

MATLAB for Geoscientists 1 - University of Maryland

Making sure your MATLAB is up to date

You can download the latest version of MATLAB for free at terpware.umd.edu. Follow the instructions to login with your University of Maryland email address and password, which will bring you to UMD's portal for downloading the latest versions of MATLAB.

The screenshot shows the 'Software' portal of the University of Maryland. At the top, there are tabs for 'PC', 'Mac', and 'Linux'. Below these is a 'Software' section with a list of categories: Academic Resources, Accessibility, Analysis & Modeling (highlighted in yellow), Data Warehouse, Design & Production, Development Tools, Multimedia, Network, Office Tools, Operating Systems, Security, Servers, Utilities, and Web & Email. To the right, under the 'ANALYSIS & MODELING' heading, there is a grid of software options. The options are arranged in two columns. The first column includes ArcGIS Desktop - Institutional, ArcGIS Desktop for Students, ArcGIS Pro - Institutional, ArcGIS Pro for Students, CircuitLab, ENVI, ESRI Supplements, IDL, JMP Pro, LabVIEW, Maple, Mathematica - Institutional, and Mathematica - Online. The second column includes Mathematica for Students, MATLAB - Institutional (highlighted in yellow), MATLAB for Students (highlighted in yellow), Minitab, NVivo, SAS (Academic Use), SAS Enterprise Guide (Administrative Use), SPSS - Institutional, SPSS for Students, STATA/MP2, Tableau, tiCrypt Connect, and Wolfram | Alpha.

If you are updating your MATLAB to the latest release, the software will simply install the same way as if you were downloading it for the first time. MATLAB has unique installs for each version, so you can have multiple versions (e.g., 2016a, 2021b, 2022a) installed on the same machine without overwriting each other.

MATLAB is backwards compatible with older versions. Sometimes, however, certain functionalities will be updated. If you are using more recent versions of MATLAB, the program will identify for you if a functionality your code uses has been changed via its built in Code Analyzer. [MATLAB Release Notes](#) documents all updates and lets you compare different MATLAB releases to see what's changed.

Data Retrieval and Import

This section illustrates automated import of a data table from a .xlsx file. **For an example of how to automate data download from a specific website, please refer to [this example script](#).**

Load the andesite rock sample data

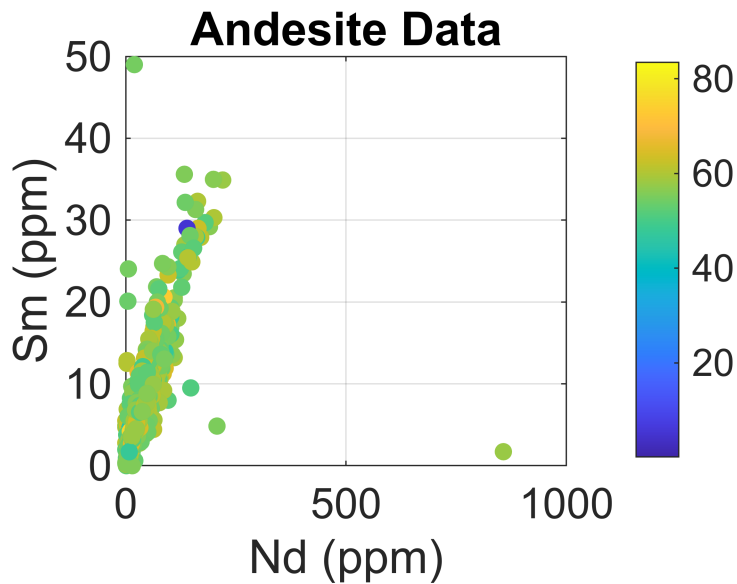
This data has been downloaded as a .xlsx file from Earthchem.org.

```
filename = 'earthchem_download_15510';
andesites = importAndesitefile1(filename);
```

Plot Rock Sample Data

Let's make a scatter plot to visually identify potentially anomalous measurements.

```
figure
createAndesitefig(andesites.ND,andesites.SM,[],andesites.SIO2)
```



Logical Indexing of Data

```
m = rand(1,9)
```

```
m = 1×9
    0.8147    0.9058    0.1270    0.9134    0.6324    0.0975    0.2785    0.5469 ...
```

```
idx = m>.7
```

```
idx = 1×9 logical array
     1     1     0     1     0     0     0     0     1
```

```
m(idx)
```

```
ans = 1×4
    0.8147    0.9058    0.9134    0.9575
```

```
m(m>.7)
```

```
ans = 1×4
    0.8147    0.9058    0.9134    0.9575
```

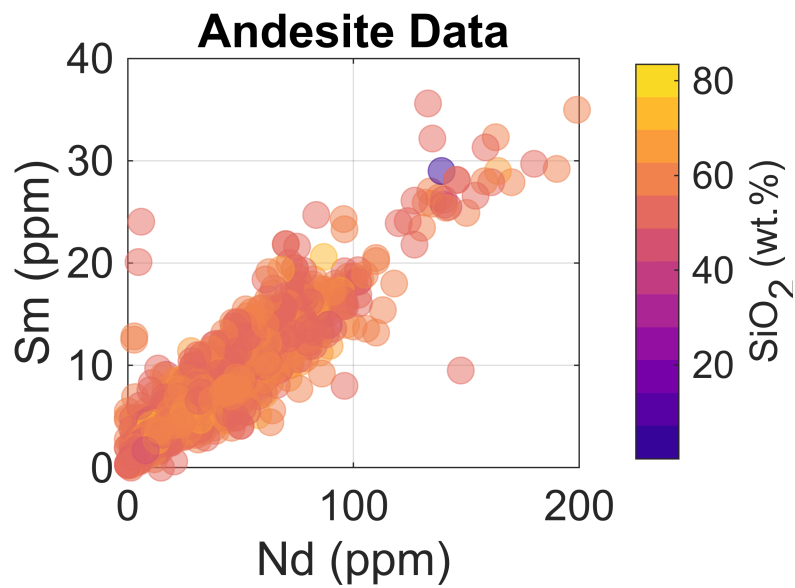
Filter Data to Exclude Outlier Nd and Sm

```
filt_idx = andesites.ND<200 & andesites.SM<40;
```

```
filteredNd = andesites.ND(filt_idx);  
filteredSm = andesites.SM(filt_idx);  
filteredSiO2 = andesites.SiO2(filt_idx);
```

Plot Filtered Data

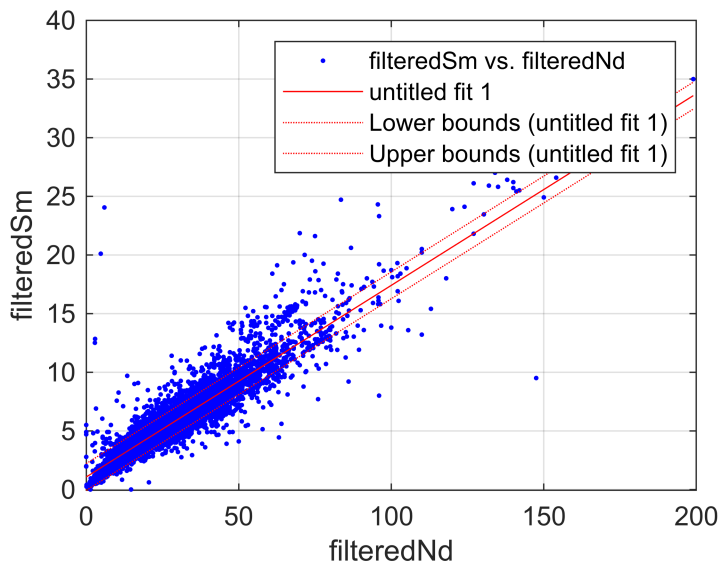
```
figure  
createAndesitefig(filteredNd,filteredSm,100,filteredSiO2)  
  
% You can also always change the properties of a figure via code, e.g.:  
colormap(plasma(12))  
alpha(0.5)  
cb = colorbar;  
ylabel(cb,'SiO2 (wt.%)')
```



Curve Fitting

Launch curve fitter app by clicking on it in the Apps tab, or by running this command:

```
createNdSmFit(filteredNd, filteredSm)
```



```
ans =
Linear model Poly1:
ans(x) = p1*x + p2
Coefficients (with 95% confidence bounds):
p1 =      0.1634    (0.1627, 0.164)
p2 =      1.067    (1.05, 1.083)
```

Display Sample Locations on Globe

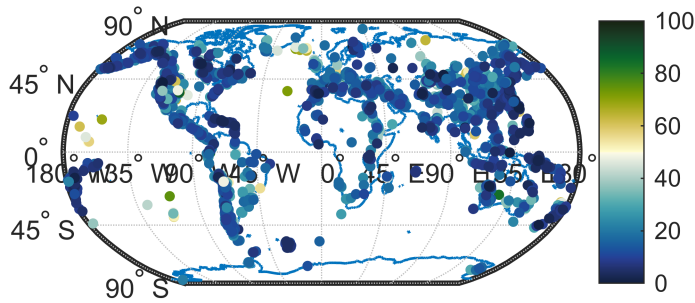
```
load coastlines

figure
axesm('apianus')
worldmap('world')

hold on
plotm(coastlat,coastlon,'linewidth',1)
scatterm(andesites.LATITUDE,andesites.LONGITUDE,15,andesites.ND,'filled')

colorbar
colormap(cmocean('delta')) % see the FileExchange resources at the end of this
% document for a list of community-created colormaps and functions. You
% must download the 'cmocean' function in order for this colormap to
% display. Otherwise, choose a different, built-in colormap, like 'parula'.

clim([0 100])
```



Toolboxes and FileExchange

File Exchange > Sciences > Earth, Ocean, Atmospheric Sciences

There are thousands of publicly available files, functions, and toolboxes on the MATLAB File Exchange and on GitHub. The link above brings you to a list of files made specifically for the EOAS community, but there are many, many, MANY other useful tools available.

File Exchange Search File Exchange File Exchange

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Filter by Source

Community	44,100
MathWorks	300

Filter by Category

Using MATLAB

MATLAB	11,784
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Using Simulink

Simulink	869
Physical Modeling	2,239
Event-based Systems	66
Real-Time Simulation and Testing	60

Workflows

Parallel Computing	195
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Systems Engineering	20

Community Toolboxes

PIVlab - particle image velocimetry (PIV) tool with GUI
Easy to use, GUI based tool to analyze, validate, postprocess, visualize and simulate (micro) PIV
74.6K Downloads ⭐⭐⭐⭐⭐

GUI Layout Toolbox
Layout manager for MATLAB graphical user interfaces
86.1K Downloads ⭐⭐⭐⭐⭐

Numerical Computing with MATLAB
Toolbox containing files and app from Numerical Computing with MATLAB
64.1K Downloads ⭐⭐⭐⭐⭐

Simulink Onramp
Learn the basics of how to create, edit, and simulate Simulink models through an interactive tutorial.
57.2K Downloads ⭐⭐⭐⭐⭐

Show All 1,627

File Exchange functions used in this document's examples:

- [borders](#)
- [cm_ocean](#) perceptually-uniform colormaps
- [Matplotlib Perceptually Uniform Colormaps](#)