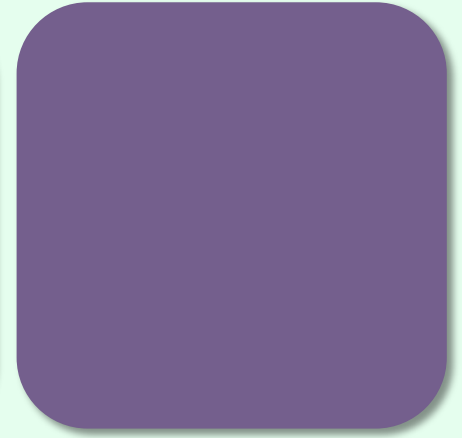
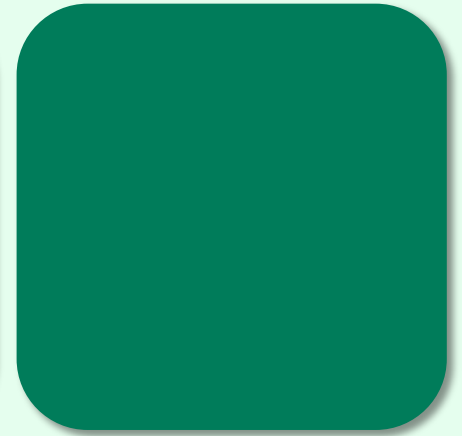


Comparing and
Analyzing Total
Precipitable Water from
Ground-Based GPS and
SSM/I Satellite Remote
Sensing



CMMAP Summer Internship
Graduate Student Colloquium

August 2, 2011

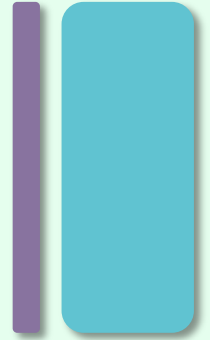
Brittany Fields

About Me

- Undergraduate at
 - Graduate this Fall!

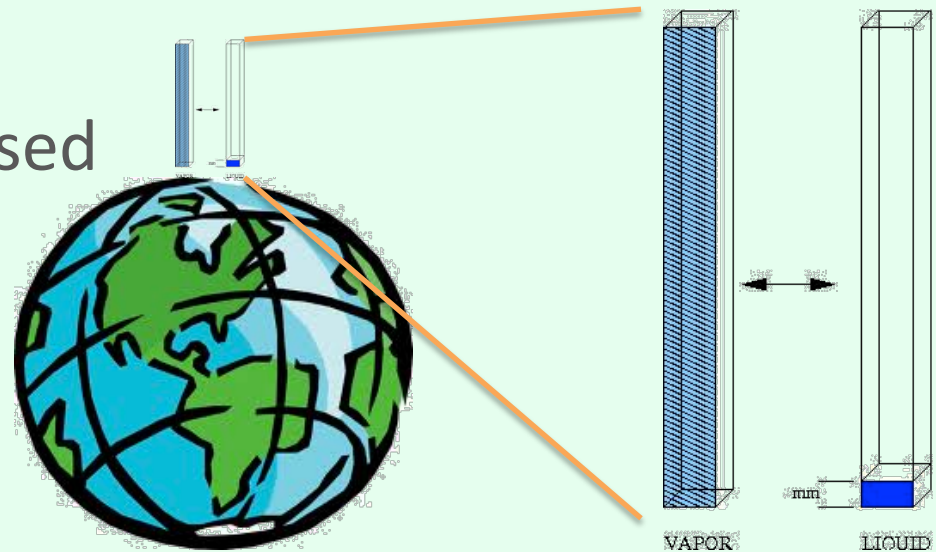


- Studying Environmental Engineering
- Intend to go to graduate school for Atmospheric Science
- Research Interests:
 - Severe Storms
 - Mesoscale Meteorology
 - Remote Sensing

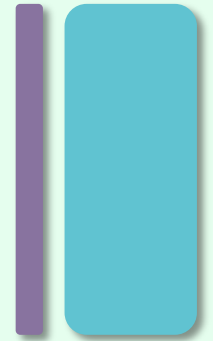


Introduction

- Total precipitable water (TPW) = Total water vapor in vertical column of air from ground to the top of the atmosphere
 - Measured in terms of height if water vapor were completely condensed



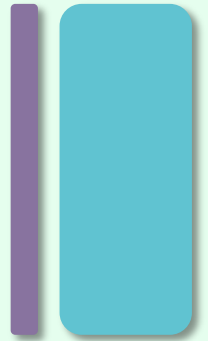
My Research



- Comparing Special Sensor Microwave/Imager (SSM/I) data to Global Positioning System (GPS) data
 - Comparing and Analyzing TPW values
- SSM/I used to measure TPW over oceans
 - Isolate island stations



Big Picture



- NASA Water Vapor Project (NVAP) created in 1990s
 - Water vapor dataset 1987 – 2010
 - John Forsythe, Tom Vonder Haar, Janice Bytheway

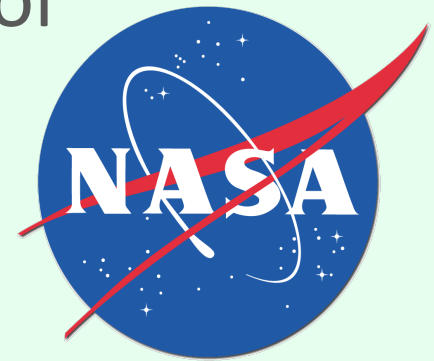
- Better understanding of water vapor

- Better models

Weather

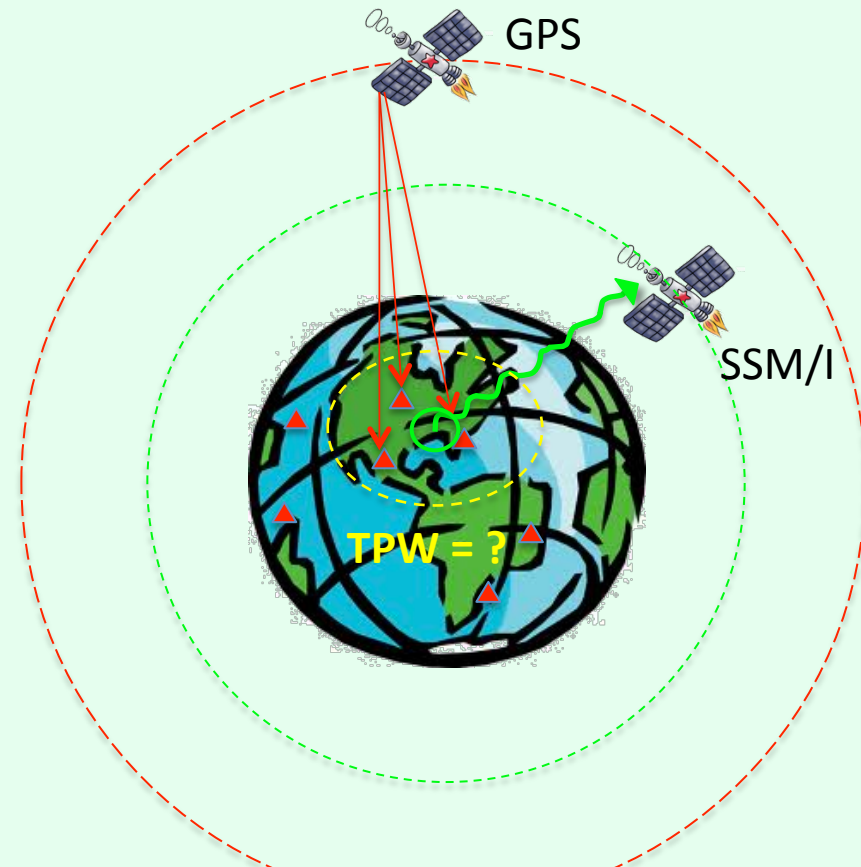
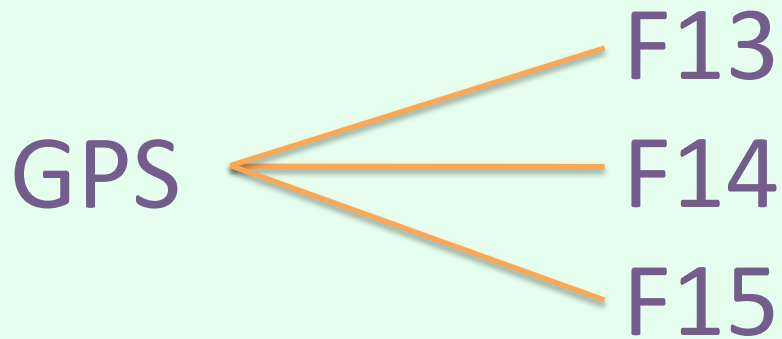
Hydrological

Climate

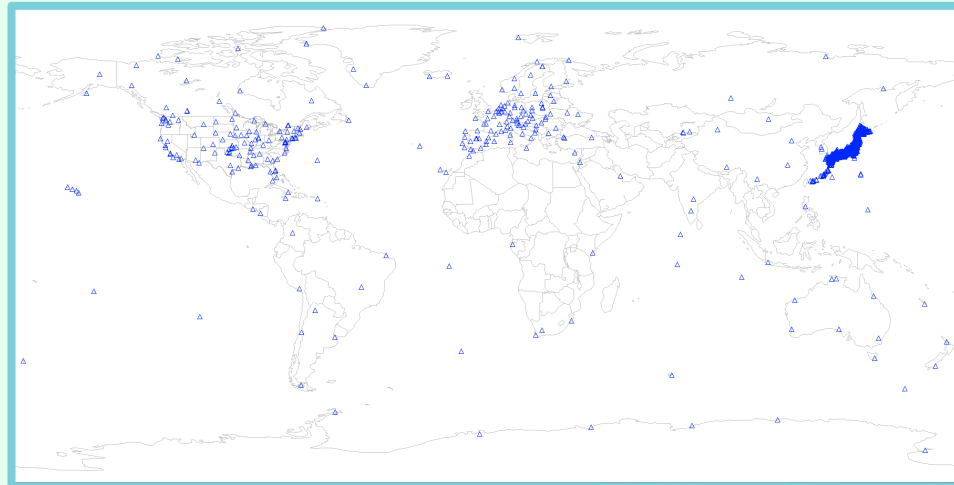


Comparison

- Data used from January 2003
- TPW from 3 SSM/I satellites compared to GPS



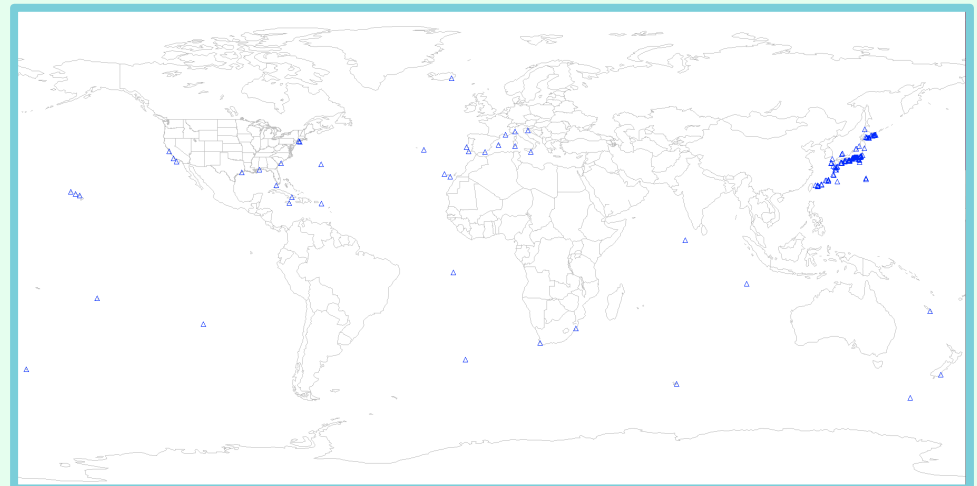
GPS Stations



- All GPS Stations
 - Large amount in Japan



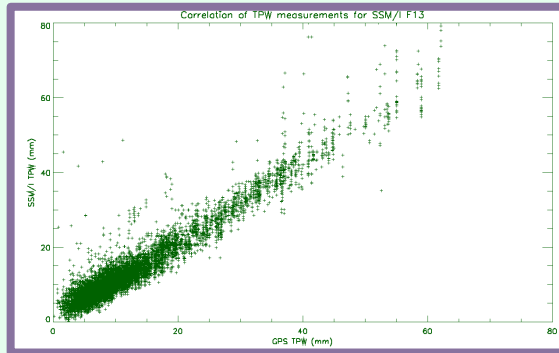
- Island GPS Stations



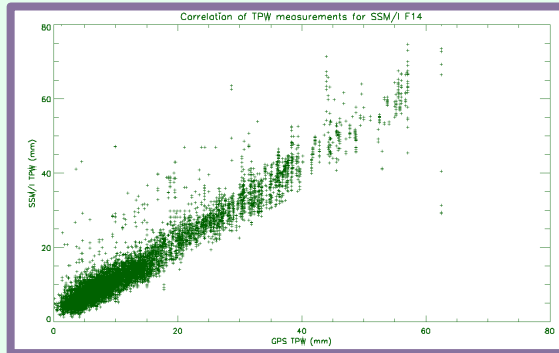
TPW Plots

All Stations

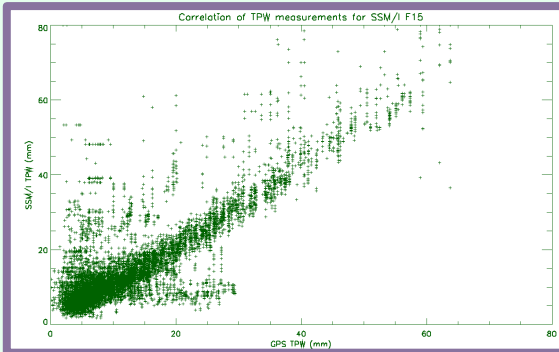
F13



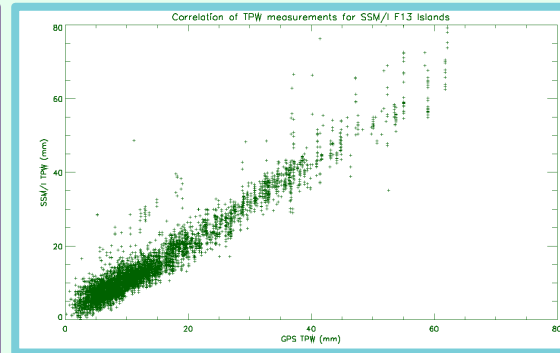
F14



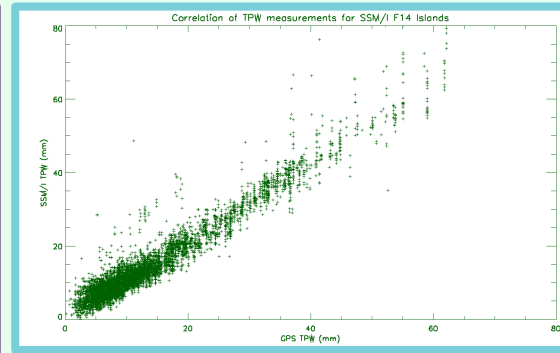
F15



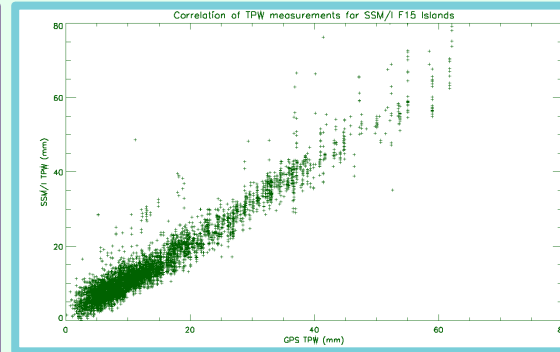
F13



F14



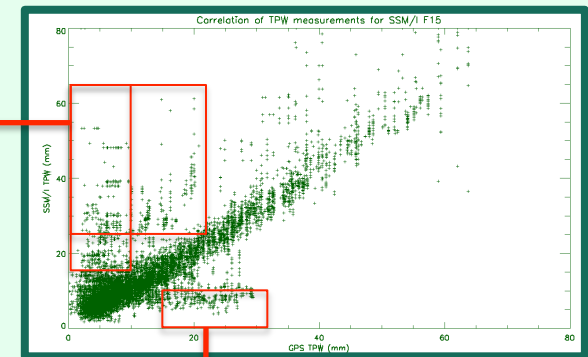
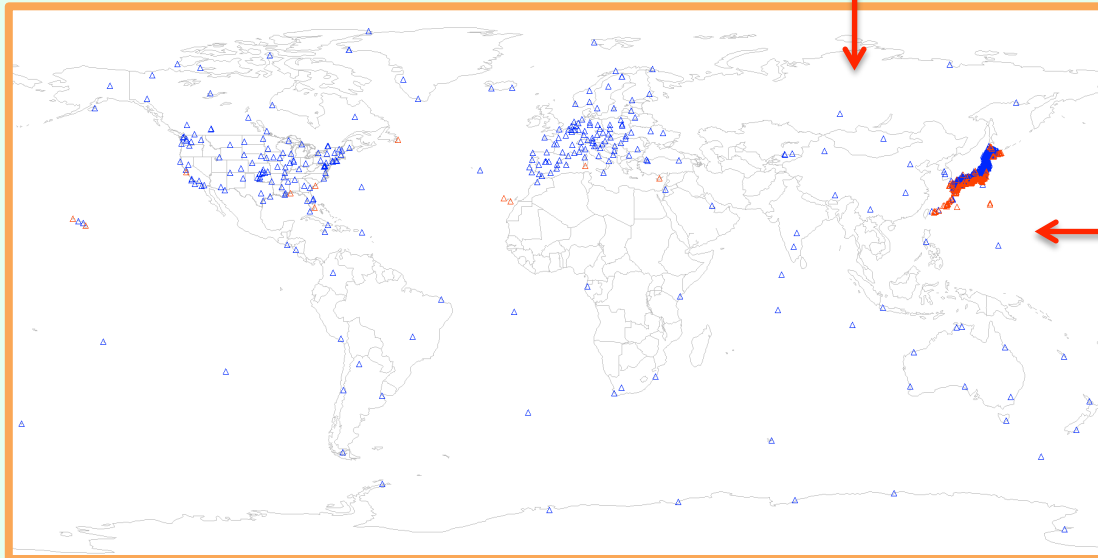
F15



Island Stations

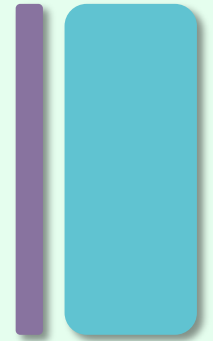
SSM/I F15?

- What caused the 'arrow' pattern
- Outlier stations plotted on world map . . .



. . . Most 'problem stations' found to be in Japan

Statistics



All GPS Stations

GPS with SSM/I #	# Points Compared	Correlation Coefficient	Slope of Best Fit Line	RMS	Bias
F13	10095	0.96099	1.03895	3.36654	1.40502
F14	11457	0.960665	1.02452	3.74991	1.96914
F15	10583	0.834851	0.931304	7.16650	2.40692

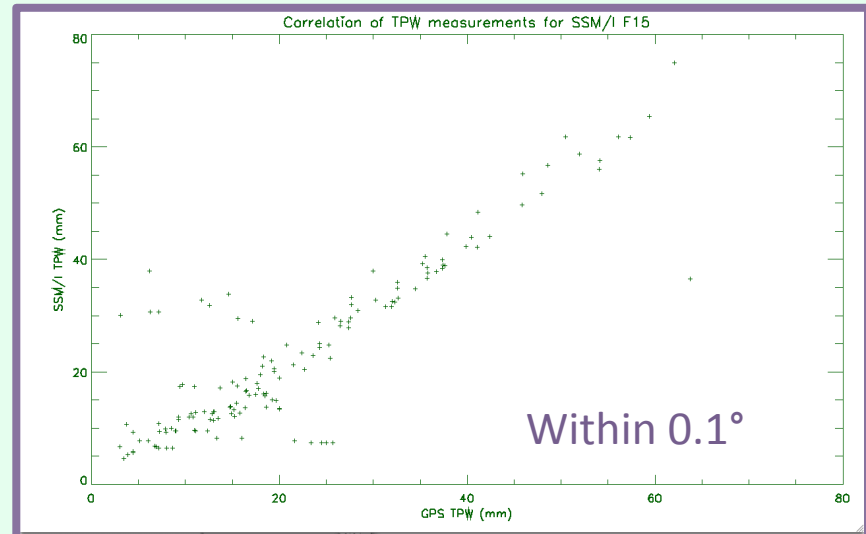
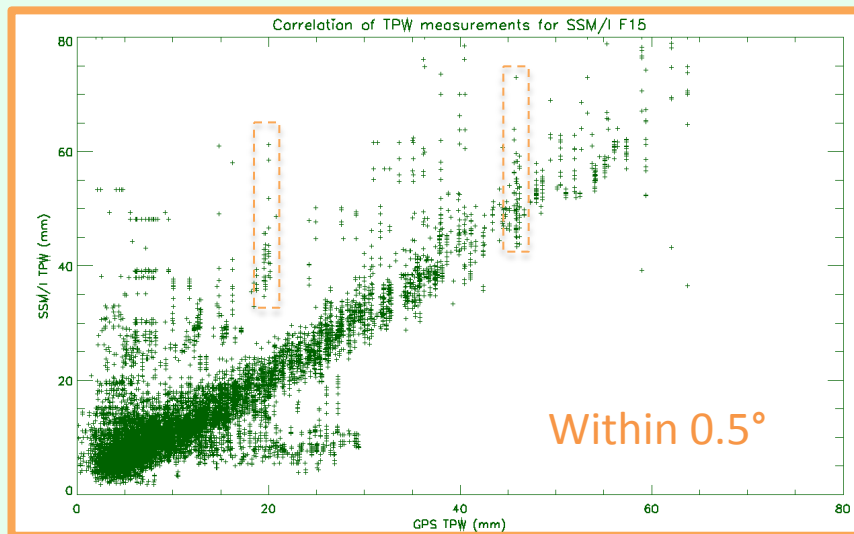
Island Stations Only

GPS with SSM/I #	# Points Compared	Correlation Coefficient	Slope of Best Fit Line	RMS	Bias
F13	7150	0.966101	1.04458	3.27785	1.23046
F14	8123	0.964996	1.03335	3.72551	1.87334
F15	7123	0.844169	0.942989	7.38947	2.39116

Statistics – continued

SSM/I F15

Latitude/ Longitude within ___	# Points Compared	Correlation Coefficient	Slope of Best Fit Line	RMS	Bias
0.5°	10583	0.834851	0.93104	7.16650	2.40692
0.1°	148	0.879883	0.96274	7.47918	1.79184



Findings

- SSM/I F15 has greater scatter than F13 and F14
- Japan is the source of most of the 'problem data'
- Vertical data lines caused by multiple SSM/I satellites matching GPS stations



Questions?

