The 2014 CICS-MD Institute of Research and Collaboration for Undergraduate Students (CIRCUS)

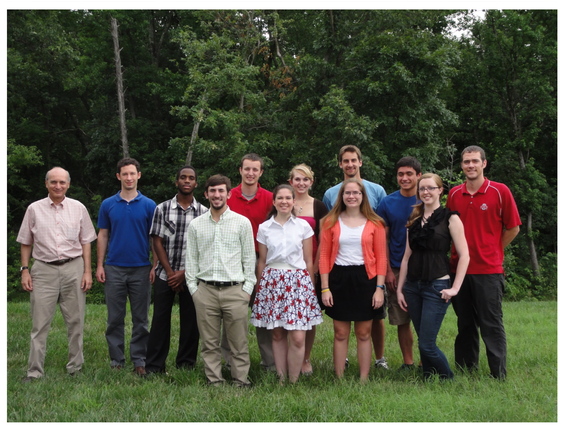
Scott D. Rudlosky, NOAA/NESDIS/STAR

Meredith Nichols, Reginald Johnson, Thomas Kelly, Douglas Kahn, Nina Randazzo, Alex Ortiz, and Katherine O'Brien

Abstract

The Cooperative Institute for Climate and Satellites at the University of Maryland (CICS-MD) hosted the second annual CICS-MD Institute of Research and Collaboration for Undergraduate Students (CIRCUS). The NOAA/NESDIS sponsored CICS-MD hosted 8 undergraduate, 4 post graduate, and 4 graduate students during summer 2014. Students represented the University of Maryland, the City College of New York, Cornell University, Boston College University, and Penn State University. Students worked with university faculty and government scientists to gain valuable research experience. Each student presented their research findings, which are summarized herein. Meredith Nichols investigated the impact of natural gas drilling on air quality, Reggie Johnson documented extreme rainfall events, Tom Kelly and Doug Kahn visualized data from lightning detection networks to examine significant lightning incidents, Nina Randazzo searched for a CO trend related to economic activity, Alex Ortiz began constructing an accurate satellite observed rain-field by using rapidly updating and readily accessible lightning data, and Kate O'Brien studied relationships between the Madden-Julian Oscillation and Tropical Cyclone prediction. These projects illustrate the valuable contributions that students can make to cutting edge research.

2013 CIRCUS



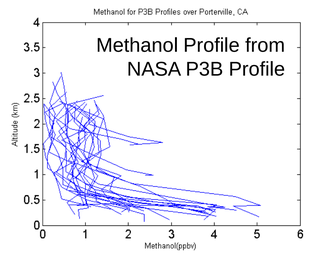
NCAS Weather Camp Visit

2014 CIRCUS

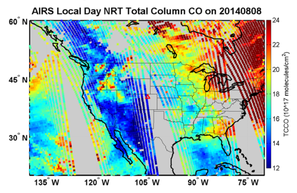
What is the Impact of Oil & Natural Gas Operations on US Air Quality?

Meredith Nichols

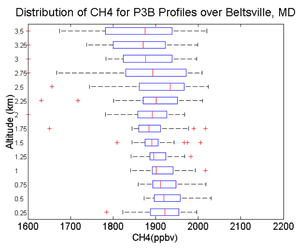
- Compared ground, flight and satellite data at 4 of the NASA DISCOVER-AQ campaign locations (Maryland-July 2011, California-Jan. 2013, Texas-Sept. 2013, Colorado-July 2014)
- Analyze different trace gases to interpret the source of methane (i.e. carbon dioxide-transportation pollution, larger concentrations of methane indicate possibility of drilling while lower localized methane concentrations indicate wetlands)
- Special Thanks to Dr. Anne Thompson and Dr. Debra Kollonige, my mentors at NASA GSFC and ESSIC

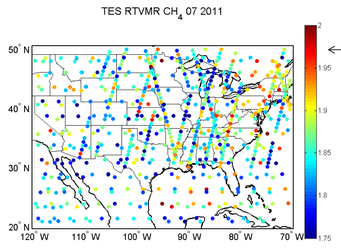


Ability to detect forest fires



NASA P3B Flight Methane Profile



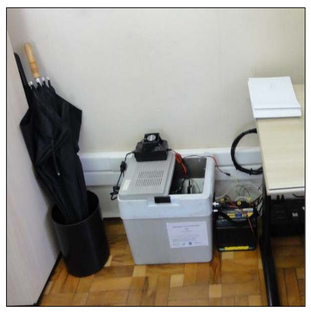


← The warmer colors indicate areas where methane values are larger, which happen to occur in several areas of natural gas production.

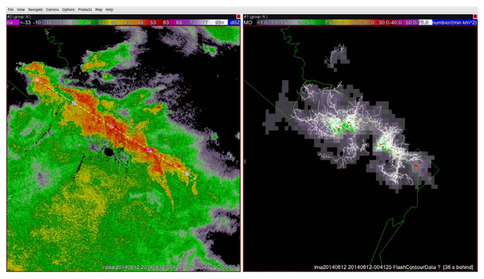
Lightning Research Using WDSS-II

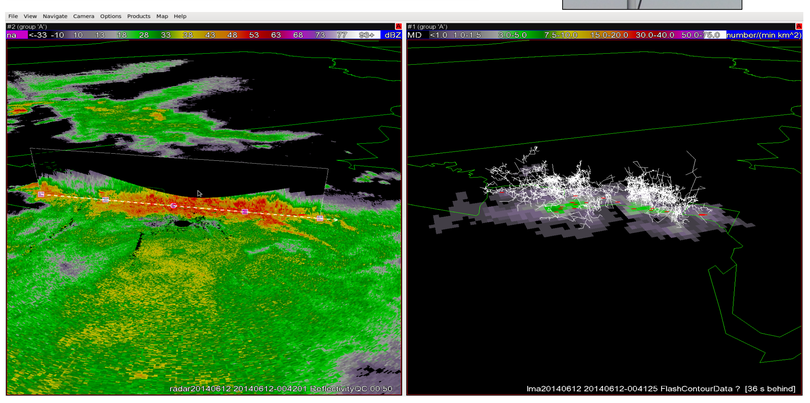
Douglas Kahn

- Research uses the Washington D.C. Lightning Mapping Array (DCLMA) & Earth Networks Total Lightning Network (ENTLN)
- WDSS-II allows us to view and cluster convective storms in an interactive, 3-D graphic display
- We are using these total lightning observations to provide detailed insights into the structure and evolution of convective storms and help protect life and property



Photographs of the LMA computer (above) and sensor (below), and examples of lightning and radar overlaid in WDSS-II.

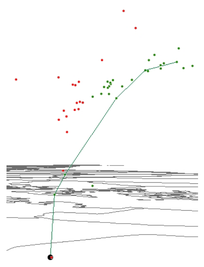




ENTLN and DCLMA Flash Height Detection and Post Event Analysis

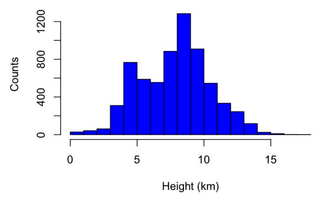
Thomas Kelly

- Median flash initiation heights are larger for ENTLN than the DCLMA indicating that flash heights may be overestimated for ENTLN.
- The DCLMA and ENTLN provide excellent tools for conducting post event analysis of lightning incidents in the Mid-Atlantic

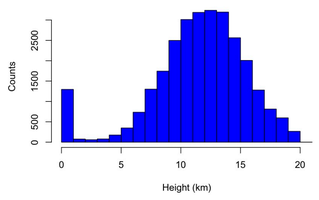


9 July 2014

DCLMA Flash Initiation Height



ENTLN Flash Initiation Height

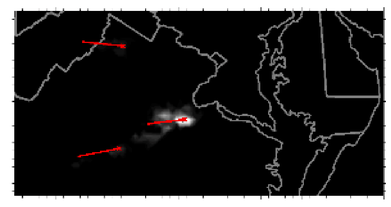


12 June 2014

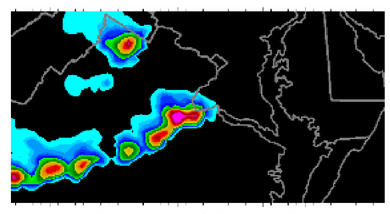
Flow Mapping Applications Related to Severe Storm Development

Alex Ortiz

- Purpose: To construct an accurate rain-field by using quick and accessible lightning data.
- Currently, satellite rainfall estimates are not retrieved instantaneously, but are delayed.
- Lightning data can be gathered more quickly.
- Motion vectors are generated by calculating the maximum correlation between each time interval within the lightning density data.

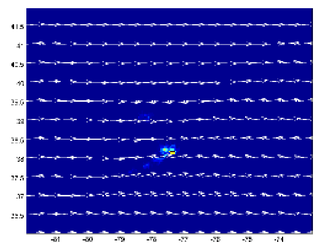


Above: Lightning Density and Motion Vectors

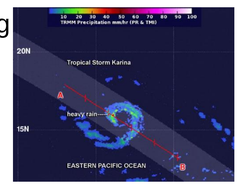


Above: Projection of Rainfall Estimates

Movement of Directional Flow Field



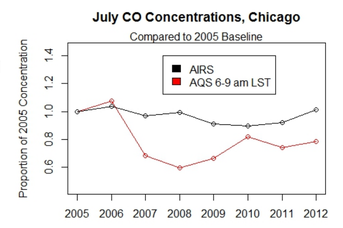
Currently constructing a flow field similar to a hurricane to simulate the movement of its rain field. →



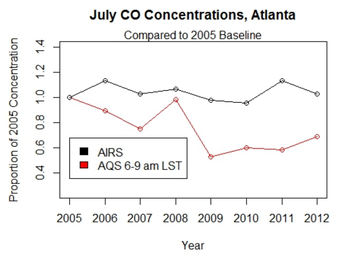
Urban Carbon Monoxide (CO) during the Global Economic Recession

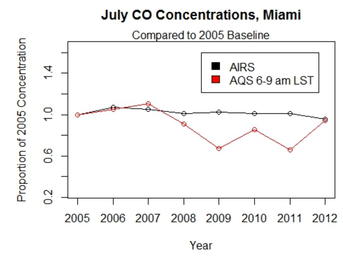
Nina Randazzo

- Motivation: To determine whether a CO trend related to economic activity could be observed
- Examined July monthly averages from 2005 to 2012 for 10 urban areas
- Decrease going into 2008 or 2009 (worst years of the Recession)
- Often another decrease into 2011
- Generally, rebound in 2012



Above: AQS shows a sharp decrease in 2007 and 2008; Rebound in 2012

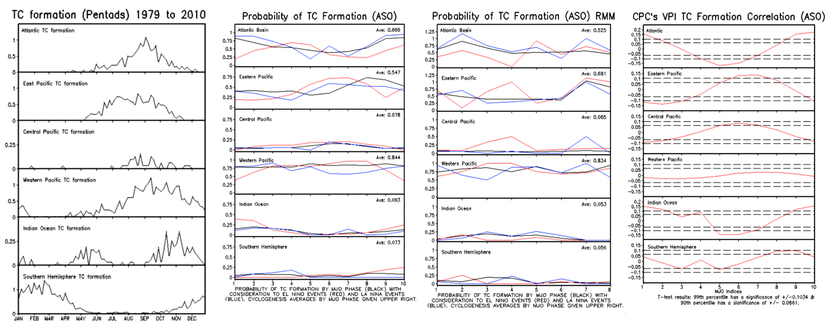




Understanding the relation between the MJO and tropical cyclogenesis

Katherine O'Brien

- Focus:
  - Atlantic Ocean
  - August, September, October
  - Northern Indian Ocean: October, November, and December
- Results
  - Probability of TC Formation, VPI, RMM, Correlation of TC Formation by VPI index



- Average number of storms per pentad
- Focusing on August, September, and October
- Average number of TC's per MJO Index
- Here the MJO is divided into 10 phases using Velocity Potential Anomalies in a Wave 1 pattern.
- Average number of TC's per MJO Phase
- Using Wheeler and Henson's Real-time MJO Monitor
- Student T-test for significance at the 99th and 90th percentiles
- TC formation modulation by the VPI Index