

**Research Proposal:  
ANALYSIS OF THE  
C-10 RESEARCH AND EDUCATION FOUNDATION DATASET**

Sam Miller and Norm Shippee  
Judd Gregg Meteorology Institute  
Plymouth State University

*June, 2007*

**ABSTRACT**

This proposed research project represents a cooperative effort between the C-10 Research and Education Foundation, and Plymouth State University's *Judd Gregg Meteorology Institute*. The purpose of the project is to subject the meteorological and radiological data recorded by C-10's Citizens Radiological Monitoring Network to rigorous scientific analysis, determine seasonal, annual, and interannual trends in the radiological data, quantify the effect of the tides on near-shore radiological measurements, identify radiological "hot spots", create a multi-variate wind climatology, and make recommendations for better positioning of available sensor equipment.

**Background.** The C-10 Research and Education Foundation (C-10) has operated a "Citizens Radiological Monitoring Network" (CRMN) since the early 1990's. The focus of C-10's CRMN is the civil nuclear reactor in Seabrook, New Hampshire, which was originally built by Public Service of New Hampshire (PSNH), and is currently owned and operated by FPL Energy. C-10's network consists of approximately 25 fully-automated monitoring stations, each recording wind and radiological data at a time interval of 1 minute. The average horizontal spacing between these stations is consistent with a small meso- $\gamma$  (2 - 20 km) or large microscale (<2 km) network. This unique and valuable dataset - recorded in a coastal region with correspondingly complex wind fields - has been steadily growing over the last decade and a half.

**Personnel and proposed work.** C-10 will partner with Plymouth State University's *Judd Gregg Meteorology Institute* (PSU/JGMI) to analyze C-10's dataset and determine the answer to several well-defined scientific questions. The purpose of this work is to assist C-10 with its current operations, and to improve the operations of its CRMN in the future. Specific individuals involved will be:

**Ms. Sandra Gavutis** - Executive Director of C-10

**Dr. Samuel T.K. Miller** - Assistant Professor of Meteorology at PSU/JGMI

**Mr. Norman J. Shippee** - Undergraduate Meteorology Major, PSU/JGMI

*Dr. Miller's CV and Mr. Shippee's resume are attached to this document.*

**Specific responsibilities follow:**

1. C-10 will provide Dr. Miller and Mr. Shippee at PSU/JGMI with electronic copies of the raw meteorological and radiological observations recorded at all available stations in their CRMN over the last ten years. These datafiles will be in an easily accessible, standard format, such as Excel spreadsheet, or flat-ASCII textfiles (the latter format is preferred), with appropriate metadata. Additional data will also be provided by C-10 that lists the latitude and longitude coordinates of each station, and any special information regarding calibration coefficients, alignment of wind measuring equipment, etc., required for the proper interpretation of the data. C-10 will communicate regularly with PSU/JGMI, responding to queries and offering suggestions for specific problems encountered while the data analysis proceeds.

2. PSU/JGMI will process the dataset provided by C-10. Mr. Shippee will take primary responsibility for this work, with the guidance and support of Dr. Miller. Mr. Shippee will utilize Dr. Miller's *AirSea* Matlab analysis package, assorted Perl scripts written for the purpose, and the computing resources of the PSU/JGMI to accomplish much of the work. Radiological and meteorological data from individual stations will be quality-controlled, and interpolated onto a rectangular grid coordinate system. The gridded data will include u and v components of the wind velocity, and radiological decay data from the two different types of radiation sensors in C-10's CRMN. The gridded data will then be used to accomplish the following scientific goals, which are subject to revision in consultation with C-10:

**2.1. Identification of secular trends, both in time and space, in the radiological data.**

The extended length of the time series makes even small variations detectable. The specific question this addresses is whether there are long-term, low-level changes in background radiation in the region around the reactor.

**2.2. Identification and spatial characterization of seasonal and annual-scale variations in radiological activity.**

**2.3. Identification of tidal influences in radiological activity at coastal sites.** The Gulf of Maine coast is dominated by the M2 (12h 29m) tide cycle. Given the extreme length of the C-10 time series, even small influences from tidal activity will be detectable.

**2.4. Identification of regions with higher and lower than average radiological activity, i.e., "hot spots" and "cold spots".** If these exist, they are almost certainly subject to temporal variations related to the local meteorology.

**2.5. Creation of a wind climatology, for each grid point, and for the CRMN domain as a whole.**

**2.6. Correlation of the results of 2.1 (secular trends), 2.2 (seasonal/annual trends), and 2.4 (hot/cold spots) with 2.5 (wind climatology).** The specific goal here is to determine the statistical importance of the wind to regions of long-term, seasonal, and annual variations in background radiation.

**2.7. Recommendations, based on all of the above, for repositioning of available sensor equipment to facilitate improved detection of atmospheric plumes from a hypothetical point source within the C-10 CRMN domain, both long-term and catastrophic.**

**Duration.** The primary (non-publication) work will begin no later than September, 2007, and be completed by the end of May, 2008.

**Presentation of results.** Dr. Miller, Mr. Shippee, and Ms. Gavutis will co-author a paper for publication in an appropriate peer-reviewed journal, with Dr. Miller assuming primary responsibility for the task. Mr. Shippee will present his available research results at the Northeast Storm Conference in the early Spring of 2008, as well as to a meeting of the C-10 principals in Newburyport, Massachusetts at a time to be arranged.

**Samuel T.K. Miller**  
**Curriculum Vitae**

OFFICE:

Plymouth State University  
Dept. of Chemical, Earth, Atmospheric and Physical Sciences  
MSC 48 • 17 High Street  
Plymouth, New Hampshire 03264  
TEL: 1 (603) 535-2811  
FAX: 1 (603) 535-2723

HOME:

172 Puckerbrush Road  
Campton, New Hampshire 03223  
TEL: 1 (603) 726-8127

INTERNET:

stmiller@plymouth.edu  
<http://vortex.plymouth.edu/~stmiller>

**I. Summary of Qualifications:**

Twenty-five years experience as a meteorologist. Conducted studies to develop practical forecasting techniques. Worked as a research scientist studying air-sea interaction and mesoscale coastal meteorology. Participated in research cruises involving oceanic and meteorological instrument deployment. Constructed and managed automated weather observing networks. Managed atmospheric and oceanic datasets using Matlab and Perl in Linux, Unix, MacOS, and Windows environments. Developed applications using C and Fortran. Created webpages using HTML, Perl, graphics applications, and automated schedulers. Extensive experience with AWIPS, FX-NET, and IFPS/GFE. Developed and taught university courses in meteorology and mathematics for Plymouth State University and the USNH. Worked as a forecaster for both the U.S. National Weather Service and the Air Force's weather service in Alaska, California, Maine, New Hampshire, New York, and Turkiye.

**II. Education:**

Ph.D., Earth Sciences, University of New Hampshire, December, 2003.  
M.Sc., Earth Sciences – Oceanography, University of New Hampshire, December, 1999.  
B.Sc., *summa cum laude*, Physics, University of New Hampshire, 1996.  
Diploma, *honors*, Weather Forecasting, U.S. Air Force Technical Training Center, Chanute Air Force Base, Rantoul, Illinois, 1984.

**III. Professional Experience:**

Plymouth State University, Department of Chemical, Earth, Atmospheric and Chemical Sciences, Judd

Gregg Meteorology Institute, Plymouth, New Hampshire: Assistant Professor of Meteorology, July, 2005 - Present.

U.S. National Weather Service (NOAA), Alaskan Region, Anchorage Forecast Office: Meteorologist, October, 2003 - June, 2005.

University System of New Hampshire: Instructor/Lecturer, January, 2000 - September, 2003.

Climate Change Research Center, University of New Hampshire, Durham, New Hampshire: Research Scientist, September, 2000 - September, 2003.

Ocean Process Analysis Laboratory, University of New Hampshire, Durham, New Hampshire: Research Scientist/Programmer, June, 1999 - August, 2000.

C-10 Research and Education Foundation, 44 Merrimac Street, Newburyport, Massachusetts: Meteorology and Physics Consultant/Software Developer, 1991 - 2003.

Pease Air National Guard Base Weather Station, Pease International Tradeport, Portsmouth, New Hampshire: Weather Observer, 1990 - September, 2003.

U.S. Air Force -- Incirlik Air Base, Adana, Turkiye; Plattsburgh AFB, New York; Travis AFB, California; and Loring AFB, Maine: Weather Forecaster, 1982 - 1989.

#### **IV. Selected Publications:**

**Miller, S.T.K.**, and B.D. Keim, Synoptic-Scale Controls on the Sea Breeze of the Central New England Coast, *Weather and Forecasting*, 18: 236 - 248, 2003.

**Miller, S.T.K.**, B.D. Keim, R.W. Talbot, and H. Mao, The Sea Breeze: Structure, Forecasting, and Impacts, *Reviews of Geophysics*, 41 (3): 1-1 - 1-31, 2003.

Angevine, W.M., C.J. Senff, A.B. White, E.J. Williams, J. Koermer, **S.T.K. Miller**, R. Talbot, P.E. Johnston, S.A. McKeen, and T. Downs, Coastal Boundary Layer Influence on Pollutant Transport in New England, *Journal of Applied Meteorology*, 43, 1425 - 1437, 2004.

**Miller, S.T.**, and F.L. Bub, Meteorological Forcing and Air-Sea Heat Flux in the Gulf of Maine During Winter, *American Geophysical Union, Eos Transactions (2000 Ocean Sciences Meeting Supplement)*, 80, OS297 - OS298, 1999.

Brown, W.S., **S.T. Miller**, F.L. Bub, and D.W. Denbo, Winter Mixed Layer Evolution in the Gulf of Maine, *American Geophysical Union, Eos Transactions (2000 Ocean Sciences Meeting Supplement)*, 80, OS297, 1999.

**Norman J. Shippee**  
**RESUME**

178 Hartford Pike  
Foster, RI 02825

Primary Phone: 1-401-647-7735

Cell Phone: 1-401-316-6076

Email: [njshippee@plymouth.edu](mailto:njshippee@plymouth.edu)  
[njshippee@gmail.com](mailto:njshippee@gmail.com)

### **1. Qualifications**

Currently an undergraduate at Plymouth State University studying meteorology. Interned Winter of 2006-07 atop Mount Washington working as observer and researching El Nino and summit weather conditions. Current Treasurer and member of the Plymouth State chapter of the American Meteorological Society. Have used FORTRAN, Windows, Macintosh, Linux, and Unix based systems. Currently work as an Information Technology Consultant for Plymouth State's Lamson Learning Commons Help Desk. Attained Plymouth State University's Presidents list Fall 2004 and Fall 2006, along with Dean's List Spring 2005, Fall 2005, and Spring 2006.

### **2. Education**

B.Sc., Meteorology, Plymouth State University, expected completion: May 2008  
Diploma, Ponaganset High School, June 2004

### **3. Experience**

Worked on El Nino project atop Mount Washington researching trends in temperature, precipitation, and snowfall during El Nino and Non-El Nino years. Results yet to be determined (end of Winter 2007).

#### Independent Study

Advisor: Dr. Sam Miller

Studied the effects of winds from four different wind regimes (NE, NW, SE, SW) and the generation of Ekman pumping on the accuracy of tidal prediction in the Gulf of Maine, September 2006 - current. Used data sets from NOAA to determine difference in observed minus predicted tidal heights and analyzed them to determine the relationship to possible Ekman pumping and the magnitude of the difference.