |
| 9. NWS office sends copies of all travel vouchers and expense records to OST12. | | | |
| 10. NWS office or SSD sends copies of publication page charge forms to OST12. | | | |
| 11. NWS office keeps SSD informed of progress on the project and any results or benefits derived from the project. | | | |