SENSING STORM SURGE

CITIZEN SCIENCE GUIDE

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Introduction

Welcome!

Thank you for your participation in the Sensing Storm Surge citizen science effort. Without your help, this research would not be possible.

This manual provides guidance and instruction for Sensing Storm Surge citizen scientists. In your role as a citizen scientist, you will be asked to collect data from one sensor and upload these data onto our website each month. You will also be asked to help researchers understand how you and your fellow community members think about the citizen science effort as well as storm surge and coastal development in Maine by participating in surveys and optional interviews.

If at any point you have any questions please do not hesitate to contact us via email: *sensingsurge@gmail.com,* or by visiting our website: *http://sensingstormsurge.acg.maine.edu*

Cheers,

The Storm Surge Team

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Introduction

Being a Sensing Storm Surge Citizen Scientist

We hope you will find being part of the Sensing Storm Surge team to be an opportunity to learn more about storm surge in the state of Maine, and the project's data collection procedures and tools. We have goals for the outcomes of our program efforts as well as goals for your own development as a citizen scientist.

Goals of the Sensing Storm Surge Project

In this project, we have several goals we hope to accomplish:

- Develop a better understanding of storm surge behavior in four Maine estuaries (Bagaduce River, Penobscot River, Southwest Harbor, and Bass Harbor) with varying physical properties
- Engage local residents in data gathering using various training methods
- Evaluate the citizen science effort by measuring the data reliability and participants' engagement

Citizen Scientist Activities

Citizen scientists on the Sensing Storm Surge team will be engaged in the following activities:

1. Training in sensor deployment, data retrieval, and data upload.
2. Deploying a sensor in the field to record storm surge data.
3. Retrieving data monthly.
4. Posting data to an online database.
5. Participating in pre and post project activities including: a pre- and post-project survey, and optional interviews.

It's important for each person to maintain their own site throughout the research period, and that each participant will be also uniquely responsible for equipment and reporting data to website.

Storm Surge

What is storm surge?

Storm surge is the rise in water level associated with coastal storms. Storm surge has two primary components: wind- and pressure-driven increases in water level, as shown in Figure 1. Wind-driven storm surge develops when an offshore storm blows wind toward the coast. The wind moves water toward the coast, which builds up at the boundary.

Imagine if you have a rectangular-shaped dish filled halfway with water. If you turn on a hair dryer at one end, you will see the buildup of water at the opposite end. When this happens along the coast, the larger water levels at one region of the coast cause the storm surge to move along the coast in the direction the storm is moving. Pressure-driven surge is caused by the low pressure inside of the storm, which sucks the water level directly under the storm upward. These mechanisms, when combined with waves and tides, cause significant flooding, as seen in Figure 1.
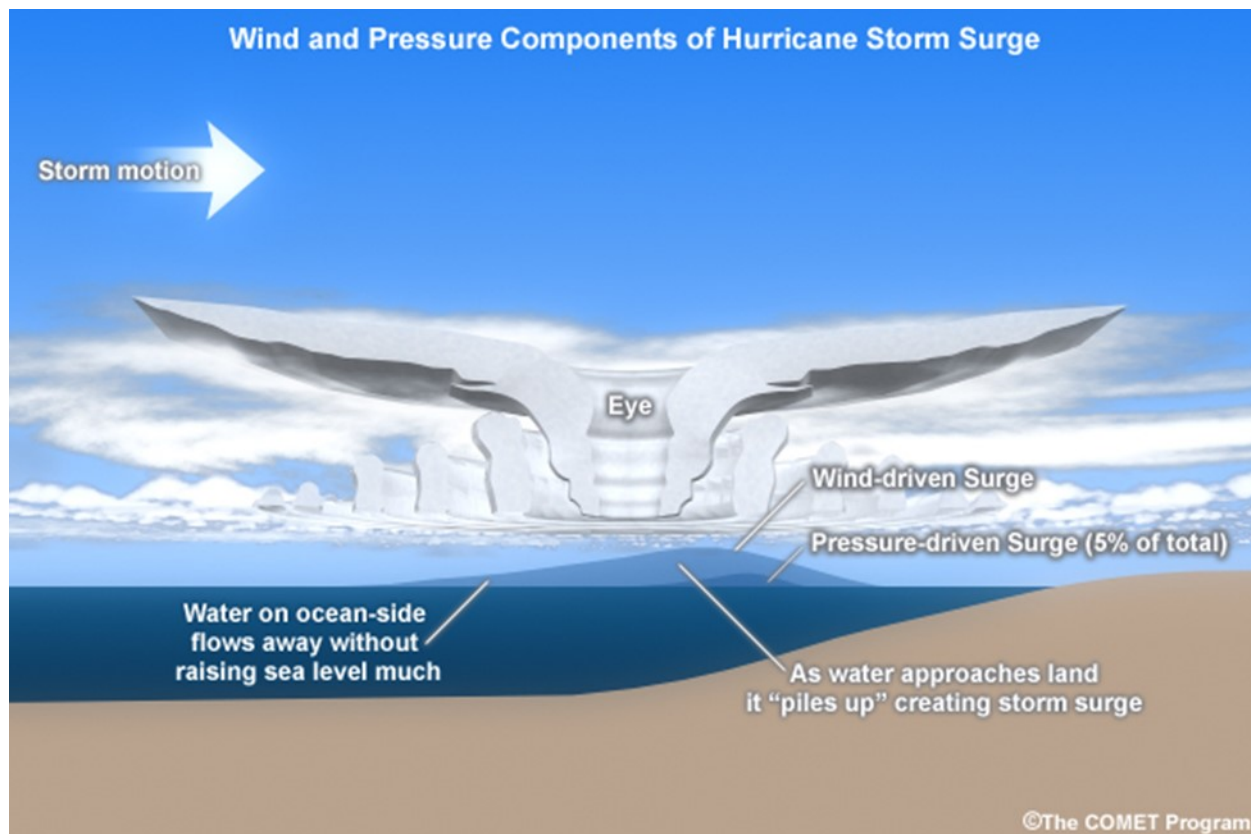
Figure 1. Schematic of storm surge associated with a hurricane. Image courtesy of The Comet Project.

Storm Surge

Particularly in regions where tidal ranges are large, such as in Maine, the combination of storm surge and the tide is referred to as the storm tide. In some areas in Maine, major flooding arises when storm surge coincides with high tide. As long-term water levels increase over the next few decades, the risk associated with storm tide flooding also increases. This is because the frictional effects associated with the shallowness of estuaries will reduce as water levels increase, which decreases the dampening effect on surge levels.

Confounding this response, Tebaldi et al. (2012) predicts that by 2050, extreme storms that presently only occur every 100 years will occur every 10 years, making coastlines particularly vulnerable to flooding from storms in the future. In order to make informed decisions regarding how to adapt the coast to these changes, an improved understanding of storm surge is vital. In particular, this is necessary for communities upstream of river mouths, where flooding can be enhanced by estuary shape and composition.

Figure 2. Waves combined with storm surge and high tide cause flooding over Rockland Breakwater. Photo courtesy of Bangor Daily News.

This project provides the unique opportunity not only to capture storm surge associated with extratropical cyclones and hurricanes. It also provides the opportunity to develop a baseline understanding of storm tide behavior in these four systems, which has never been done before. These findings will help inform decision making in the future by providing an understanding of tides and storm surge to local communities.

Storm Surge

Relation to Maine

In February 1976, downtown Bangor was rapidly inundated with 12 feet of Penobscot River water in less than 15 minutes (Morrill et al., 1979). The quickly rising water levels trapped people in cars, buildings and on rooftops in frigid temperatures. The damage to personal property was extensive, estimated at approximately $2.6 million (Morrill et al., 1979), which is equivalent to over $10 million today. This particular flood event occurred because Bangor is uniquely located along a tidal river that contracts or "funnels" as it meanders inland. Off the coast of Maine, an extratropical cyclone produced south-southeasterly winds, which created significant storm surge. As the surge was pushed inland, it was amplified by the narrowing shoreline of the Penobscot River, which combined with high tide to produce extraordinary water elevations (Morrill et al., 1979).

What do we know?

It is currently understood that a wide, gently sloping continental shelf can enhance storm surge at the coast, while wetlands can attenuate surge levels (Wamsley et al., 2010), and funnel-shaped (converging) estuaries can amplify surge levels upstream (Friedrichs & Aubrey, 1994). Inside of estuaries, models have been used in idealized scenarios to investigate how river discharge interacts with storm surge (Maskell et al., 2014). However, there are no observations that capture how storm surge behaves inside of an estuary, leaving the influence of channel geometry, geographic orientation, and geomorphologic interaction a mystery. Understanding the location where storm surge accelerates or amplifies is a critical design aspect of climate change mitigation measures targeted to reduce damage to waterfront infrastructure.

Why do we care?

To date, researchers have relied on models to represent idealized scenarios of storm surge behavior; however, without detailed observations to capture how storm surge behaves inside an estuary, actual effects remain a mystery. To explore this problem, this project aims to develop an improved understanding of storm surge behavior in four Maine estuaries with varying physical properties.

Storm Surge

Climate Change Adaptation

The eminent risk of damage to infrastructure and local economies from environmental change has focused the attention of coastal communities. The range of Sea Level Rise (SLR) by 2050 is forecasted between 0.2 m - 0.6 m (Walsh et al., 2014), threatening the loss of wetlands, narrowing beaches, increasing flood zones (Fernandez et al., 2015) and causing permanent inundation of infrastructure. By 2100, sea levels in some areas are predicted to rise 1 m, leading to an expected cost to the United States of $270 billion to $475 billion (OECD, 2010).

States with lengthy shorelines are at greater risk of exposure to climate change. According to the National Oceanic and Atmospheric Association (NOAA), Maine has the fourth longest shoreline in the US, with approximately 5,597 km (NOAA, 1975). In terms of damage vulnerability, the state is ranked 18th, with 80 km^2 of land and land features susceptible to a 1 m rise in sea level (Strauss et al., 2012). Compounding this risk is storm surge, which will increase in frequency and intensity in the future.

Funded by the Maine Coastal Program (and NOAA, more broadly), several Maine communities have already begun to assess the vulnerability of their infrastructure, such as historic downtown buildings, to SLR and storm surge, and to consider potential engineering adaptation

Figure 3. Lincoln County Regional Planning Commission SLR scenario in downtown Damariscotta for a 100 year storm combined with 1 m of SLR.

strategies. The Lincoln Country Regional Planning Commission developed a series of climate change scenarios that predict the cumulative inundation and risk from storms and SLR along the River (Lincoln County Sea Level Rise, 2014). Figure 3 depicts the inundation footprint predicted for a 100-year storm combined with 1 m of SLR in downtown Damariscotta. The red markers indicate infrastructure at risk.

Storm Surge

Climate Change Adaptation: Relation to Maine

Essentially, a significant amount of historical infrastructure will be fully inundated. As a result, the Town of Damariscotta is currently exploring various climate change adaptation measures (i.e. sea walls, rock revetments, etc.) to protect their historic downtown infrastructure from rising water levels and storm surge (Switzer, 2015).

Thanks to a Coastal Communities Grant by the Maine Coastal Program, town officials have partnered with an engineering firm to devise coastal adaptation design, which include a 12-foot seawall that borders the vulnerable downtown area (Switzer, 2015). While marine structures are excellent at reducing local erosion and protecting against inundation, structures also modify the hydrodynamics, create adjacent shoreline erosion and alter marine ecosystems (Dugan et al., 2011). Shoreline armoring can also result in loss of habitat, both from the structural foundation excavation and from erosional scour at the base of structures. Given that the vulnerable downtown region of Damariscotta is principally perpendicular to the direction of the river and therefore the direction of flow (Fig. 3), this increases the risk of erosion at the base of the structure under strong forcing conditions (such as a storm). However, such "statistical risks" are often not a priority in community planning until a storm crisis occurs and catastrophic infrastructure damage results.

Methods of Adaptation

If storm tide behavior is better understood in a Maine estuaries, alternative, "greener" methods of adaption can be used. These include planting vegetative buffers along shorelines, which are known to decrease storm surge levels over long distances. Alternatively, strategically placed kelp curtains can simultaneously reduce storm wave energy, while also reducing storm surge levels.

All of the information covered in this section is covered in the online tutorials, which can be found at our website: http://sensingstormsurge.acg.maine.edu

Equipment

This section is designed to help familiarize you with the equipment that you will be using during your time as a citizen scientist. In your citizen science kit you will receive the following:

- HOBOware Pro Software
- U20L Water Level Logger
- Waterproof Shuttle with coupler

- Concrete Mooring System
- Zip Ties
- Citizen Science Guide

HOBOware Pro Software

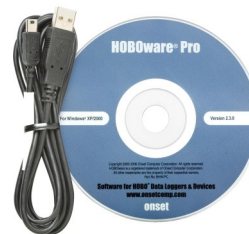HOBOware software (Fig. 4) is used for launching, reading out, and plotting data from HOBO data loggers.

Figure 4. HOBOware Software and USB cord

U20L Water Level Logger

The logger (Fig. 5 & 6) records absolute pressure, which is later converted to water level readings by HOBOware Pro Software. Please always protect the logger and handle it with care. This logger can be damaged by shock, and it may lose its calibrated accuracy or be damaged if it is dropped.
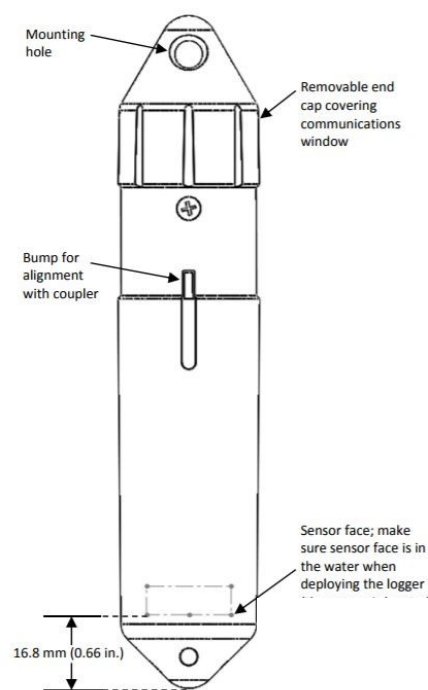

Figure 5. U20L Water Level Logger

Figure 6. U20L Water Level Logger

Equipment

Waterproof Shuttle

The HOBO Waterproof Shuttle (Fig. 7 & 8) performs several major functions. It reads out all logger information from loggers in the field for transfer to a computer. Additionally, it relaunches the logger's time to the shuttle's time and synchronizes the logging interval on relaunch U20L Water Level Logger.

Figure 7. Waterproof Shuttle

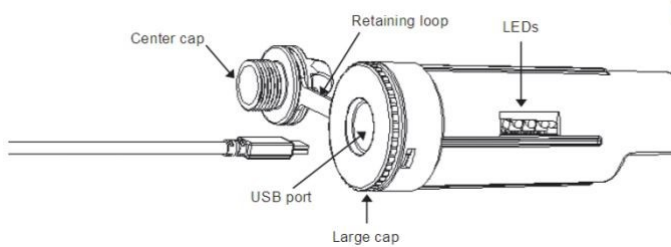*Figure 8. Waterproof Shuttle*

LED Lights

Green "OK" LED:

The green "OK" LED (Fig. 9) blinks when HOBOware recognizes it and when it finishes reading out and relaunching the logger. To stop the blinking, momentarily press the coupler lever (pressing hard enough so the lever bends). The green LED will glow steadily when the shuttle is connected to a computer and logger.

Yellow "Transfer" LED:

The yellow "Transfer" LED (Fig. 9) blinks when the shuttle is reading out logger information and during relaunching. Do not remove the logger when the "Transfer" light is lit.

Red "Fail" LED:

The red "Fail" LED (Fig. 9) blinks whenever the shuttle encounters an error condition. If this happens while you are using the water shuttle, please email sensingsurge@gmail.com.

All LEDs simultaneously blinking:

The LEDs will blink in unison when the shuttle is connected to the computer's USB port.

Figure 9. LED lights on HOBO Waterproof Shuttle

Equipment

Logger Mooring System

The logger mooring system (Fig. 10) houses the logger and protects it during field deployment. The concrete platform ensures that the logger stays in a fixed position under the water. The sensor mooring system weighs approximately 15 pounds.

Figure 10. Logger Mooring System

Field Site

Your field site is where you will be deploying the logger and mooring system. Each month you will visit your field site to collect data. For data retrieval instructions please **see page 24.**

Field Site Requirements

Your field site should adhere to the conditions listed below:

- The field site should have some type of permanent structure (ex. rock, piling, pier, tree). This permanent structure should be able to secure the logger and mooring system with the tying of a rope.

- The field site should be accessible by land and you should feel comfortable and safe while collecting data.

- The field site should be in an area that allows for the logger and mooring system to be **submerged under a foot of water at all times.**

If you have any questions about your site and/or the deployment of the logger and mooring system please email sensingsurge@gmail.com.

Field Site

Field Site Freezing

Some field sites will freeze over during the winter months. These sites will require citizen scientists to keep the logger and mooring systems in the water (no data retrieval) for these months, as well as change the data logging interval. We recommend changing the data logging interval to 8 minutes prior to last deployment before freezing. Please refer to **page 21**, "Launch Settings," for instructions on how to reset the sampling interval. The time at which the interval is changed is at the discretion of the citizen scientist and the conditions observed at their site. Although you will not be actively downloading data, your sensor will still be collecting data so we request that you continue to check your site each month to ensure that your logger is still in a stationary position under the ice and water. *If you are aware that your field site could or will freeze over please contact the Sensing Storm Surge team at sensingsurge@gmail.com.*

Software Installation

Installing HOBOware

Methods

HOBOware can be installed in two different ways:

1. If you have a CD-ROM drive on your computer, you may use the CD provided to you in the citizen science kit.

   - *For Windows*: Insert the CD into your computer's CD-ROM drive. The installation should start automatically. If it does not, navigate to the CD drive in My Computer and double-click *HOBOware_setup.exe* to launch the HOBOware installer.

   - *For Mac*: Insert the CD into your computer's CD-ROM drive. Double-click the CD icon in the Finder and double-click the *HOBOware.pkg* to launch the HOBOware installer. Now go to the Installation section of this manual. When you reach the final screen of the installation program, click restart. After restarting, open HOBOware by double-clicking the HOBOware icon in your computer's Applications folder. Proceed to the next task, Activating HOBOware.

2. If you do not have a CD-ROM drive, you can go to: *www.onsetcomp.com/hobware-free-download*. Locate the link that says "Download HOBOware for Windows" or "Download HOBOware for Mac."

NOTE: *The entire Installation process for both methods can be found in video form on our website: http://sensingstormsurge.acg.maine.edu/.*

Installation

Whether you use the CD or the online version, once you open the setup file, you can then begin installation for HOBOware.

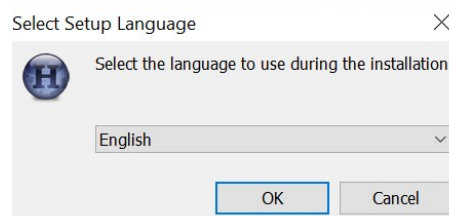1. English should be the default language, click OK (Fig. 11).

Figure 11. Selecting Setup Language

Software Installation

Installing HOBOware

Installation

NOTE: HOBOware for Windows Requires the Java Runtime Environment.

- If the correct version of Java Runtime Environment is not already installed on your computer, the HOBOware setup program will ask you if you want to install it at this time. In this case, you will see a message window.

- If you don't see a message about Java, that means that the correct version of Java is installed on your computer and you can continue the download.

If you need to install Java, click YES to install and follow the prompts. Once Java has installed the HOBOware setup will automatically continue.

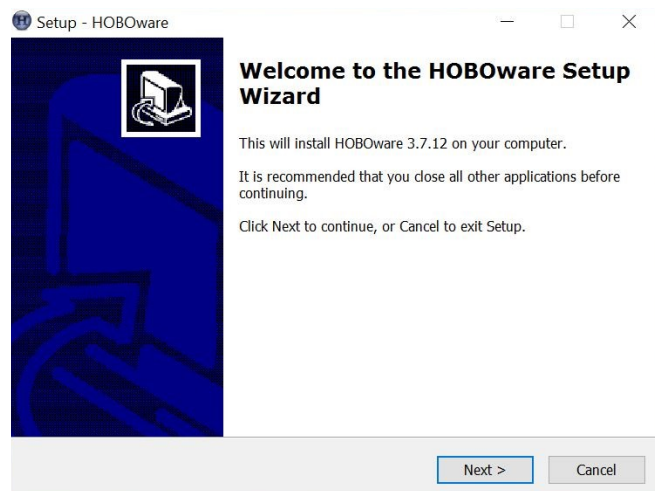2. Figure 12 shows the HOBOware Setup Wizard, click NEXT (Fig. 12).

Figure 12. HOBOware Setup Wizard

3. Figure 13 shows the software license agreement. Click "I accept the agreement", and click NEXT to continue (Fig. 13).
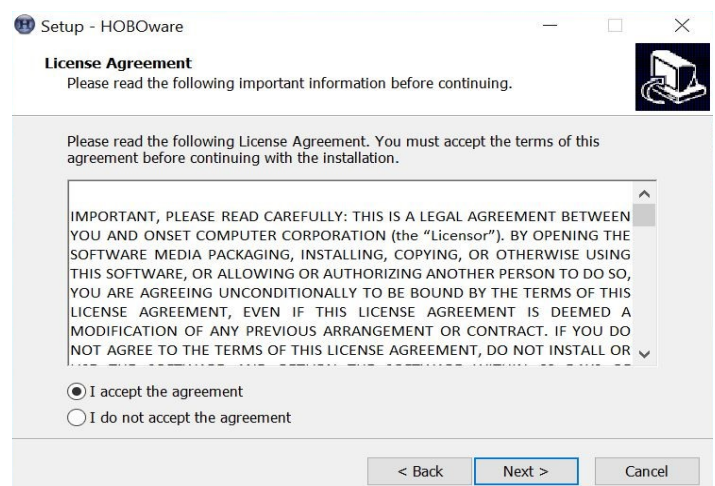

Figure 13. Software License Agreement

Software Installation

Installing HOBOware

Installation

4. The next window (Fig. 14) will ask you to select a location on your computer where the program will be installed. The default setting is to save to "Program Files", and this is generally where all of your computer programs are located. Click NEXT.
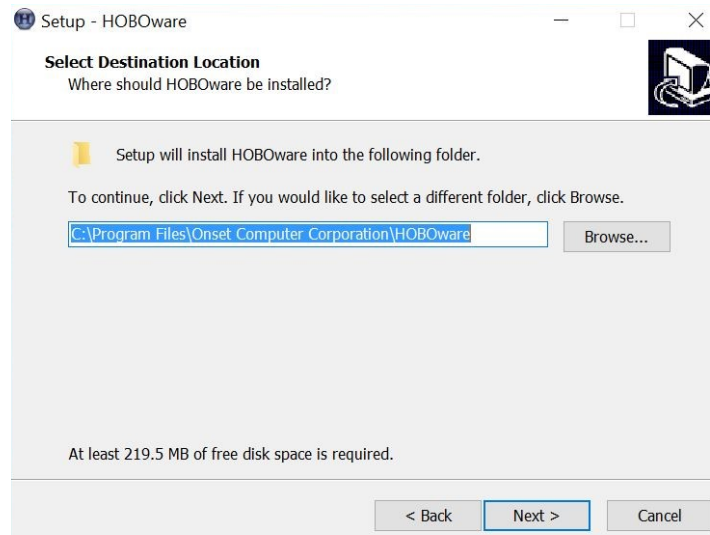

Figure 14. Select Destination Location

5. The next window (Fig. 15) will tell you that a program shortcut will be created in your Start menu. It will be convenient to have a shortcut to HOBOware in your Start menu, now that you will be using it. Click NEXT.
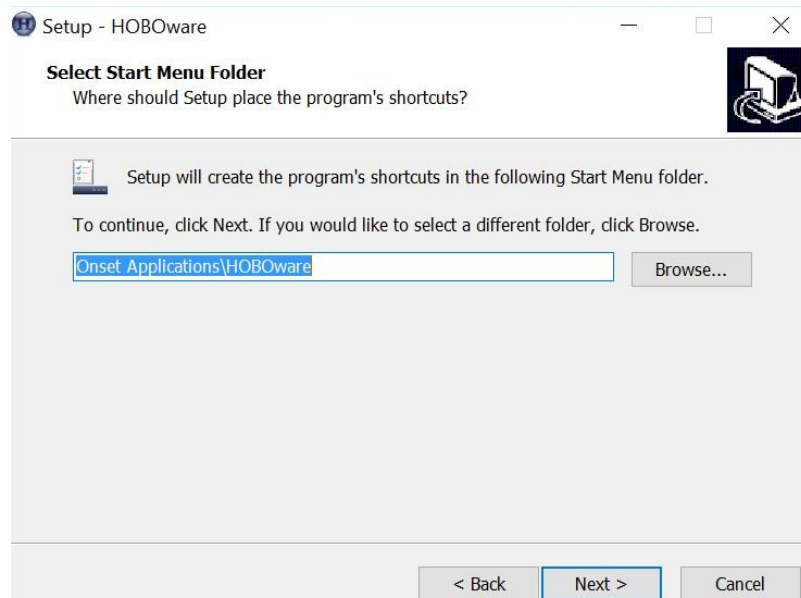

Figure 15. Select Start Menu Folder

Software Installation

Installing HOBOware

Installation

6. The next window (Fig. 16) will ask you if you would like to create a desktop icon for HOBOware. You can check or uncheck this box to create a desktop shortcut. Then click NEXT.
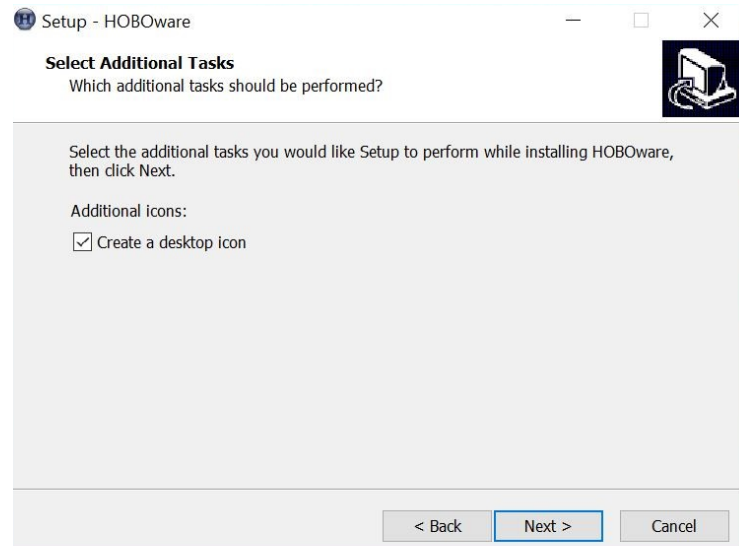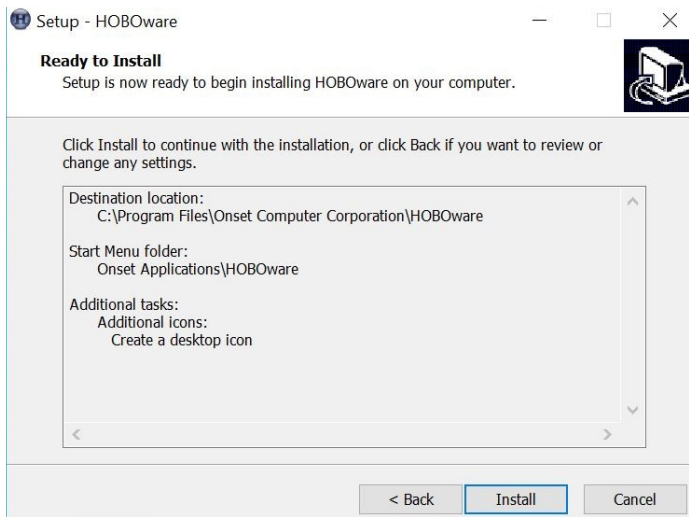

Figure 16. Desktop Icon Prompt

Figure 17. Ready to install

7. The next window (Fig. 17) will ask you to install, you can click INSTALL. The program will now begin installing (Fig. 18).
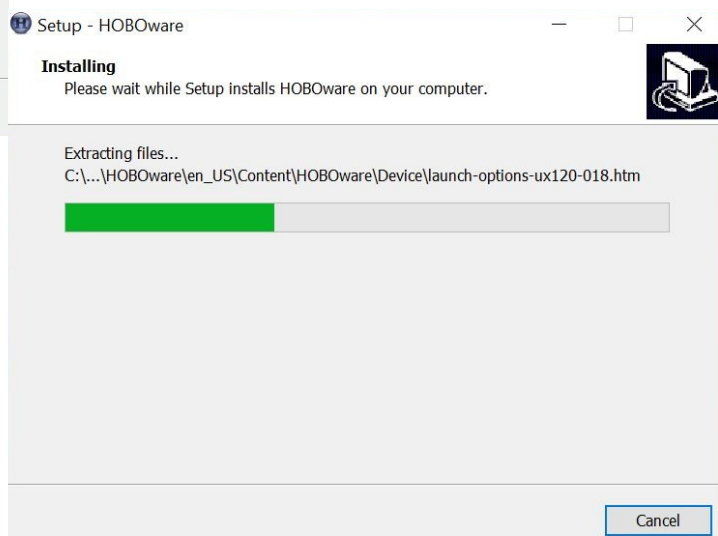

Figure 18. Installing files window

Software Installation

Installing HOBOware

Installation

8. When the installation is complete, the window shown here (Fig. 19) will pop-up. Before you click FINISH, uncheck the box that says *README.* If this box is checked it will open a Word document with technical software information. If you are interested in this information, you may leave it checked, but you will not need it for this project.
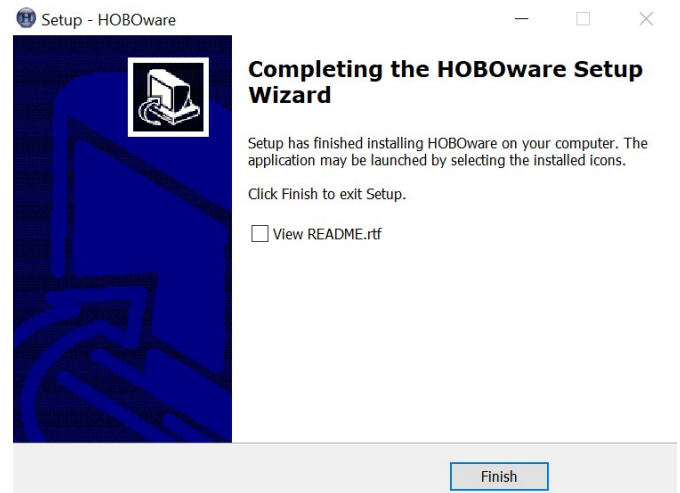

Figure 19. Completing HOBOware Setup

9. After you click FINISH, HOBOware should open automatically. If it does not, you can launch HOBOware by clicking the desktop icon (Fig. 20) you created, or by going to your Start menu.

Figure 20. Desktop Icon

10. When you first open HOBOware you will be asked about checking for updates. Go ahead and click NO.

11. Next, the HOBOware Set-up Assistant (Fig. 21) will appear. It will guide you through a couple of program settings. These will ensure that HOBOware is operating the way we want it to for this project. Click START.

Figure 21. HOBOware Setup Assistant

Software Installation

Installing HOBOware

Installation

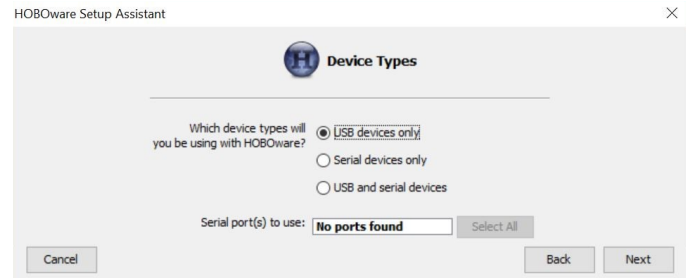**12.** A Device Types window (Fig. 22) will appear, select *USB devices only* and click NEXT.

Figure 22. Device Types Window

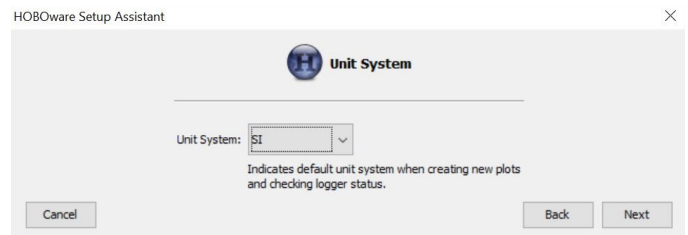**13.** A Unit System window (Fig. 23) will appear; select *SI*. Click NEXT.
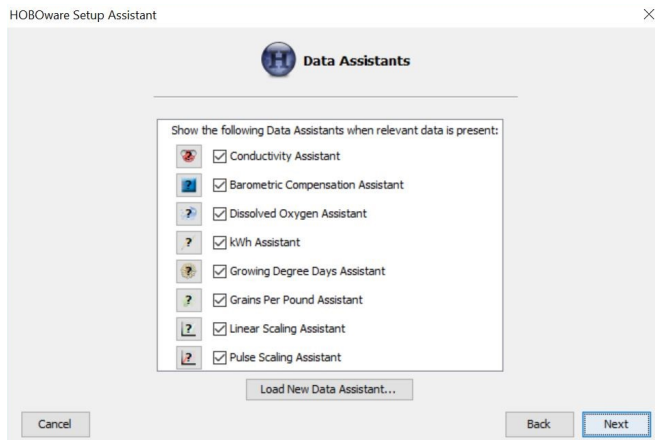

Figure 23. Unit System Window

Figure 24. Data Assistant List

14. A list of Data Assistants (Fig. 24) will appear, click NEXT.

15. Metric improvement window (Fig. 25) will appear, click NEXT

16. A congratulations window (Fig. 26)

Figure 25. Metric improvement window

will appear, click DONE.

Figure 26. Congratulations window

Software Installation

Installing HOBOware

Activating HOBOware

The first time you install HOBOware it will be in Trial Mode. You will need to activate it by entering a license key.

Go to the *Help* menu (Fig. 27) at the top of the HOBOware window. Click on *Manage License Key.*
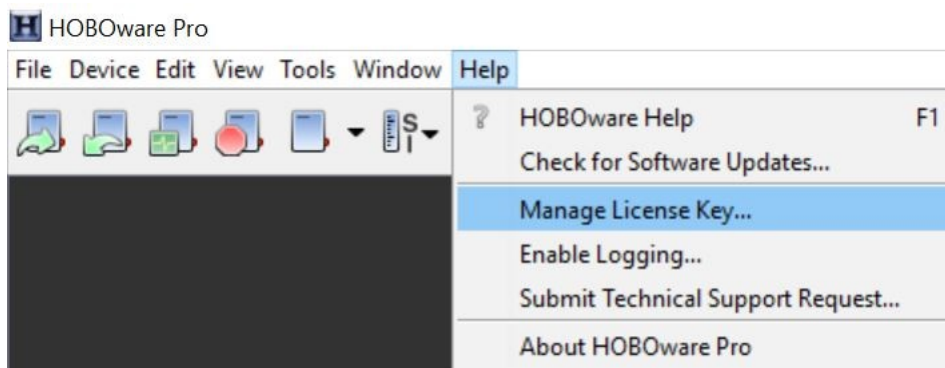

Figure 27. Help menu

The License Key Manager window (Fig. 28) will appear. The license key can be found on the case of the installation CD. Enter your license key and click OK.
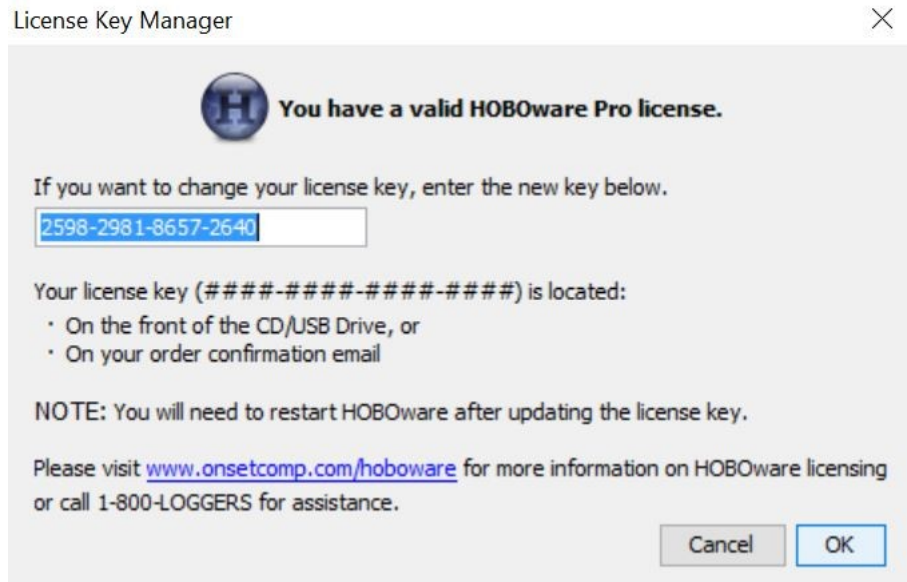

Figure 28. License Key Manager window

The First Launch

At Home

Connecting the logger to a computer

1. Unscrew the black plastic end cap from the logger by turning it counter-clockwise.

2. If the couple is not already attached to the water shuttle, attach it to the water shuttle by pressing the two ends together.

3. Insert the logger into the coupler with the flat on the logger aligned with the arrow on the coupler label (Fig. 29 & 30). Gently twist the logger to be sure that it is properly seated in the coupler (it should not turn).
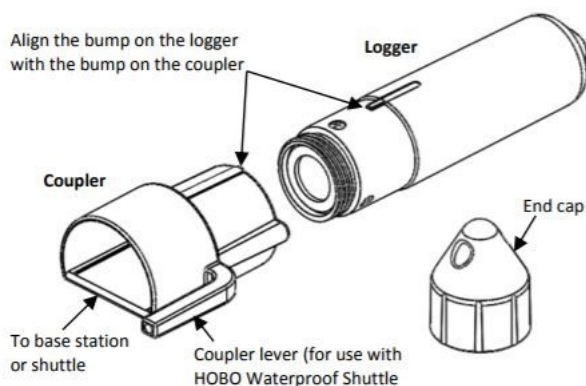
Figure 29. Coupler alignment

Figure 30. Coupler alignment

Connecting the water shuttle

Now that the logger and water shuttle are connected, you can use the USB interface cable (black cord) to connect the water shuttle to the computer (Fig. 31).
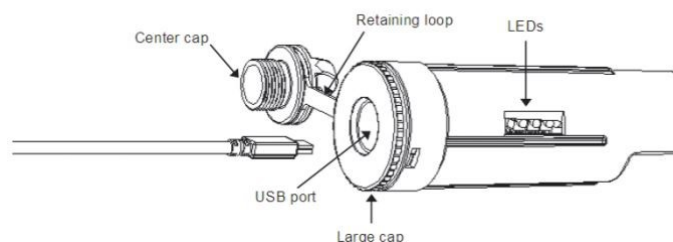
Figure 31. USB interface cable & Water shuttle

1. Unscrew the small cap (Fig. 32) on the end of the water shuttle. If the cap is too tight to loosen by hand, insert a screwdriver through the lanyard hole and rotate counterclockwise until the cap is loosened.

2. Plug the small end of the USB interface cable (black cord) into the USB port in the shuttle.

Figure 32. Water shuttle with cap removed.

3. Plug the large end of the USB interface cable into a USB port on the computer.

The First Launch

At Home

Communicating with HOBOware

1. Before opening HOBOware, check the time on your computer and ensure that it is correct. If it is not, update your computer's clock manually or synchronize it with an online time server (if available).

2. Launch HOBOware.

3. Once HOBOware is open, briefly press the coupler lever, hard enough to bend the lever. It may take a few seconds for the device to be detected by the computer. Once the device is recognized, the status bar at the bottom of the window should look like Figure 33.

Figure 33. Status Bar

NOTE (Windows Only):

If the device has never been connected to this computer before, it may take some time for the computer to detect the new hardware and report that it has been connected successfully. One or more messages will appear, indicating that new hardware has been found. You may also hear a chime.

WARNING: Do not leave the logger in the coupler for extended periods of time. When connected to a coupler, the logger is "awake" and consumes significantly more power than when it is disconnected and considered "asleep." Always remove the logger from the HOBO Waterproof Shuttle as soon as possible after launching, reading out, or checking the status to avoid draining the battery.

The First Launch

Water Level Logger

Launch Settings

Now that the logger is connected, we will configure the data logging settings.

Figure 34. Launch in the Device Menu

1. Click on the *Device* menu at the top of the window, and then scroll to *Launch* in the drop-down menu Fig. 34). The launch configuration window should appear.

2. To set up the logger to record data, there are two settings that need to be adjusted in the launch window and they are both under the *Deployment* section.

- Logging Interval: Click on the drop down menu and select *Custom*. Type 2 in the *Min* window. This sets the logger to record data every two minutes.

- Start Logging: It should already be set to *On Date/Time*. This setting is up to you. Select a date and time that you can be sure that the logger will be deployed (will be in the water at your field site).

3. Once you have adjusted these settings, the window should look similar to the photo to the right. Click on *Delayed Start* at the bottom right corner of the launch window to launch the logger with these settings.
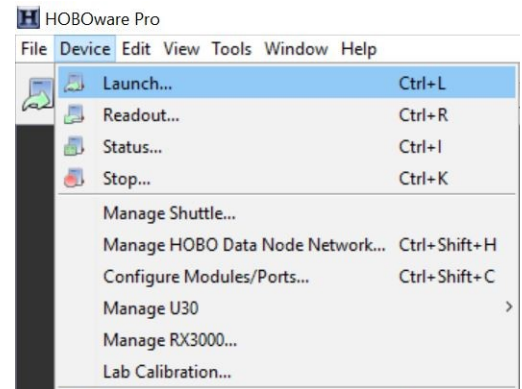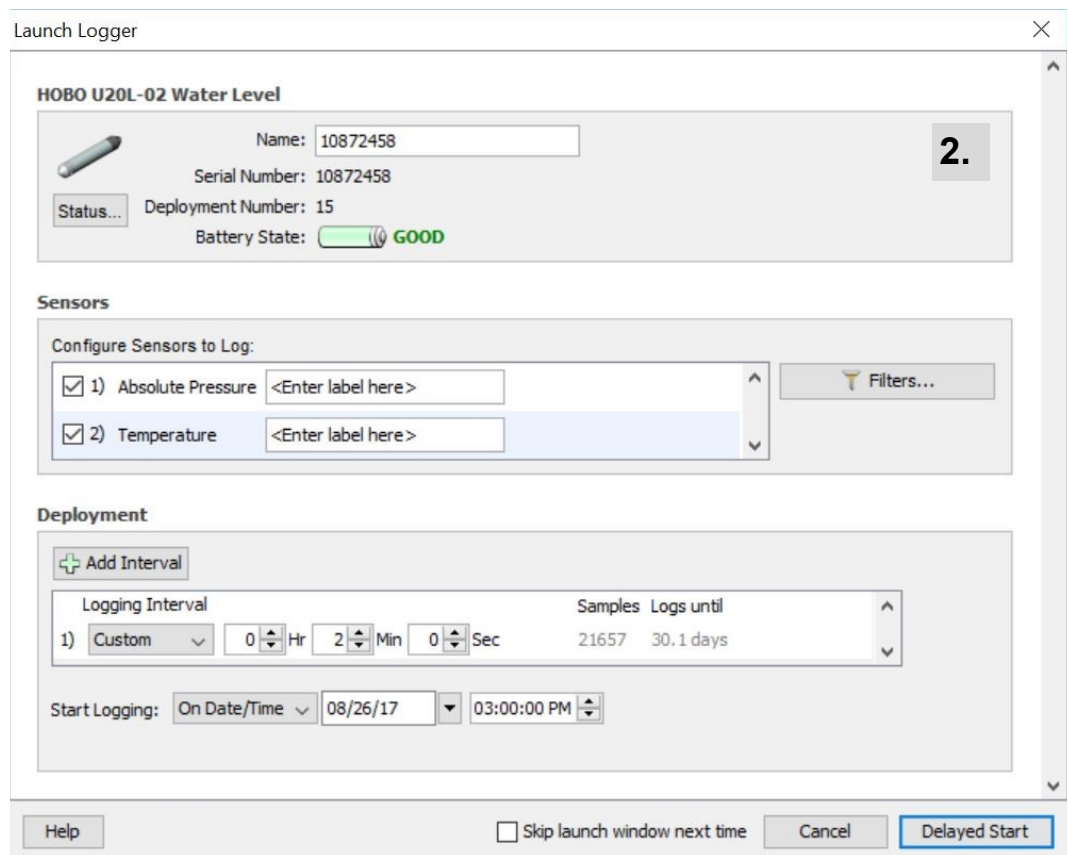
Figure 35. Logging interval window

The First Launch

Barometric Pressure Sensor

Launch Settings

If you have been given a barometric pressure sensor:

1. Make sure the Micro Station contains four AA batteries. These should come with the station.

2. Make sure the barometric pressure sensor is plugged in to the Micro Station and all other sensor ports on the Micro Station are plugged with rubber.

3. HOBOware should already be downloaded from water level logger set up. Open HOBOware on your computer. Connect the Micro Station to your computer with the USB cable.

   a) Select "Preferences" then "Communications" in HOBOware. Click "Device Types" and make sure "USB and serial devices" is selected.

   b) Click "Serial Ports". A new COM port is listed under "Serial Ports", which will be used for the Micro Station. Make sure the box next to the new COM port is checked.

   c) Click "Ok" in "Preferences".

4. Launch the logger by selecting "Launch" from the "Device" menu.

   a) Check that the serial number of the barometric pressure sensor is listed under the "Launch Logger" window.

   b) Select a logging interval of 2 minutes.

   c) Select when to start logging. Preferably set a date/time start which will begin logging once you have finished mounting the sensor and station at your site.

   d) Select when to stop logging as "When Memory Fills".

   e) Select "Start" when done and the logger will begin recording at the date/time specified. Unplug the Micro Station and set-up at your site.

Please refer to user manuals for both the Micro Station and Barometric Pressure Sensor. *If you have questions please visit: http://www.onsetcomp.com/files/manual_pdfs/20875-E%20H21-USB%20Manual.pdf; http://www.onsetcomp.com/files/manual_pdfs/12291-F%20MAN-S-BPB.pdf , or contact us at sensingsurge@gmail.com*

The First Launch

Before Going Into The Field

List of items to bring

- Mooring
- Logger
- Zip ties

- Citizen Science Guide
- Cellphone, camera or other device to take photos
- Appropriate outdoor gear

Securing the logger to the mooring

All of the information covered in this section is covered in the online tutorials, which can be found at our website: http://sensingstormsurge.acg.maine.edu/

Before you head to your field site, you will need to secure the logger to the mooring system. In your citizen science kit, you have been provided with zip ties. These are for securing the logger to the PVC pipe on the mooring.

Figure 36.

There are two holes on one end of the PVC pipe. Insert the logger into the PVC pipe so that the end of the logger with the cap and the end of the pvc pipe with the holes are lined up. Then, insert the zip tie through one of the holes on the pvc, through the holes on the cap of the logger and through the other hole in the PVC pipe. It should look like Figures 36 and 37. Finally, secure the zip tie (Figures 38 and 39).
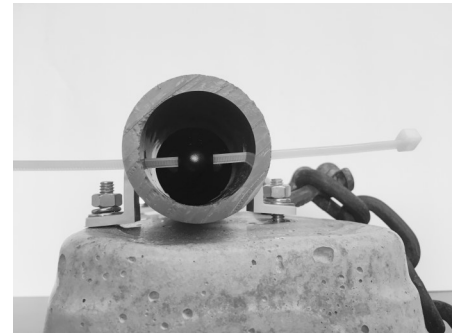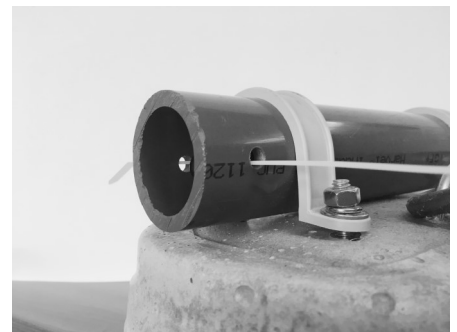

Figure 37

Figure 39

Figure 38

The First Launch

In The Field

Mooring placement

As mentioned in *The Basics* section of this guide, you will need to place the mooring in a location that will ensure the logger will be submerged in at least one foot of water at all times, even at low tide.

Securing the mooring

If you are tying your mooring system off to a waterfront structure (such as a pier piling, cleat, or screw anchor), you are going to need to know how to tie a secure knot.

Pier Piling

Cleat

Screw Anchor

The knot you should use is the bowline knot. A link to a video can be found on our website, or you can refer to the picture below.
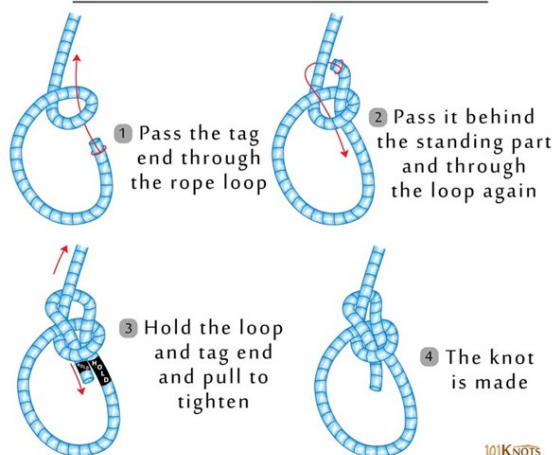

Figure 40

http://www.101knots.com/bowline-knot.html

The First Launch

In The Field

Making observations

Each month when you upload data you will be asked to record observations you have made in the field by answering various journal prompts. Instructions on how to record observations are outlined in the "uploading to the website" section **on page 31.**

Data Retrieval

Before Going Into the Field

List of items to bring

- Water shuttle
- Scissors/Knife
- Zip ties

- Citizen Science Guide
- Cellphone, camera or other device to take photographs
- Appropriate outdoor gear (ex. sturdy shoes, rain jacket, sunglasses)

In the Field

Data collection

All of the information covered in this section is covered in the online tutorials, which can be found at our website: http://sensingstormsurge.acg.maine.edu/

1. Retrieve the mooring from the water. Take care to remember the location that the mooring was previously in.

2. Using scissors or a knife, cut the zip tie holding the logger in the PVC pipe.

3. Remove the logger from the PVC pipe and inspect it for biofouling. Biological growth on the face of the pressure sensor will throw off the pressure sensor's accuracy. Organisms that grow inside the sensor nose cone and on the sensor itself can interfere with the sensor's operation and eventually make the sensor unusable. If the deployment area is prone to biofouling, check the logger periodically for marine growth.

4. Unscrew the black plastic end cap from the logger by turning it counter-clockwise. *Note: There may be water in the end cap. This is normal; this water will not penetrate the waterproof seal around the communications window in the logger.*

5. If is not already, attach the coupler to the base station or shuttle.

6. Insert the logger into the coupler so that the alignment bump on the logger slides into the alignment bump on the coupler. Be sure it is properly seated in the coupler.

7. Momentarily press the coupler lever (pressing hard enough so the lever bends). Readout should begin immediately. The yellow LED links continuously while readout and relaunch are in progress. Do not remove the logger when the yellow LED is blinking.

Data Retrieval

In The Field

Data Collection

8. When the relaunch is complete, the green LED will blink, indicating the data has been successfully transferred. To stop the blinking press down momentarily on the coupler lever (press hard enough so the lever bends). If the red LED blinks instead, there was an error, and the logger may have stopped please contact the Sensing Storm Surge team at: sensingsurge@gmail.com.

9. Remove the logger from the coupler.

10. Replace the cap on the logger.

11. Following the steps previously outlined in "The First Launch," on **page 19,** secure the logger to the mooring using a zip tie.

12. Once the mooring system is ready to go, replace it in the same location.

At Home

Connecting the water shuttle

1. Unscrew the small cap on the end of the water shuttle. If the cap is too tight to loosen by hand, insert a screwdriver through the lanyard hole and rotate counterclockwise until the cap is loosened.

2. Plug the small end of the USB interface cable (black cord) into the USB port in the shuttle (Fig. 41).
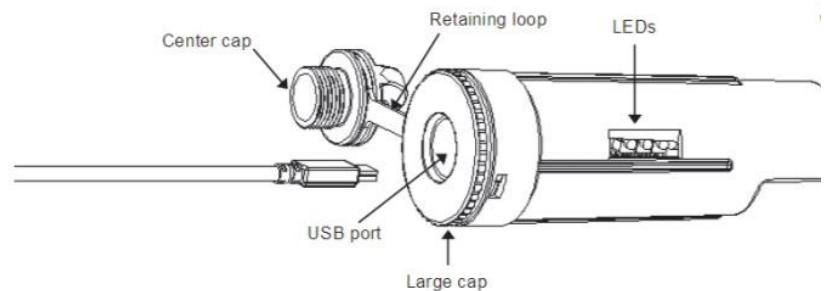

Figure 41. Water shuttle and USB cord

3. Plug the large end of the USB interface cable into a USB port on the computer.

Data Retrieval

At Home

Offloading the data from the water shuttle

At this point, the water shuttle should be connected to your computer.

1. Open the HOBOware program. It may take a few seconds for the water shuttle to be recognized by HOBOware. Once the water shuttle is recognized, the status bar at the bottom of the window should look like the picture to the right.
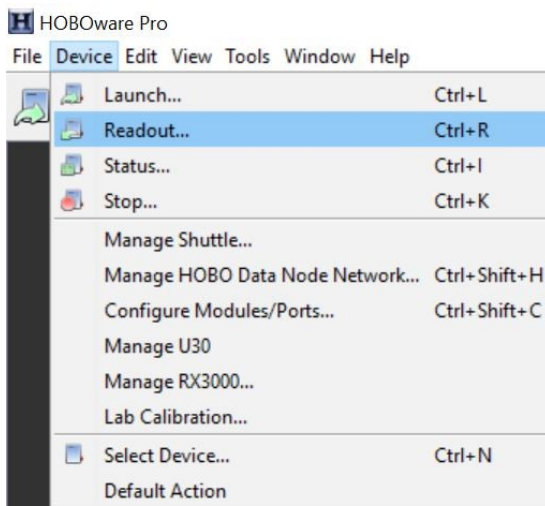
Figure 42. Status bar

Figure 43. Device dropdown menu

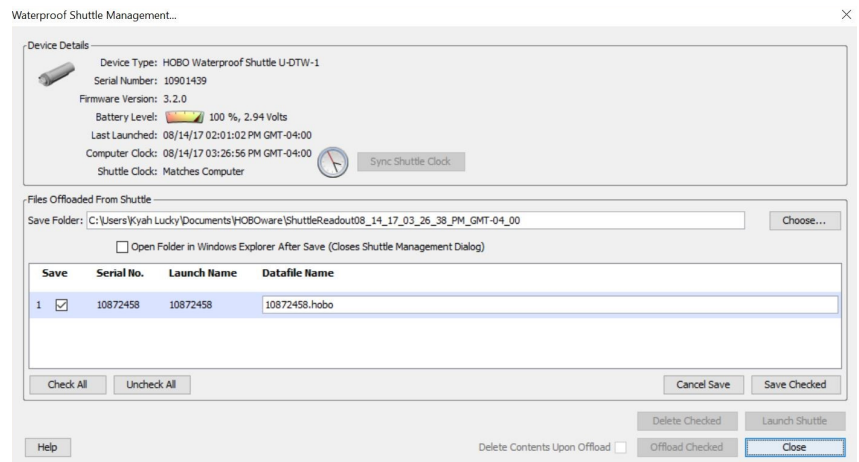2. Select *Device > Readout* to readout the data from the shuttle (Fig. 42).

Figure 44. Saving the data file

3. HOBOware prompts you to save the datafile. Use the default location and click *Save Checked* in the bottom right corner of the window (Fig. 43)

4. Now that the data file has been saved to your computer, you need to launch the shuttle before you can unplug it. To do this, click *Launch Shuttle* in the bottom right corner of the window (Fig. 44) .
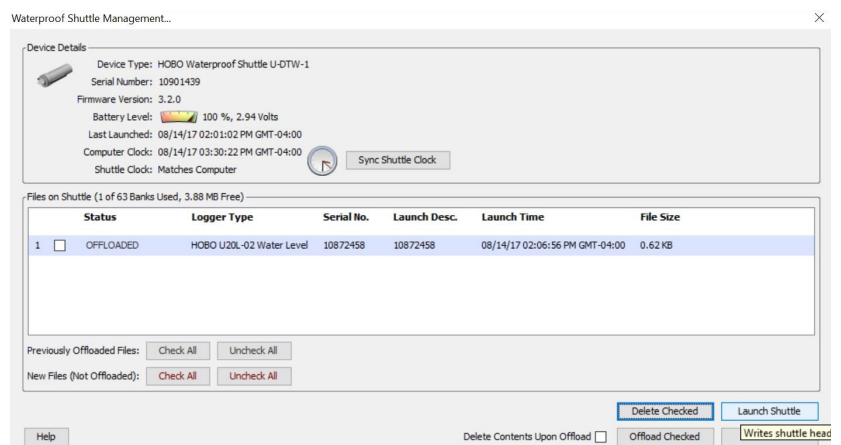
Figure 45. Launch Shuttle window

Data Retrieval

At Home

Offloading the data from the water shuttle

5. After you click Launch Shuttle, a message window may appear asking if you are sure you want to launch the shuttle (Fig. 46). Click YES.
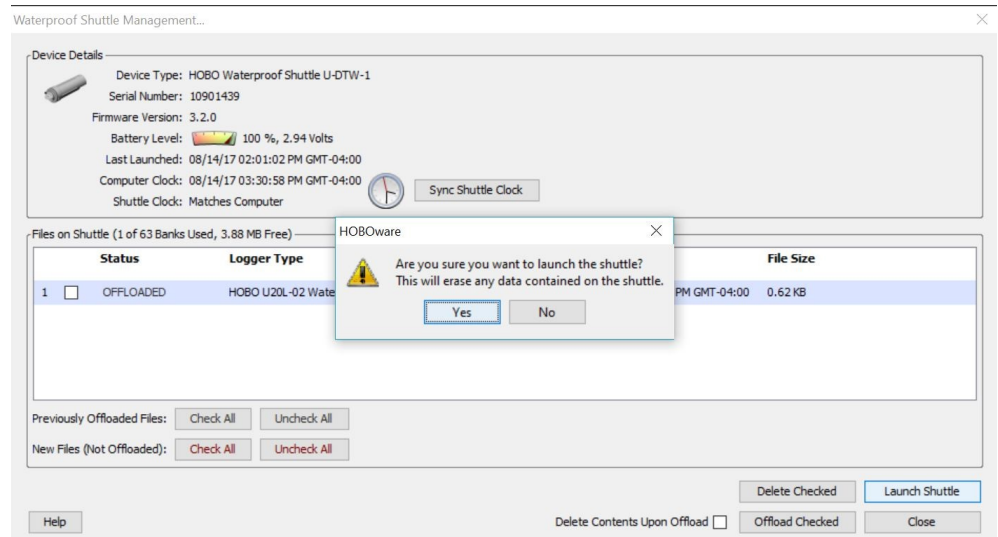

Figure 46. Launch shuttle message

6. The shuttle should now be launched, which means you can unplug it from the computer (Fig. 47).
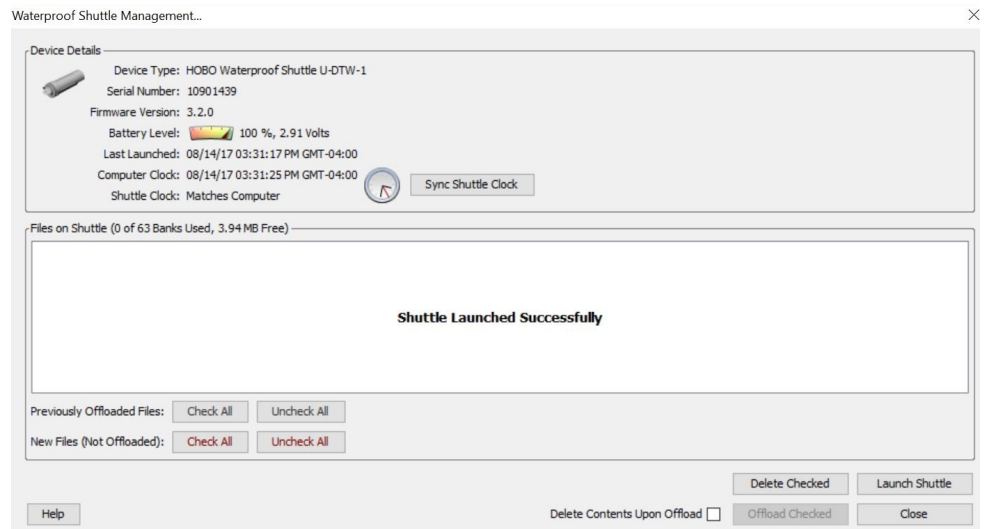

Figure 47: Shuttle success window

Data Retrieval

At Home

Offloading the data from the barometric pressure sensor

1. To read out the logger, open the door on the Micro Station and connect it to the computer with USB cable.

> a) From "Device" menu in HOBOware, select "Readout". If the logger is logging, select whether to stop or continue logging. You may continue as long as the sensor and Micro Station are not displaced for an extended period.

> b) Under "File", select "Export Data Table" to download the data to your
>
> computer. This is the file you will upload to the Sensing Storm Surge website.

Data Retrieval

At Home

Uploading to the website

1. To begin uploading data from your computer onto the online database you will need to visit the project website: http://sensingstormsurge.acg.maine.edu/.

2. Once you are on the website click, "login", on the upper right-hand side of the site. Then type in your participant username (your email address), and your password. If you forget your username or password please contact the Sensing Storm Surge team at: sensingsurge@gmail.com.

3. After you have successfully logged in and you are on the, "dashboard" page, click the, "add record" button on the left-hand side of the page (Fig. 48).
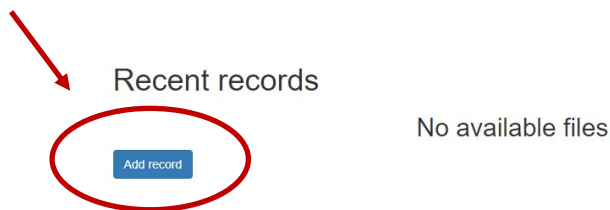

Figure 48. Add Record

4. Once the, "add record" button has been pushed a dialogue box will appear that will prompt you to enter your username, site location (i.e. Bass Harbor or Southwest Harbor; Bagaduce River; Penobscot River), date of data upload, answers to various journal prompts (including the upload of photographs), and to upload the water level data (Fig. 49).

Figure 49. Data upload window

Data Retrieval

At Home

Uploading to the website

5. After you have inserted your username, site location, date of data upload, and answered the various journal prompts (including the uploading of any photographs), click the, "choose file" (Fig. 50) button to begin uploading the water level data and/or barometric pressure data.

6. Once you have clicked the, "choose file" button, a dialogue box will appear, prompting you to choose a file to upload. Choose the data file you wish to upload and press, "open".

7. Your data is now ready to be submitted. In order to submit your data press the, "submit" button in middle of the dialogue box (Fig. 51).

8. Once your data is successfully uploaded a notification will appear at the top of the page (Fig. 52). If the notification does not appear your data has not been successfully uploaded and you will need to upload your data again. If you have issues with uploading data please contact sensingsurge@gmail.com.

Figure 50. Choose file

Figure 51. Submit

Figure 52. Success notification

Safety Procedures

Overview

Each citizen scientist must read over and sign a safety procedure form before participating in the project. We encourage citizen scientists to follow the following safety guidelines:

- Alert others when you go to collect data

- Check the weather

- Wear appropriate gear

- Be aware of your surroundings

Contact Information

Logger and HOBOware troubleshooting

Data uploading and website troubleshooting

General questions

If you have questions about the project or your role please email:

Sensing Storm Surge Team

University of Maine, Orono
sensingsurge@gmail.com

Kim Huguenard
(207) 581-1216
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Additional Resources

Storm Surge

Storm Surges Explained by Ginger Zee: http://abcnews.go.com/US/video/storm-surges-explained-ginger-zee-42622227

Why storm surge is so deadly: https://weather.com/storms/hurricane/video/why-storm-surge-is-so-deadly

40 Years later: Remembering the Bangor flood of '76:

http://bangordailynews.com/2016/02/02/news/bangor/40-years-later-remembering-the-bangor-flood-of-76/

Hurricane Storm Surge: https://oceantoday.noaa.gov/hurricanestormsurge/

Citizen Science Efforts

Cornell Lab of Ornithology: http://www.birds.cornell.edu/Page.aspx?pid=1478

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