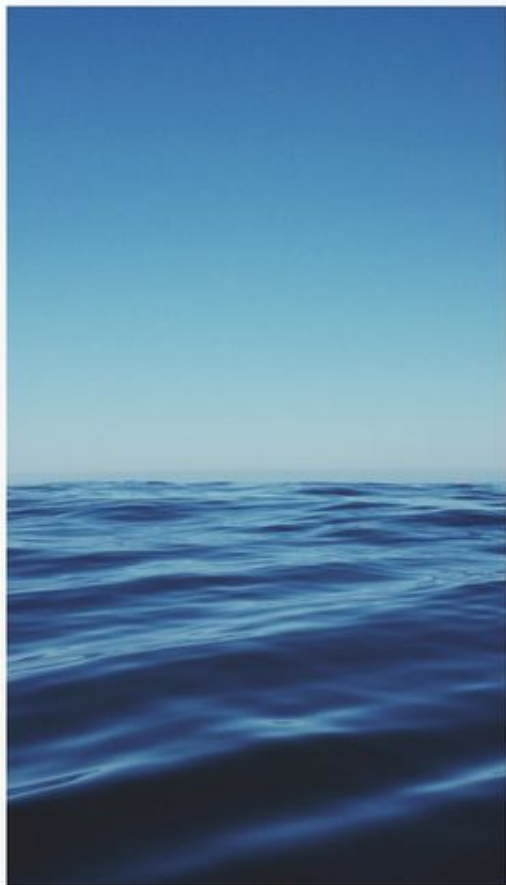


# SENSING STORM SURGE

A citizen science approach to measuring storm surge-estuarine interaction in three Maine communities





---

## SESSION **OVERVIEW**

- Project personnel
- Study methods + timeline
- Story of two storms + data sharing

### ***\*\*Short Intermission\*\****

- Challenges + difficulties
- Implications for climate change adaptation + coastal development

### ***\*\*Networking, questions, etc.\*\****



**DR. LAURA RICKARD**



**DR. KIMBERLY HUGUENARD**



**ABBY ROCHE**



**PRESTON SPICER**



**KEVIN DUFFY**



**KYAH LUCKY**





DYLAN SCHLICHTING



DR. LINDA SILKA

**... and our citizen scientists!**



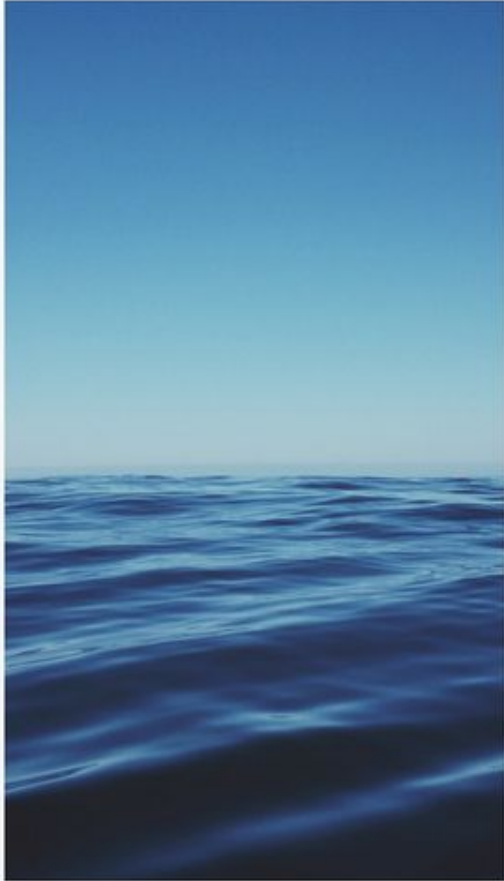
---

## ICE-BREAKER

**Where are you from?**

Visit: [www.menti.com](https://www.menti.com)

Use code: 43 26 11



---

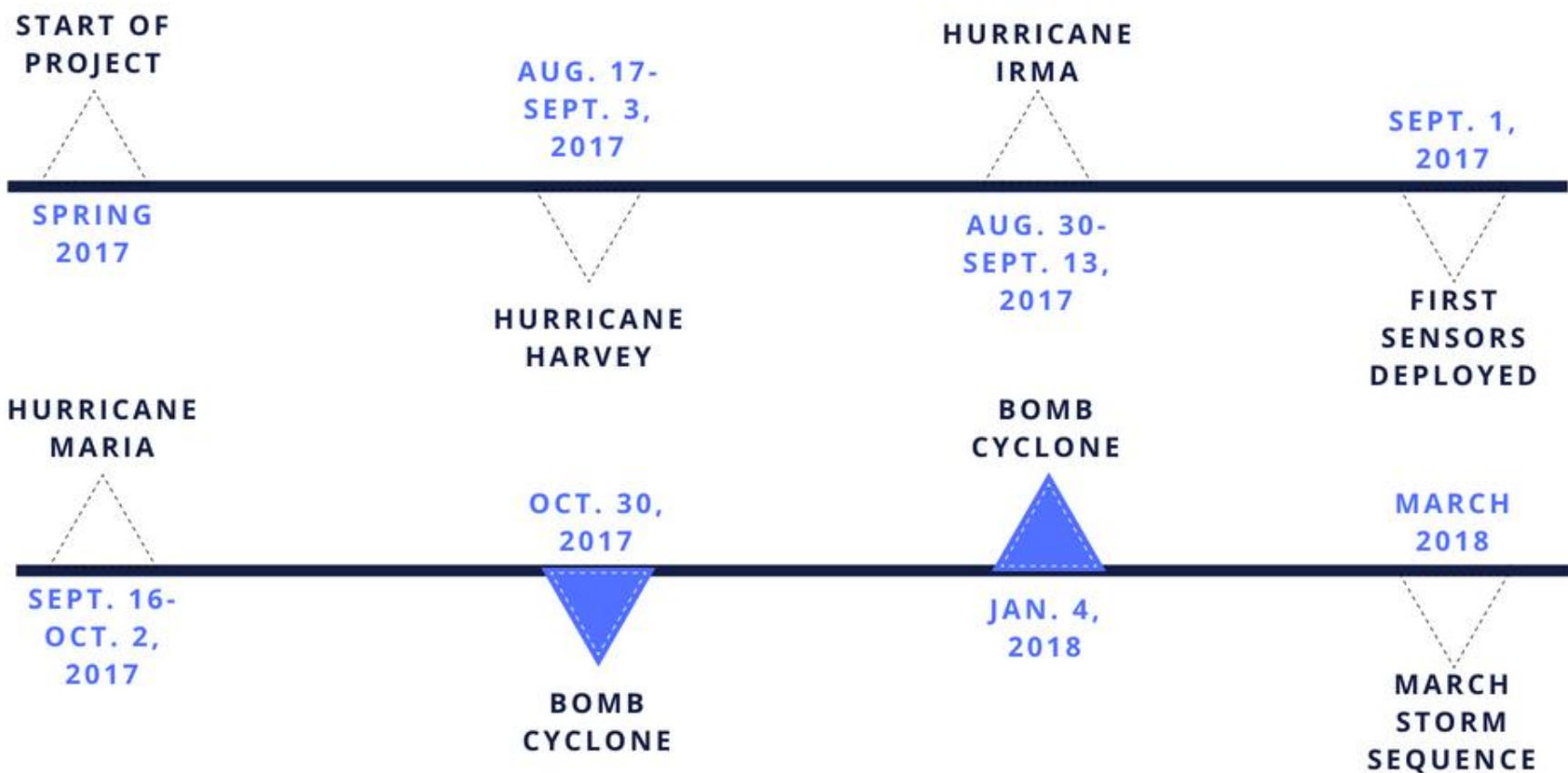
## ICE-BREAKER

**What brings you here today?**

Visit: [www.menti.com](https://www.menti.com)

Use code: 94 36 17

# PROJECT TIMELINE



## STORM SURGE BACKGROUND

- Storm surge a growing concern in Maine communities
- Frequency of extreme storms is increasing .



### February 1976 Bomb Cyclone

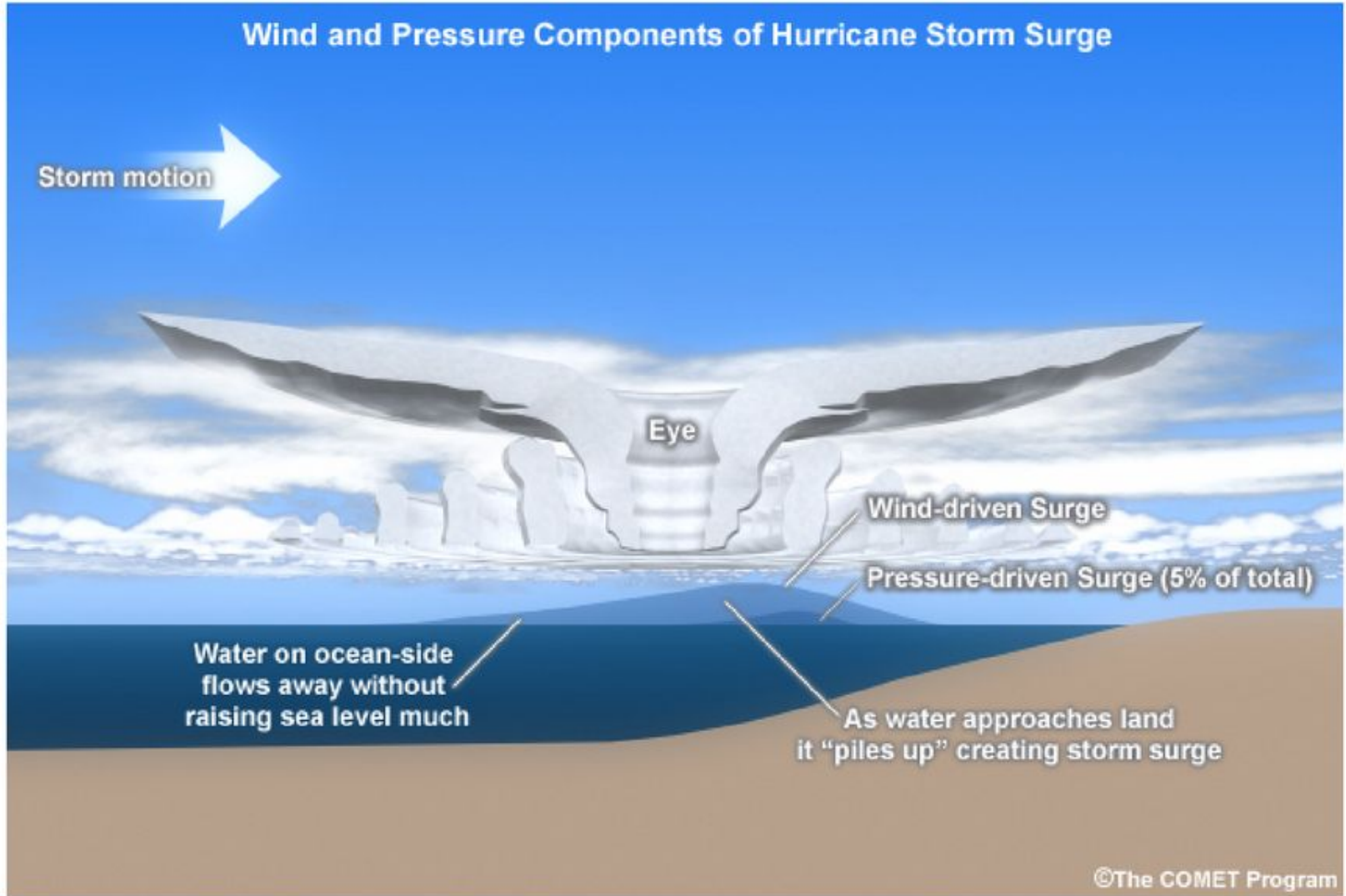
Lowest Pressure	964 mb
Expected Pressure Surge	49 cm
Max. Sustained Wind	46 mph
Average Wind Direction	from SSW
Time of Max. Surge	2 hrs before HT



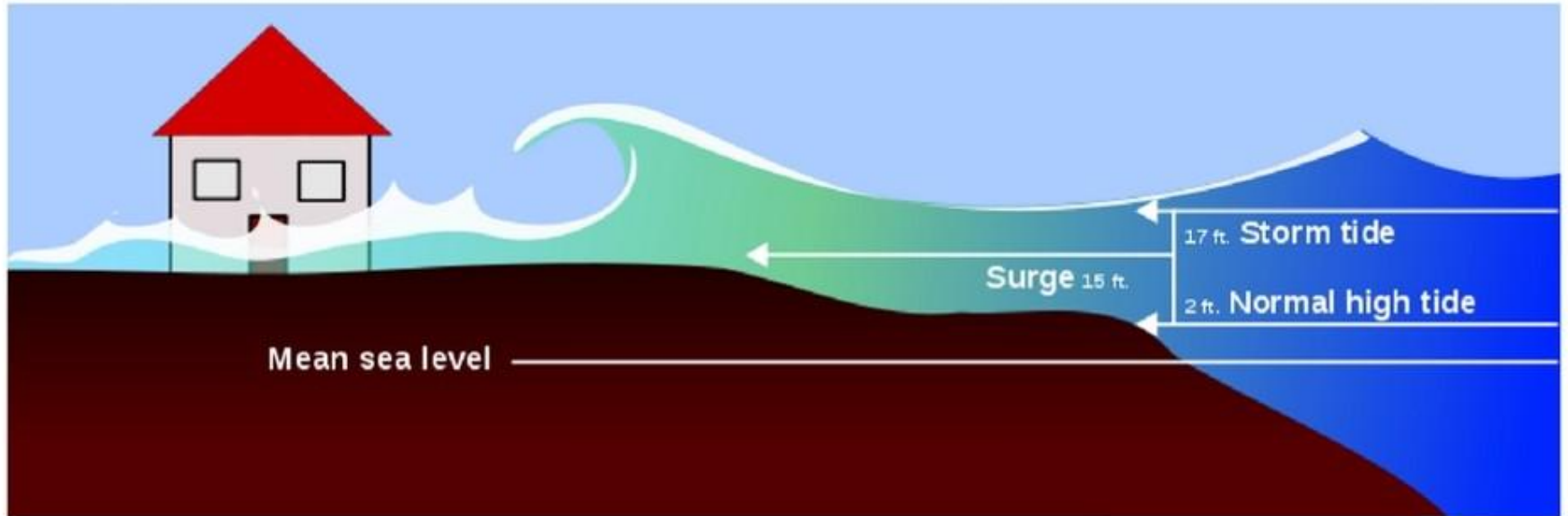
Photos courtesy of Bangor Daily News



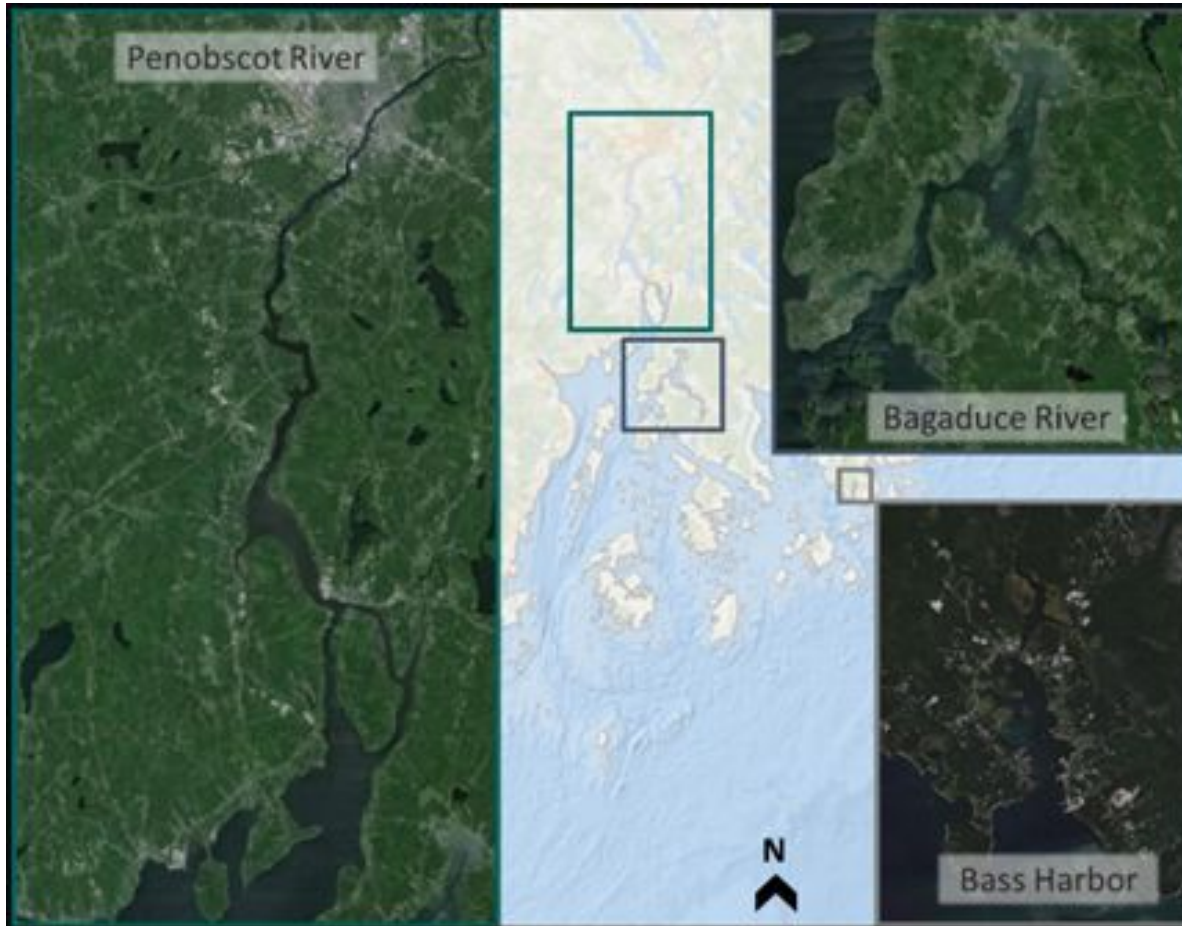
## Wind and Pressure Components of Hurricane Storm Surge



# INTRODUCTION TO THE PROJECT



## INTRODUCTION TO THE PROJECT



### **Penobscot:**

Converging, long, north-south orientation, deep system, freshwater input

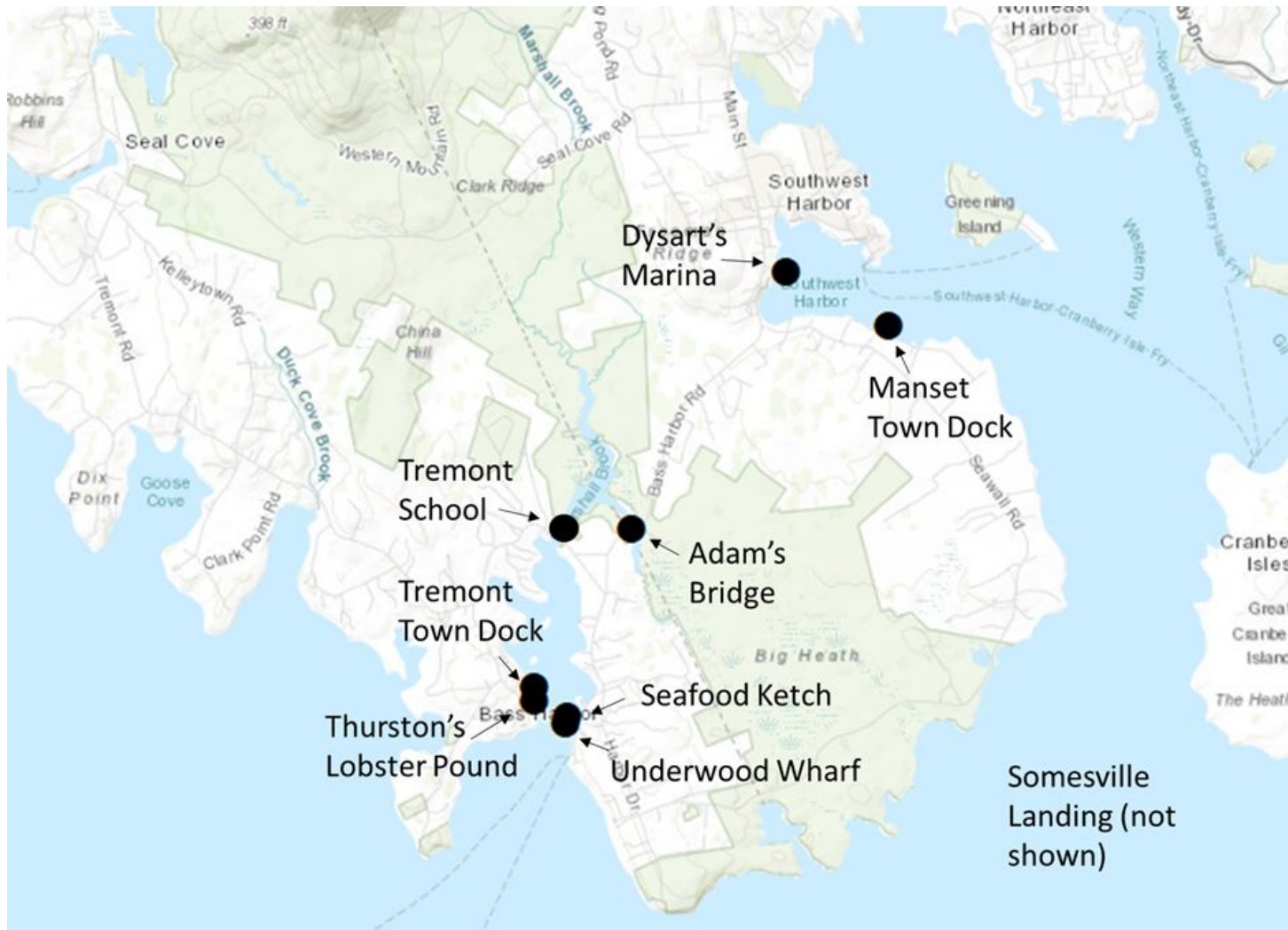
### **Bagaduce:**

L-shaped, shallow, constrictions (reversing falls), tidal flats

### **Bass Harbor/SW Harbor:**

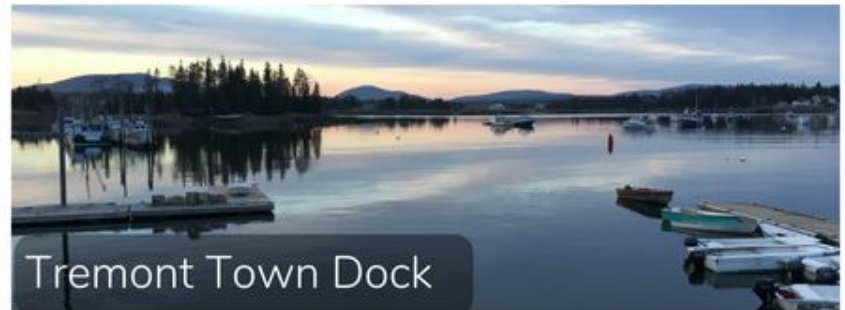
Small, converging, north-south orientation, salt marsh

## INTRODUCTION TO THE PROJECT

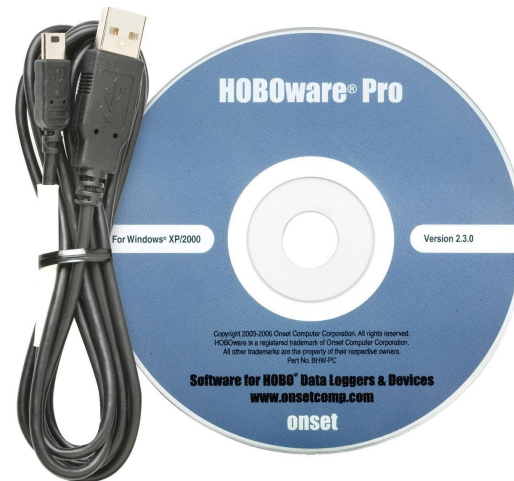


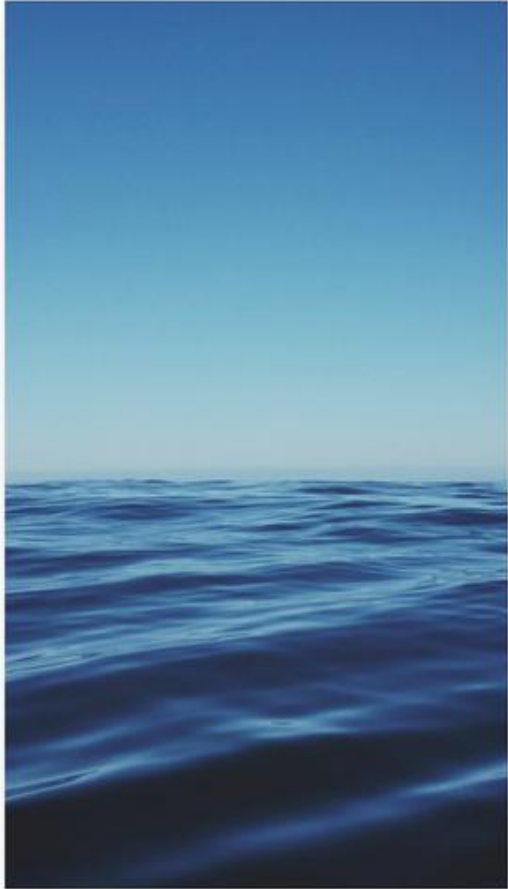


## INTRODUCTION TO THE PROJECT



# INTRODUCTION TO THE PROJECT





---

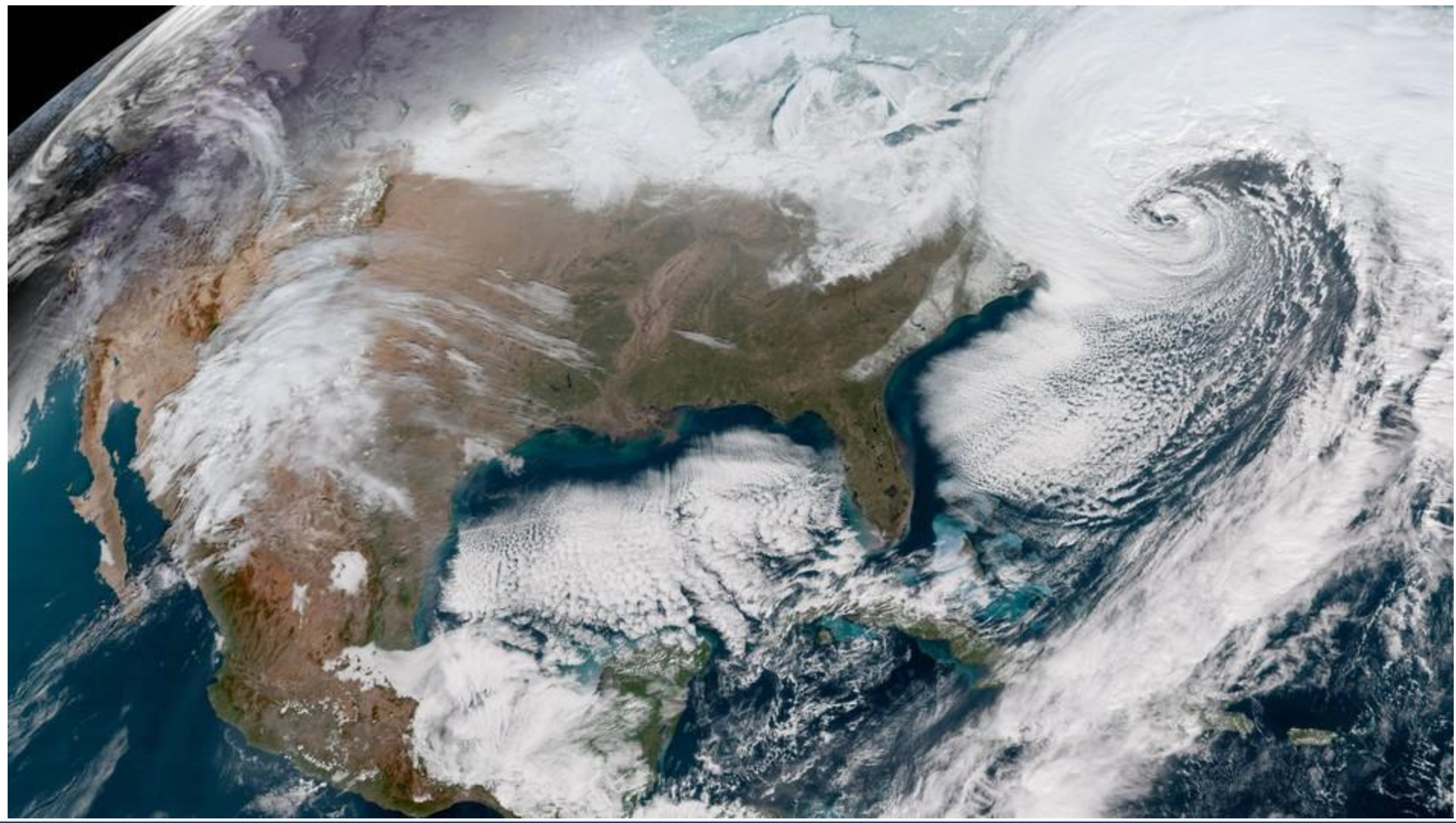
## Recollections of “bomb cyclone” weather events

Visit: [www.menti.com](https://www.menti.com)

Use code: 52 85 66



## STORY OF TWO STORM EVENTS





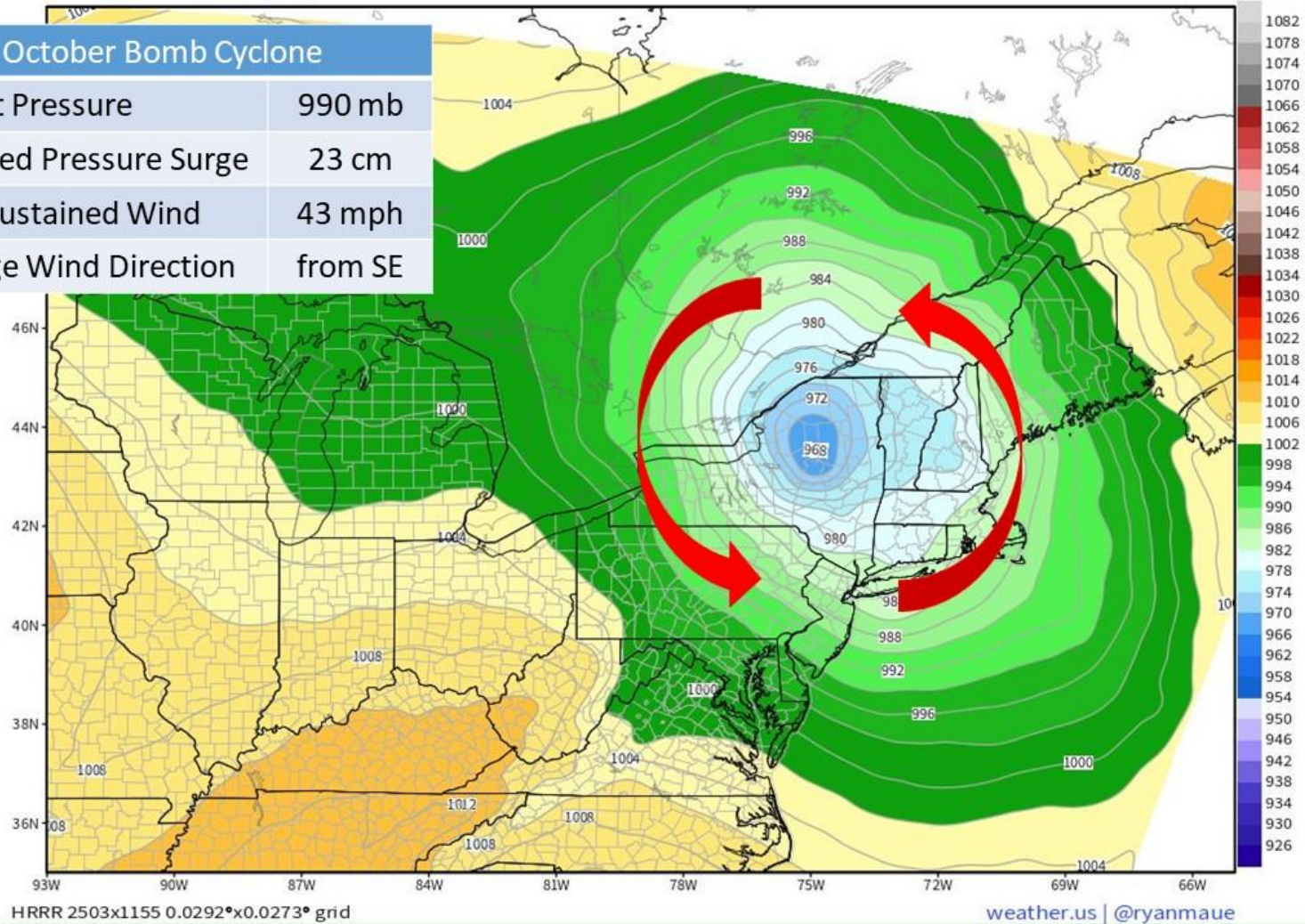
## PRESENTATION OF THE DATA

Name	Water Level Data									
	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May
Penobscot										
Bucksport				15-Nov	x	x	x	x	x	17-May
Searsport				21-Nov	6-Dec		2/5 to 2/27	3/12 to 3/27	4/10 to 4/25	5/1 to 5/16
Rockport			11-Oct	9-Nov						
Fort Point SP				4-Nov	x	x	x	x	29-Apr	
Hampden		20-Sep	20-Oct	4-Nov	x	1-Jan	20-Feb	x	18-Apr	
Winterport								3-Mar	29-Apr	
Bangor				4-Nov	16-Dec					
Belfast				4-Nov	x	x	x	x	29-Apr	
Bagaduce										
B3		17-Sep	x	4-Nov						
B4		17-Sep	x	x	16-Dec		24-Feb	26-Mar		
B1	22-Aug	x	x	x	x	x	x	x	x	14-May
B5		17-Sep	x	x	16-Dec	16-Jan	x	x	x	16-May
B2			12-Oct	x	x	30-Jan	2-Feb	x	x	26-May
B6						10-Jan	x	x	2-Apr	
Bass Harbor										
Thurston's Lobster Pound	18-Aug	x	x	x	x	x	x	31-Mar		
Tremont School		4-Sep	x	x	x	x	x	x	29-Apr	
Underwood Wharf	26-Aug	x	x	x	x	x	x	x	x	5-May
Seafood Ketch		17-Sep	x	x	x	x	x	x	30-Apr	
Tremont Dock	31-Aug	x	x	x	x	x	x	x	30-Apr	
Adam's Bridge				3-Nov	12/3 then 12/7	6-Jan				
Southwest Harbor										
Manset Town Dock			3-Oct	x	x	x	x	x	30-Apr	
Dysart's Marina		17-Sep	x	x	x	x	x	31-Mar		
Somesville Landing									4/9 to 4/24	5/9 to 5/24

# STORY OF TWO STORM EVENTS

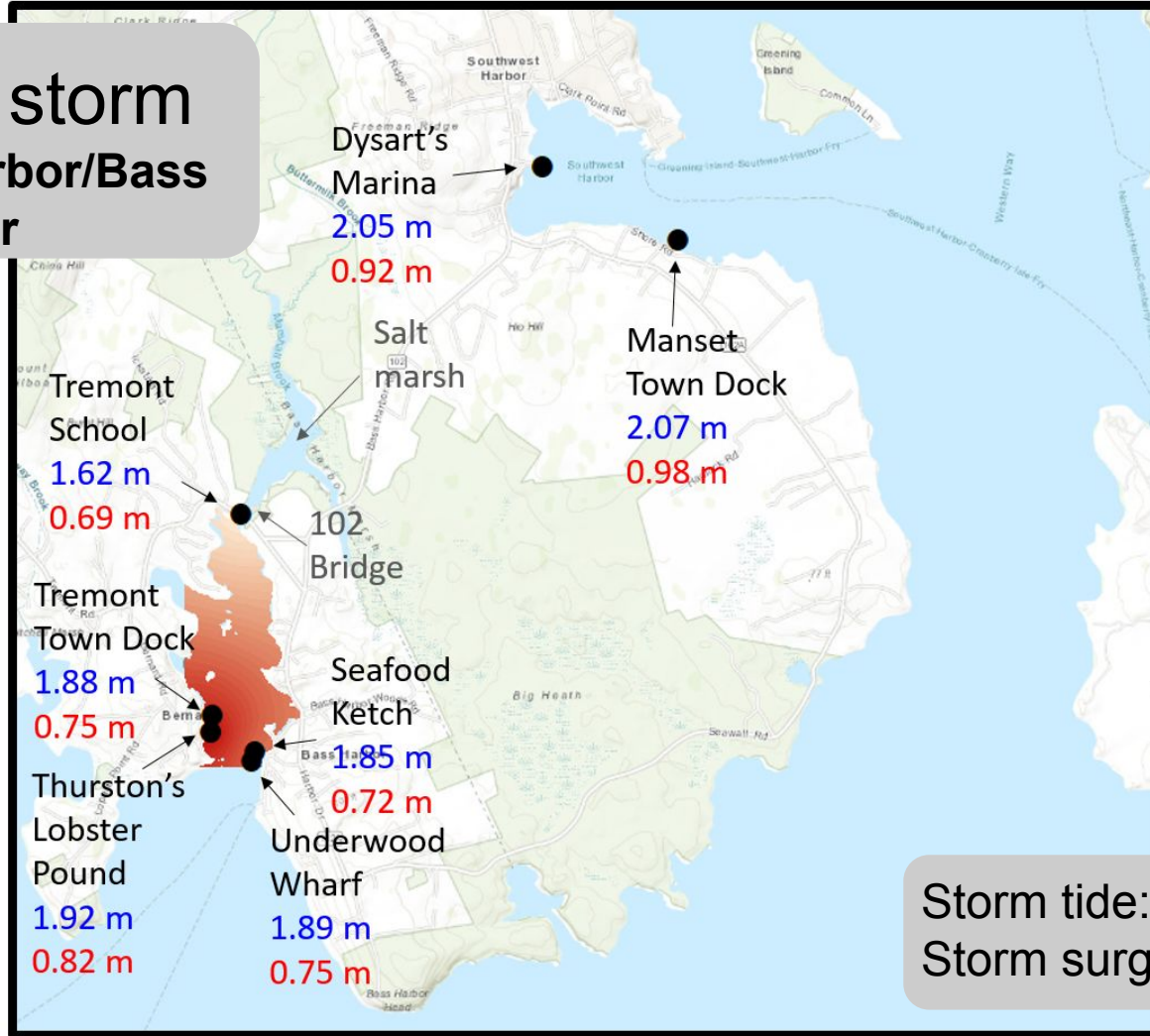
## October Bomb Cyclone

Lowest Pressure	990 mb
Expected Pressure Surge	23 cm
Max. Sustained Wind	43 mph
Average Wind Direction	from SE



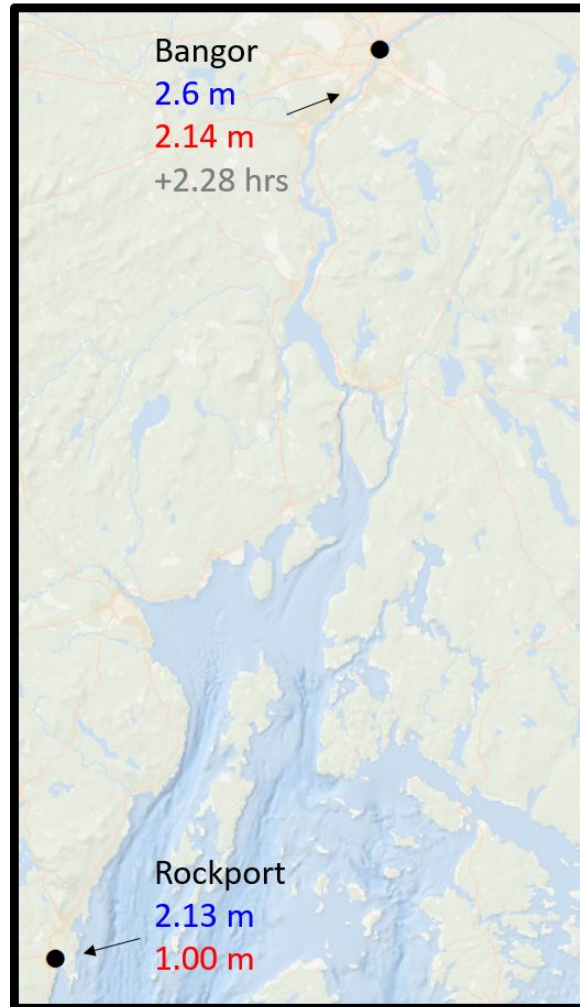
PRESENTATION OF THE DATA



Oct. 30th storm  
Southwest Harbor/Bass  
Harbor





Oct. 30th storm  
Penobscot River





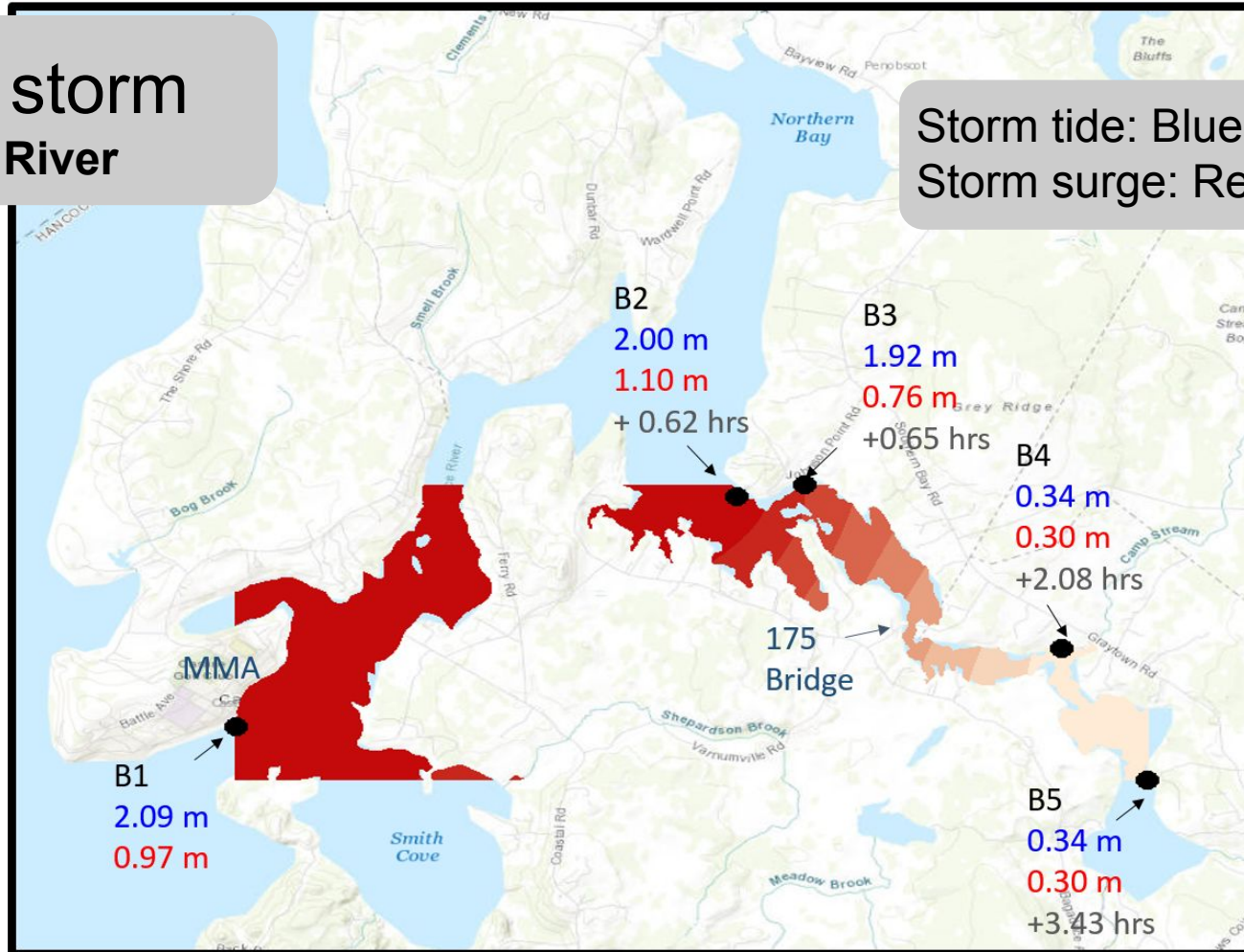
Storm tide: Blue   
Storm surge: Red 



PRESENTATION OF THE DATA

Oct. 30th storm  
Bagaduce River

Storm tide: Blue   
Storm surge: Red 



## Summary:

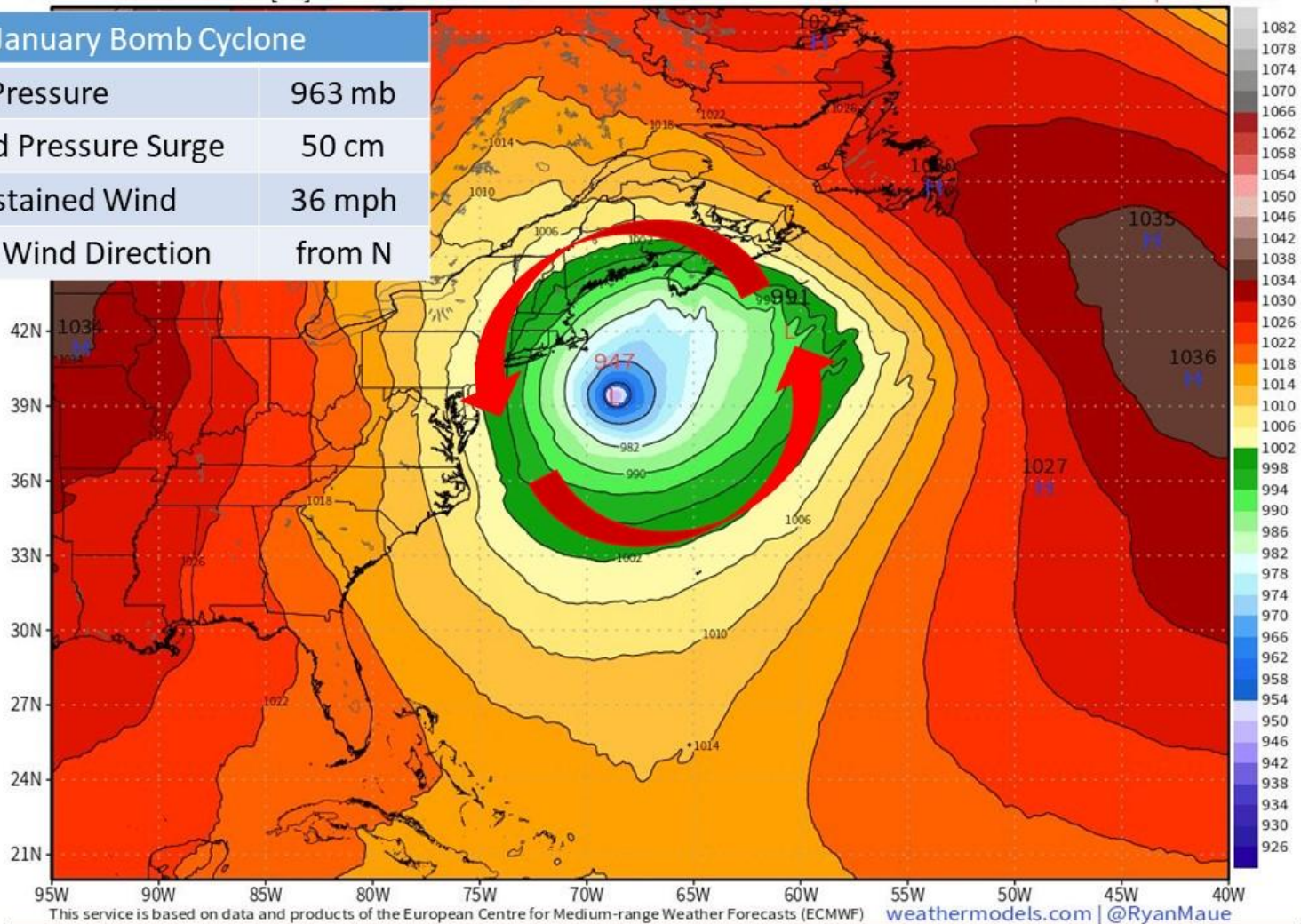
October Bomb Cyclone	
Lowest Pressure	990 mb
Expected Pressure Surge	23 cm
Max. Sustained Wind	43 mph
Average Wind Direction	from SE
Time of Max. Surge	~30 min after HT

- **Penobscot:** surge **increases** moving up-estuary
  - Wind supportive of surge propagation...predominately wind enhanced surge
- **Bagaduce**
  - Surge **increases** from narrow channel
  - Surge then **decreases** from shallow depth and restriction of bridge
- **Bass Harbor**
  - **Decrease** in surge moving up estuary from shallow depth and restriction of bridge
- **Southwest Harbor**
  - **Increase** in surge relative to Bass Harbor from narrower Western Way

# STORY OF TWO STORM EVENTS

## January Bomb Cyclone

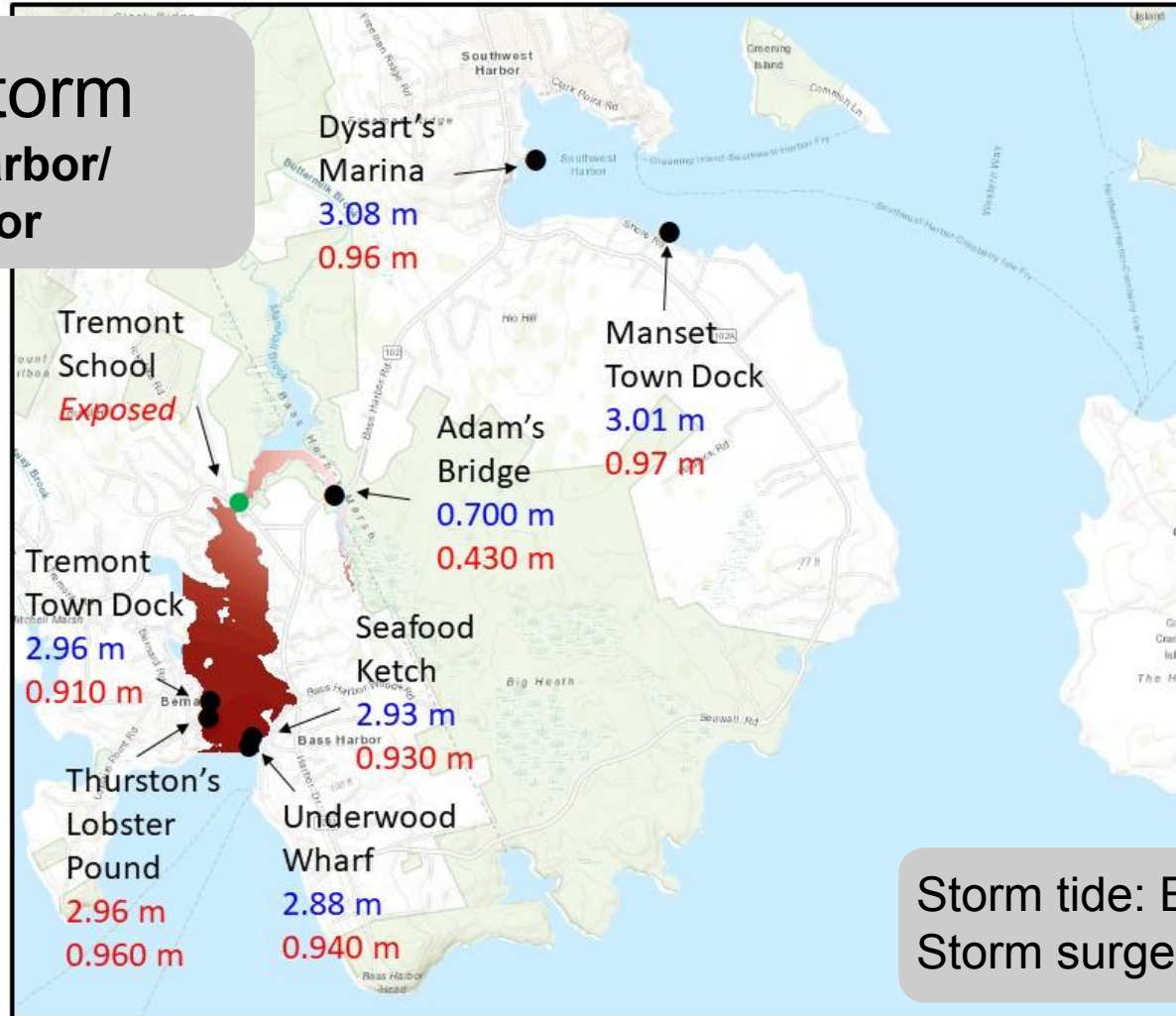
Lowest Pressure	963 mb
Expected Pressure Surge	50 cm
Max. Sustained Wind	36 mph
Average Wind Direction	from N







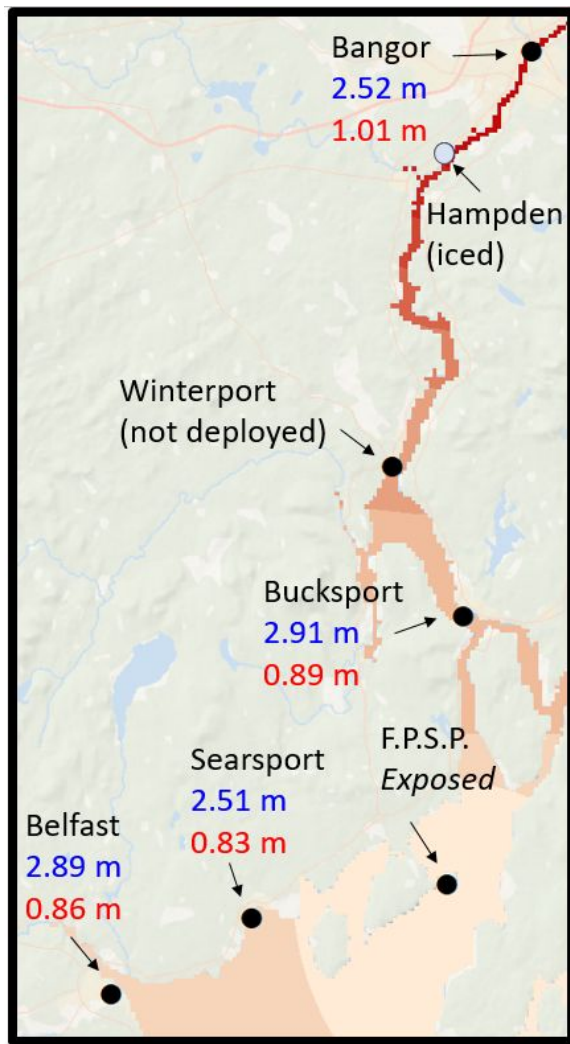
PRESENTATION OF THE DATA



Jan. 4th storm  
Southwest Harbor/  
Bass Harbor



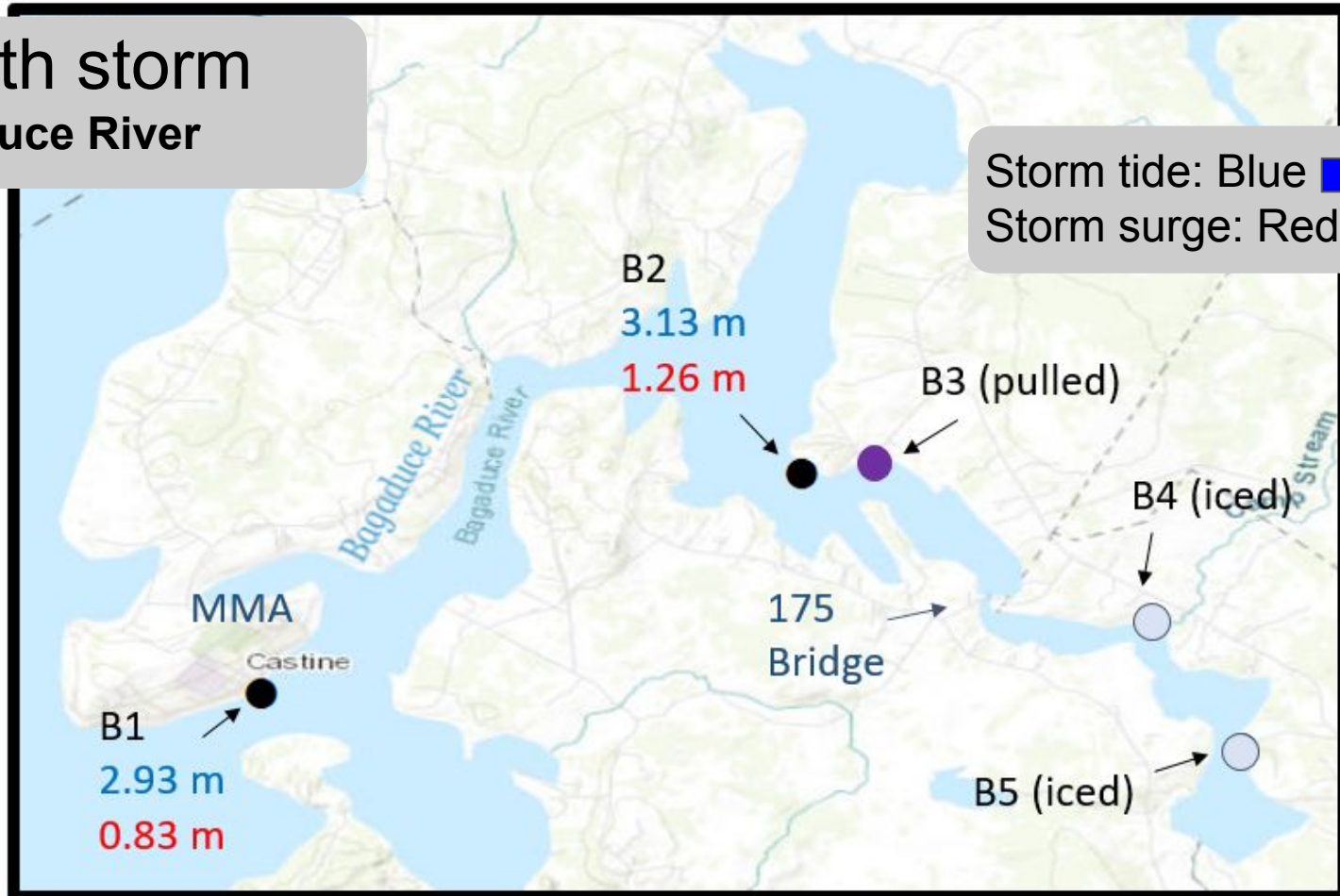
Storm tide: Blue   
Storm surge: Red 

# Jan. 4th storm Penobscot River



Storm tide: Blue   
Storm surge: Red 

Jan. 4th storm  
Bagaduce River





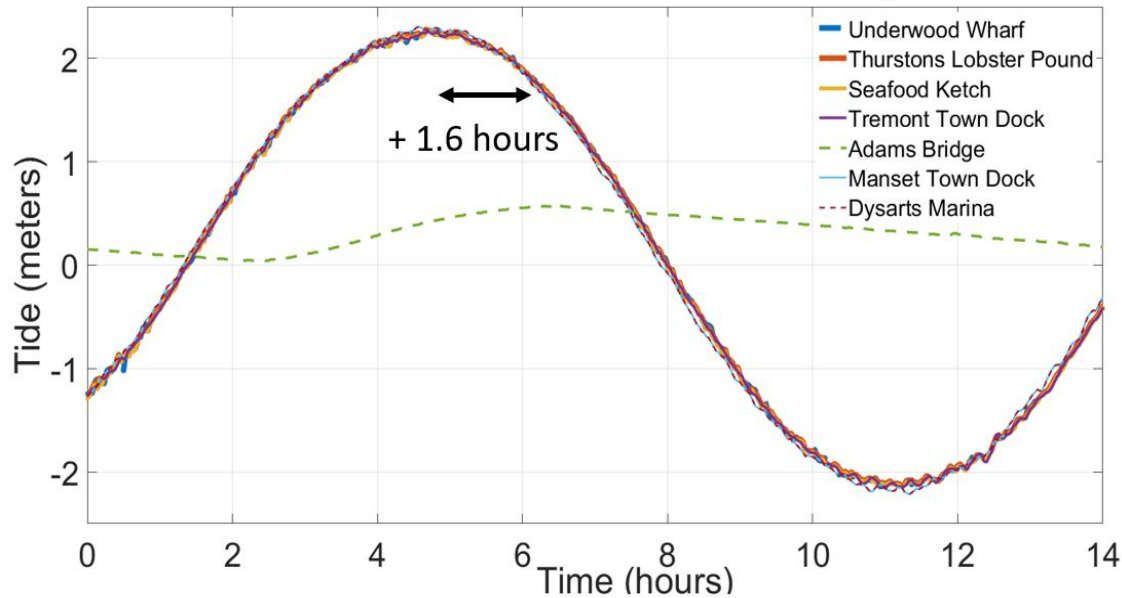
## Summary:

- **Penobscot: slight increase moving up estuary**
  - Wind working against surge propagation
  - Smaller surge than October storm...opposing wind
- **Bagaduce, Bass Harbor, Southwest Harbor**
  - Similar patterns in estuary compared to October storm
  - Coastal values generally larger
- **Main Message**
  - Storm path really important

January Bomb Cyclone	
Lowest Pressure	963 mb
Expected Pressure Surge	50 cm
Max. Sustained Wind	36 mph
Average Wind Direction	from N
Time of Max. Surge	~2.5 hrs after HT

# PRESENTATION OF THE DATA

## Bass Harbor and Southwest Harbor Spring Tides



## Typical Tidal Ranges

	Spring (m)	Neap (m)
Underwood Wharf	4.32	3.64
Thurston's Lobster Pound	4.32	3.64
Seafood Ketch	4.32	3.64
Tremont Town Dock	4.32	3.64
Adam's Bridge	0.595	0.319
Dysart's Marina	4.47	3.66
Maset Town Dock	4.47	3.66
Somesville Landing	4.34	3.22

INTERMISSION

# INTERMISSION

[5 MINUTES]



## CHALLENGES & DIFFICULTIES



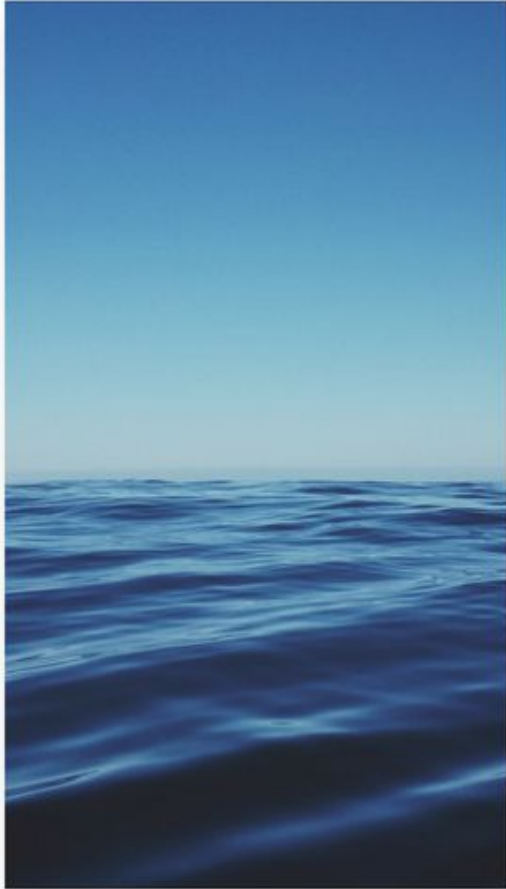


---

## Citizen scientist challenges and difficulties

### Icing over of equipment

*“..and then the ice freezing over. So it was the **weather that really impeded us** in doing it correctly. We just couldn't pull the sensor out of the ice.”*



---

## Citizen scientist challenges and difficulties

Community building with other citizen scientists

*“(I was) hoping to connect with new people through it, and locally that hasn’t been the case. I know that there’s another data logger just up the road from me, but besides one other person in the study I haven’t communicated with any of those people.”*

*“I think that we would of or I would’ve enjoyed contacting other people and not just feeling on my own. That’s one thing. I think creating a team in an area who have a common interest would be more effective in a way then this one on one thing.”*



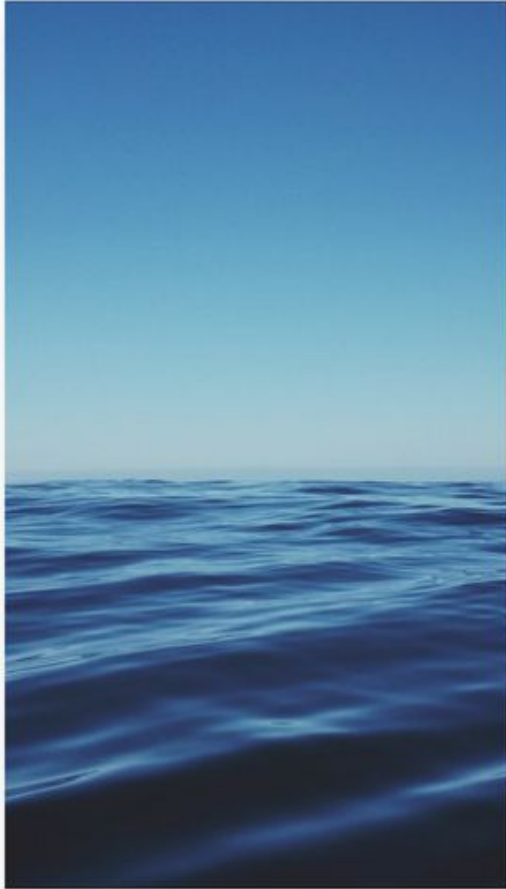


---

## Citizen scientist challenges and difficulties

### Data collection frequency

*“..because it’s **so infrequent**, when you’re doing it once a month you don’t get really good and right in the hang of it so much as if you were doing it every day or every week or something...**so it doesn’t become like second nature** because there’s a big interval in between you gotta remind yourself what to do.”*



---

## Citizen scientist challenges and difficulties

### Periodic check-ins and updates

*“ (a suggestion) would be to see some simple graphs of the trends that are the product of the data you’re collecting rather than waiting for some longer time. Like you’re collecting it but unless you go in and you were to make your own graphs and things – you can see the day to day kinda ups and downs if you open the data files. But pulling out some of the patterns that are emerging during the data collection time from different sites would be interesting and engaging I think for all the participants. So you’re not working in isolation and not knowing even perhaps what your own data looks like.”*

---

## STORM SURGE IN ESTUARIES

### What we have learned

- Storm path and timing with tide is critical
- Importance of accurate storm forecasting for flood advisories inland versus coastal
- Need for hydrodynamic modeling to inform future coastal adaptation

### Why is this important for Maine?

- Coastal infrastructure
- Coastal economic development
- Climate change adaptation

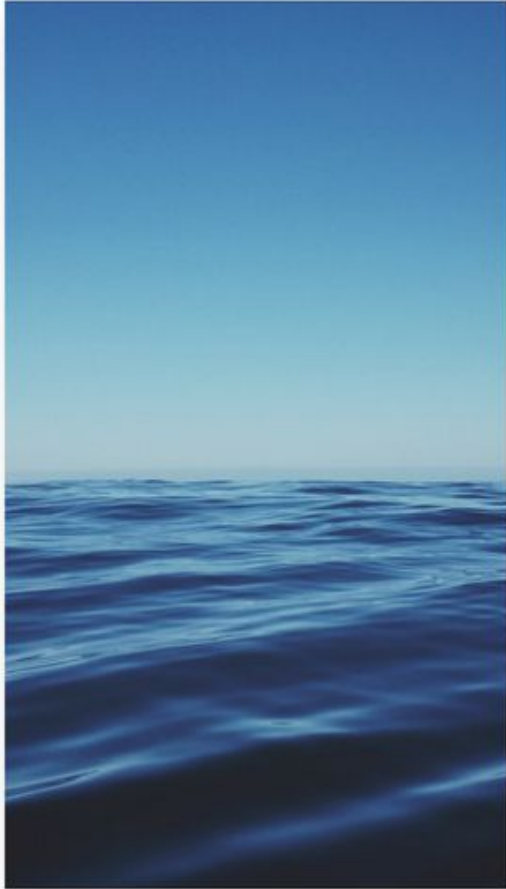


---

## What's next?

- Electronic technical report
- Data in sharable form
- Scientific publications
- Opportunities for expansion and funding in the future

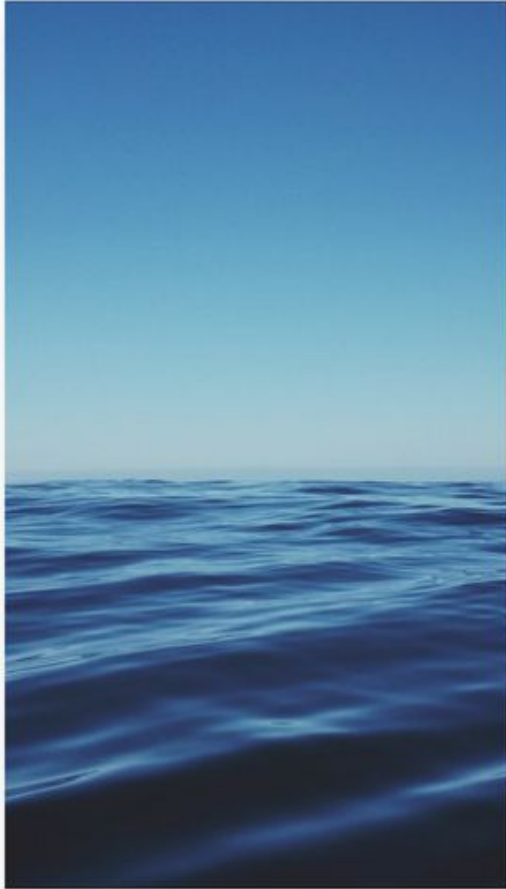




---

## Where do we go from here?

- Who should receive these data?
- What future research or studies or analysis are needed?



---

## RELEVANT ORGANIZATIONS

### National

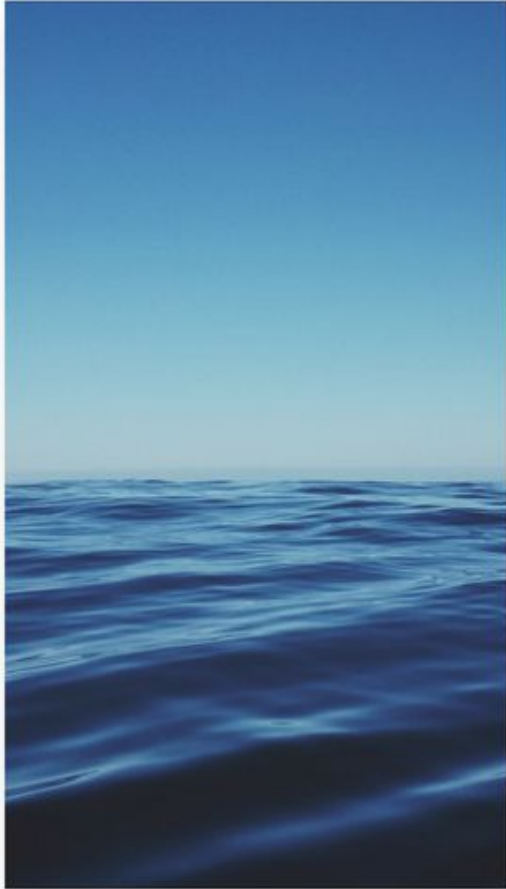
National Weather Service, National Park Service, National Oceanic and Atmospheric Administration

### State

Downeast Conservation Network, Maine Geological Survey, Maine Coastal Program, Natural Resources Council of Maine, Maine Coast Heritage Trust, Island Institute, Maine Sea Grant, Maine EPSCoR, Maine DOT

### Local

MDI Biological Lab, Friends of Acadia, Downeast Conservation Network, Somes-Meynell Wildlife Sanctuary, Frenchman Bay Partners, Frenchman Bay Conservancy, Schoodic Institute



---

## CONTACT INFORMATION

**Dr. Kimberly Huguenard**  
**Dr. Laura Rickard**

Email: [sensingsurge@gmail.com](mailto:sensingsurge@gmail.com)

Website: <http://sensingstormsurge.acg.maine.edu>



@SensingSurge @LNRickard

Interested in becoming a citizen  
scientist or being interviewed?

**Contact us!**

# SENSING STORM SURGE

A citizen science approach to measuring storm surge-estuarine interaction in three Maine communities

