Macrosystems EDDIE:
Getting Started + Troubleshooting Tips

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Macrosystems EDDIE: Using Data to Improve Ecological Forecasts.

Macrosystems EDDIE Module 7, Version 1.

https://serc.carleton.edu/eddie/macrosystems/module7

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Macrosystems EDDIE

Environmental Data-Driven Inquiry & Exploration in Macrosystems Ecology

NSF | neon Operated by Battelle

SERC the Science Education Resource Center at Carleton College

R Shiny Applications

- Statistical environment

- Interactive web app built using R.
  - Allows users to interact with data
  - Conduct their own analysis

Check-in:

- Can you access the Shiny app or this module?
  - Copy and paste this link into your browser: https://macrosystemseddie.shinyapps.io/module6/
  - If this is not working contact us at MacrosystemsEDDIE@gmail.com and we will help you resolve this issue.

Landing Page of the Shiny App

eddie
environmental data-driven inquiry & exploration

Teaching materials associated with this module can be found at http://module7.macrosystemseddie.org.

Help

Module 7: Using Data to Improve Ecological Forecasts

Bookmark my progress

At any time, use this button to obtain a link that saves your progress.

Overview | Presentation | Introduction | Activity A | Activity B | Activity C

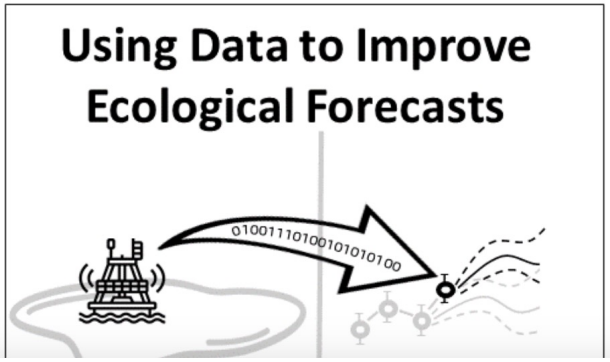
Using Data to Improve Ecological Forecasts

Focal question

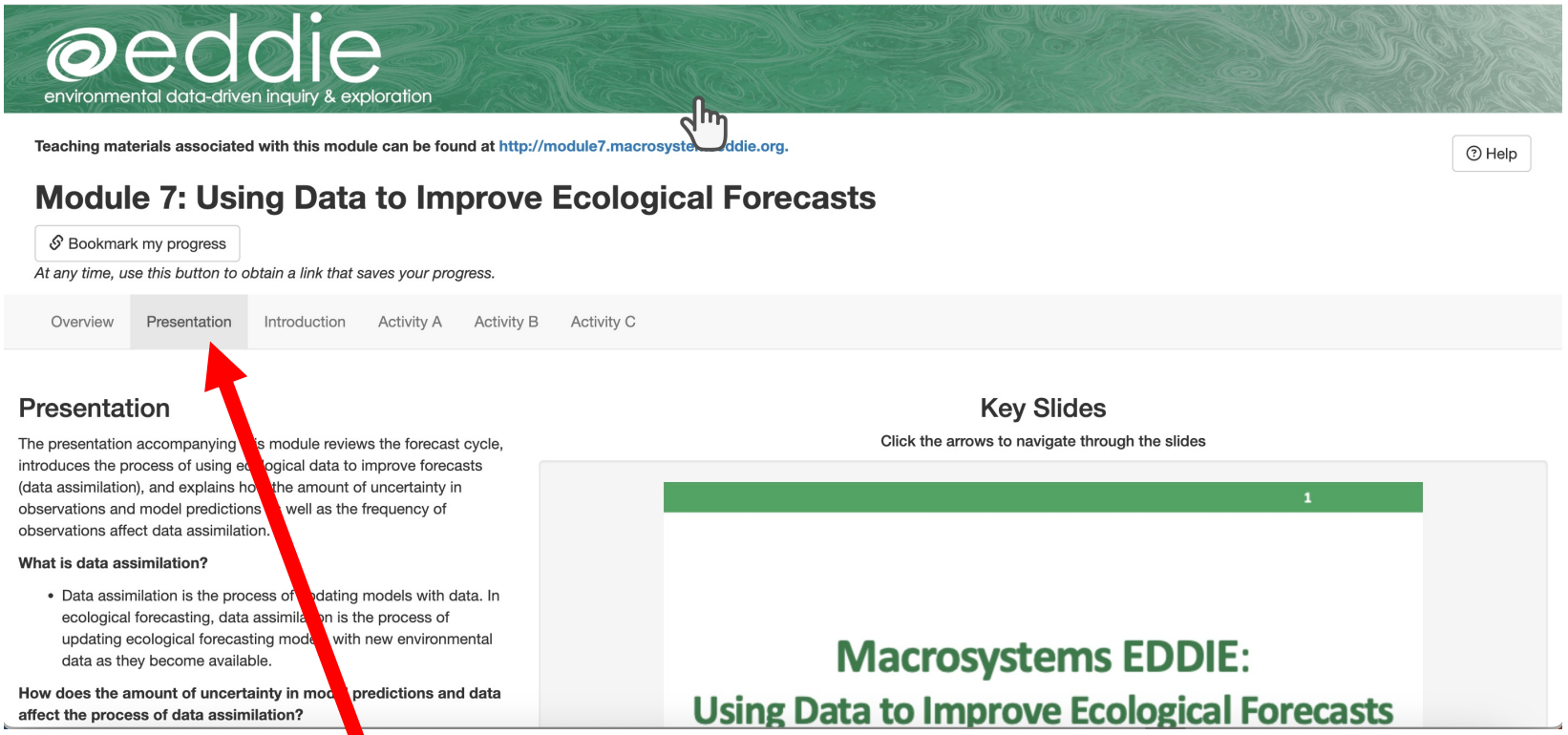
How can we use data to improve ecological forecasts?

Summary

To be useful for management, ecological forecasts need to be both accurate enough for managers to be able to rely on them for decision-making *and* include a representation of forecast uncertainty, so managers can properly interpret the probability of future events. To improve forecast accuracy, we can update forecasts with observational data once they become available, a process known as **data assimilation.** Recent improvements in environmental sensor technology and an increase in the number of sensors deployed in ecosystems have increased the availability of data for assimilation to develop and improve forecasts for natural resource management.



Navigating the Shiny App



Select a tab by clicking on it

Navigate slides

Advance slides by clicking on the arrows

Presentation

The presentation accompanying this module reviews the forecast cycle, introduces the process of using ecological data to improve forecasts (data assimilation), and explains how the amount of uncertainty in observations and model predictions as well as the frequency of observations affect data assimilation.

What is data assimilation?

- Data assimilation is the process of updating models with data. In ecological forecasting, data assimilation is the process of updating ecological forecasting models with new environmental data as they become available.

How does the amount of uncertainty in model predictions and data affect the process of data assimilation?

- The amount of uncertainty in model predictions and data determines how much we adjust our forecasts based on new observations. If we observe a new data point and we have low observation uncertainty (i.e., high confidence in the accuracy of that observation), our forecast starting conditions will be adjusted to closely correspond to the new observation. If we observe a new data point and we have high observation uncertainty (i.e., low confidence in the accuracy of that observation), our forecast starting conditions will not be adjusted as much.

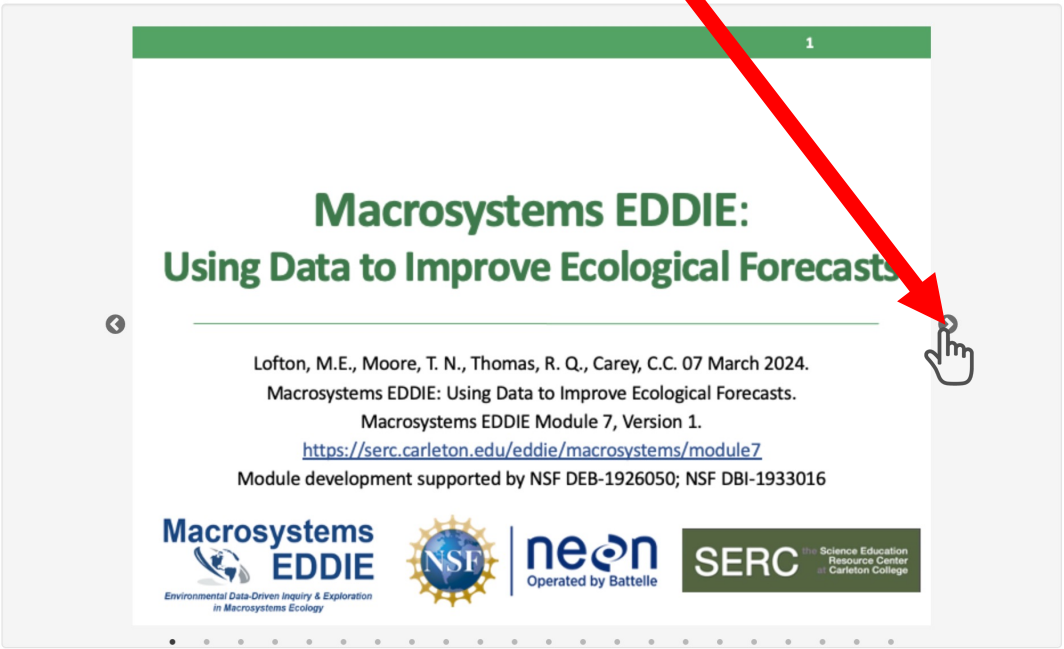
How does the frequency of observations affect data assimilation?

- More frequent observations allow us to update our forecast models more often, potentially improving forecast accuracy.

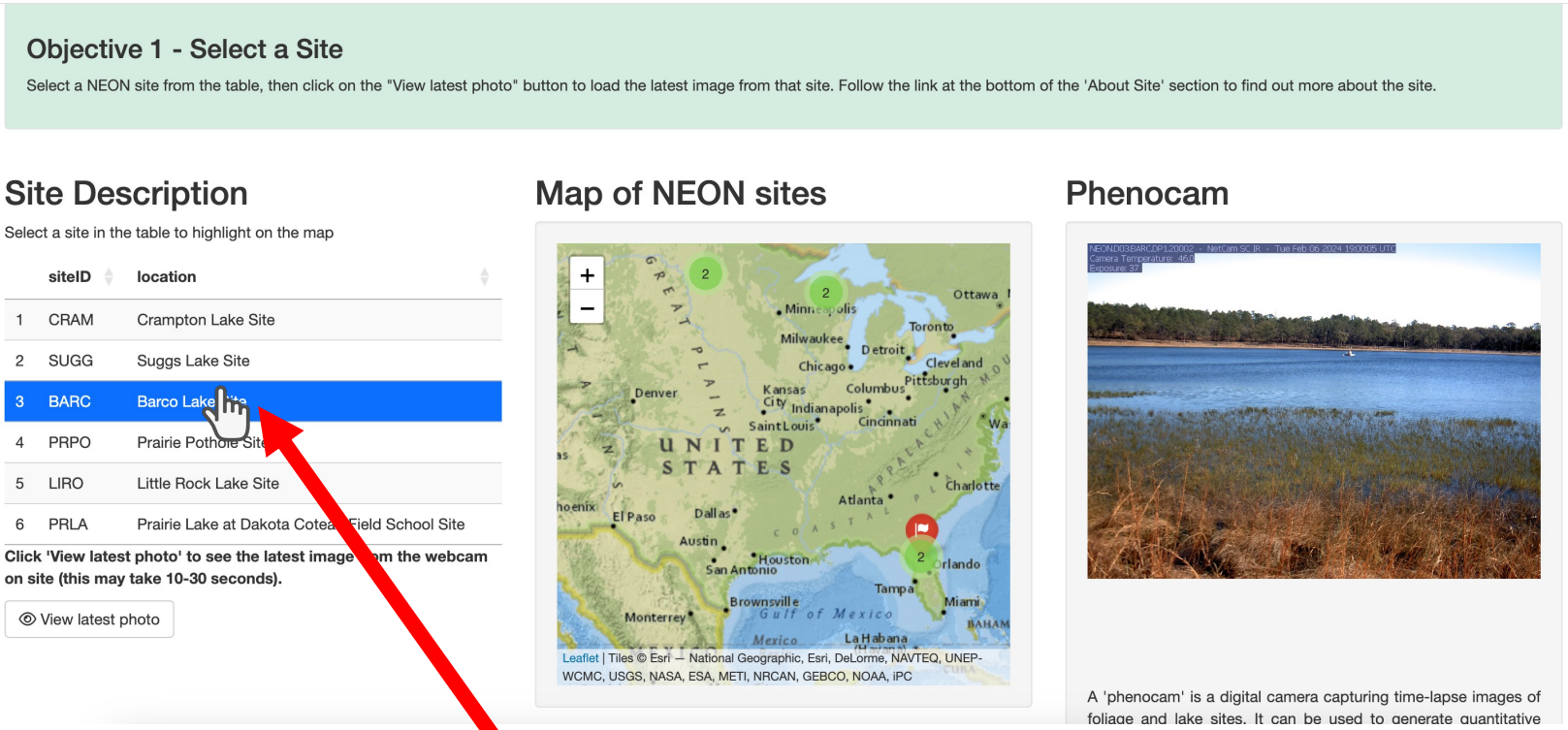
Click through the slides to recap some of the main points from the lecture.

Key Slides

Click the arrows to navigate through the slides

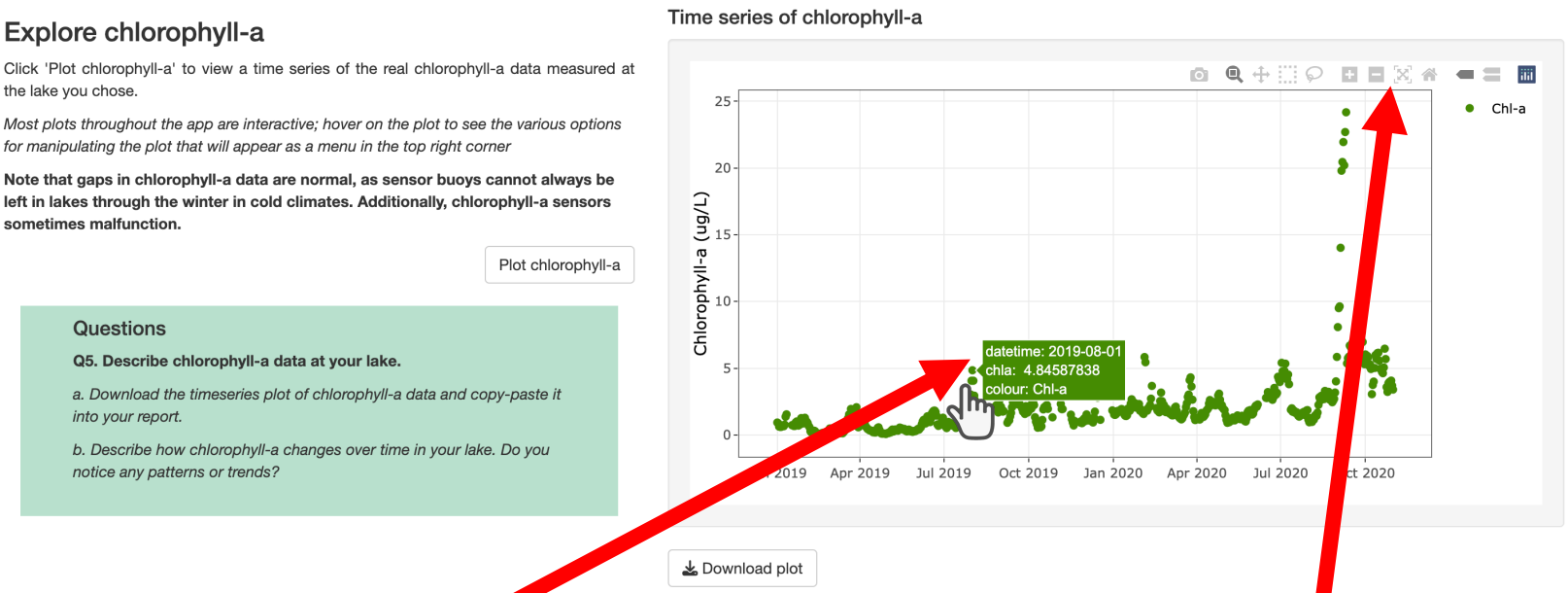


Interact with app



Select data table rows and click buttons

Interact with plots



Hover cursor over points or click and drag to zoom in

Hover cursor over plot to bring up options

Saving plots

Explore chlorophyll-a

Click 'Plot chlorophyll-a' to view a time series of the real chlorophyll-a data measured at the lake you chose.

Most plots throughout the app are interactive; hover on the plot to see the various options for manipulating the plot that will appear as a menu in the top right corner

Note that gaps in chlorophyll-a data are normal, as sensor buoys cannot always be left in lakes through the winter in cold climates. Additionally, chlorophyll-a sensors sometimes malfunction.

Plot chlorophyll-a

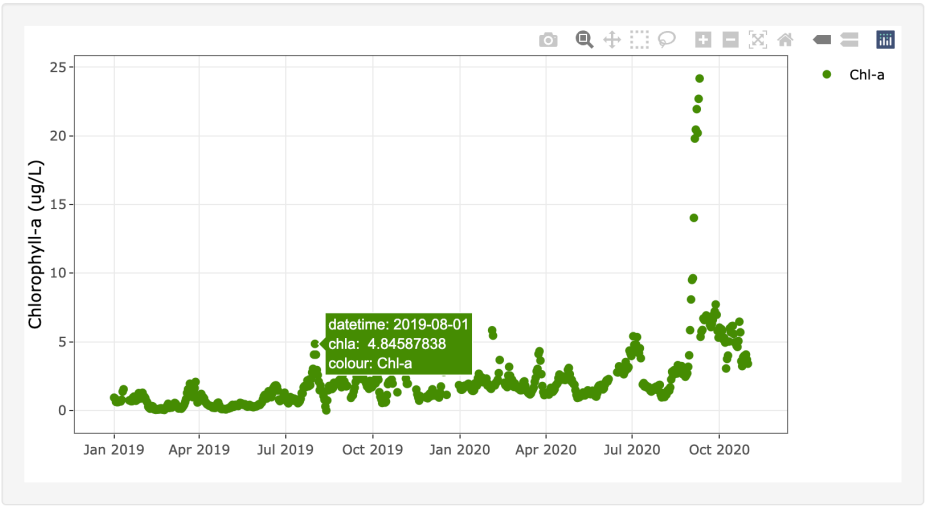
Questions

Q5. Describe chlorophyll-a data at your lake.

a. Download the timeseries plot of chlorophyll-a data and copy-paste it into your report.

b. Describe how chlorophyll-a changes over time in your lake. Do you notice any patterns or trends?

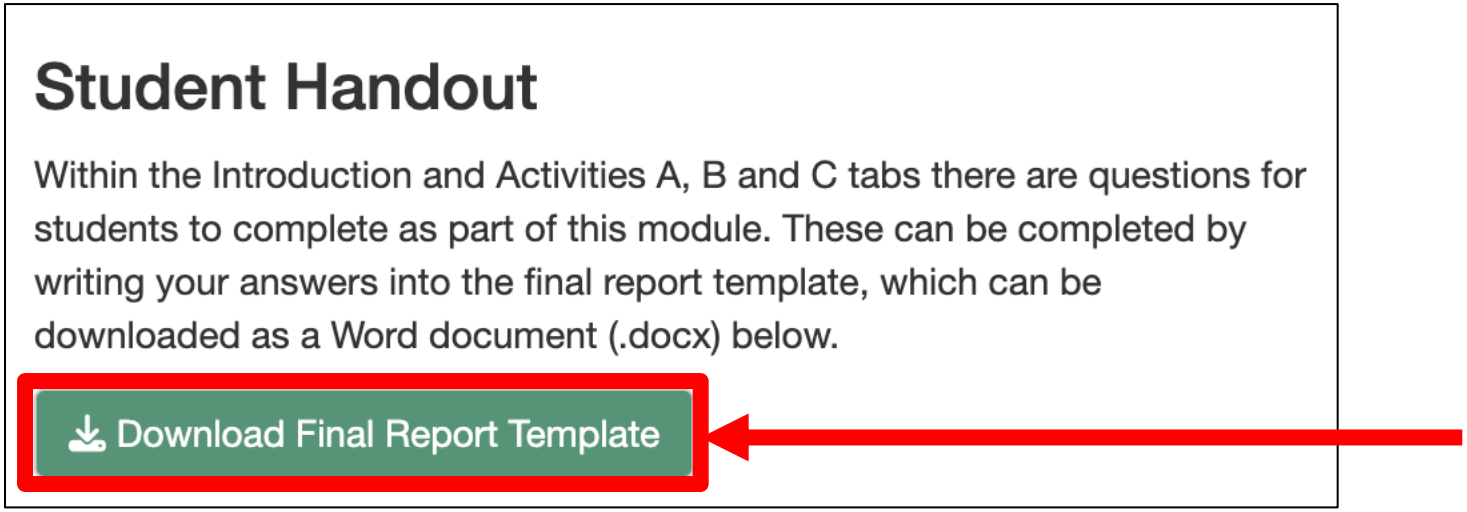
Time series of chlorophyll-a



Download plots to copy-paste into your final report

Downloading the Report

1. Navigate to the “Introduction” tab
2. Click on the “Download Final Report Template” button to download a Word document into which you can type your answers.



Answer questions

Type your answers into the final report template

Activity B - Explore Data Assimilation

Now we will explore the effect of data assimilation on forecasts. First, we will compare forecasts generated with and without data assimilation. Then, we will investigate how the frequency of data assimilation (e.g., daily vs. weekly) and the amount of uncertainty associated with observations affects data assimilation and forecasts.

Objective 5: Assimilate data

Compare one-day-ahead forecasts generated with and without data assimilation.

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24. Briefly describe in your own words how an ensemble Kalman filter can be used to assimilate data into an ecological forecast.

    Answer:

25. Examine the forecast plot with an updated initial condition.

    a. Download the plot of a forecast with an updated initial condition and copy-paste it into your report.

       Please copy-paste your Q25a-plot.png image here.

       Figure 9. One-day-ahead forecast with updated initial condition using newly observed chlorophyll-a data.

    b. Compare the difference between the forecast distribution (white) for 2020-09-26 and the updated initial condition (blue distribution) for 2020-09-26. How are these two distributions different?

       Answer:

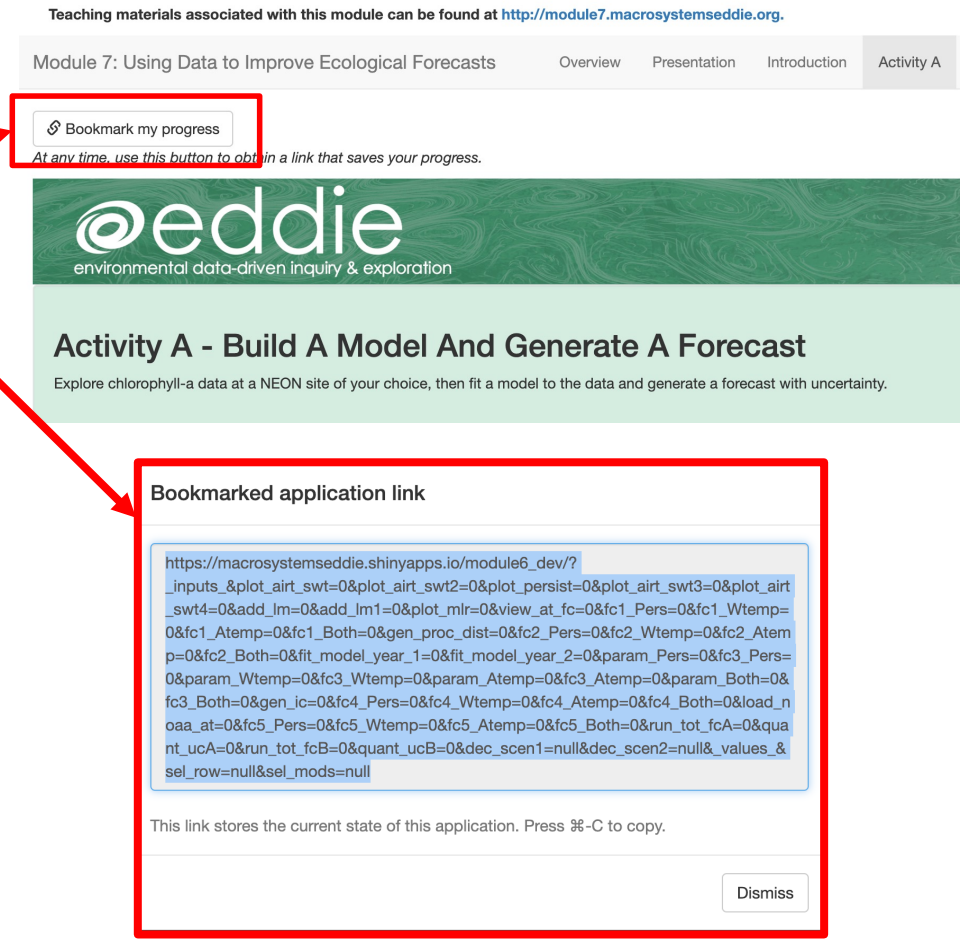
Saving & Resuming Progress

Saving Progress

1. Scroll to top of the page.
2. Click on the “Bookmark my progress” button. A pop-up window with a *very long link* will appear.
3. Copy-paste the link and store it at the top of your final report.

Resuming progress

1. Open your browser.
2. Copy-paste the link into your browser.
3. As you navigate through the tabs in the module, your progress will reappear.



We recommend that you save your progress often!

- Because the Shiny app can time out after inactivity (15 minutes) or disconnect if an internet connection is interrupted, we don’t want you to lose your work.

- Save your progress as you go, as well as every time you close your computer or close the Shiny app in your internet browser.

- After you save the link somewhere safe, you should be able to resume your progress where you left off!