

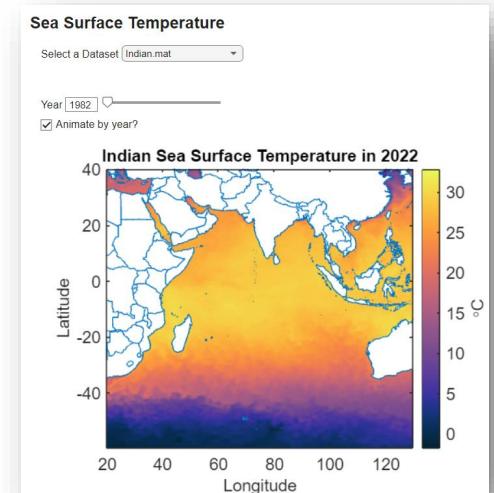
Increasing Your Research Impact with MATLAB

Accessible data

Friction-free exploration

Open code sharing and reuse

Lisa Kempler,
Research and Education Strategist, MathWorks
WHOI
August 11, 2025

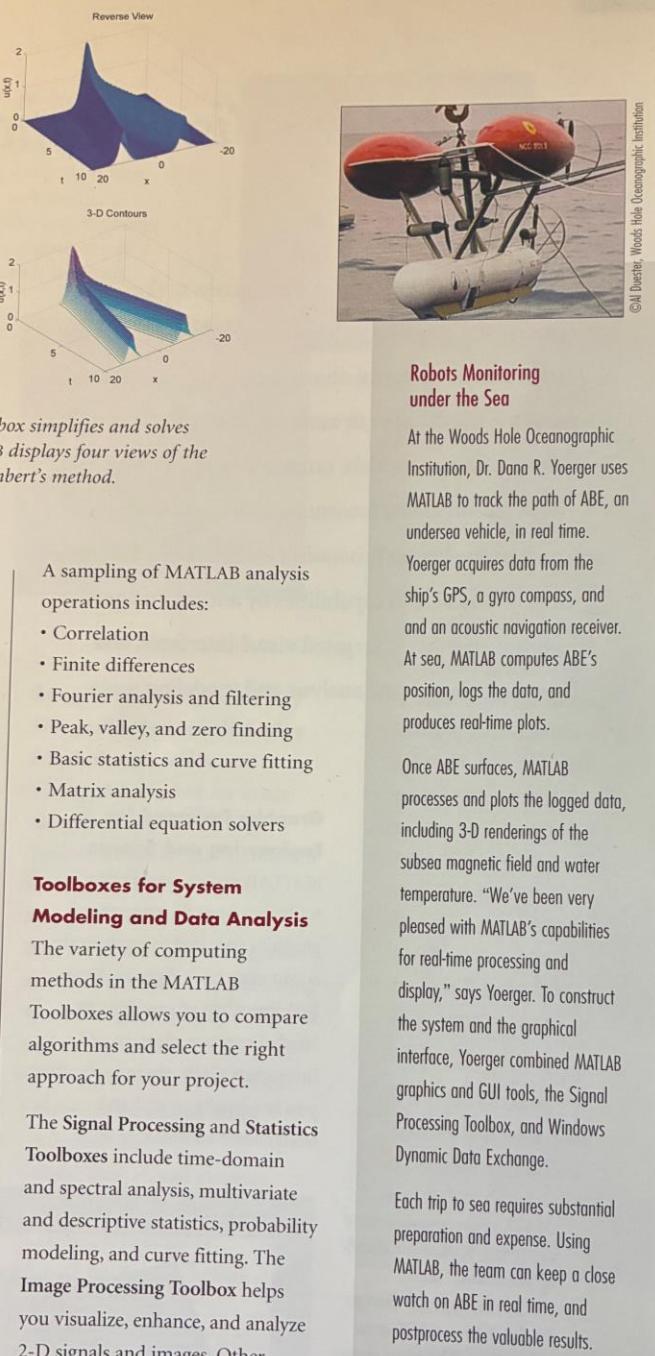


MATLAB® File Exchange

Open on  CODE OCEAN

Open in MATLAB Online





Reverse View

3-D Contours

box simplifies and solves
displays four views of the
abert's method.

A sampling of MATLAB analysis operations includes:

- Correlation
- Finite differences
- Fourier analysis and filtering
- Peak, valley, and zero finding
- Basic statistics and curve fitting
- Matrix analysis
- Differential equation solvers

Toolboxes for System Modeling and Data Analysis

The variety of computing methods in the MATLAB Toolboxes allows you to compare algorithms and select the right approach for your project.

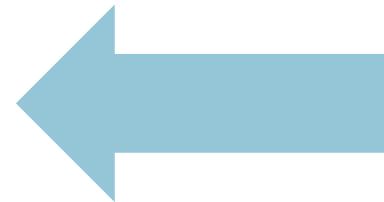
The Signal Processing and Statistics Toolboxes include time-domain and spectral analysis, multivariate and descriptive statistics, probability modeling, and curve fitting. The Image Processing Toolbox helps you visualize, enhance, and analyze 2-D signals and images. Other

Robots Monitoring under the Sea

At the Woods Hole Oceanographic Institution, Dr. Dana R. Yoerger uses MATLAB to track the path of ABE, an undersea vehicle, in real time. Yoerger acquires data from the ship's GPS, a gyro compass, and an acoustic navigation receiver. At sea, MATLAB computes ABE's position, logs the data, and produces real-time plots. Once ABE surfaces, MATLAB processes and plots the logged data, including 3-D renderings of the subsea magnetic field and water temperature. "We've been very pleased with MATLAB's capabilities for real-time processing and display," says Yoerger. To construct the system and the graphical interface, Yoerger combined MATLAB graphics and GUI tools, the Signal Processing Toolbox, and Windows Dynamic Data Exchange. Each trip to sea requires substantial preparation and expense. Using MATLAB, the team can keep a close watch on ABE in real time, and postprocess the valuable results.

©Al Duester, Woods Hole Oceanographic Institution

WHOI and MathWorks (and I) Go Way Back



1997 MATLAB 5 Brochure

featuring



WHOI's ABE UAV that uses MATLAB for underwater ocean mapping

“Open” Requirements: Publications, Funders, Data Portals



The screenshot shows the NOAA Climate Data Online homepage. At the top, there's a navigation bar with links for Home, Climate Information, Data Access, Contact, About, and a search bar. Below the header, a main section titled "Climate Data Online" describes the service and features a large circular graphic of a landscape with a sun, clouds, and snowflakes. Below this are four buttons: "Browse Datasets", "Certify Orders", "Check Status", and "Find Help". Further down, a "DISCOVER DATA BY" section contains three tool boxes: "SEARCH TOOL", "MAPPING TOOL", and "DATA TOOLS". Each box has a brief description and a link to "»". At the bottom, there are "ADDITIONAL DATA ACCESS" and "GETTING STARTED" buttons.



The screenshot shows a news article from the "INDUSTRY NEWS" section of the website. The title is "Nature's new policy mandates data-availability statements". The author is Kakoli Majumder, and the date is Sep 14, 2016, with 601 views. Below the title are social sharing options: "Save to read later", "Add a comment", "Republish on your website", and "Print". The article text discusses a new policy from Nature mandating data-availability statements for all papers accepted for publication. It includes a green-toned graphic of a globe and charts. The text continues below the graphic.

In a move to reinforce its long standing support towards data sharing, *Nature* has announced a new policy mandating data-availability statements. From this month onwards, all papers accepted for publication in *Nature* and 12 other *Nature* titles will be required to provide a statement reporting whether and how the underlying data in the study can be accessed.

Preparing Your Data Management and Sharing Plan

Funding at NSF

Funding
Funding

Preparing
Your
Proposal

The two-page data management and sharing plan is a required part of a proposal to the U.S. National Science Foundation. It describes how a proposal will follow NSF policy on managing, disseminating and sharing research

2025: The Ocean Funding Backdrop



UNPACKING OCEAN FINANCE FOR CLIMATE ACTION

A ROADMAP FOR THE UNITED
NATIONS FRAMEWORK



Navigating Ocean Finance: Investing in a Sustainable Blue Future

15 November | 1.15-2.45 PM (AZT) | Side-event Room 6, Blue Zone

Organisers and Partners : Ocean & Climate Platform, Climate Champions Team, Global Ocean Trust, IUCN, ORRAA, UN Global Compact

During this event, experts will present the conclusions of the policy brief “[Unpacking Ocean Finance for Climate Action](#)” and discuss opportunities to integrate the ocean into finance negotiations, highlighting the role of the private and financial sectors in driving investments for ocean-based climate solutions.

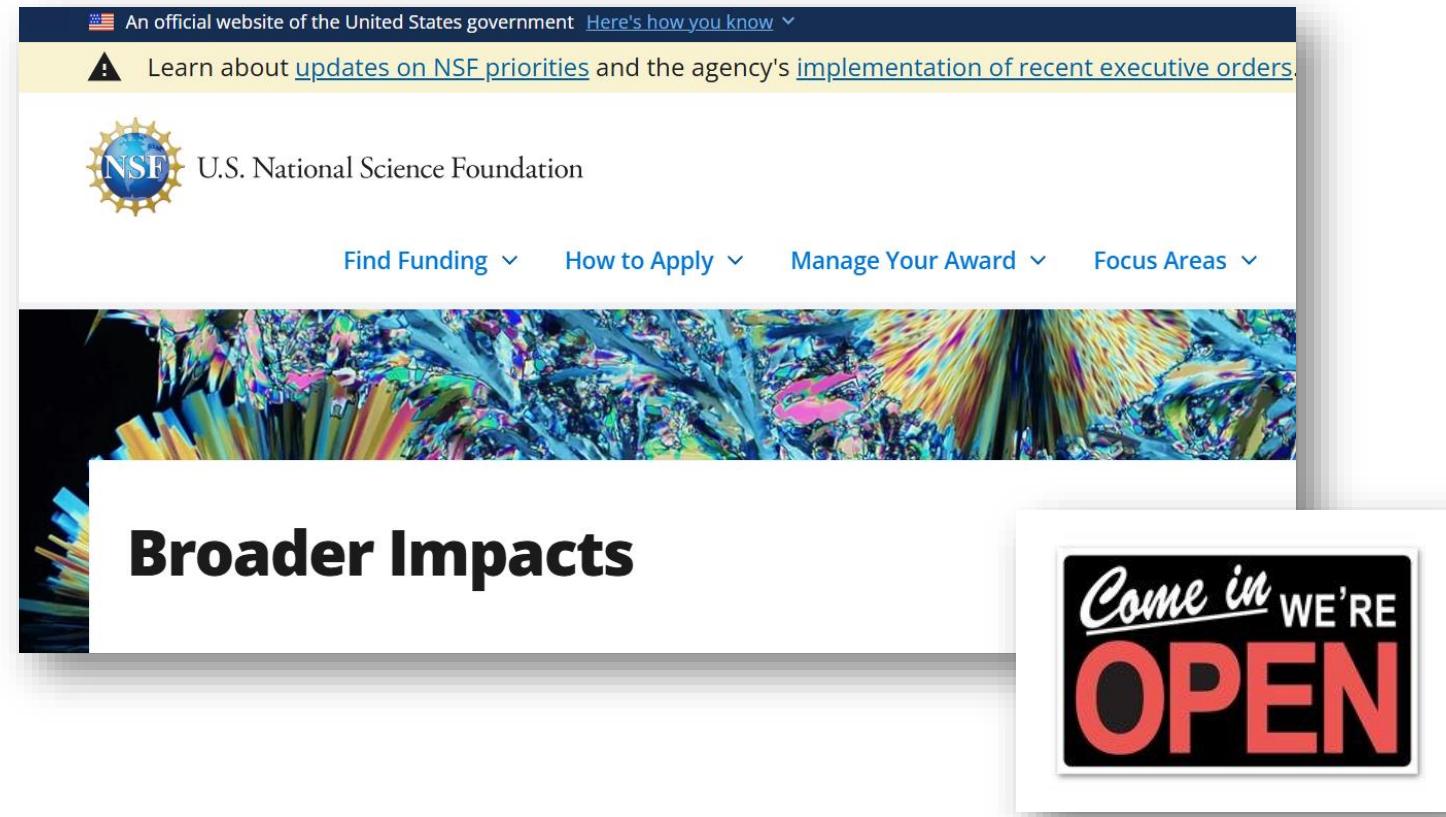


Proposed Funding Cuts to the National
Oceanic and Atmospheric
Administration Threaten U.S. Oceans

Press Release Date: July 2, 2025

Research Requirements: Create Impact

- Open Research
 - Open Data
 - Open Code
 - Open Access
 - Open Source
- Collaboration
 - “Reusable”
 - “Reproducible”
 - “Sharable”



→ *Research Sharing*

Geoscience Funding is Going to CI – Can Scientists Piggyback?



“Science” Funding

I have a new idea to research in my field
- Dr. Earl E. Career

I have a follow-on idea for continuing my research
- Dr. F. Amos



I will innovate new science while publicly archiving my data for reuse by my discipline
- Dr. Isa Player



I will innovate new science and share new math algorithms in a MATLAB toolbox!
- Dr. Cher Tuls

\$900k

I will innovate new science, archive my data, and create open-source code for sharing and applying across disciplines
- Dr. Ina Hou Touplay



Data management plan requirement followed!

Multidisciplinarity!

Cyber-Infrastructure Funding

I need to create a database to store my samples
- Dr. Don T. Thinkso

I will expose the new data formats via APIs and language-specific tools for use and extensibility by the community
- Dr. Amos There



I will apply experimental CS theories and create a searchable data portal that curates a range of sub-discipline data for use by researchers and the public.

- Dr. Prob Lee + Dr. C. I. Buddy

\$50M?

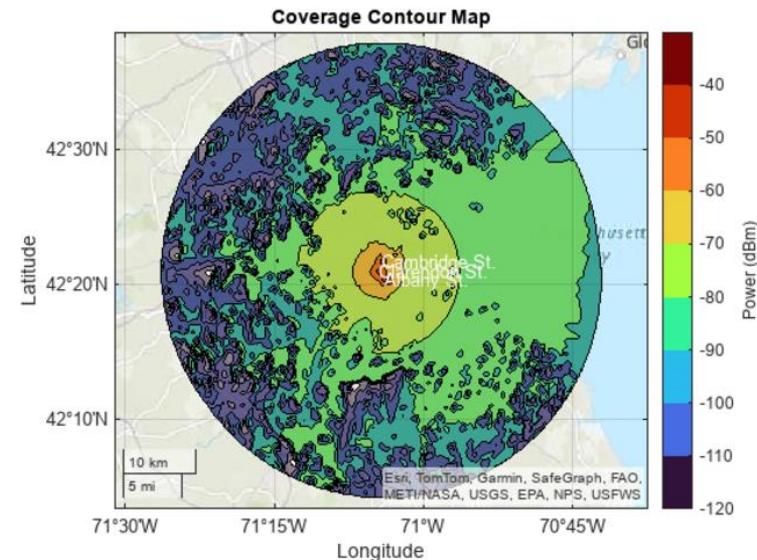
Partnering with multiple sciences and CI experts, I will create a storage repository for code, data, and research sharing (all w/ metadata and ontologies), for reuse and collaboration, under the auspices of Science Gateway X, using my research + other disciplines' contributions as verifiable science.
- Dr. Hugh Gotit + Dr. Hugo Girl



Today's Focus – Accelerating the Research Code Flow

- Developing Code
- Reusing Code
- Sharing Code
- Teaching with Code
- Platforms for Code and Data

```
names = ["Clarendon St.", "Cambridge St.", "Albany St."];  
bostonLat = [42.348722 42.361222 42.338444];  
bostonLon = [-71.075889 -71.069778 -71.065611];  
bostonH = [260 30 23];  
freq = [852.637e6 862.012e6 862.012e6];  
txs = txsite(Name=names, Latitude=bostonLat, Longitude=bostonLon, ...  
    AntennaHeight=bostonH, TransmitterFrequency=freq);  
geocoverage(txs, basemap)
```



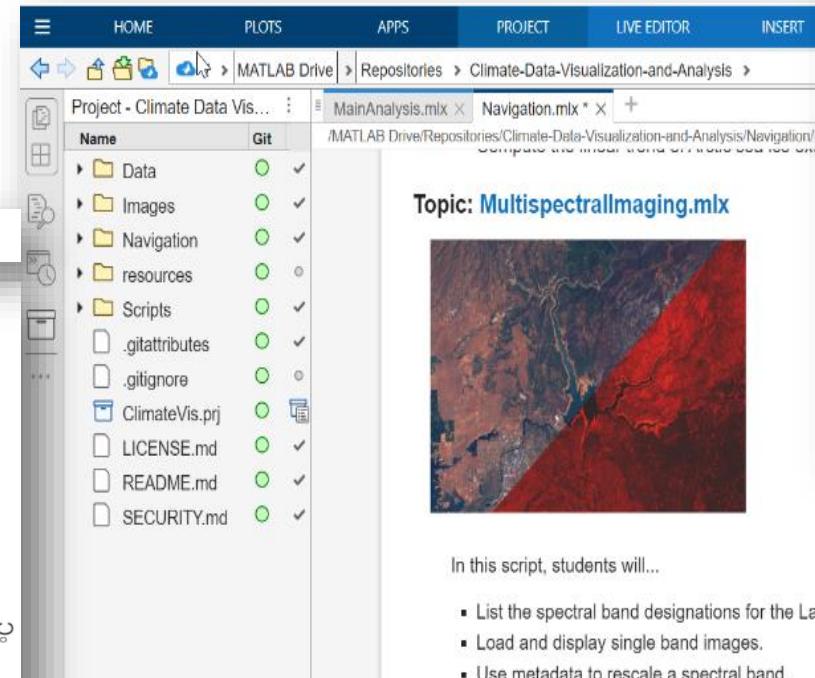
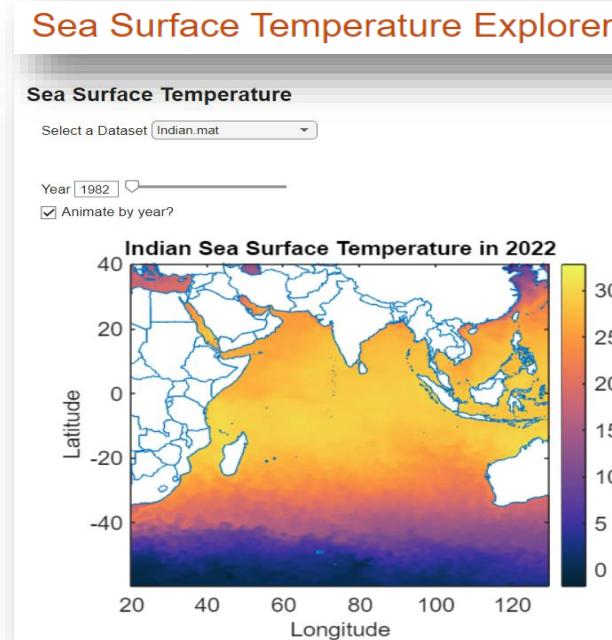
The cell towers are close together. View the area immediately around the towers by zooming in on the coverage map.

(meta-theme: Best Practices for Sustainability)

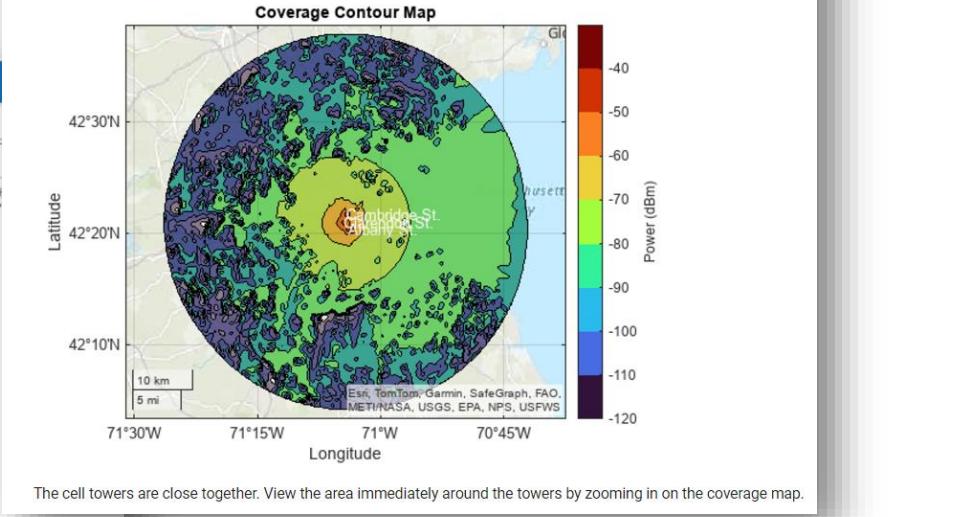
MATLAB for Open Research

Data access, Friction-free exploration, Code sharing and reuse

Developing Code



```
names = ["Clarendon St.", "Cambridge St.", "Albany St."];  
bostonLat = [42.348722 42.361222 42.338444];  
bostonLon = [-71.075889 -71.069778 -71.065611];  
bostonH = [260 30 23];  
freq = [852.637e6 862.012e6 862.012e6];  
txs = txsite(Name=names, Latitude=bostonLat, Longitude=bostonLon, ...  
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geocoverage(txs,basemap)
```



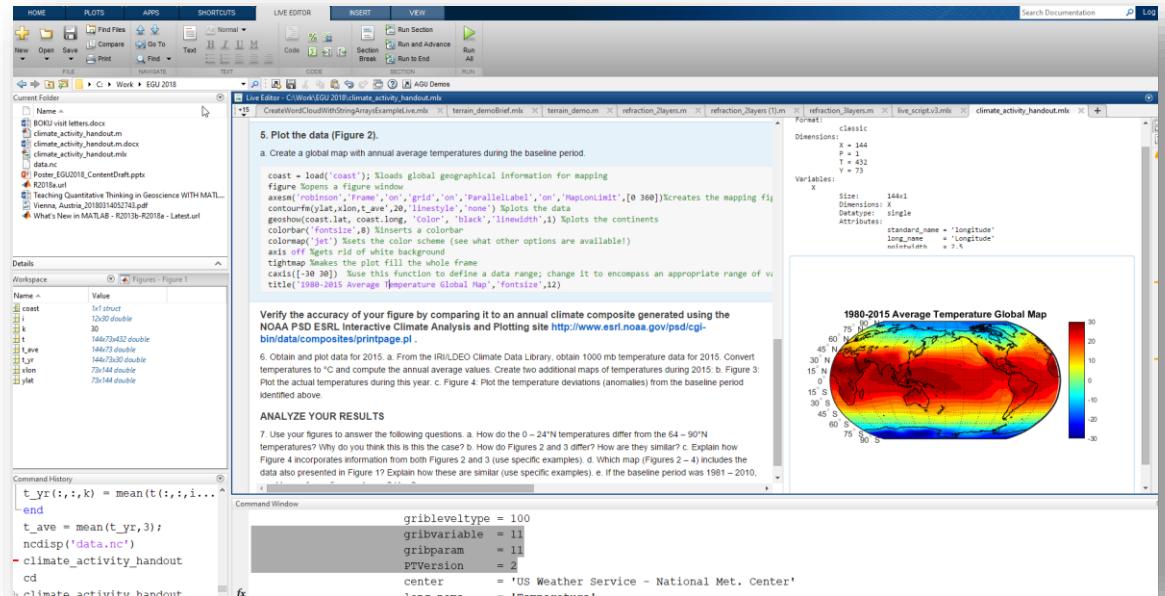
Reference Architecture

MATLAB Integration for Jupyter

Access MATLAB directly from Jupyter

Tell Your Story in Readable Code: MATLAB Live Notebooks

Code, words, pictures, equations, images, and UIcontrols . . .

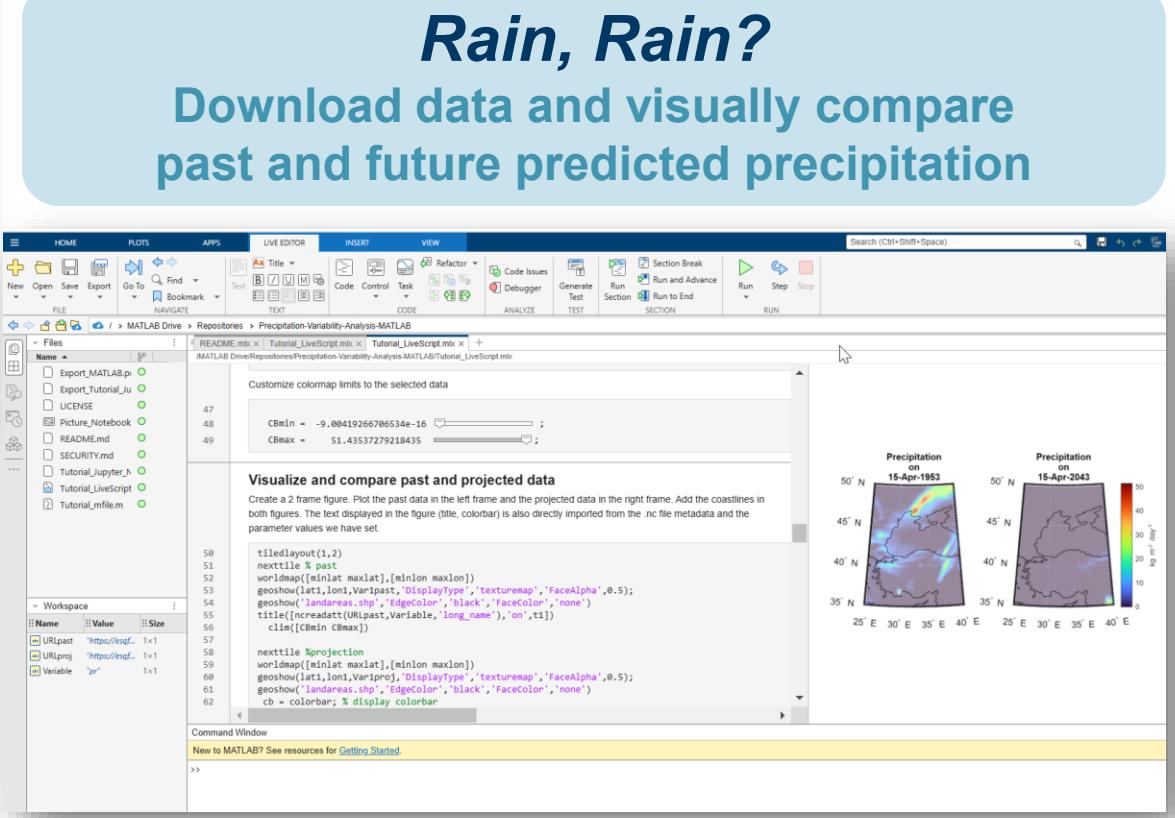


How hot was it?

Use NASA and NOAA data to calculate and map 35 years of average global temperature

[Temperature teaching activity](#)

[Precipitation-variability-analysis-matlab](#)



Rain, Rain?

Download data and visually compare past and future predicted precipitation

Add UIs to Live Scripts: More Experimentation, Less Code

The screenshot illustrates the integration of user interfaces (UIs) directly into MATLAB's Live Scripts. On the left, the MATLAB File Exchange page for "Precipitation-Variability-Analysis-MATLAB" is shown. The right side displays the MATLAB Live Editor environment where the same code is being run.

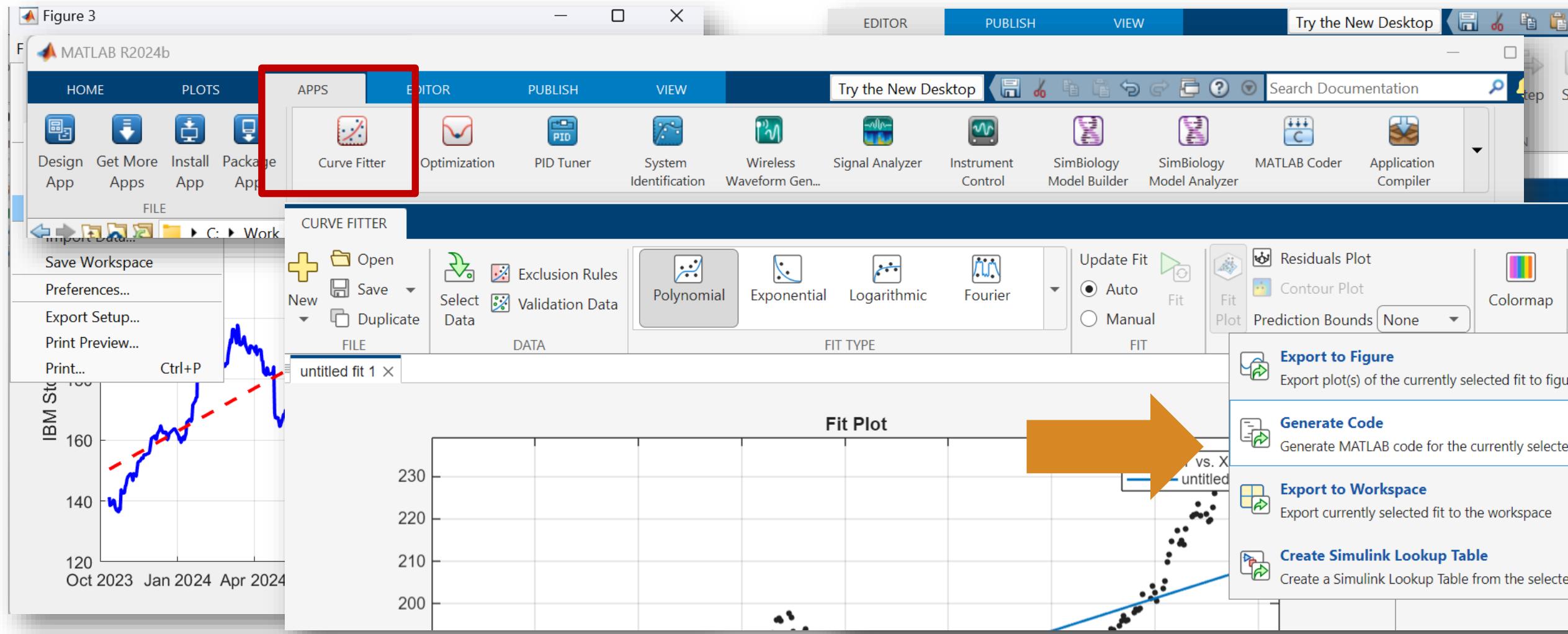
File Exchange Page:

- Title:** Precipitation-Variability-Analysis-MATLAB
- Version:** Version 1.0.2 (6.21 MB)
- Author:** Kostas Leptokaropoulos (STAFF)
- Description:** Access, process and visualize global climate (precipitation) data from the WCRP CMIP6 database
- Link:** <https://github.com/mathworks/Precipitation-Variability-Analysis-MATLAB>
- Follow:** + Follow
- Buttons:** Share, Open in MATLAB Online
- Navigation:** Overview, Functions, Examples, Version History, Reviews (0), Disc

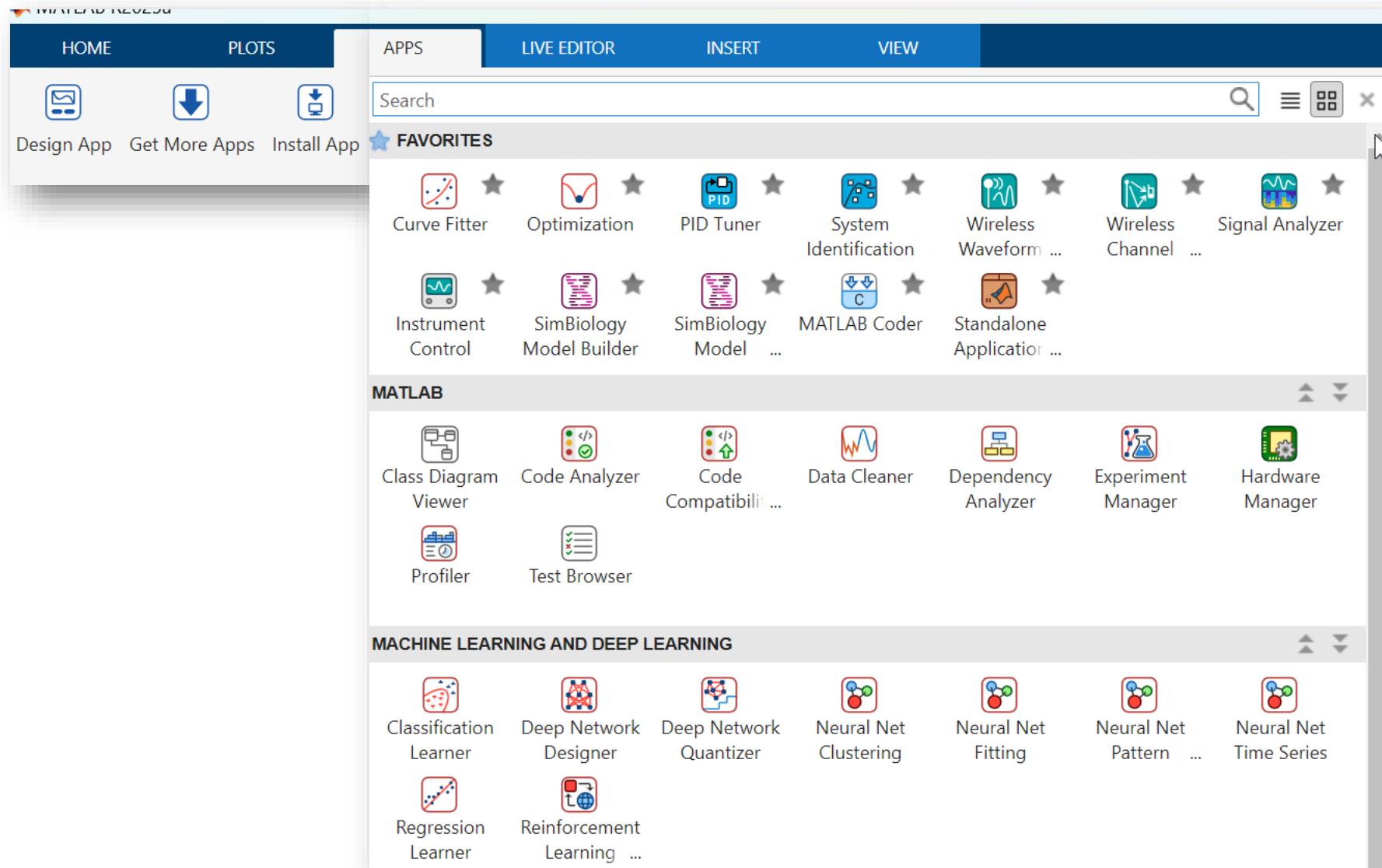
Live Editor Environment:

- Toolbar:** HOME, PLOTS, APPS, LIVE EDITOR, INSERT, VIEW, CODE, ANALYZE, TEST, SECTION.
- File Explorer:** Shows files like README.mlx, Tutorial_LiveScript.mlx, Export_MATLAB.pc, Export_Tutorial_Ju, LICENSE, Picture_Notebook, README.md, SECURITY.md, Tutorial_Jupyter_N, Tutorial_LiveScript, Tutorial_mfile.m.
- Code Area:** Displays the MATLAB code for reading geospatial data and filtering it based on time and space.
- UI Elements:** Includes input fields for minlon (25, 35, 40, 50) and maxlon (100, 190), and descriptive text for selecting boundaries and importing filtered data.

Generate Code from MATLAB Graphics and Apps

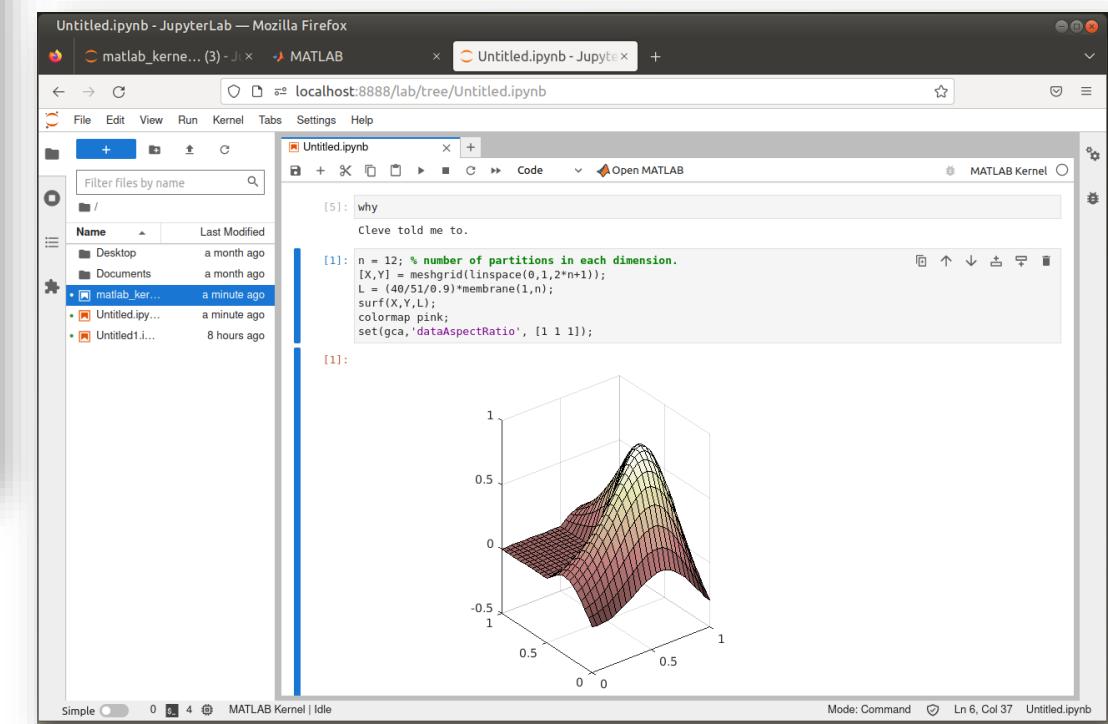
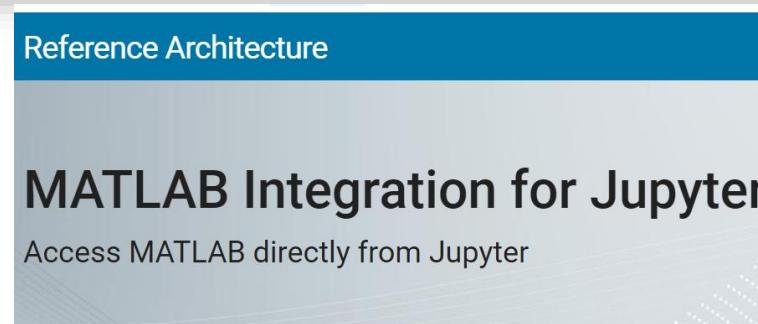
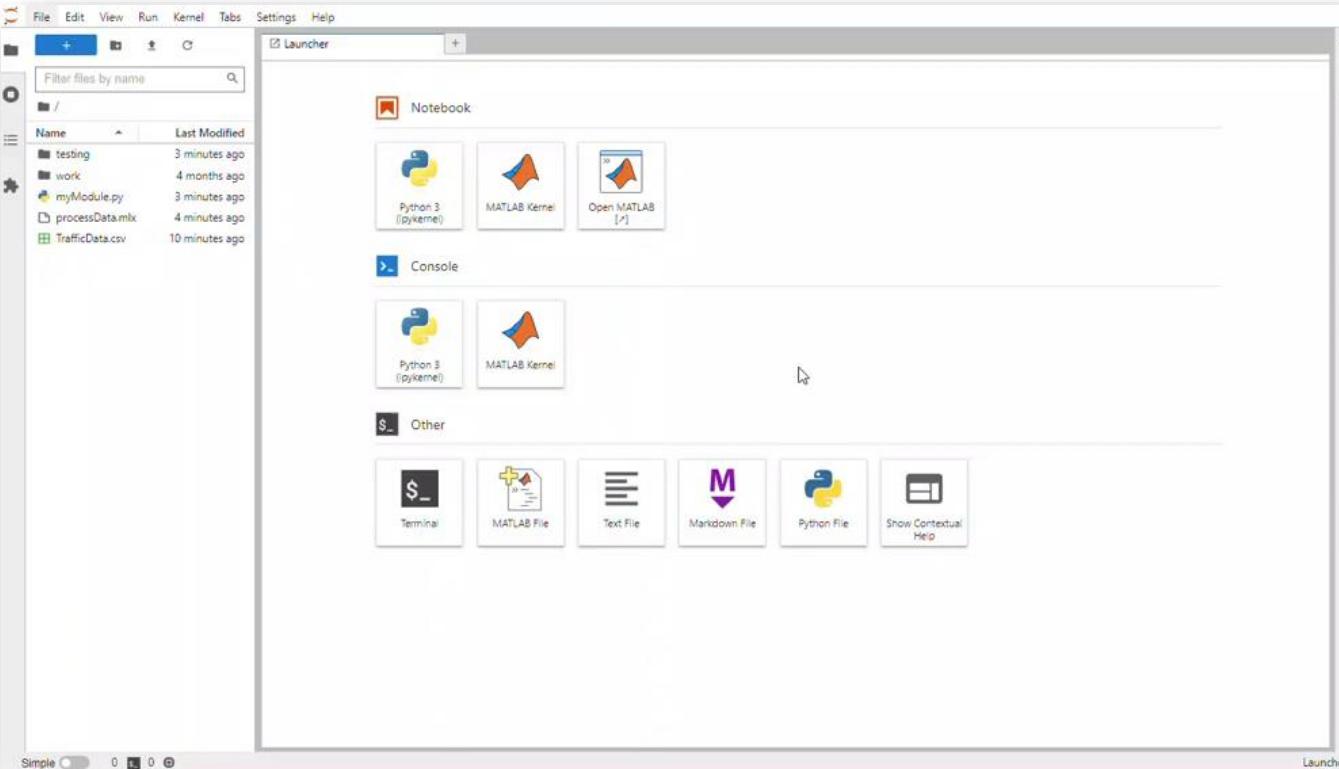


Built-in MATLAB Apps: Would Lower-Code Apps Work Better?



Run MATLAB Code in Jupyter Notebooks

Call MATLAB from Python and Call Python from MATLAB



mathworks.com/products/reference-architectures/jupyter.html

Auto-Convert Live Scripts to Jupyter Notebooks: “Export”

The screenshot illustrates the process of auto-converting a MATLAB Live Script into a Jupyter Notebook.

Left Panel (File Exchange):

- Title:** Precipitation-Variability-Analysis-MATLAB
- Version:** 1.0.2 (6.21 MB)
- Author:** Kostas Leptokaropoulos (STAFF)
- Description:** Access, process and visualize global climate (precipitation) data from the WCRP CMIP6 database.
- GitHub Link:** <https://github.com/mathworks/Precipitation-Variability-Analysis-MATLAB>
- Follow:** + Follow
- Buttons:** Share, Open in MATLAB Online
- Bottom Content:** A box titled "Export files to documents viewable outside of MATLAB." lists supported formats: PDF, Microsoft® Word, HTML, LaTeX, Markdown, and Jupyter® notebooks. The "Jupyter® notebooks" item is highlighted with a red border.

Right Panel (MATLAB Live Editor):

- Toolbar:** FILE, PLOTS, APPS, LIVE EDITOR, INSERT, VIEW.
- FILE Menu:** New, Open, Save, Export (highlighted with a blue box), Export to PDF..., Export to Word..., Export to HTML..., Export to LaTeX..., Export to Markdown..., Export to Jupyter Notebook..., Export Folder... (highlighted with a red box).
- LIVE EDITOR Area:** Displays the MATLAB code for "Tutorial_LiveScript.mlx".
- Code Block:**

```
change/Precipitation-Variability-Analysis-MATLAB-1.0.2/Tutorial_LiveScript.mlx
```
- Text Block:**

Find and filter Geospatial Data
longitude and latitude from the .nc file
- Code Block:**

```
for Data in Time and Space  
    % Find boundaries of a rectangular area
```
- Inputs:** minlon 25, maxlon 40, minlon 35, maxlon 50.
- Text Block:**

Select first day and number of days after the first (their sum must not exceed 365)
- Inputs:** minlon 100, maxlon 190.
- Text Block:**

Find the indexes of longitude and latitude that correspond to the selected geographical boundaries
- Section:** Import Filtered Data
- Text Block:**

Import longitude, latitude, time and precipitation values for past and future data, as constrained in the previous section

github.com/mathworks/Precipitation-Variability-Analysis-MATLAB

Coding Evolution: From Blinking Cursor to Smart Guided Coding

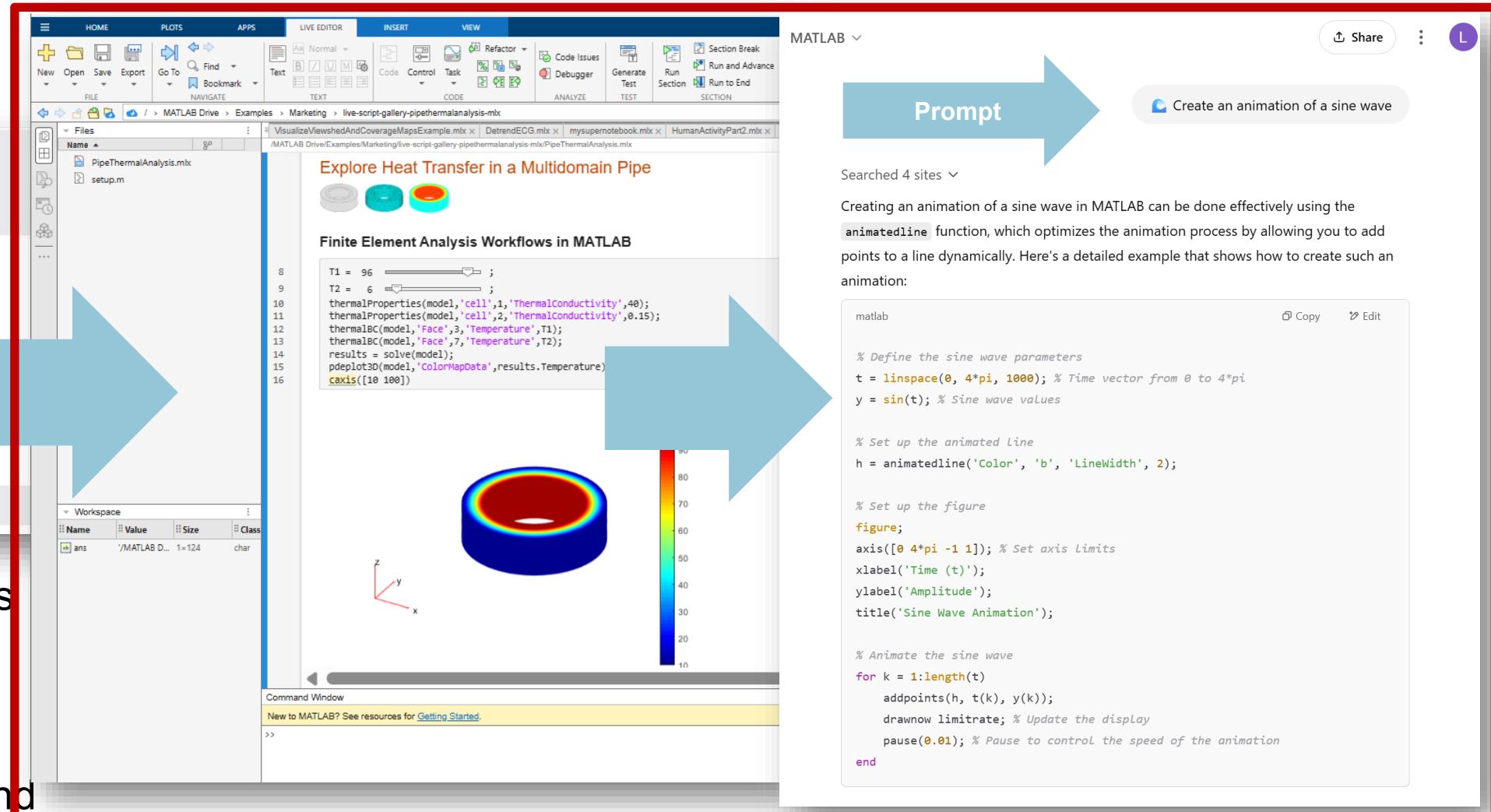
myfirstprogram.c

```
#include <stdio.h>

int main() {
    printf("Hello World!");
    return 0;
}
```

Programming in the '80s
('70s was assembly!)

Blank screen of death
Debug = “print” command



“IDEs” + 4GLs → Executable Notebooks

Apps that know how to program

Code with GenAI and MATLAB

Try *MATLAB GPT* and *MATLAB Copilot*

The screenshot shows a blog post titled "5 ways of using MATLAB with Large Language Models (LLMs) such as ChatGPT and Ollama". The post was written by Mike Croucher on October 2, 2024. It has 773 views, 6 likes, and 2 comments. The post discusses how MATLAB can be used with AI models like ChatGPT and Ollama.

This screenshot shows the MATLAB GPT page on the OpenAI GPT Store. It features a large MATLAB logo and a "Get MATLAB GPT" button. Below the button, there's a brief description of what MATLAB GPT is and how it can help users. The page also includes a rating of 4.1 stars, a "Programming" category, and a "25K+" conversations count. There are also "Conversation Starters" and a "Smooth a noisy dataset" button.

The screenshot shows the MATLAB Copilot product page on the MathWorks website. It highlights the AI assistant optimized for MATLAB. Below the page, there's a detailed description of what MATLAB Copilot does, including generating code, providing autocompletions, and explaining code. The right side of the screenshot shows the MATLAB Editor interface with the MATLAB Copilot toolstrip open, displaying various options like "Ask Copilot", "Autocompletions Preferences", and "Generate Test". A green starburst graphic in the top right corner indicates the release date: May 14th.

MATLAB GPT Talk-Prep Example: Bedmap 3-D with Bad Prompts

how do i create a 3-d map in matlab similar to this chad greene's bedmap

Cancel

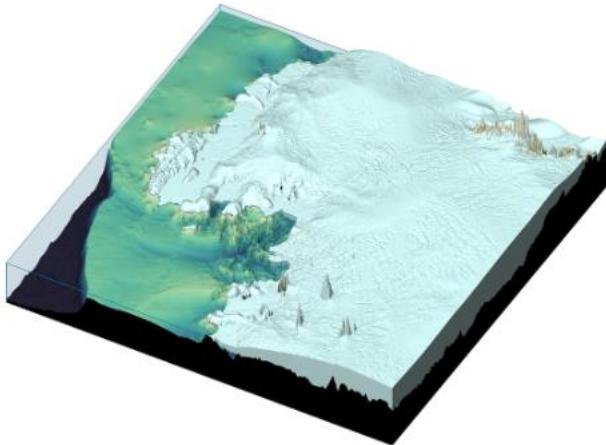
Send

show me the code

Success!
(in 3 prompts)

please display the code for chad greene's bedm
toolbox

- `bedmachine_3d` creates a 3D map of BedMachine data.



- `bedmachine_data` : Loads gridded data.
- `bedmachine_interp` : Interpolates variables like surface elevation and bed elevation at specified locations.
- `bedmachine` : Plots BedMachine data using `imagesc` or `contour`.
- `bedmachine_profile` : Creates profile slices along specified paths or flowlines.
- `bedmachine_3d` : Generates 3D maps of BedMachine data.

The source code for these functions is available on GitHub:

- Repository: [chadagreene/BedMachine](#)

Citing this dataset

If you use BedMachine data, please cite the Morlighem paper listed below. And if this function please do me a kindness and cite my Antarctic Mapping Tools paper.

GenAI with MATLAB and ChatGPT

MATLAB GPT

OpenAI's ChatGPT

- LLM = GPT-4o-mini



MATLAB plug-in with

- www.mathworks.com contents
(documentation, examples, etc.)

The screenshot shows a web browser window with the URL <https://chatgpt.com/g/g-QFTjbeK3U-matlab>. The page is titled "MATLAB" and is identified as "By mathworks.com". It features a sidebar with a "MATLAB" dropdown menu, where "ChatGPT" is highlighted with a red box. Other options in the sidebar include "Library" and "MATLAB". Below the sidebar, there are sections for "Previous 7 Days" and "March", listing various MATLAB-related topics like "Plant Classification in MATLAB" and "Graph Avg Temp Precip". On the right side, there are four cards with icons and text: "Explain k-means clustering with an example", "What are the latest features of MATLAB?", "Smooth a noisy dataset", and "How do I get MATLAB?". At the bottom, there is a "Ask anything" input field with a "+" button and microphone/speaker icons.

Summary: Searching for the Right Data Can Be a Lot of Work



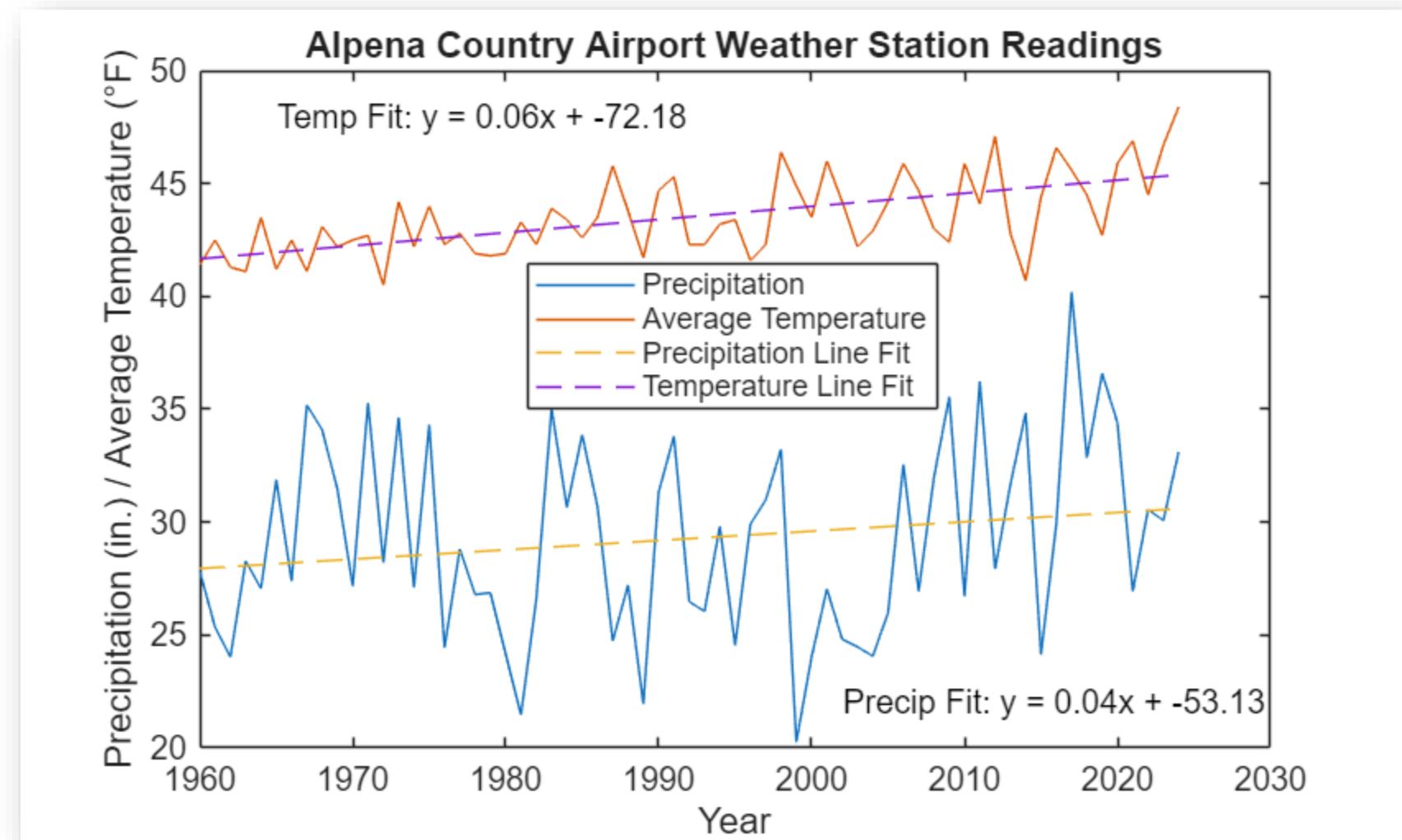
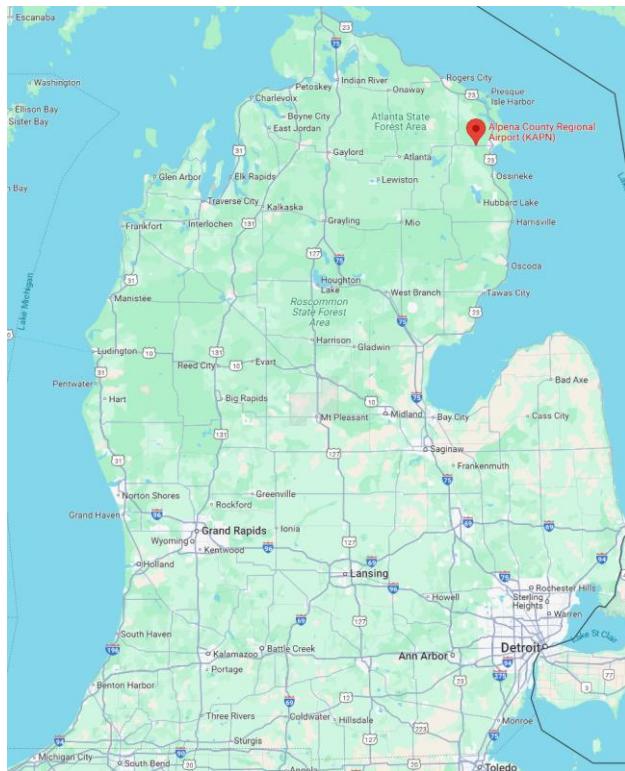
The screenshot shows the homepage of the NOAA Climate Data Online (CDO) website. At the top, there's a navigation bar with links for Home, Climate Information, Data Access, Contact, About, and a search bar. Below the navigation is a main header with the NOAA logo and the text "NATIONAL CENTERS FOR ENVIRONMENTAL INFORMATION" and "NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION". A large graphic of a globe with weather symbols (sun, clouds, rain, lightning) is centered above a section titled "Climate Data Online". To the left of the globe, there's a brief description of what the CDO offers. Below the globe are four buttons: "Browse Datasets", "Certify Orders", "Check Status", and "Find Help". At the bottom of the page, there's a section titled "DISCOVER DATA BY" with three categories: "SEARCH TOOL", "MAPPING TOOL", and "DATA TOOLS", each with a brief description and a link to more information.

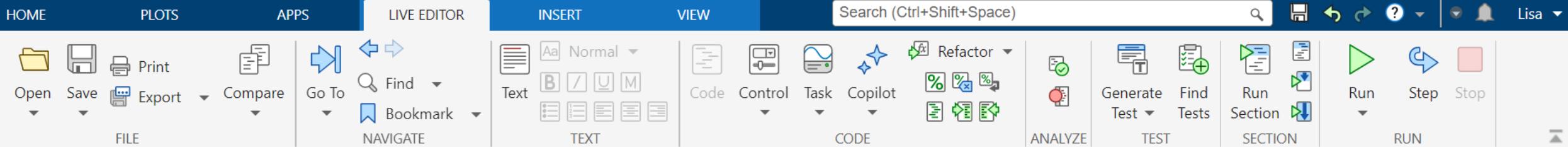
Example: Precip., temp analysis

- I found a site with precipitation over time: NOAA's NCEI CDO
- Having the actual data helped me think about possibilities
- I got desired results in MATLAB
 - With help from MATLAB Copilot

GenAI in MATLAB: MATLAB Copilot: Precipitation and Temperature Analysis (Slide Demo)

Visualization of Alpena, MI Weather Station: Rain, Temperature (Station data recorded from 1930 onward!!!)





File tree: C: > Users > lisak > OneDrive - MathWorks > science-research > Shared Documents > SERC and Curriculum Development > Michigan State workshop > Rainfall example

Files

Name	Size
4007321.csv	31 KB
Alpena MI 1950 data 40120...	21 KB
Alpena MI airport data 4007...	27 KB
Rainfall_ChatGPT_Example....	326 KB
Rainplot.asv	157 KB
Rainplot.mlx	157 KB

Workspace

Name	Value	Size
------	-------	------

LIVE EDITOR

```
% label and title
xlabel('Year');
ylabel('Precipitation (in.) / Average');
title('Alpena Country Airport Weather Station Readings');
legend(['Precipitation', "Average Temp"]);

% label with the tempFit and precipFit
text(1965, 48, sprintf('Temp Fit: y = %f * x + %f', ...));
text(2002, 22, sprintf('Precip Fit: y = %f * x + %f', ...));
% calculate % change in temperature ar
```

CODE

```
% label plot with tempFit and precipFit
% Compare with Florida data
floridaYears = table2array(Floridadata);
floridaPrecip = table2array(Floridadata);
floridaAveTemp = table2array(Floridadata);
```

ANALYZE

TEST

SECTION

RUN

Copilot Chat

Copilot

Hello! Copilot is here to answer your questions, help write and explain code, and even identify code issues. Learn more about [Copilot](#).

Remember that Copilot sometimes writes code and text that seems accurate, but is not. Make sure to verify any received code and give feedback on the results to help improve the responses.

Shuffle Example Prompts

Solve the linear equations with coefficients A = [2, 4; 1, 3] and constants B = [8; 5]

Ask Copilot

New to MATLAB? See resources for [Getting Started](#).

Prerelease License -- for engineering feedback and testing purposes only. Not for sale.

Built-in MATLAB 2025a CoPilot saves coding time vs. MATLAB GPT. But . . .

May 14th
Release



This graph annotation code appeared



Plus . . . code to fit a line to the temperature data

The screenshot shows a portion of a MATLAB script. At the top, there is a comment: % label and title (how did CoPilot do that?). Below it, there is code to set the x-axis label to 'Year' and the y-axis label to 'Precipitation and Average Temperature'. A context menu is open over this code, with the 'Accept All' option highlighted. The menu also includes options like 'Accept Word', 'Dismiss Autocompletions', 'Pause Autocompletions', and 'Autocompletions Settings'. At the bottom of the menu, there is a note: Validate generated output before use. The main code block below the menu contains code to fit a polynomial curve to average temperature data:

```
% Fit a polynomial curve to the average temperature data
tempFit = polyfit(years(11:75), Avg_temp(11:75), 1);
tval = polyval(tempFit, years(11:75));
hold on; % Keep the current plot
plot(years(11:75), tval, '--');
hold off; % Release the plot hold
```

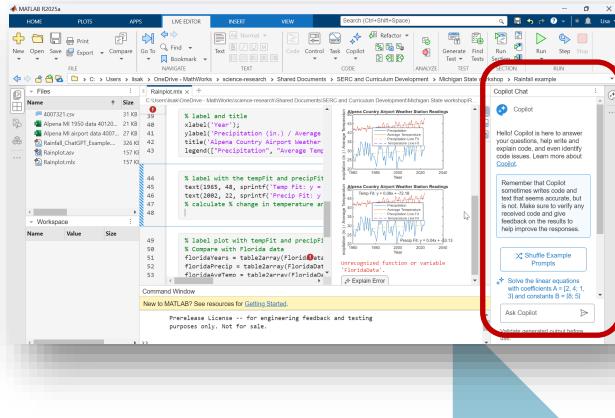
44

```
44
45 % label with tempFit and precipFit coefficients
46 % Display the coefficients of the fitted polynomial curves
47 disp('Precipitation Fit Coefficients:');
48 disp(precipFit);
49 disp('Average Temperature Fit Coefficients:');
50 disp(tempFit);
```

This is not what my
comment asked for



MATLAB Copilot: AutoComplete did well. Copilot Chat assisted.



So I asked the
MATLAB Copilot Chat
(side panel)

Copilot Chat

Lisa

how can I add the precipFit and tempfit coefficients to the plot?

Copilot

To add the coefficients from `precipFit` and `tempFit` to your plot in MATLAB, you can use the `text` function to display the coefficients at specific locations on the graph. Here's a concise example of how to do this:

```
% Sample data
years = 2000:2020;
Avg_temp = [14.5, 14.7, 15.0, 15.2, 15.5, 15.8, 16.0, 16.2, 16.5, 16.8, 17.0];
precipitation = [100, 120, 130, 110, 140, 150, 160, 170, 180, 190, 200];

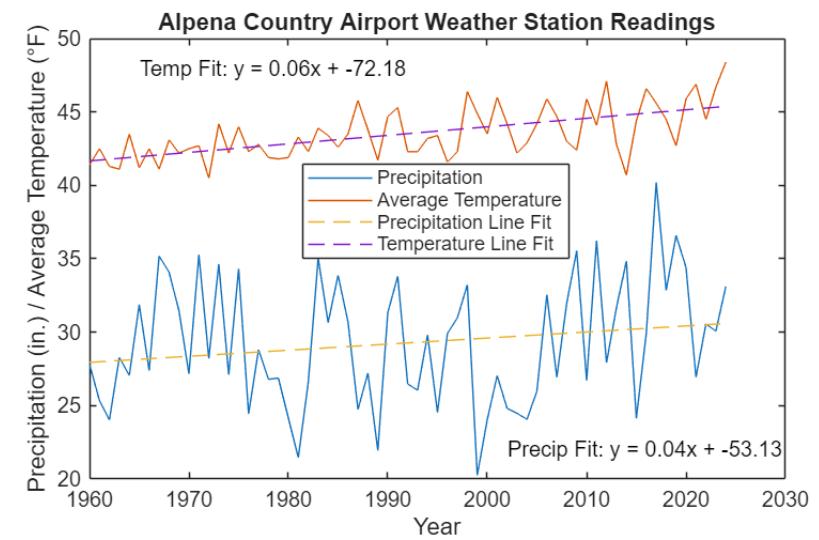
% Fit polynomials
tempFit = polyfit(years, Avg_temp, 1); % Linear fit for Average Temperature
precipFit = polyfit(years, precipitation, 1); % Linear fit for Precipitation

% Create plot
figure;
plot(years, Avg_temp, 'r-', 'DisplayName', 'Avg Temp');
hold on;
plot(years, precipitation, 'b-', 'DisplayName', 'Precipitation');
hold off;

% Add legend
legend show;

% Add coefficients to the plot
text(2005, 18, sprintf('Temp Fit: y = %.2fx + %.2f', tempFit));
text(2005, 250, sprintf('Precip Fit: y = %.2fx + %.2f', precipFit));

% Add titles and labels
title('Alpena Country Airport Weather Station Readings')
```



May 14th
Release

I Learn So Much Interacting with MATLAB GPT + MATLAB Copilot

What can it help you do?

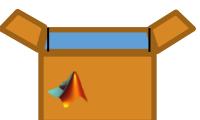
- Model
 - Computation requires a framework – a thinking model – to approach a problem
 - MATLAB GPT typically suggest approaches when it responds.
 - (Observation: Microsoft Copilot gave better model advice but no sample data.)
 - Data – on the cloud or downloaded?
 - Can be messy to work with cloud data: Account? \$\$?
 - Decide if your process is postprocessing of downloaded data or working in the cloud
 - Code
 - MATLAB GPT may write code that doesn't work or is incomplete
 - Remember – it doesn't know your data source and other task details.
- Good prompts are essential!
 - Think about what you want GenAI to do.

Developing More Sustainable Research Software: Best Practices with MATLAB

- Live Scripts and Notebooks
Create computational code stories for papers and teaching
- Object Oriented Programming
Develop object-based software tools and projects (tamper-proof, modularity)

- Code Analyzer
Find performance hits, waste, bad logic, runtime errors
- Source Control (and Content Management)  git

- MATLAB Projects
Organize, manage, and share your work



- Testing and Test Frameworks
Unit, Performance, App, and Framework tests



- Continuous Integration
[MATLAB CI with CircleCI, Jenkins](#)



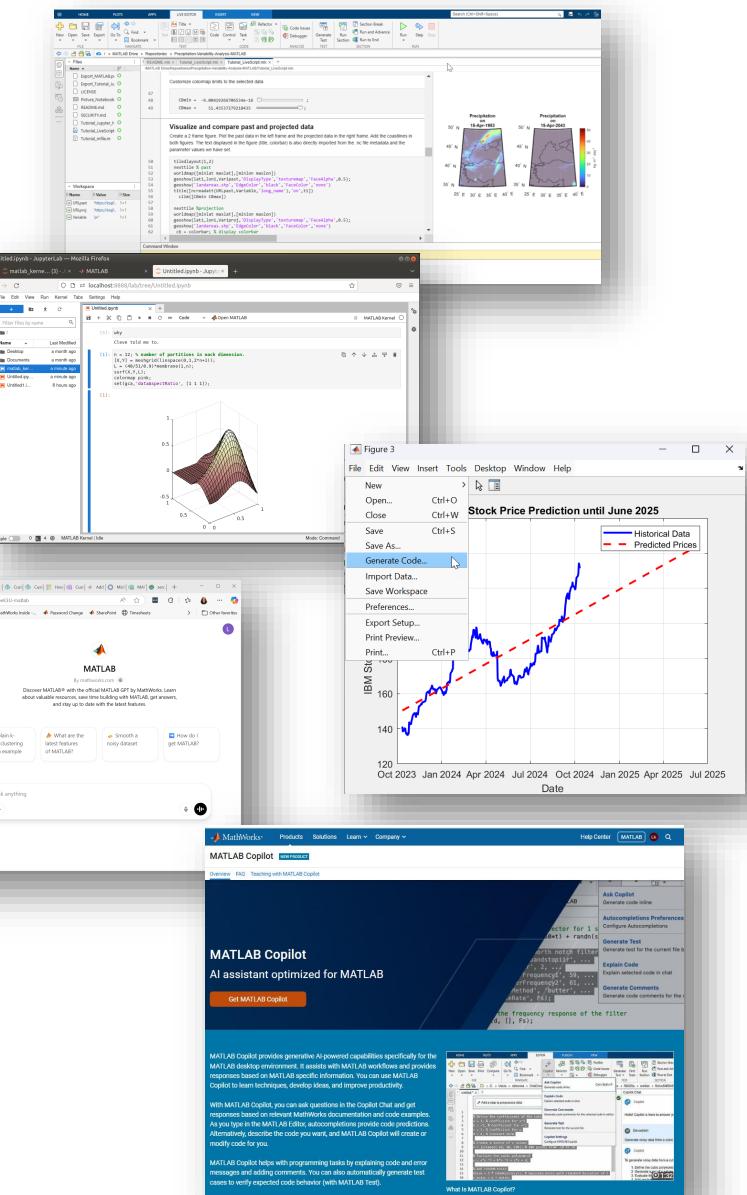
The image consists of three vertically stacked screenshots. The top screenshot shows the MATLAB Help Center with a search bar and a sidebar containing 'CONTENTS' and navigation links like 'Documentation Home' and 'MATLAB'. The middle screenshot shows the MATLAB Answers page on MATLAB Central, featuring a 'Highlights' section and a post about the introduction of the Code Analyzer. The bottom screenshot shows the MATLAB Code Analyzer feature in the AI Chat Playground, displaying a toolbar with 'CODE', 'ANALYZE', and 'RUN' buttons, and a preview window showing code issues with severity markers (red, yellow, green).

This is a screenshot of the MATLAB Help Center's 'Category' sidebar. It lists various software development tools and testing frameworks, each with a corresponding icon and a brief description.

Category	Description
Debugging and Analysis	Find performance hits, waste, bad logic, runtime errors
Performance and Memory	Use git and SVN from MATLAB
Background Processing	Organize, manage, and share your work
Projects	Unit, Performance, App, and Framework tests
Source Control	MATLAB CI with CircleCI, Jenkins
Testing Frameworks	Continuous Integration (CI)
	Toolbox Distribution
	Package Management
	Extension Points
	Tool Qualification and Certification

Summary: Developing Code

- **Code with Live Scripts for clearer code and stories**
 - Create Jupyter Notebooks from Live Scripts
- **Add UI Controls for easy experimenting**
- **Generate Code from**
 - Graphics
 - Curve Fitter App, other apps
- **Toolbox apps for less programming**
- **Try GenAI: MATLAB GPT and MATLAB Copilot**
- **Programming Best Practices**

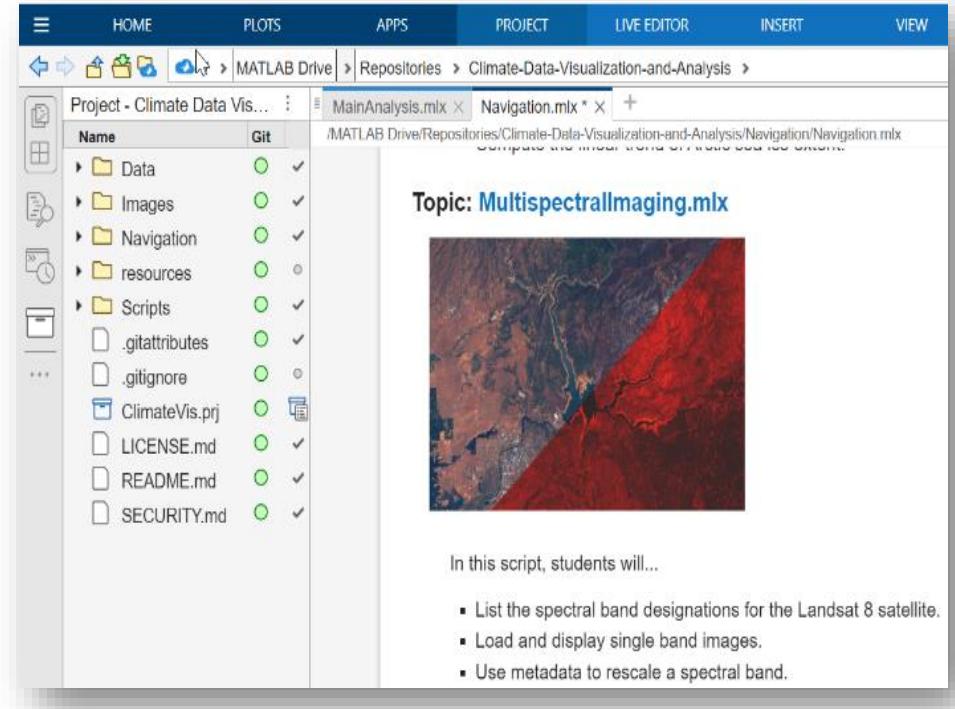


MATLAB for Open Research

Data access , Friction-free exploration, Code sharing and reuse

Reusing Code

Open in MATLAB Online



Project - Climate Data Vis... MainAnalysis mlx X Navigation mlx * X

MATLAB Drive\Repositories\Climate-Data-Visualization-and-Analysis\Navigation\Navigation.mlx

Topic: MultispectralImaging mlx

In this script, students will...

- List the spectral band designations for the Landsat 8 satellite.
- Load and display single band images.
- Use metadata to rescale a spectral band.

Code Examples: Mapping Code Notebooks for Many Applications

mathworks.com/help/map/applications.html

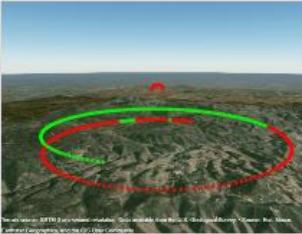


Documentation

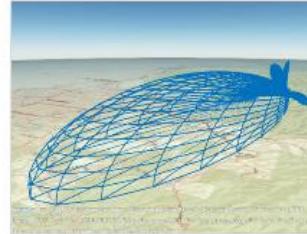
Featured Examples



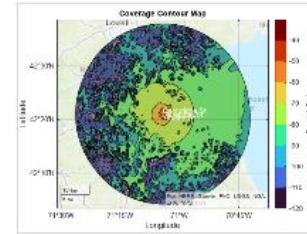
Build Pikes Peak
RoadRunner 3D Scene Using
RoadRunner HD Map



Radar Performance Analysis
over Terrain



Radar Vertical Coverage
over Terrain



Visualize Viewsheds and
Coverage Maps Using
Terrain

with ADT & RoadRunner

with Radar Toolbox

with Antenna Toolbox

Display the basemap image and the combined viewshed on the right. Specify the z-coordinates for the labels

```
nexttile([2,2])
mapshow(A,RA)
hold on
mapshow(xz,yz,vis,EdgeColor="none",DisplayType="surface")
axis off
```

zdelta = 150;
 $z1 = \text{height1} + \text{towerHeight1} + \text{zdelta};$
 $z2 = \text{height2} + \text{towerHeight2} + \text{zdelta};$

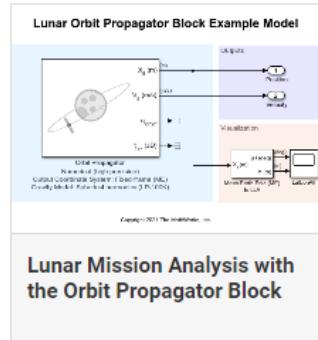
```
text(x1,y1,z1,text1,Color="k",EdgeColor="k",BackgroundColor="w")
text(x2,y2,z2,text2,Color="k",EdgeColor="k",BackgroundColor="w")
title("Combined Viewshed Over Basemap Image")
subtitle("Attribution: " + attrib)
```

Viewshed Tower 1

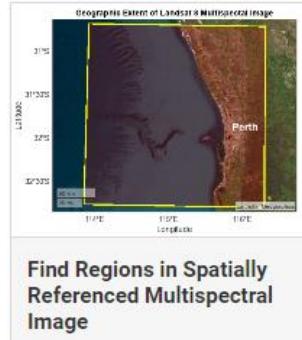
Combined Viewshed Over Basemap Image

Attribution: Earthstar Geographics

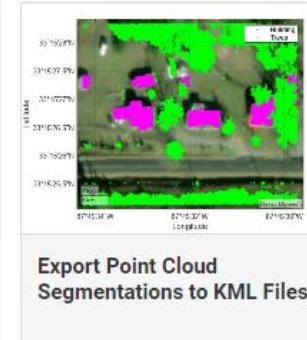
Viewshed Tower 2



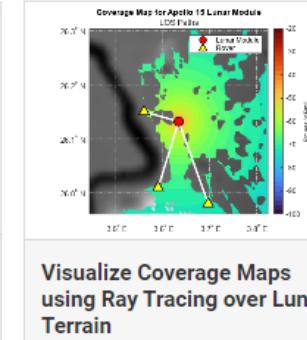
Lunar Mission Analysis with
the Orbit Propagator Block



Find Regions in Spatially
Referenced Multispectral
Image



Export Point Cloud
Segmentations to KML Files



Visualize Coverage Maps
using Ray Tracing over Lunar
Terrain

with Aerospace Blockset

with Hyperspectral library

with Lidar Toolbox

with Comms Toolbox

R2024a

with SatCom Toolbox

R2023b

Doc Code Examples: Open in MATLAB → Reuse for Projects

Hurricane Natural Catastrophe Risk Estimation

MATLAB Help Center Community Learning

CONTENTS

- « Documentation Home
- « Mathematics and Optimization
- « Radar
- « Mapping Toolbox
- « Applications
- « Climate
- Hurricane Natural Catastrophe Risk Estimation**

ON THIS PAGE

- Import and Process Hurricane Data
- Visualize Hurricane Data
- Specify and Visualize Property Assets
- Define and Visualize Damage Function
- Calculate Property Losses
- Analyze Property Losses
- Helper Functions

Documentation Examples Functions Videos Answers

Hurricane Natural Catastrophe Risk Estimation

Since R2025a

This example measures natural catastrophe (NatCat) risk for hurricanes in an area of interest (AOI) by using simulations from a hazard model, data about property assets, and a damage function.

Hurricanes are a common natural catastrophe and a key focus for NatCat modeling in the insurance industry. Traditionally, NatCat models measure financial risk by combining three inputs [7]:

- Data related to a hazard of interest. For this example, the hazard data comes from hurricane simulations [2] generated from the approach used in [1].
- Data related to a set of exposures. For this example, the exposure data includes the addresses of several property assets, the geographic locations of the property assets, and the median values of surrounding property assets.
- Information related to asset vulnerability. Asset vulnerability is typically calculated using a damage function, which estimates damage by combining an intensity metric with data about the asset. For this example, the intensity metric is wind speed.

NatCat risk models typically cover a short time period, often a year. A related risk model, physical climate risk, measures NatCat risk using multiple long-term climate scenarios, then models the impact of the long-term risk on financial variables such as house prices and insurance costs. Physical risk models typically cover longer time periods, often decades. As a result, NatCat risk models are useful in isolation and for physical risk models.

Within the example, you perform these tasks:

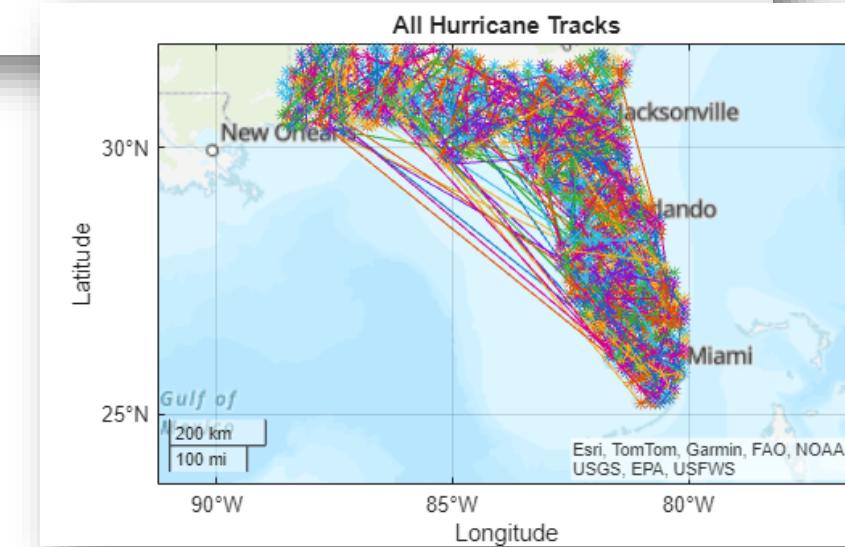
- Import, process, and visualize the hurricane simulations.
- Specify the exposure data using the addresses of properties in Florida.
- Define a damage function.
- Estimate property loss using the hurricane simulations, the exposure data, and the damage function.
- Analyze the property loss for individual properties and for a portfolio of properties.

R2025a

Open in MATLAB Online

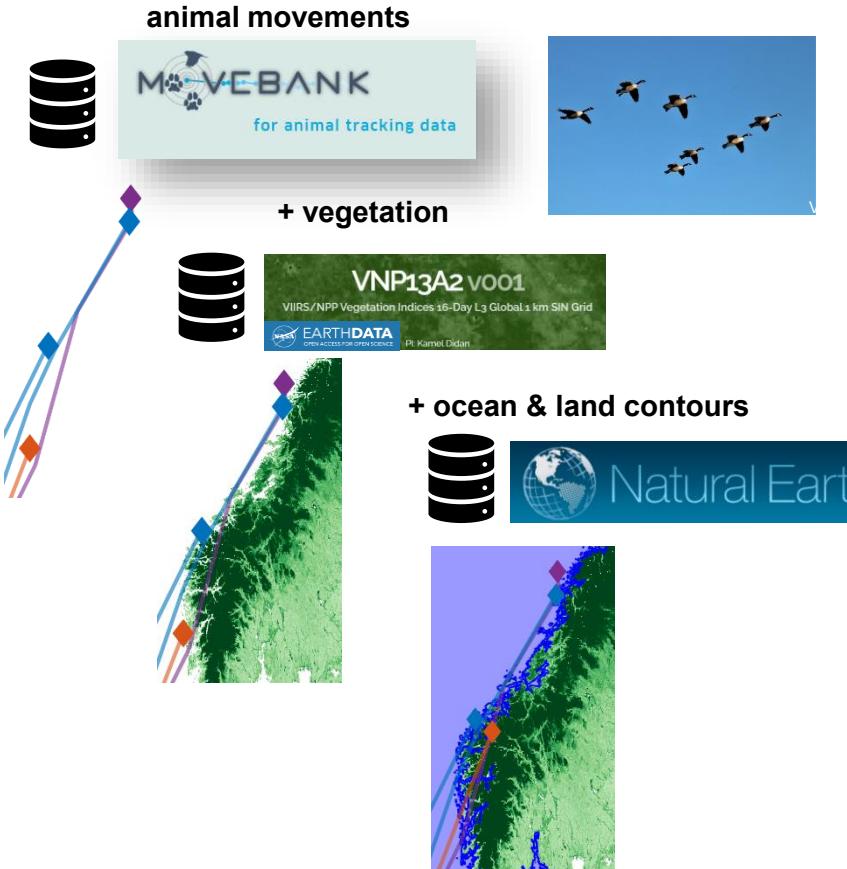
Copy Command

- View in documentation
- Open in MATLAB Online
 - Clear Output
 - Side Output
 - Run and Advance



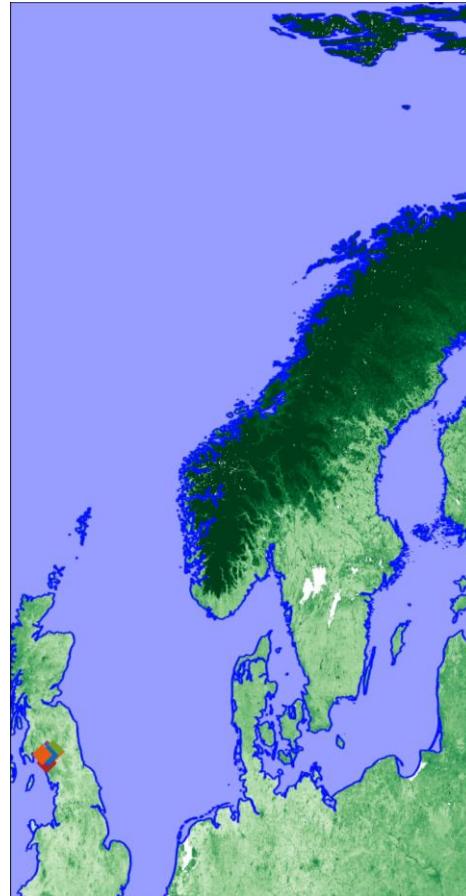
DEMO

ECODATA-Animate: MATLAB App for Animal Movement Animations *for animal behaviorists, land managers, and transportation experts*



“These animations are great for meetings with community members as we work on developing the [...] area.” – Nick Wilson, Data Analyst, Government of Northwest Territories, Canada

[Migration patterns of barnacle geese](#)



Data: [Migration timing in barnacle geese \(Griffin, 2014\)](#).
Vegetation: [NASA product MYD13A2VO61](#).
Water and political boundaries: [Natural Earth](#).

MathWorks News and Stories

View all stories

Animating Wildlife Movement Data for Researchers, Conservationists, and Urban Planners

Open-Source App Accelerates New Environmental Discoveries

ECODATA-Animate

Version 1.2.3 (4.74 MB) by Justine Missik
Create customized animated maps of animal movements
<https://ecodata-animate.readthedocs.io/>

Follow

Overview Functions Version History Reviews (0) Discussions (0)

ECODATA-Animate



MATLAB for Open Research

Data access, Friction-free exploration, Code sharing and reuse

Sharing Code



Open in MATLAB Online



Add to ½ Million Free MATLAB Community Tools on Sharing Sites

File Exchange

Filter by Source

- Community 861
- MathWorks 8

Filter by Category

Disciplines

- Sciences
 - Agriculture 60
 - Biological and Health Sciences 493
 - Business, Economics, and Finance 3
 - Chemistry 359
 - Earth, Ocean, and Atmospheric Sciences
 - Environmental Science 15
 - Geology 167
 - Glaciology 53
 - Oceanography and Hydrology 213
 - Climate Science and Analysis 36
 - Earth and Planetary Science 127
 - Geodesy and Mapping 46
 - Geophysics 9
 - Seismology 77
 - Weather and Atmospheric Science 147
 - Food Sciences 67
 - Material Sciences 338
 - Mathematics 125
 - Neuroscience 664
 - Physics 1,234
 - Psychology 16

Filter by Type

- Toolboxes 38
- Apps 10
- Simulink Models 19
- Hardware Support Packages 1
- Optional Features 7
- Functions 813

Filter by Product Family

- Google Earth Toolbox
- borders
- UTide Unified Tidal Analysis and Prediction Functions
- LatLon distance

Earth, Ocean, and Atmospheric Sciences (869)

CLIMATE DATA TOOLBOX FOR MATLAB
A set of low-level functions and tutorials for analyzing and displaying Earth science data.
10.5K Downloads

Driving Cycle (Simulink Block)
Produces NEDC, Artemis, WLTP Class 3 and selected EPA driving cycles easily.
15.7K Downloads

Wind Rose
Graph and table for Direction-Intensity data.
20.9K Downloads

cmocean perceptually-uniform colormaps
Perceptually-uniform colormaps inspired by oceanography.
9.9K Downloads

Wind Turbine Model
Wind turbine model including blades, nacelle, pitch and yaw actuation, generator and control system.
62.2K Downloads

TopoToolbox
A MATLAB program for the analysis of digital elevation models.
6K Downloads

Satellite Orbits: Models, Methods and Applications
Satellite Orbits: Models, Methods and Applications
High Precision Orbit Propagator
Precise modeling of satellite's perturbed motion (special perturbations approach).
5.1K Downloads

LatLon distance
LatLon distance

Product Solutions Resources Open Source

figshare

CODE OCEAN

Reproduce computational code and data from anywhere, with anyone.

HYDROSHARE

HydroShare is CUAHSI's online collaboration environment for sharing data, models, and code.

Discover

Discover content shared by your colleagues and other researchers. Access a broad range of data types used in hydrology.

Community Toolboxes: More Foundation Functions, Examples

Example: *Climate Data Toolbox – 18K downloads, doc, code examples*

The screenshot shows the MATLAB File Exchange interface. At the top, there's a navigation bar with links to MATLAB Answers, File Exchange (which is highlighted), Cody, AI Chat Playground, Discussions, Contests, Blogs, and More. Below the navigation bar, there's a search bar and a menu icon. The main content area features a toolbox entry for the "Climate Data Toolbox for MATLAB". The entry includes a thumbnail image of a toolbox case with a globe, the title "Climate Data Toolbox for MATLAB", the version "Version 1.01 (109 MB) by Chad Greene", a brief description of the toolbox, a link to its website (http://www.chadagreene.com/CDT/CDT_Contents.html), and a "Unfollow" button. To the right of the description are the average rating (5 stars from 52 reviews), the number of downloads (18.2K), the last update date (7 Mar 2025), and a "View License on GitHub" link. Below the description are three buttons: "Share", "Open in MATLAB Online", and "Download". At the bottom of the entry, there are links for "Overview", "Functions", "Examples", "Version History", "Reviews (52)", and "Discussions (25)". A large text block at the bottom provides a detailed description of the toolbox's purpose and functionality.

This toolbox contains a standard set of MATLAB functions for analyzing and displaying climate data. The functions are computationally efficient, easy to use, and come with many tutorials that describe not only how to use CDT functions, but also offer guidance on how to interpret the results in the context of Earth science processes.

[Toolbox](#)

[Blog/Code script](#)

Help Others Open Your GitHub Repos in MATLAB Online

Add [Open in MATLAB Online](#) to your repos to open in MATLAB

The screenshot shows a dual-pane interface. On the left, the MATLAB Online workspace displays a heatmap titled "Pacific Sea Surface Temperature Annual Trend 1950 to 2016" with axes for Latitude (-40 to 60) and Longitude (20 to 120). A color bar on the right indicates values from -0.01 to 0.04 in degrees Celsius per year. Below the plot are two checkboxes: "Show statistical significance" (checked) and "Center colormap about 0". On the right, a browser window is open to a GitHub repository page for "how-to-turn-your-script-into-a-simple-app-3". The README.md file contains the title "How to Turn Your Script into a Simple App" and two buttons: "MATLAB® File Exchange" and "Open in MATLAB Online". A tooltip over the "Open in MATLAB Online" button provides a detailed description of how MATLAB integrates with GitHub. The browser's address bar shows "github.com" and the URL "https://github.com/michellehirsch/how-to-turn-your-script-into-a-simple-app-3". The GitHub page itself shows the repository's structure, releases (1), packages (0), contributors (2), and languages (MATLAB 100.0%).

Open in MATLAB Online

Include Tutorials with Your Research Code

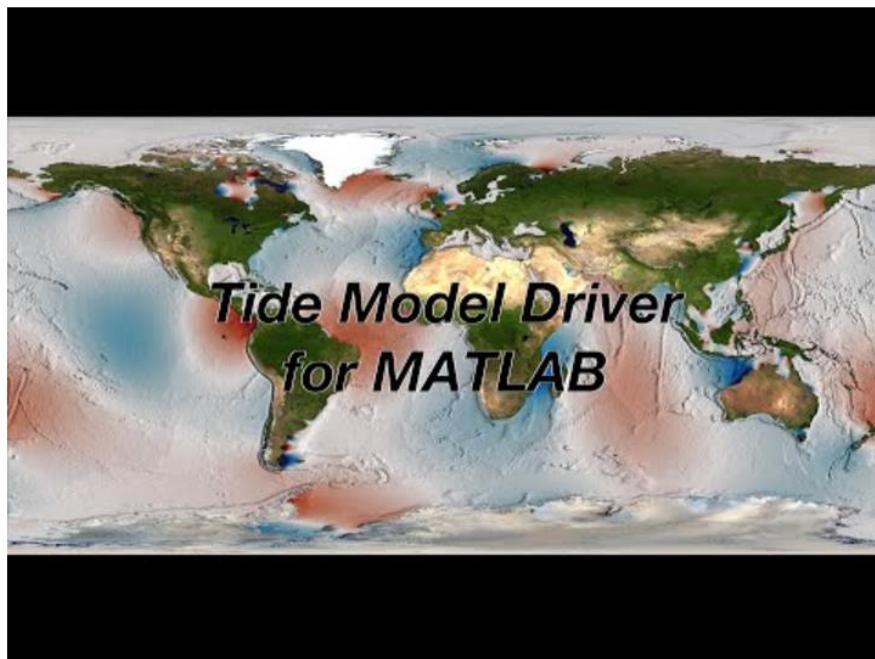
Example: Tide Model Driver's [Getting Started Tutorial](#)

Tide-Model-Driver / doc / tmd_getting_started.md

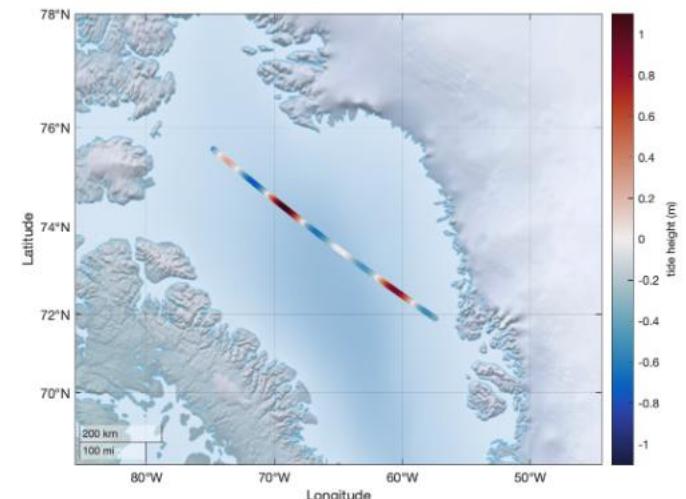
Preview Code Blame 213 lines (162 loc) • 7.82 KB

Getting Started with TMD

This page contains the code from the introductory video tutorial [found on youtube](#).



```
% Two day time series:  
t = datetime('jan 10, 2020'):minutes(1):datetime('jan 12, 2020');  
  
% Corresponding locations:  
lat = linspace(75.6,71.9,length(t));  
lon = linspace(-74.8,-57.4,length(t));  
  
z = tmd_predict('Gr1kmTM_v1.nc',lat,lon,t);  
  
figure  
geoscatte(lat,lon,20,z,'filled')  
geolimits([68 78],[-85 -45])  
geobasemap colorterrain  
caxis([-1 1]*1.1)  
cb = colorbar;  
ylabel(cb,'tide height (m)')  
cmocean balance optional colormap
```



Code Ocean: Publicly link your code and published paper (for Reuse)

CODE OCEAN Company Solutions Product Pricing Contact Explore Go to Dashboard

Search keyword, research field, title, author, DOI, etc.

EARTH SCIENCES August 2020
The past century of coral bleaching in the Saudi Arabian central Red Sea

Thomas M. DeCarlo

Data and code for the manuscript, "The past century of coral bleaching in the Saudi Arabian central Red Sea". The analyses here perform climate analyses using remote sensing data and statistical analysis of coral core stress bands. The climate analyses include (1) comparisons among four different satellite-based sea surface temperature products for representing maximum summer temperatures in the Red Sea, (2) numbers of shipboard observations made historically in the Red Sea, and (3) wind

EARTH SCIENCES August 2020
Patterns, drivers, and ecological implications of upwelling in coral reef habitats of the south...

Thomas M. DeCarlo

Data and code to reproduce the analyses in the manuscript, "Patterns, drivers, and ecological implications of upwelling in coral reef habitats of the southern Red Sea". Data includes publicly-available weather data in addition to primary temperature logger data from instruments deployed underwater in the Farasan Banks region of the Saudi Arabian Red Sea. The code does the following analyses: (1) compares *in situ* temperature logger data to satellite-based sea surface temperature (SST), (2) tests which

ENGINEERING August 2020
Code for Comparison of Dynamic Programming Policies for Long-term Hydrothermal Sched...

Thayze D'Martin Costa & Secundino Soares

Jupyter notebooks with Python code for comparison of Markov Stochastic Dynamic Programming, Unconditional Stochastic Dynamic Programming and Deterministic Dynamic Programming in long-term hydrothermal scheduling of single-reservoir systems in steady-state regime.

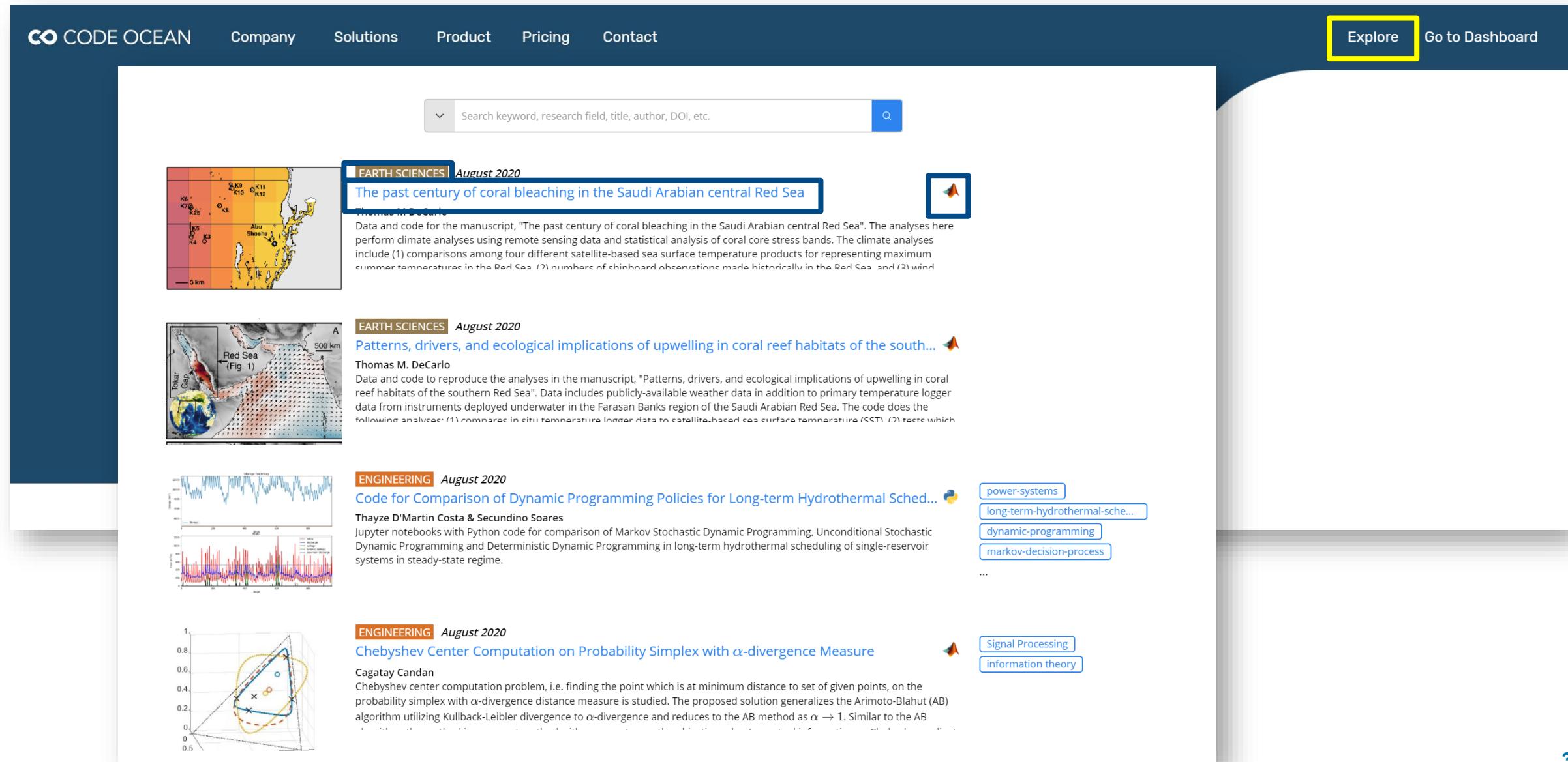
power-systems
long-term-hydrothermal-sche...
dynamic-programming
markov-decision-process
...

ENGINEERING August 2020
Chebyshev Center Computation on Probability Simplex with α -divergence Measure

Cagatay Candan

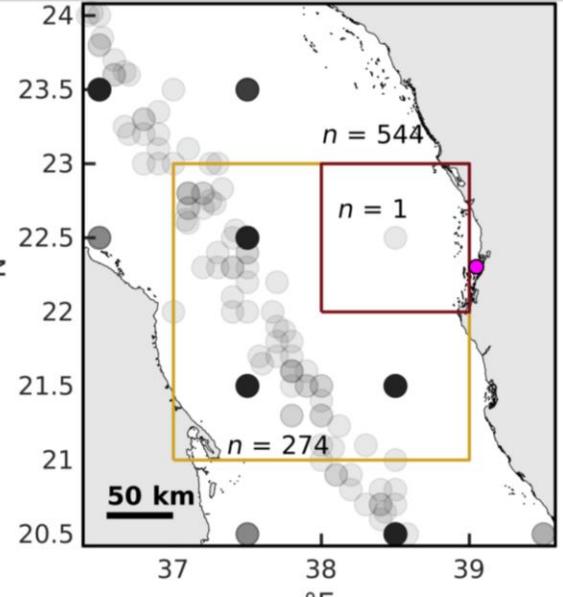
Chebyshev center computation problem, i.e. finding the point which is at minimum distance to set of given points, on the probability simplex with α -divergence distance measure is studied. The proposed solution generalizes the Arimoto-Blahut (AB) algorithm utilizing Kullback-Leibler divergence to α -divergence and reduces to the AB method as $\alpha \rightarrow 1$. Similar to the AB

Signal Processing
information theory



Codeocean.com example: Past Century of Coral Bleaching in the Saudi Arabian Central Red Sea (DeCarlo)

Open on  CODE OCEAN



Core Files

- metadata
- LICENSE
- environment
- code
- data Manage Datasets

```
+ matlab -nodisplay -r 'addpath(genpath('.','.')); Thuwal_area_stress_bands_all'
< M A T L A B (R) >
Copyright 1984-2019 The MathWorks, Inc.
R2019a (9.6.0.1072779) 64-bit (glnxa64)
March 8, 2019

To get started, type doc.
For product information, visit www.mathworks.com.

Warning: A newer version of export_fig is available. You can download it from
matlabweb?&browser=https://github.com/altmany/export\_fig
or matlabweb?&browser=https://www.mathworks.com/matlabcentral/fileexchange/23629-export-File-Exchange/&, or run matlabexport\_fig?&update=export\_fig?&update to install it directly.

> In export_fig>checkForNewerVersion (line 1734)
In export_fig (line 304)
In Thuwal_area_stress_bands_all (line 88)
If you need expert assistance with Matlab, please consider my professional <a href="https://Urcm">https://Urcm</a>]
```

Core Files

- metadata
- Y: metadata.yml
- environment
- code
- data Manage Datasets

Reproducible Run

You have 1 uncommitted change

Edited metadata.yml

Commit Changes

Run 8792129

Run 8792129

- 2010_DHW.png
- Fig_4A.png
- Fig_4B.png
- Fig_4C.png
- Fig_5A.png
- Fig_5B.png
- Fig_7D.png
- ICOADS_1931.png
- ICOADS_1982.png
- ICOADS_1998.png
- output
- winds_fig.png

15 minutes ago Capsule duplicated from: The past century of coral bleaching ...

Show Prior History

Run environment setup complete, running code...

```
+ matlab -nodisplay -r 'addpath(genpath('.','.')); Thuwal_area_stress_bands_all'
< M A T L A B (R) >
Copyright 1984-2019 The MathWorks, Inc.
R2019a (9.6.0.1072779) 64-bit (glnxa64)
March 8, 2019

To get started, type doc.
For product information, visit www.mathworks.com.
```

DOIs + Versioning: Citing Your Shared Code (and Data) in Papers

codeocean.com DeCarlo “coral bleaching in Red Sea” continued

The screenshot shows a publication page from the PeerJ Life & Environment journal. At the top, there's a logo for PeerJ Life & Environment, a banner for "The Open Access journal for Life & Environment research", and a "VIEW ARTICLES" button. Below the header, the title of the article is "The past century of coral bleaching in the Saudi Arabian central Red Sea". The author is listed as Thomas M DeCarlo, 1,2✉. The editor is Anastazia Banaszak. Below the author information, there are links for "Author information", "Article notes", "Copyright and License information", and identifiers "PMCID: PMC7587059" and "PMID: 33150088". A large blue arrow on the left points towards the journal section, labeled "Open Access Journal". Another blue arrow on the right points towards the data availability section, labeled "Open Data and Code (netCDF, MATLAB)".

PeerJ
Life & Environment

The Open Access journal for
Life & Environment research

VIEW ARTICLES

▶ PeerJ. 2020 Oct 23;8:e10200. doi: [10.7717/peerj.10200](https://doi.org/10.7717/peerj.10200)

The past century of coral bleaching in the Saudi Arabian central Red Sea

Thomas M DeCarlo ^{1,2}✉
Editor: Anastazia Banaszak

▶ Author information ▶ Article notes ▶ Copyright and License information
PMCID: PMC7587059 PMID: [33150088](https://pubmed.ncbi.nlm.nih.gov/33150088/)

Open Access Journal

Author Contributions

Thomas M. DeCarlo conceived and designed the experiments, performed the experiments, analyzed the data, prepared figures and/or tables, authored or reviewed drafts of the paper, and approved the final draft.

Open Data and Code (netCDF, MATLAB)

Data Availability

The following information was supplied regarding data availability:

Raw data and code are available at Code Ocean: DOI <https://doi.org/10.24433/CO.8604403.v3>.

MATLAB for Open Research

Data access, Friction-free exploration, Code sharing and reuse

Teaching with Code

serc.carleton.edu/teaching_computation/index.html

Bookmarks Inbox (174) - lisa.keh... SchwabPlan RECURRENT PLOT... Brookline, MA 10 D... Exercise Tracking Our COV... All Bookmarks

Your Account

Teaching Computation With MATLAB®

MathWorks®

Teaching Computation with MATLAB

Content on these pages is derived from participant presentations, discussions, and breakout groups at the [Teaching Computation with MATLAB workshops](#).

Computation is the use of computers to perform calculations, model data, make predictions, and test hypotheses. Computational skills are necessary to employ quantitative methods in complex scientific contexts and with large data sets. With today's unprecedented data availability there are numerous new science and engineering opportunities if one has the necessary computational skills. Developing these skills requires students to be comfortable with languages and tools such as [MATLAB](#) that enable them to express and explore solutions to scientific problems.

In order to provide students with the computational skills they need to be successful, the teaching of computation must change to reflect the changing landscape of computation. Teaching Computation in the Sciences Using MATLAB provides resources to help educators incorporate computation into their classrooms and engage with a community of educators interested in improving the teaching of these important skills.

Why teach computation? Explore the teaching materials »



HOME PLOTS APPS PROJECT LIVE EDITOR INSERT VIEW

Project - Climate Data Vis... MainAnalysis.mlx Navigation.mlx * +

Name Git

- Data
- Images
- Navigation
- resources
- Scripts
 - .gitattributes
 - .gitignore
 - ClimateVis.prj
 - LICENSE.md
 - README.md
 - SECURITY.md

Topic: MultispectralImaging.mlx

In this script, students will...

- List the spectral band designations for the Landsat 8 satellite.
- Load and display single band images.
- Use metadata to rescale a spectral band.

MATLAB Online + MATLAB Drive: Teaching and More

MATLAB, toolboxes and file sharing online

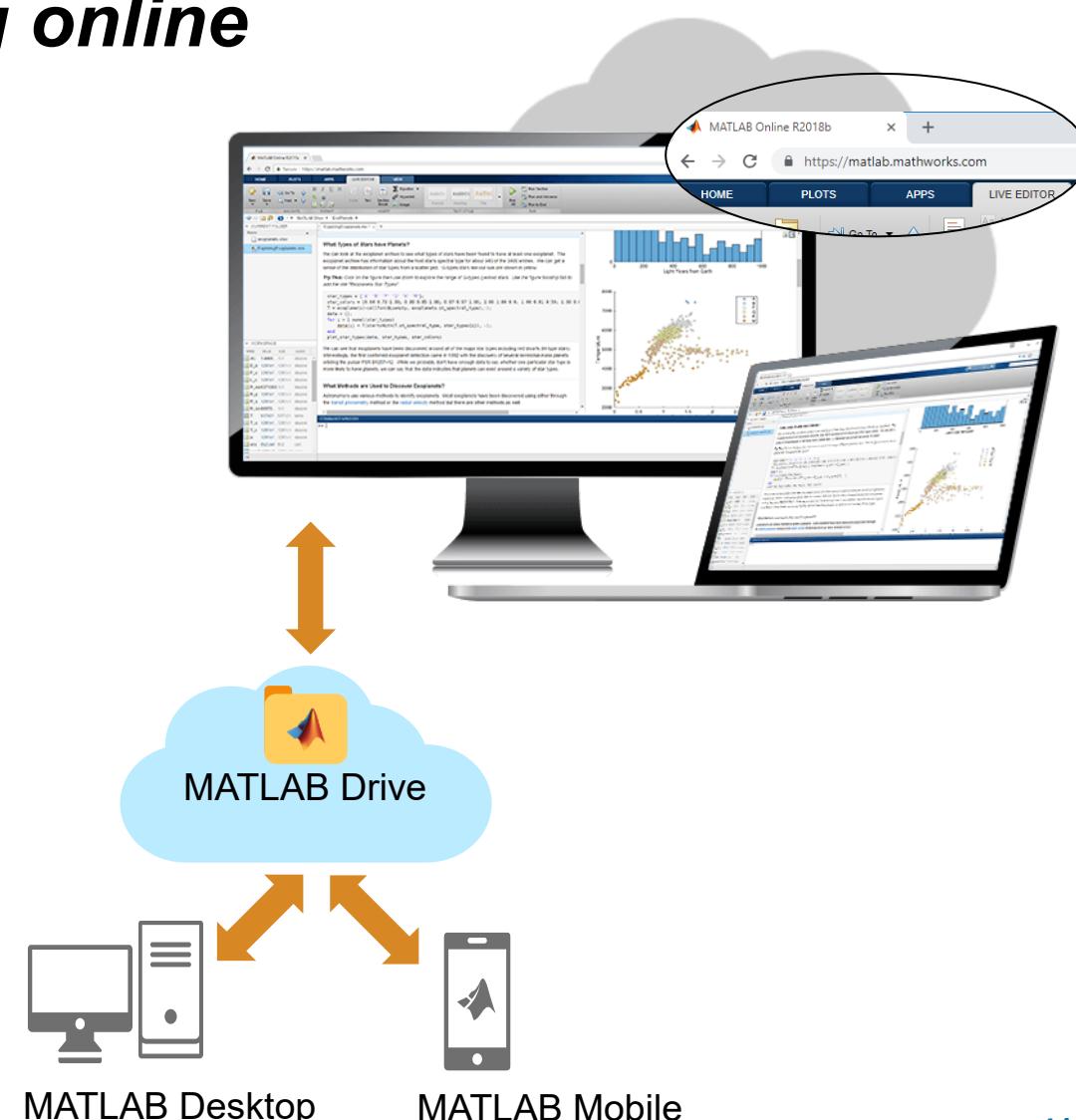
Hosted on MathWorks Cloud

- MathWorks provides compute
- You use on computer or laptop
- Available anytime, anywhere

Store files and share on MATLAB Drive

More recent MATLAB version

matlab.mathworks.com



Free Curriculum: Teach from GitHub Repo in MATLAB Online

Students click in GitHub, opens in MATLAB Online



MATLAB Online

Use MATLAB and Simulink through your web browser

Climate Data Visualization and Analysis

File Exchange OR Open in MATLAB Online

Curriculum Module

[mathworks.com/matlabcentral/fileexchange/
110125-climate-data-visualization-and-analysis](http://mathworks.com/matlabcentral/fileexchange/110125-climate-data-visualization-and-analysis)

A hand cursor is clicking the 'Open in MATLAB Online' button.

1980-2015 Average Temperature Global Map

Topic: MultispectralImaging.mlx

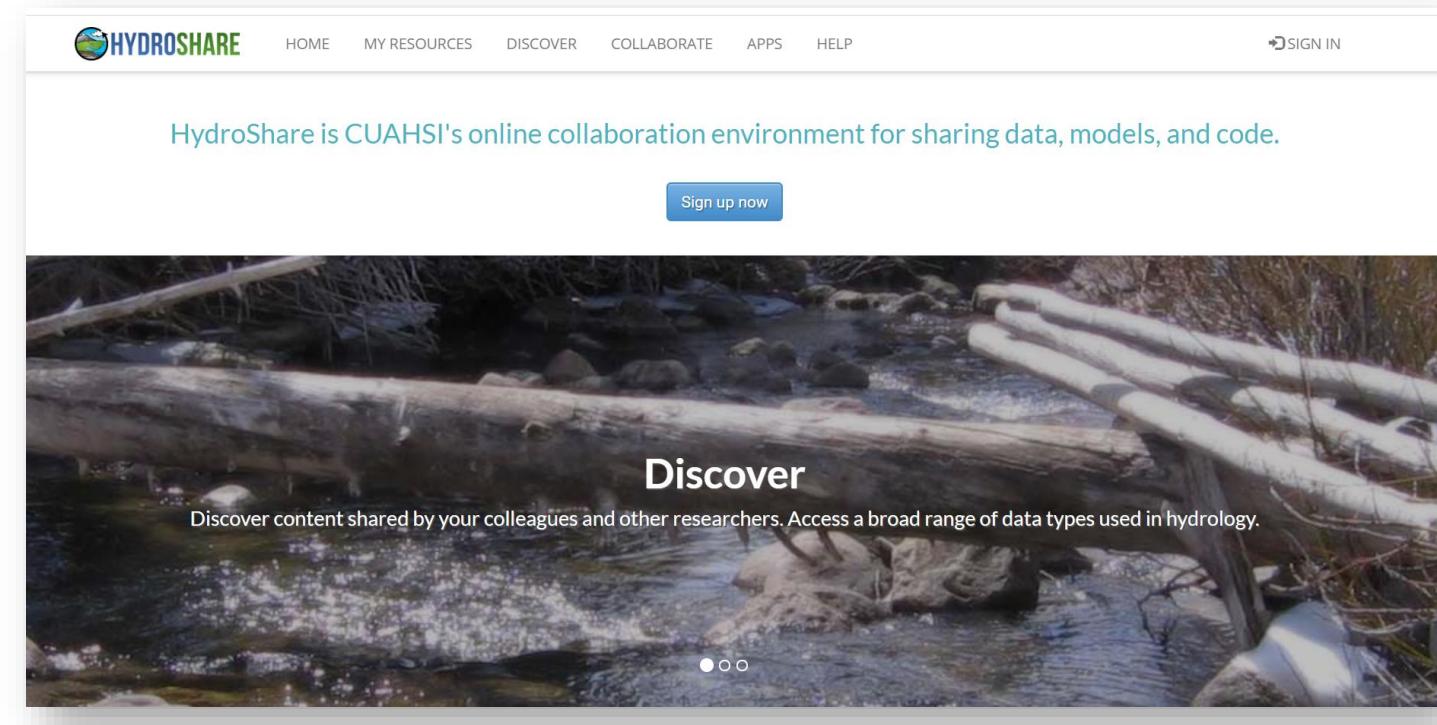
In this script, students will...

- List the spectral band designations for the Landsat 8 satellite.
- Load and display single band images.
- Use metadata to rescale a spectral band.

MATLAB for Open Research

Data access, Friction-free exploration, Code sharing and reuse

Platforms for Code and Data



The screenshot shows the HydroShare homepage. At the top, there is a navigation bar with links for HOME, MY RESOURCES, DISCOVER, COLLABORATE, APPS, and HELP. On the far right, there is a 'SIGN IN' button. Below the navigation bar, a main heading reads: "HydroShare is CUAHSI's online collaboration environment for sharing data, models, and code." A blue "Sign up now" button is positioned below this text. The central feature is a large photograph of a stream flowing over rocks, with several large logs and branches in the water. Overlaid on this image is the word "Discover" in white. Below "Discover", a subtitle reads: "Discover content shared by your colleagues and other researchers. Access a broad range of data types used in hydrology." At the bottom of the image, there are two small circular dots.



Get ECMWF data – MATLAB Climate Data Store Toolbox

cds.climate.copernicus.eu/datasets

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Files Authors My File Exchange Publish About

Climate Data Store Toolbox for MATLAB

Version 2.3.0 (512 KB) by Rob Purser STAFF

MATLAB(R) Tools to access the Climate Data Store (<https://cds.climate.copernicus.eu/>)
<https://github.com/mathworks/climatedatastore>

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Share Download

Overview Functions Examples Version History Reviews (1) Discussions (4)

Climate Data Store Toolbox for MATLAB

File Exchange matlab 100.0% Climate Data CI passing open bug issues 0 Stars 42

code issues 0 tested with R2025a | R2024b | R2024a | R2023b | R2023a | R2022b

MATLAB® Tools to access The Climate Data Store. It is a wealth of information about the Earth's past, present and future climate. There are hundreds of data sets associated with climate change. This toolbox allows you to easily access data and download it for analysis in MATLAB.

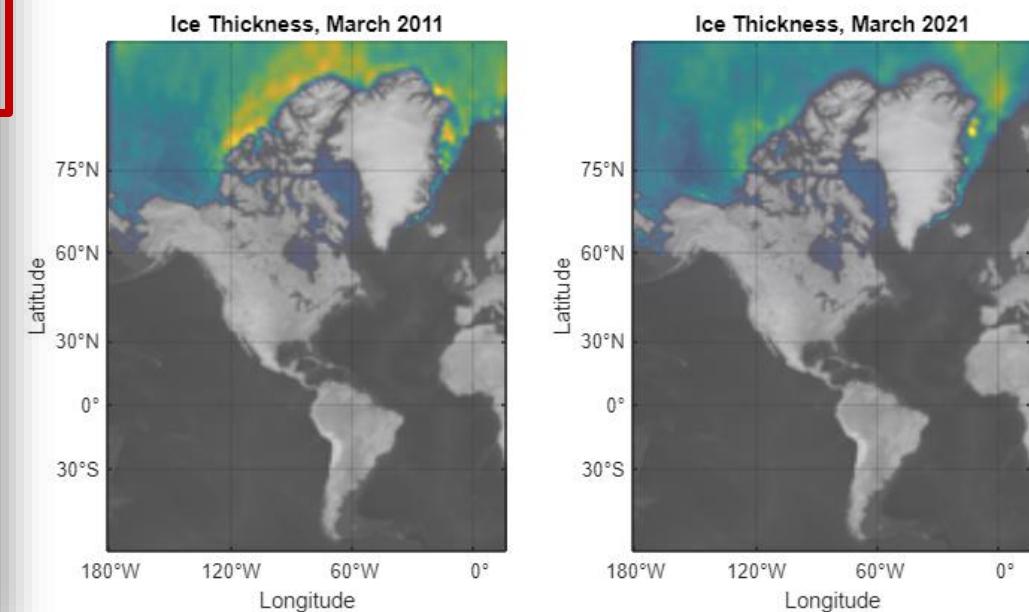
Please report bugs and suggest enhancements by [creating a new issue on GitHub](#).

MATLAB Release Compatibility
 Created with R2023b
 Compatible with R2020a and later releases

Platform Compatibility
 Windows macOS Linux

Others Also Downloaded
 Climate Data Toolbox for MATLAB
 18.2K Downloads ★★★★☆

Free GitHub download



Access 1000s of datasets from MATLAB with Climate Data Store Toolbox

Example Code: Teaching Materials Aren't Just for College Students

Teaching Computation with MATLAB

- Why Teach Computation?
- Teaching Online
- Skills and Techniques**
 - Computational Thinking
 - Visualization
 - Modeling
 - Data Analysis
- Teaching Strategies**
 - Building Self-Efficacy
 - Cooperative Learning
 - Assessment
 - Developing Skills Within a Degree Curriculum
- Events**
- Workshops and Webinars**
 - MATLAB Workshop 2025
 - Past Workshops**
 - 2024 MATLAB Workshop
 - Taller Virtual para Educadores 2023
 - October 2023 MATLAB Workshop
 - November 2022 MATLAB Workshop
 - October 2022 MATLAB Workshop
 - 2021 MATLAB Workshop
 - 2020 MATLAB Workshop
 - 2019 MATLAB Workshop
 - 2018 MATLAB Workshop
 - 2017 MATLAB Workshop
 - 2016 MATLAB Workshop
 - Workshop Synthesis
 - Workshop Outcomes
 - Overview
 - Program
 - Participants
- Teaching Activities**
- Essays
- Planning Workspace

Monitoring Algal Blooms with Landsat (OLI)

Andrew Fischer
University of Tasmania,
This activity has been reviewed by 2 review processes (view details)

Initial Publication Date: October 7, 2016 | Reviewed: November 25, 2019 (see revision history)

Summary

Algal blooms are caused by an aggregation of either microscopic phytoplankton or cyanobacteria within the ecosystem. The purpose of this activity is to teach students how to use MATLAB to work through a case study from Lake Erie. At the end of this activity students will learn how to 1) use Landsat imagery, 2) access band specific .TIF files directly from Amazon Web Services, 3) use the MATLAB Mapping Toolbox to produce presentation quality maps, and 4) work with the atmospherically corrected Land Surface Reflectance (OLI) data.

Geoscience, Water Quality and Quantity, Ecosystems, Environmental ... (more) | Collected

Expand for more details

Learning Goals

In this activity, student will learn about the cause and management of algal blooms using remote sensing data. Students will use a single-band algorithm based on a study by Vincent et al. (2004) to correct and Uncorrected data. They will also derive lake surface temperature with biophysical extract information on the surface of the earth. Students use MATLAB to generate a raster georeferencing object and use various mapping toolbox functions to produce presentation quality figure.

Context for Use

This computer lab activity is well suited for a small class (<20 students). Students should have basic knowledge of MATLAB. This exercise has been packaged as a MATLAB Live Script (MATLAB 2016) providing a template for use in MATLAB. This exercise is given in a course called Ecosystem Assessment. We go through a particular marine ecosystem and align data collection and analysis with an ecosystem.

Description and Teaching Materials

The data in this activity are accessed at the following website.

- 1) <http://earthexplorer.usgs.gov>
- 2) <https://aws.amazon.com/public-data-sets/landsat>

The activity includes an article by Vincente et al. (2004).

Vincent, R.K., Qin, X., McKay, R.M.L., Miner, J., Czajkowski, K., Savino, J. and Bridger, M. (2004). Monitoring algal blooms in Lake Erie. *Remote Sensing of Environment*, 99(3), pp.381-392.

350 Reusable Examples @



Working with Scientific Datasets - Monitoring Algal Blooms with Landsat (OLI)

Landsat data

- [USGS glovis](#)
- [EarthExplorer](#)

Contents:

- 1) Satellite background (The Landsat Program)
- 2) Algal blooms
- 3) Satellite overpass timing
- 4) Data acquisition
- 5) Algorithms
- 6) Atmospheric correction
- 7) Lake surface temperature

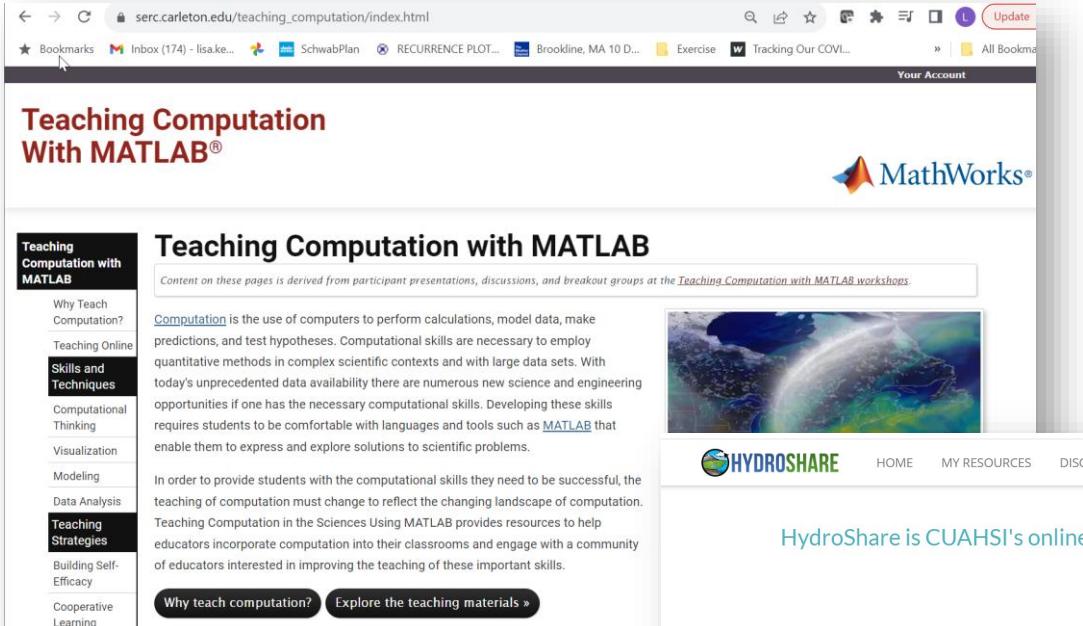
Command Window

New to MATLAB? See resources for [Getting Started](#).

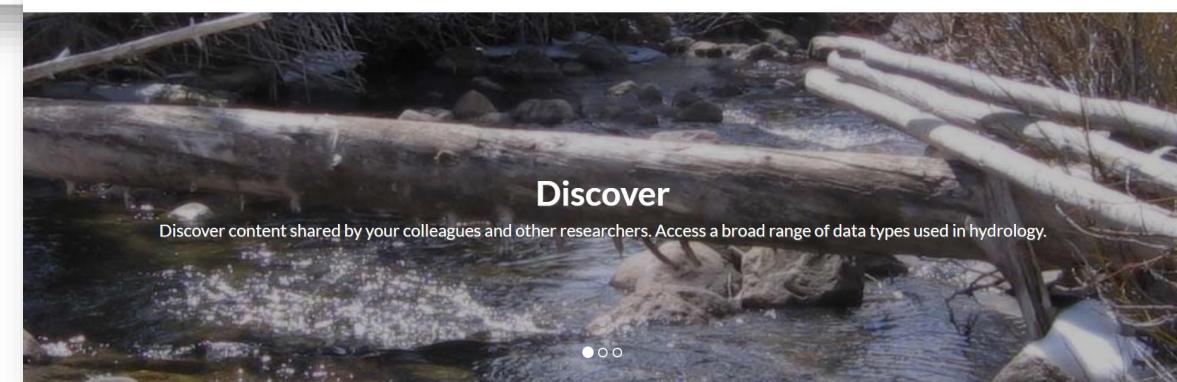
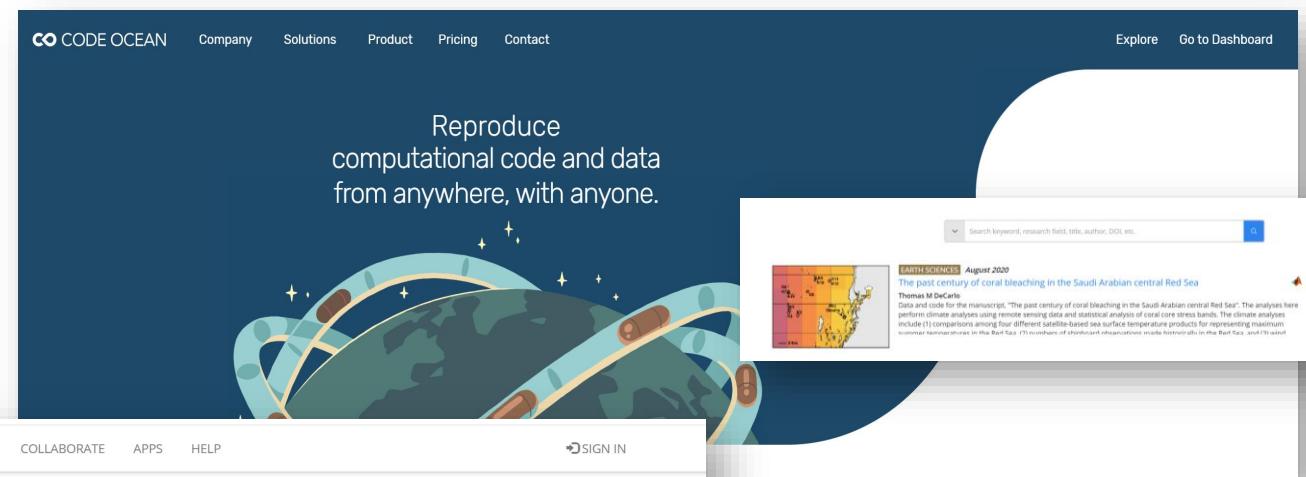
>> Press Ctrl + Shift + P to generate code with Copilot

MATLAB Today: Integrated with Online Research and Teaching Communities

Teaching



Hydrology

**Reproducibility/Reuse/
Publishing research code**

CUAHSI Repos: Reusable MATLAB Code for Hydrology Data

The screenshot shows the HydroShare interface. At the top, there is a navigation bar with links: HOME, MY RESOURCES, DISCOVER (which is highlighted with a blue border), COLLABORATE, APPS, and HELP. To the right of the navigation bar are links for SIGN IN and a profile icon. A large orange box on the right contains the word "DEMO". Below the navigation bar, a teal banner states: "HydroShare is CUAHSI's online collaboration environment for sharing data, models, and code." The main content area features a thumbnail image of a river scene, the title "Interpolating GHCN Timeseries on a Rectangular Mesh", and a "Create" button. To the right of the title are "Open with..." and a YouTube-like video player icon. The resource details section includes fields for Authors (Anthony Michael Castranova), Owners (Anthony M. Castranova), Type (Resource), Storage (305.2 KB), Created (Jul 23, 2019), Last updated (Jul 30, 2019), and Citation (See how to cite this resource). To the right of these details is a "Sharing Status" section showing Public, Views (4647), Downloads (399), +1 Votes (You +1), and Comments (No comments yet). Below this are "Subject Keywords" including Hydroinformatics, 2019 HIC, MATLAB Online, MATLAB, and GHCN. A "Live Script" link is also present. A sidebar on the left shows a list of recent activity or resources.

HydroShare

HOME MY RESOURCES DISCOVER COLLABORATE APPS HELP

SIGN IN

DEMO

HydroShare is CUAHSI's online collaboration environment for sharing data, models, and code.

HydroShare

HOME MY RESOURCES DISCOVER COLLABORATE APPS HELP Create

Interpolating GHCN Timeseries on a Rectangular Mesh

Open with...

Authors: Anthony Michael Castranova
Owners: Anthony M. Castranova
Type: Resource
Storage: The size of this resource is 305.2 KB
Created: Jul 23, 2019 at 5:01 p.m.
Last updated: Jul 30, 2019 at 8:08 p.m. Anthony M. Castranova
Citation: See how to cite this resource

Sharing Status: Public

Views: 4647
Downloads: 399
+1 Votes: You +1
Comments: No comments yet

Data Series Viewer
 MATLAB Online
 CyberGIS-Jupyter for Water

Subject Keywords

Hydroinformatics, 2019 HIC, MATLAB Online, MATLAB, GHCN, Live Script

MATLAB in Google Colab: Running MATLAB in Community Hubs

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< Do these 3 things to... Pair programming with Claude to... >

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- Pair programming with Claude to produce computational art in MATLAB
- Using MATLAB on Google Colab
- Do these 3 things to increase the reach of your open source MATLAB toolbox
- What's with all the big changes in R2025a?
- MATLAB R2025a has been released - What's new?

Categories

New Features	32
performance	25
MATLAB Programming Language	18
High Performance Computing	8
Open Source	17
▼ Show more	


Community Treasure Hunt
Find the treasures in MATLAB Central and discover how the community can help you!
» Start Hunting!

Using MATLAB on Google Colab

Posted by [Mike Croucher](#), June 27, 2025

890 views (last 30 days) | 11 Likes | 2 comments

Google recently announced that [Colab Terminal is Now Free For All Users](#) and a few MathWorkers immediately thought to themselves "Well, this makes it rather easier to use MATLAB there then!" and an internal conversation on how to do it kicked off.

This is all rather experimental and rough around the edges and but I'm excited so wanted to share with you all what we got working. I wouldn't suggest using this for production work but maybe you'll have fun playing with it too?

Installing MATLAB into Google Colab and using it in terminal mode

Once you've opened the Colab terminal, run the following commands to install MATLAB:

```
wget https://www.mathworks.com/mpm/glnxa64/mpm
chmod +x mpm
./mpm install --release=R2025a --products=MATLAB
```

This makes use of the MathWorks `mpm` tool to download and install MATLAB into Colab.

```
/content# ./mpm install --release=R2025a --products=MATLAB
Installing with the following parameters:
--release=R2025a
--products=MATLAB
-----
The following MathWorks Products are licensed under the The MathWorks
, Inc. Software License
Agreement, available in the installation of the MathWorks Product or
in the virtual machine image.
MATLAB

Starting install
Products will be installed to: /usr/local/MATLAB/R2025a
Finished install
Completing setup...
Installation complete
```

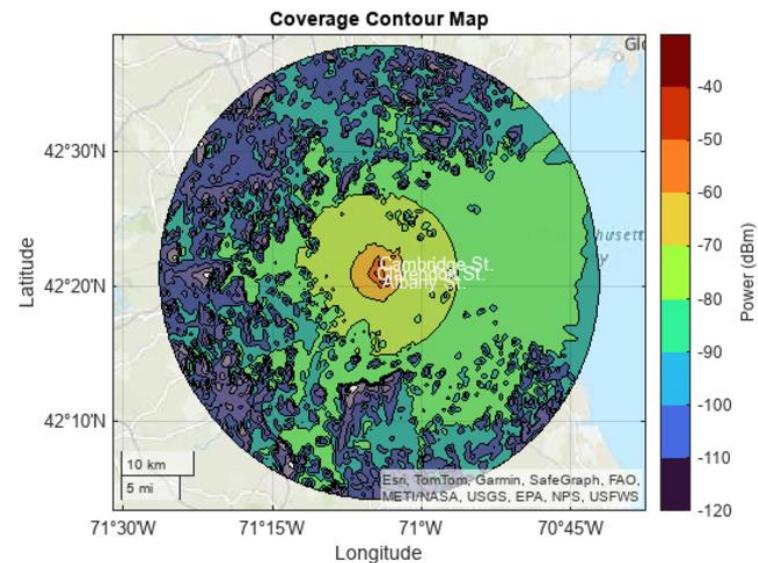
Once this has completed, run MATLAB like this:

```
/usr/local/MATLAB/R2025a/bin/matlab -nodesktop -licmode onlinelicensing
```

Today's Focus – Accelerating the Research Code Flow

- Developing Code
- Reusing Code
- Sharing Code
- Teaching with Code
- Platforms for Code and Data

```
names = ["Clarendon St.", "Cambridge St.", "Albany St."];  
bostonLat = [42.348722 42.361222 42.338444];  
bostonLon = [-71.075889 -71.069778 -71.065611];  
bostonH = [260 30 23];  
freq = [852.637e6 862.012e6 862.012e6];  
txs = txsite(Name=names, Latitude=bostonLat, Longitude=bostonLon, ...  
    AntennaHeight=bostonH, TransmitterFrequency=freq);  
geocoverage(txs, basemap)
```



The cell towers are close together. View the area immediately around the towers by zooming in on the coverage map.

(meta-theme: Best Practices for Sustainability)

Summary: *Increasing Your Research Impact with MATLAB*

- Access to data files + open data portals (built-in functions, community tools)
 - NOAA, NASA, USGS, ECMWF, etc.
- Code reuse from
 - File Exchange/GitHub tools
 - Course Curriculum sites
 - MATLAB Documentation examples
- Code and data sharing and publishing with papers
 - GitHub/File Exchange
 - Code Ocean
 - Discipline-specific sites (e.g., CUAHSI/Hydroshare)
- Best practices for sharing code and developing robust software
 - Live Scripts/Jupyter Notebooks
 - Multiple tools (MATLAB Projects, source control, testing, code analyzer, etc.)

Resources Covered (Partial List)

- Data Access
 - Climate Data Store Toolbox to access ECMWF/CDS data ([download](#))
 - Climate Data Toolbox ([Repo](#), [Blog/Code script](#))
- Code Sharing
 - Downloadable [Geoscience tools on File Exchange](#)
 - Code Examples: mathworks.com/help/map/applications.html
- Reuse Reproducibility and Publishing
 - Code Ocean Capsule: <https://codeocean.com/capsule/9706930/tree/v3>
 - [Past Century Coral Bleaching in S-A Sea in PeerJ Open Journal](#)
- Teaching and Collaboration
 - [Monitoring Algal Blooms with Landsat](#)
 - [Climate Data Visualization and Analysis](#)