

Thank you for submitting an application for the MU-MUSE Program. Below is your submission.

Student Name

Major Meteorology (BS)

Overall GPA 3.68

GPA in Major 3.54

Facaculty Mentor

Faculty Department

Faculty MU Email

Project Title Assessing the Potential Impact of Climate Variability on Key Pre-Cursor Parameters for Severe Weather in Southeast Pennsylvania

Starting Date 06/03/2019

Ending Date 08/16/2019

Other Funding for this project

MU-MUSE

Project Abstract:

This project will focus on identifying pre-cursor parameters for high precipitation events in Lancaster County and the surrounding counties of York and Chester. The study will begin with an analysis of past weather events over the last 30 years that have had high precipitation amounts and identify the atmospheric conditions that led to the development of these events. The data will be retrieved from the National Centers for Environmental Information (NCEI). These records date back to January of 1950. This climatological analysis component of the study will be combined with data collected during an observational period for the region of interest. The key atmospheric data will be collected through the launch of weather balloons to further analyze the potential impact of climate change on the parameters that are pre-cursors to severe weather. Once the data on the key parameters are collected, the study will focus on comparing the data from the current events with the event climatology.

Attached:

Grant Uploaded

Project Narrative

Faculty Letter of Endorsement

cc: Faculty Mentor

MUSE Committee

MU-MUSE Program 2019

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Project Narrative:

Student Statement

Gaining research experience in the MU-MUSE will significantly help with my education as well as provide me with an opportunity to enhance and apply what I have learned and continue to learn in my meteorology courses. I knew since I was young that I wanted a career in meteorology. Now that I am studying meteorology, I have a much deeper appreciation for the

breadth of the field. The MU-MUSE would enable me to conduct research and gain skills that I will be able to carry with me through graduate school and beyond. After my undergraduate studies I plan on obtaining a Master's degree in atmospheric sciences with a focus on climate science. I am very passionate about studying the subject of climate change and the potential impacts. Lessening the impending effects is vital for future generations and I would like to spend my career researching and finding solutions for mitigation and adaptation strategies. If I was afforded the opportunity to participate in the MU-MUSE program, it would prepare me for future academic endeavors and allow me to be involved in my first research project.

The majority of my experience in meteorology and climate comes from the courses I have completed up to this point. Starting with freshman year, I took UNIV 103 with Dr. Yalda. This class introduced me to the topic of climate change and initiated my passion to study this global issue and related areas. I also took Resources and the Environment and Physical Geography. These two courses both focused on the steady depletion of our non-renewable resources and specific effects of climate change seen around the world. As for my experience related to Meteorology, I have taken several core courses for my major. Courses such as Meteorology, Cloud Physics and Precipitation Processes, Atmospheric Radiative Transfer, Satellite Meteorology, Atmospheric Dynamics 1 & 2, and Atmospheric Thermodynamics have all contributed to my fundamental knowledge in meteorology. The courses which will help me most for my research project are Cloud Physics and Precipitation Processes, Meteorology, and Atmospheric Dynamics 1. Understanding the prediction models, various observational charts and diagrams, visualization tools, and analysis techniques will be instrumental for my research project. Aside from meteorology and climate, I will also utilize my computer programming and data analysis skills from the programming courses that I have completed in Fortran and Python.

Project Proposal

This project will focus on an analysis of pre-cursor parameters leading to events that can lead to significant flooding and the potential impact of climate change on the frequency and intensity of these events in Lancaster County and immediate surrounding counties. According to the Pennsylvania Emergency Management Agency's (PEMA) Hazard Vulnerability Analysis (2018), flooding is the most frequent and damaging natural disaster in Pennsylvania. Flooding can be a result of high precipitation associated with severe weather events. This project will have two parts. One will include a study of past weather events over the last 30 years with high precipitation episodes and determine the atmospheric conditions that caused them from NOAA's Storm Events Database, the NCDC's Database, and NOAA's Local Climatological Dataset. At the completion of this analysis, a high precipitation event climatology will be developed for the study's area of interest.

The second part of the project will focus on observations and data collection. The main method of data collection will be through the use of a radiosonde which will be launched during the intensive observing periods when the conditions are likely for the events of interest. The radiosonde is a small instrument package that is suspended below a balloon filled with helium. As the instrument rises, sensors measure profiles of pressure, temperature, and relative humidity and other key variables. The sensors communicate with a ground-based receiver through a transmitter. The radiosonde can continue to transmit data for over two hours and can rise to about 115,00 feet and cover an area greater than 120 miles. Once the data is collected a thorough analysis can be made for the pre-cursive variables of interest for local severe storm generation and potential for high precipitation.

The final phase of the project will focus on the comparison of observed local events with the event climatology. Furthermore, the entire period of study will be analyzed to determine if a signal can be identified for the impact of climate change on high precipitation event frequency and strength. Specific comparisons and correlations will be calculated to determine the changes in the key pre-cursor variables and environments.

The Dissemination Plan

The two parts of the projects will be done simultaneously to allow for efficiency and to allow for more opportunities for observations and data collection through the proposed period of study. The compilations of the climatological data and the development of the high precipitation event climatology will be accomplished through data access and analysis of the event summaries and daily observational archived and available online through the NCEI portal.

In order to maximize the opportunity for data collection, each day of the proposed study will include a thorough analysis of the daily conditions which will include a review of the observations, climatology, model analyses, National Weather Service expert discussions, and daily forecasts by the Storm Prediction Center. This component will guide the daily decisions to determine if the conditions are favorable for the instrument launch and the location of the launch. After each launch, data will be archived, analyzed, and categorized.

The last component of the dissemination plan will involve the comparison analysis of the collected data with the developed climatology. This aspect will also be completed at the same time as an analysis of the entire dataset for signals of impacts of climate change and variability on high precipitation events with potential for flooding.

Weekly Timeline

Week 1:

Begin analyzing data collections from former publications and weather station records. Study the geography, topography, and orography of Lancaster county and the surrounding counties of interest for data collecting.

Week 2-5:

Begin collecting data through the use of a radiosonde which will be launched during the intensive observing periods when the conditions are likely for the events of interest. If no storms were present during this time, research would continue with data from meteorological archives and climatological publications.

Week 6-8:

Analyze the data collected from my radiosonde. Specific comparisons and correlations will be calculated to determine the changes in the key pre-cursor variables and environments. Assess my data and show the area's climatological variability. At the completion of this analysis, a high precipitation event climatology will be developed for the study's area of interest.

Week 9-10:

Complete a comparison analysis of the collected data with the developed climatology. Simultaneously, develop an analysis of the entire dataset for signals of impacts of climate change and variability on high precipitation events with potential for flooding. Work towards bringing the project to a close. Write a thorough, detailed paper to explain all of my research carried out in the MU-MUSE. Begin working on the Made in Millersville final project.