

Coastal image labeler User Instructions

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Written by Evan B Goldstein, with input from Eli Lazarus and Dan Buscombe

Hello, and thanks for your interest in labeling images! This document will walk you through the basics of the interface, picking images to label, and give specific instructions for each set of questions.

1) Overview of labeler and project.

The Coastal Image Labeler was designed to attach labels or text to images. Labeled images are important for supervised machine learning research, and there are many well known labeled image databases that focus on general features. Our goal here is to develop a discipline-specific database of labeled images that is relevant for coastal scientists. To build this database, we needed a tool to easily accommodate multiple users labeling a single images to ensure correct labeling via consensus. So the interface was built to solve this problem — to provide a bunch of people with images to be labeled using a given set of questions. Users interactively label images, and results are written to a database to be exported as open data with a [Creative Commons Attribution 4.0 International License](#).

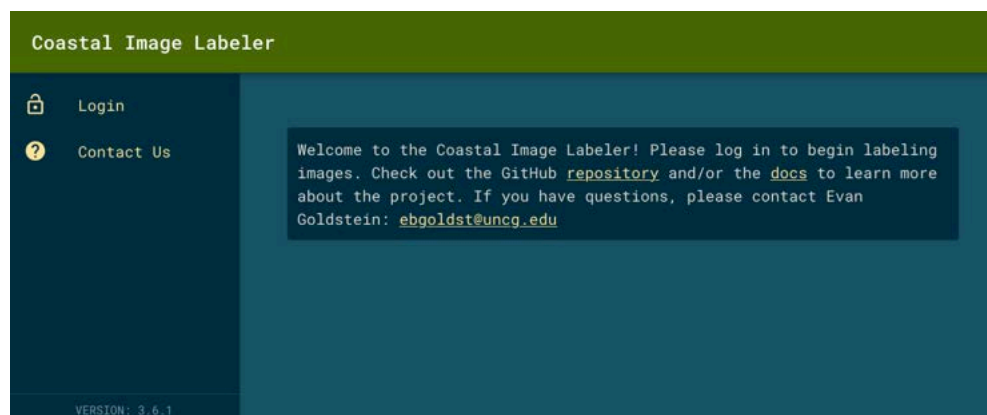
The labeler code is available on GitHub: <https://github.com/UNCG-DAISY/Coastal-Image-Labeler>. There is some documentation on this code: <https://uncg-daisy.github.io/Coastal-Image-Labeler/>. And the labeler is currently deployed on an Azure Virtual Machine: <https://coastalimagelabeler.science/>

The labeler is also part of a Machine Learning project, which is described in this workshop paper:

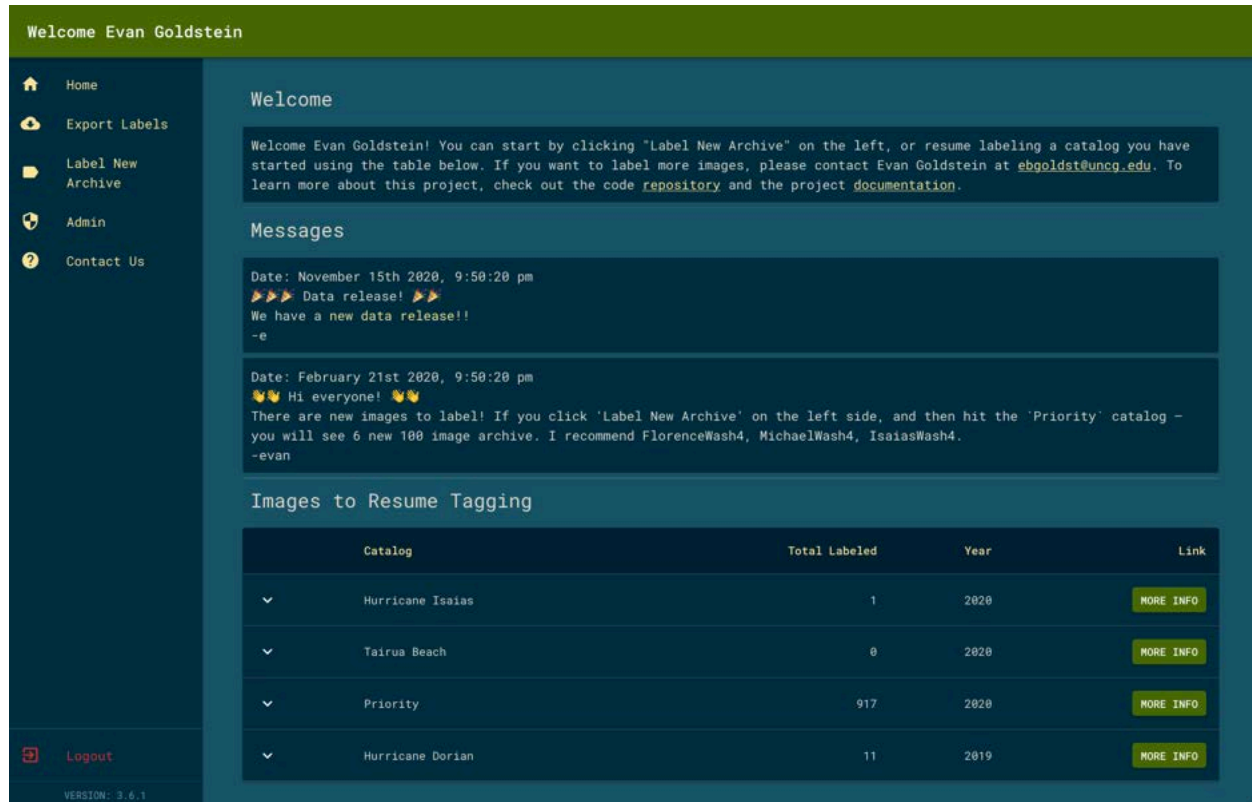
Goldstein EB, Mohanty SD, Rafique SN, Valentine J, (2020), An Active Learning Pipeline to Detect Hurricane Washover in Post-Storm Aerial Images, AI for Earth Sciences Workshop at NeurIPS 2020, <https://doi.org/10.31223/X5JW23>

2) Logging on and picking a set of images to label

The first step is to navigate to the labeler: <https://coastalimagelabeler.science/>. The landing page has links to the code, the docs, and a contact email. You need to log on to use the labeler. We do not store credentials, instead we use Auth0 to handle this. You can either sign on using a new username/password you create for the labeler, or sign on using your Google credentials. We do not see or store your password.



After logging on you are presented with a screen with 4 key features:



- The sidebar/drawer on the left side.
 - 'Home' brings users back to this page
 - 'Export labels' allows you to download your labels as a csv file
 - 'Label new archive' brings users to a screen where they pick new images to label
 - 'Admin' only exists for admins, and displays info about the virtual machine
 - 'Contact Us' shows details on how to contact the Coastal Image Labeler team
- 'Welcome' box — a brief set of instructions.
- 'Messages' box — displays recent news/instructions written by the Coastal Image Labeler team for
- 'Images to resume tagging' box — displays the current images you are working with, and allows you to resume labeling images if you have not finished a set of images.

The labeler stores many images. Each image is assigned to a directory structure. The first layer is referred to as the catalog — for example, these are all the images from a given Hurricane, or given beach, etc. subdirectories under each catalog are called archives. For example, all Hurricane Florence images are one catalog, in this catalog each NOAA flight is its own archive.

From this screen you really have two options if you want to label images. You can resume labeling images that you have started (seen in the 'Images to resume tagging' box) or you can pick a new set of images to label (the 'Label new archive' button on the left sidebar).

If you have never labeled images, you can click the "Label New Archive" on the left and be brought to a screen with the catalogs you can work with. By default, everyone is shown the

‘priority’ catalog. Others can be enabled by asking the Team for appropriate permissions (we can also host images for you and your colleagues to label).

Welcome Evan Goldstein

Home

Export Labels

Label New

Archive

Admin

Contact Us

Logout

Catalog	Total Images	Year	Link
Post-Storm Tiles	34608	2018	MORE INFO
Hurricane Michael	9600	2018	MORE INFO
Hurricane Florence	28155	2018	MORE INFO
Hurricane Dorian	18425	2019	MORE INFO
Hurricane Isaias	3482	2020	MORE INFO
Priority	1500	2020	MORE INFO

Info

Images from Hurricane Florence, Hurricane Michael, and Hurricane Isaias.

Archive	Total Images	
Florence4	100	TAG
FlorenceWash4	100	TAG
Michael4	100	TAG
MichaelWash4	100	TAG
Isaias4	100	TAG
IsaiasWash4	100	TAG

| Tairua Beach | 3851 | 2020 | MORE INFO |

If you click the down arrow next to priority, you are shown the available archives to label. By clicking on the button to the right of each archive — ‘TAG’ — you start the process of labeling.

3) Labeling Questions

Each catalog is assigned a specific set of questions that will be asked. Here we review and give detailed instructions about those questions.

- Coastal Storm Questions

When you pick a catalog/archive with the Coastal Storm Questions, the labeler will look like this 🙌

Above the image you will see the name of the Catalog, Archive and Image. Two buttons allow you to open a new browser tab to inspect a compressed version of the image or a full resolution version of the image.

Below the image you will see the Questions, the Skip and Submit Buttons.

The screenshot shows a web application interface for labeling coastal storm images. At the top, a green banner reads "You're labeling now! 🙌". Below this is a dark blue sidebar with navigation links: Home, Export Labels, Label New Archive, Admin, and Contact Us. The main content area has a header "Catalog Priority" and "Archive Florence4 - P26056280.jpg". Below the header are two buttons: "VIEW COMPRESSED IMAGE" and "VIEW FULL IMAGE". The central part of the interface is a large image of a coastal area with buildings and a beach. Below the image, the "Coastal Storm Questions:" section contains several questions with radio button and checkbox options. The questions are: "Quick Submit" (with a "LABEL IMAGE AS ALL WATER AND GO TO NEXT IMAGE" button), "Development Type" (Undeveloped, Developed), "Washover Type" (No visible washover, Visible washover (active in this storm)), "Damage Type" (No visible damage to structures/infrastructure, Visible damage to structures/infrastructure), "Impact Type(s)" (Swash, Collision, Overwash, Inundation), and "Terrain Type(s)" (Sandy Coastline, Marsh, Inland, River). There is also a text input field for "Additional Comments". At the bottom left is a "SKIP" button and at the bottom right is a "SUBMIT" button. The footer shows "Logout" and "VERSION: 2.4.1".

The 7 Questions are discussed in detail on the following pages so you know how to answer these in clear and consistent way.

Coastal Storm Question 1: Quick Submit Button

Option: 'Label image as all water and go to next image' — either hit this button or not

Goal: Some images will show all water, or is so much water that the questions are not possible to answer. This button is for those cases — by clicking it you will quickly move to the next image since all the other Questions are not important.

Examples: All Water examples (i.e., click the all water button):



Here are some examples that have lots of water, but still enough land to classify, even if it is just the terrain (i.e., do not click the all water button for these examples below):



Coastal Storm Question 2: Development Type

Options: 'Buildings' or 'No buildings'

Goal: To understand if the image shows a landscape that has human development - buildings, infrastructure, etc.) or has no permanent human structures. We are primarily interested in buildings — for detecting damage to buildings. Some images will show a single building — please classify those as developed. Some images will show roads, parking lots, etc. — please classify those as undeveloped.

Examples: It is relatively easy to see buildings, here are some examples that are edge cases with roads, parking lots, borrow pits, but no buildings. These should all be classified as 'No Buildings'



Coastal Storm Question 3: Washover Type

Options: 'No visible washover' of "Visible washover (active in this storm)'

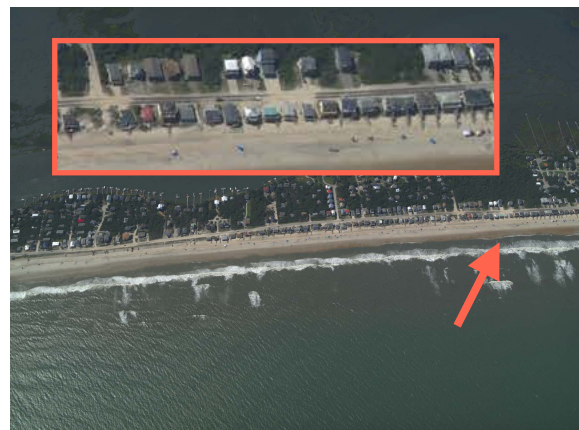
Goal: Price (1947) coined the term 'Washover' to refer to sediment that is deposited beyond the beach as a result of elevated water levels. This deposit is the result of overwash (the process). Washover deposits can be deposited in a variety of identifiable contexts, such as beyond a berm into a marsh or developed area, or beyond a dune crest into the back dune area. Defining washover can be a difficult task that requires care and attention (and zooming in). Note that currently, finding and defining washover is the primary focus of the labeler.

We are interested in finding washover deposits that were active recently, presumably in the storm that caused the flight to be commissioned by NOAA. So this question is asking if you see washover deposits that you think were active during the past storm event? You will likely need to zoom in and inspect the image closely. For example, by hitting those buttons above the image to look at the compressed version or full resolution version in new tabs.

When there is beachfront development (buildings) in the scene, beach-access points and spaces between buildings often allow for overwash and washover deposits to form.

We have observed that a new user can easily pick out a large washover deposits. But smaller deposits are a bit harder to spot. Here are some examples of small, cryptic deposits just to show you some examples. To reiterate, you will likely need to zoom in to confirm the presence/absence of these deposits.

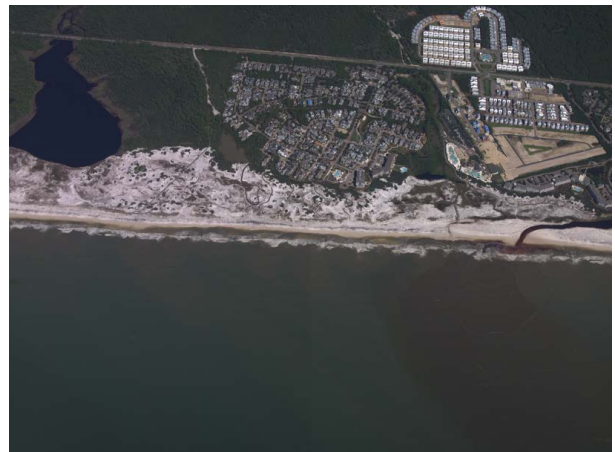
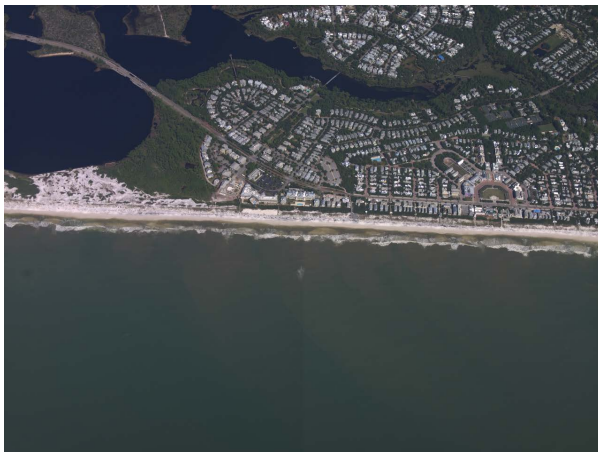
Examples: Cryptic and/or small washovers.



Examples: (continued) widespread, easier to see washover example



Examples: Features that look like washover, but are not. Below are two examples of hummocky dunes and blowouts that give the impression of Washover, but further inspection suggest that recent flow did not cause these features.

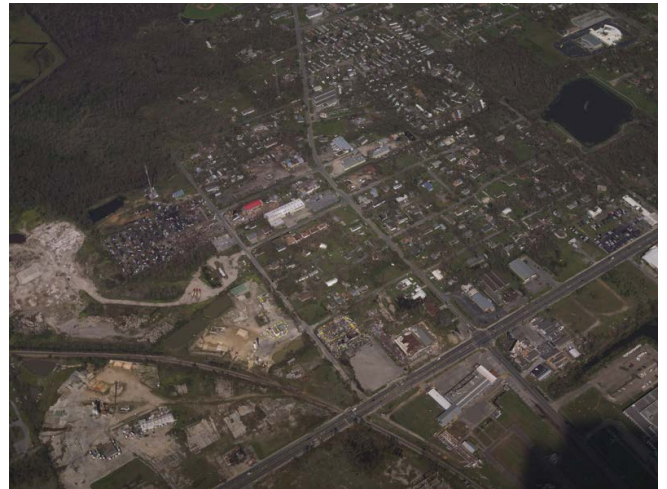


Coastal Storm Question 4: Damage Type

Options: 'No visible damage to buildings' or 'Visible damage to buildings'

Goals: Determine if buildings in the image are damaged. We are interested in catastrophic damage, as well as minor damage, which is often visible as debris scattered around buildings (e.g., siding or roofing that falls off). You will likely need to zoom in and inspect the image closely — by hitting those buttons above the image to look at the compressed version or full resolution version in new tabs.

Examples:



Coastal Storm Question 5: Impact Type

Options: Swash, Collision, Overwash, Inundation. you can check as many as you want.

Goals: We are interested in determining the impact of the storm that caused the flight to be commissioned by NOAA. This is likely the hardest question, and is derived from the Storm Impact Scale from Sallenger (2000). Sallenger proposed 4 regimes:

- 1) Swash Regime: where the water is confined to the foreshore. If there is no scarp, and no washover, the seaward side of the coastal dune is irregular, and you are looking at a sandy coastline, I would pick `swash`.
- 2) Collision Regime: Where the total water level is high enough to interact with the Dune — Look for a dune scarp (or shadow of a scarp) in the image. this will likely require you to zoom
- 3) Overwash Regime: Where the maximum runup height is above the dune, but the still water level (setup) is below the dune. Realistically, the easiest way to tell a storm was in the overwash regime in these pictures is to see if there are washover deposits. If there are deposits (and you answered yes to the above Question on washover, then you should say yes to this regime.
- 4) Inundation Regime: Where the setup is above the island, and the island is underwater. If you see a broad terrace of washover that extends from the front of the island to the back, then it's a good guess that inundation occurred.

If you see multiple regimes in a single image, please check all the boxes that apply.

Examples:



Coastal Storm Question 6: Terrain Type

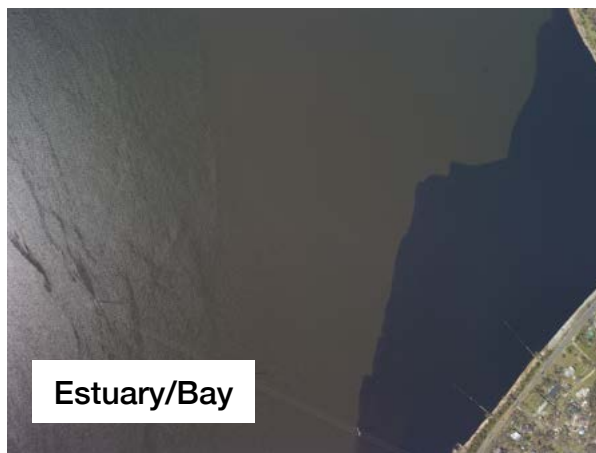
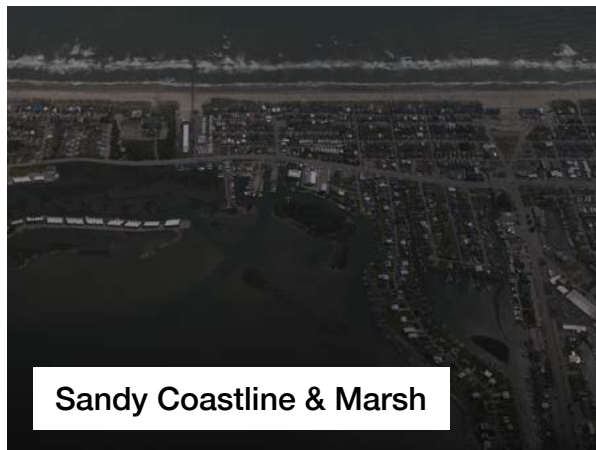
Options: Sandy Coastline, Marsh, Estuary/Bay, Inland— You must check 1, but can select as many as you want.

Goals: The goal is to develop a dataset that can classify the terrain in the image. If you see any of the landscapes in the picture, please select them. For example if you see Sandy Coastlines and Marsh (a common occurrence as the back barrier is a marsh, then select both options.

The Estuary/Bay and Inland classes can be confusing. If you see a coastline that is not sandy, I would suggest that it is an Estuary/bay coastline. Since not all Estuaries/bays have significant marsh areas, we have broken these out.

For inland, this is for pictures that are mostly of broad inland areas, with no coastlines/water, or only just rivers. These are areas where no estuary/bay or sandy coastline can be seen.

Examples:



Coastal Storm Question 7: Additional Comments

Options: This is a text box, you can type what you want

Goals: Leave notes to yourself if you find a particularly interesting image. Since a user can download the data, this can be a note to yourself, or to the Coastal Image Labeler team.

4) Scribbling interface

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5) Data releases

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