What's New in MATLAB

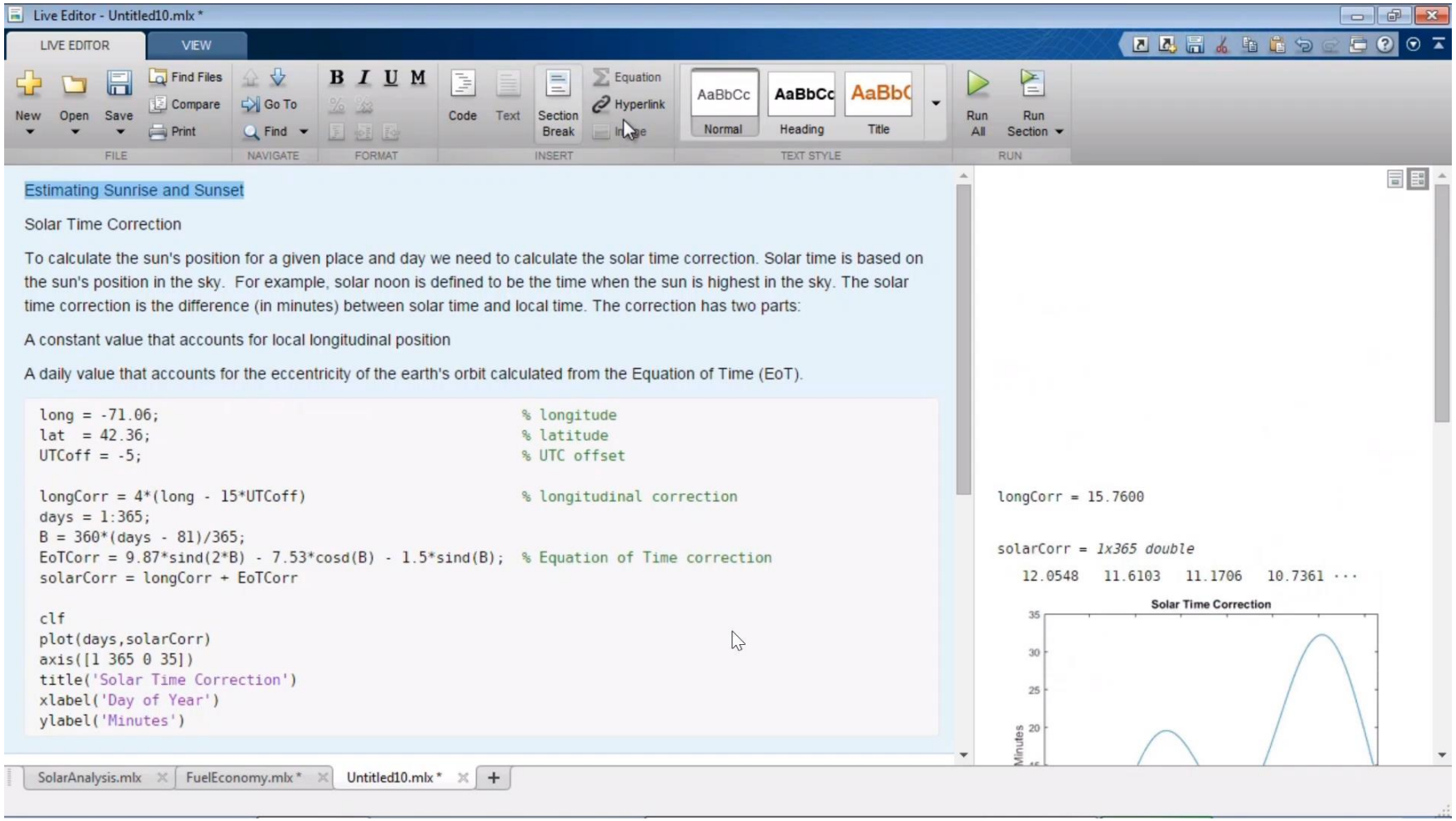
R2018b

Sarah Hung, Application Engineer

Live Editor

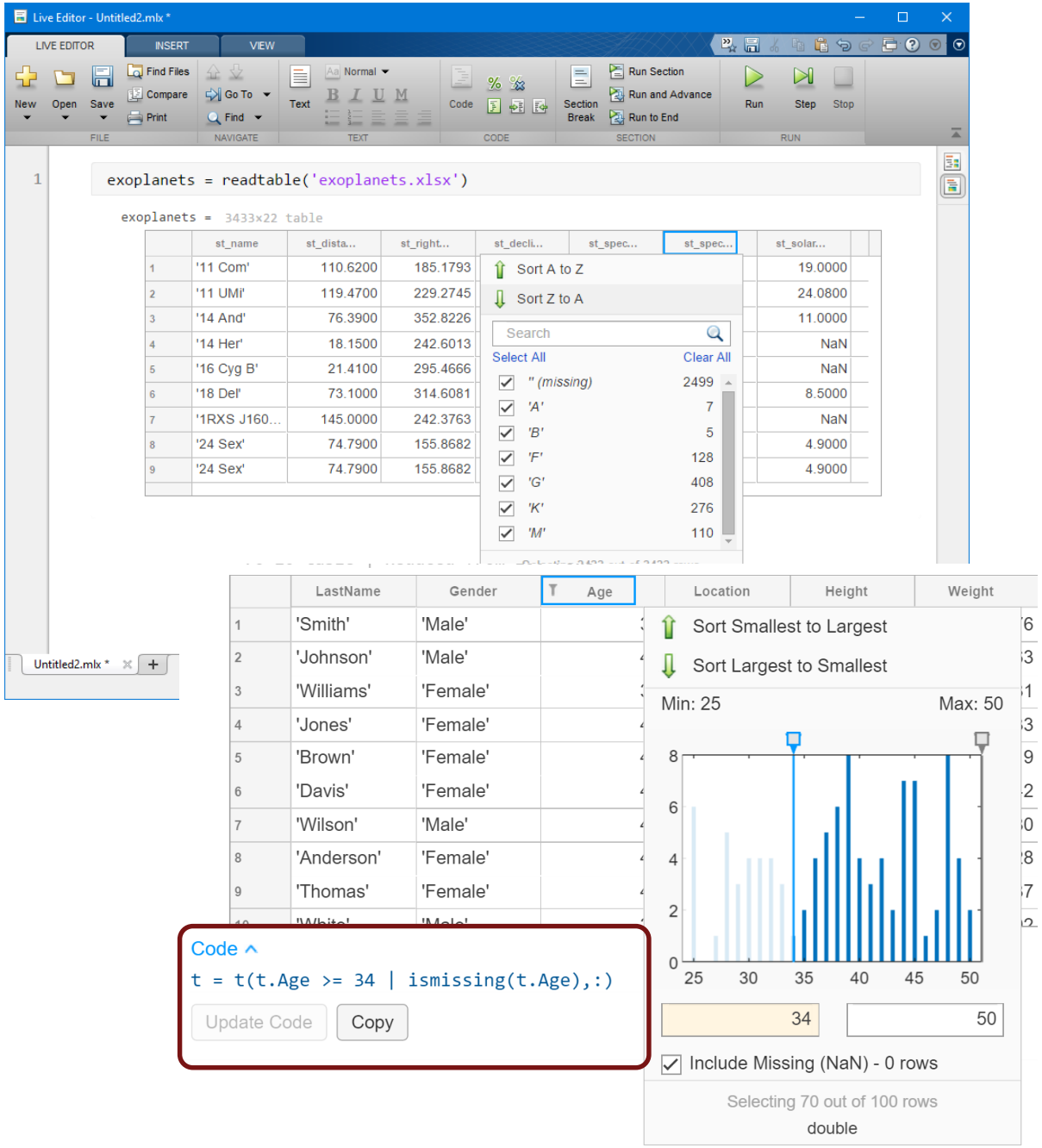
Live Editor

Live scripts are program files that contain your code, output, and formatted text together in a single interactive environment called the Live Editor.

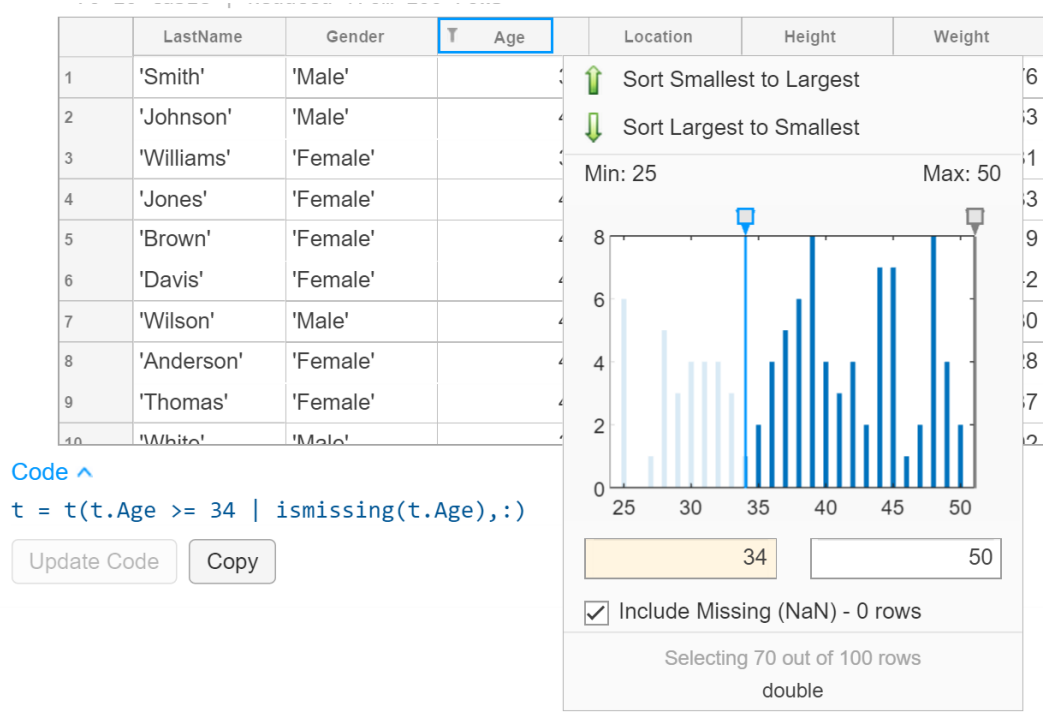


Live Editor

- Filter table output interactively with generated code
- Merge two versions of a live script or function
- Additional subheading styles
- Internal hyperlinks within a live script



Data Analysis



R2018b

Data Workflows Continue to Improve

Import

```
t1 = readtable("S3://bucket_name/file.txt");
```

Preprocess

```
t1 = removevars(t1,"P");
t1 = convertvars(t1,["T","RH"],"double");
t = synchronize(t1,t2,t3);
t = sortrows(t);
t = fillmissing(t,"linear");
t = rmoutliers(t);
t = smoothdata(t);
t = normalize(t);
t.T = rescale(t.T);
```

Explore

```
[tmin,tmax] = bounds(t.Time);
top5 = topkrows(t,5,"RH");
byTime = groupsummary(t,"Time","year");
g = grouptransform(t,"AQILabel","rescale");
chgpts = islocalmin(t,"MaxNumExtrema",5);
```

Visualize

```
stackedplot(t);
geoplot(t.Lat,t.Lon,t.RH);
heatmap(t,"AQILabel","Year");
scatterhistogram(t.RH,t.DP);
```

Import Data

Import

```
t1 = readtable("S3://bucket_name/file.txt");
```

Preprocess

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Visualize

```
stackedplot(t);
geoplot(t.Lat,t.Lon,t.RH);
heatmap(t,"AQILabel","Year");
scatterhistogram(t.RH,t.DP);
```

```
t1 = readtable("S3://bucket_name/file.txt");
t2 = readtable("wasbs://container@account/path/file.txt");
```

- Import from more places
- Support more formats (**`stlread`**, **`stlwrite`**)

R2018b

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Preprocess

Import

```
t1 = readtable("S3://bucket_name/file.txt");
```

Preprocess

```
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```

Explore

```
[tmin,tmax]
top5 = topk
byTime = gr
g = grouptr
chgpts = is
```

Visualize

```
stackedplot(t);
geoplot(t.Lat,t.Lon,t.RH);
heatmap(t,"AQILabel","Year");
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```

Explore Data

Import

```
t1 = readtable("S3://bucket_name/file.txt");
```

Prepr

```
t1 =
t1 =
t = s
t = s
t = f
t = r
t = s
t = n
t.T =
```

Explo

```
[tmin,tmax] = bounds(t.Time);
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Visualize

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```
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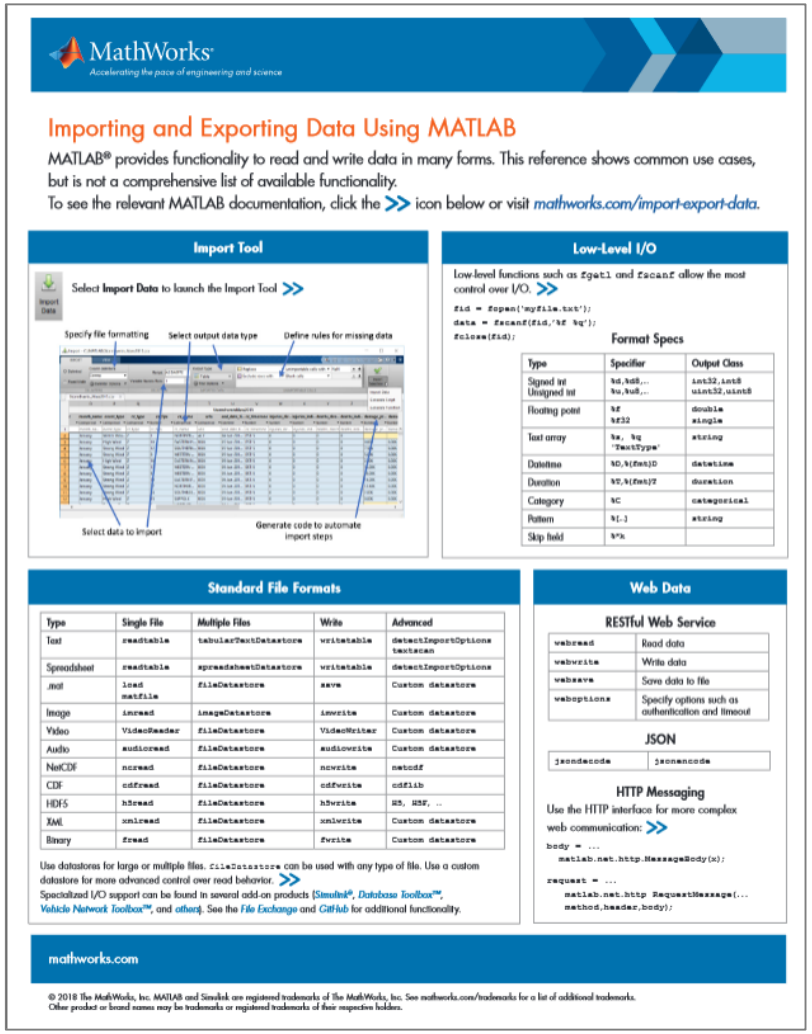
```


- **`grouptransform`**
  - Perform grouped computations, such as normalization or filling missing data, on table and timetable variables

R2018b

New Cheat Sheets Available

[Importing and Exporting Data Using MATLAB]



MathWorks
Accelerating the pace of engineering and science

Importing and Exporting Data Using MATLAB

MATLAB® provides functionality to read and write data in many forms. This reference shows common use cases, but is not a comprehensive list of available functionality.
To see the relevant MATLAB documentation, click the >> icon below or visit *mathworks.com/import-export-data*.

Import Tool

Select **Import Data** to launch the Import Tool >>

Specify file formatting | Select output data type | Define rules for missing data

Select data to import | Generate code to automate import steps

Low-Level I/O

Low-level functions such as `fgetl` and `fscanf` allow the most control over I/O. >>

```
fid = fopen('myfile.txt');
data = fscanf(fid,'%f %q');
fclose(fid);
```

Format Specs

Type	Specifier	Output Class
Signed int Unsigned int	%d,%d8,... %u,%u8,...	int32,int8 uint32,uint8
Floating point	%f %f32	double single
Text array	%s, %q 'TextType'	string
Datetime	%D,%{fmt}D	datetime
Duration	%T,%{fmt}T	duration
Category	%C	categorical
Pattern	%[..]	string
Skip field	%*x	

Standard File Formats

Type	Single File	Multiple Files	Write	Advanced
Text	readtable	tabularTextDatastore	writetable	detectImportOptions textscan
Spreadsheet	readtable	spreadsheetDatastore	writetable	detectImportOptions
.mat	load matfile	fileDatastore	save	Custom datastore
Image	imread	imageDatastore	imwrite	Custom datastore
Video	VideoReader	fileDatastore	VideoWriter	Custom datastore
Audio	audioread	fileDatastore	audiowrite	Custom datastore
NetCDF	ncread	fileDatastore	ncwrite	netcdf
CDF	cdfread	fileDatastore	cdfwrite	cdflib
HDF5	h5read	fileDatastore	h5write	H5, H5F, ..
XML	xmlread	fileDatastore	xmlwrite	Custom datastore
Binary	fread	fileDatastore	fwrite	Custom datastore

Use datastores for large or multiple files. `fileDatastore` can be used with any type of file. Use a custom datastore for more advanced control over read behavior. >>
Specialized I/O support can be found in several add-on products (*Simulink®, Database Toolbox™, Vehicle Network Toolbox™*, and *others*). See the *File Exchange* and *GitHub* for additional functionality.

Web Data

RESTful Web Service

`webread`	Read data
`webwrite`	Write data
`websave`	Save data to file
`weboptions`	Specify options such as authentication and timeout

JSON

`jsondecode`	`jsonencode`

HTTP Messaging

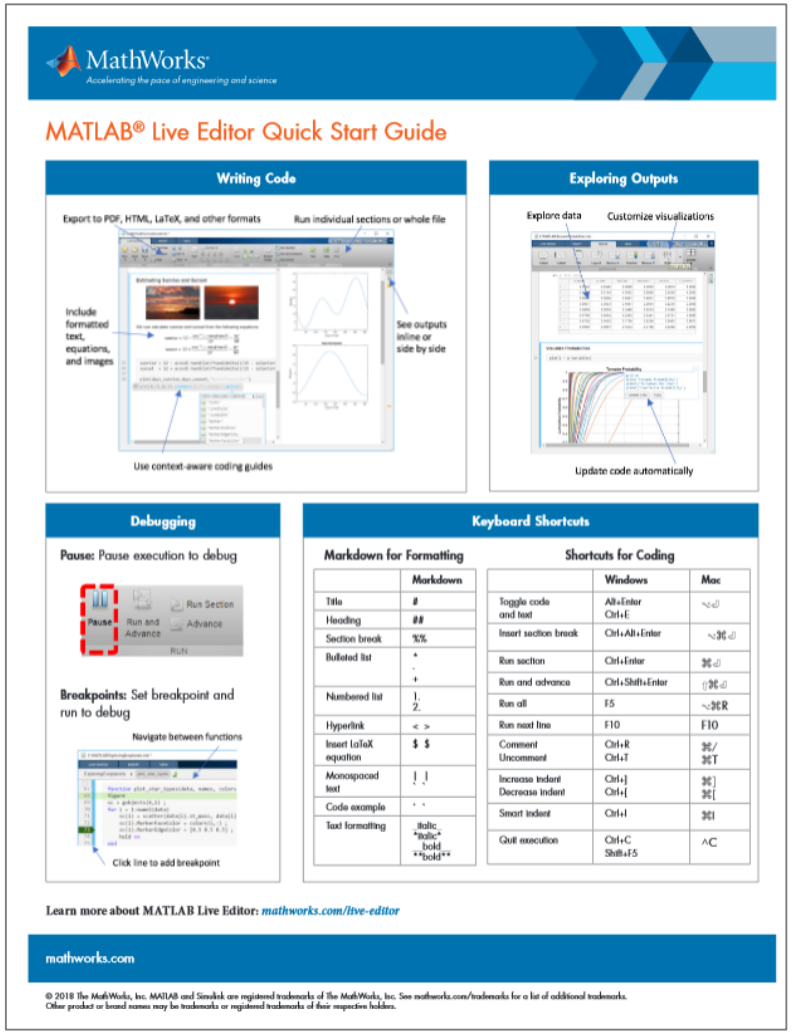
Use the HTTP interface for more complex web communication: >>

```
body = ...
  matlab.net.http.MessageBody(x);

request = ...
  matlab.net.http.RequestMessage(...
  method,header,body);
```

mathworks.com

[MATLAB Live Editor Quick Start Guide]



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MATLAB® Live Editor Quick Start Guide

Writing Code

Export to PDF, HTML, LaTeX, and other formats | Run individual sections or whole file

Include formatted text, equations, and images | See outputs inline or side by side

Use context-aware coding guides

Exploring Outputs

Explore data | Customize visualizations

Update code automatically

Debugging

Pause: Pause execution to debug

Pause | Run and Advance | Run Section | Advance | RUN

Breakpoints: Set breakpoint and run to debug

Navigate between functions

Click line to add breakpoint

Keyboard Shortcuts

Markdown for Formatting

	Markdown
Title	#
Heading	##
Section break	%%
Bulleted list	* - +
Numbered list	1. 2.
Hyperlink	< >
Insert LaTeX equation	$ $
Monospaced text	` ` ^ ^
Code example	``` ```
Text formatting	*italic* **bold** ***bold***

Shortcuts for Coding

	Windows	Mac
Toggle code and text	Alt+Enter Ctrl+E	⌥⏎
Insert section break	Ctrl+Alt+Enter	⌥⌘⏎
Run section	Ctrl+Enter	⌘⏎
Run and advance	Ctrl+Shift+Enter	⇧⌘⏎
Run all	F5	⌥⌘R
Run next line	F10	F10
Comment Uncomment	Ctrl+R Ctrl+T	⌘/ ⌘T
Increase indent Decrease indent	Ctrl+] Ctrl+[	⌘] ⌘[
Smart indent	Ctrl+I	⌘I
Quit execution	Ctrl+C Shift+F5	^C

Learn more about MATLAB Live Editor: *mathworks.com/live-editor*

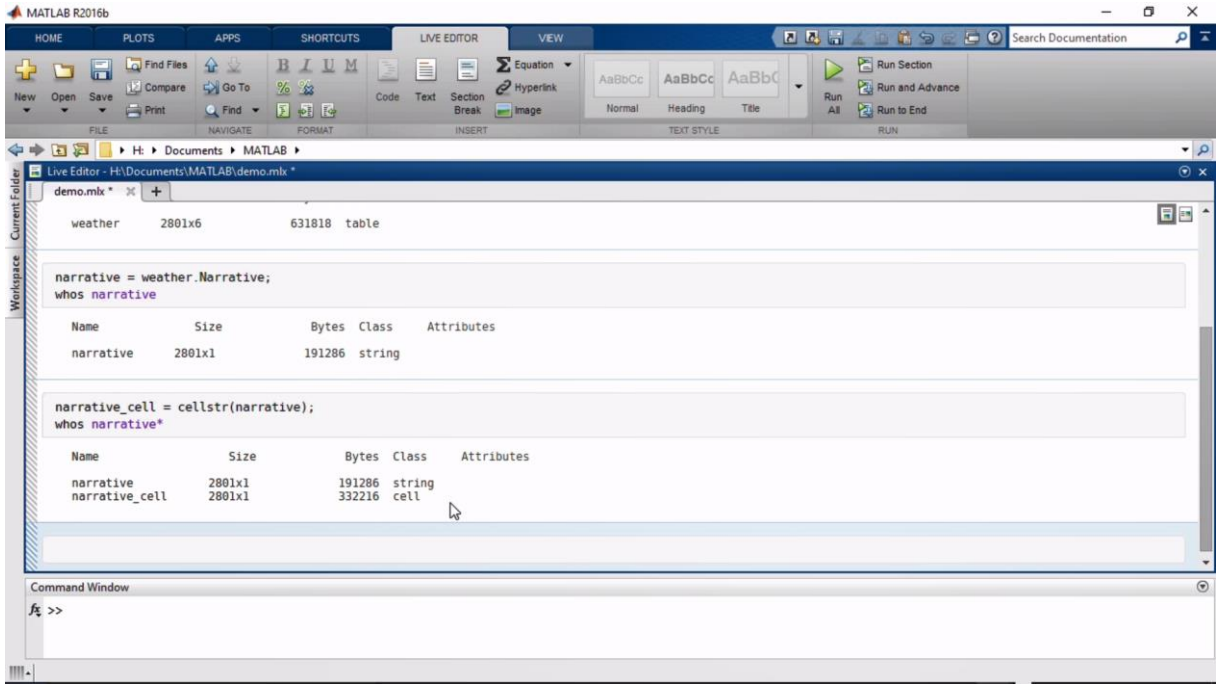
mathworks.com

String Arrays

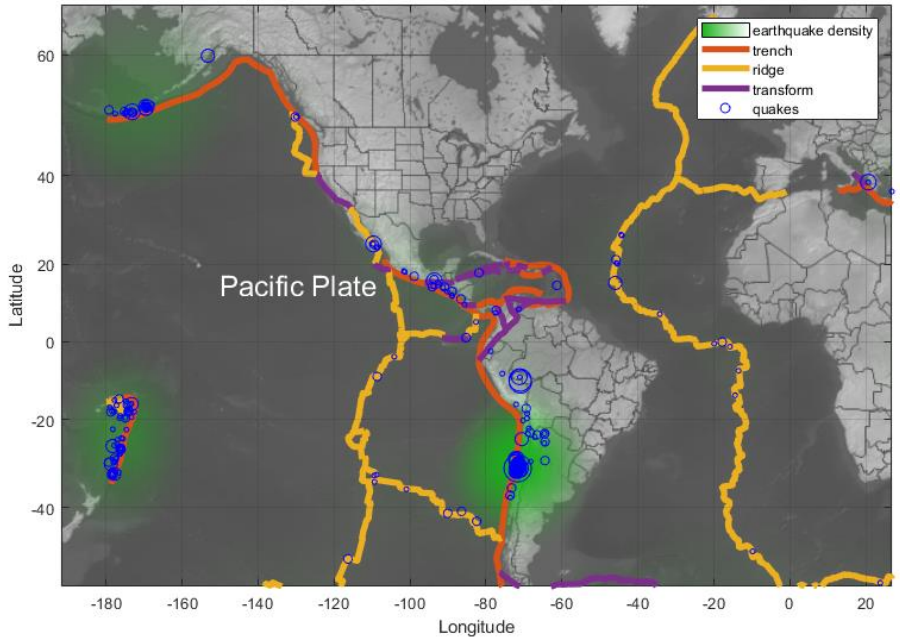
String Arrays

- Introduced in R2016b
  - Designed and optimized for working with and manipulating text

- In R2018b you can use string arrays for data, properties, and name-value pair arguments nearly everywhere in MathWorks products



Graphics


earthquake density
trench
ridge
transform
quakes
Pacific Plate
Latitude
Longitude
60
40
20
0
-20
-40
-180
-160
-140
-120
-100
-80
-60
-40
-20
0
20

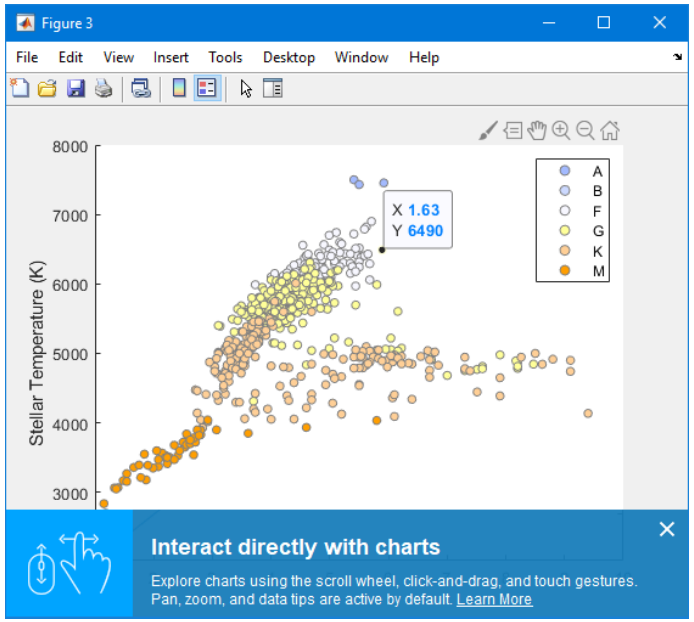
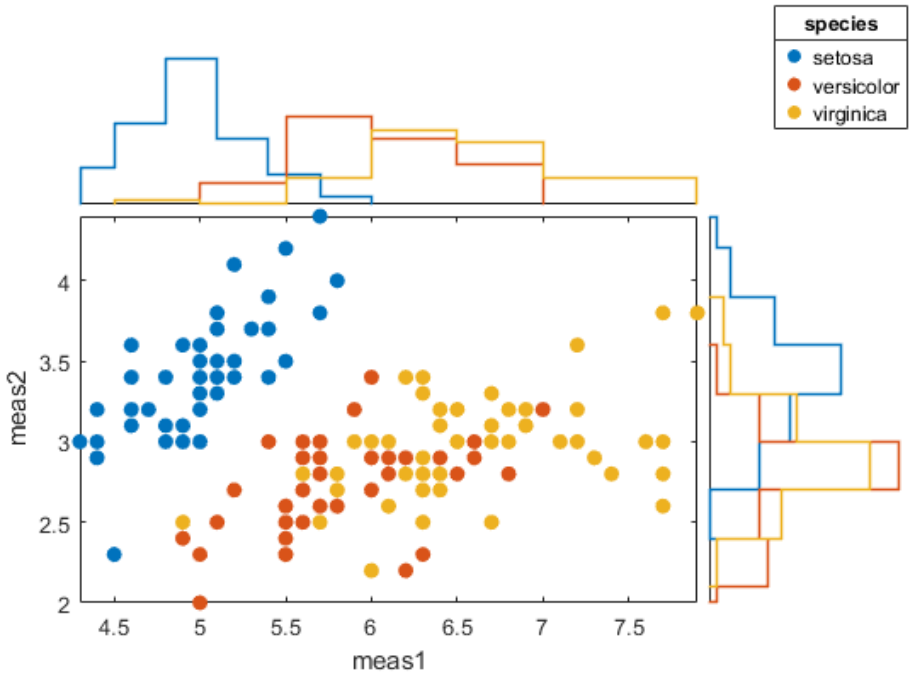


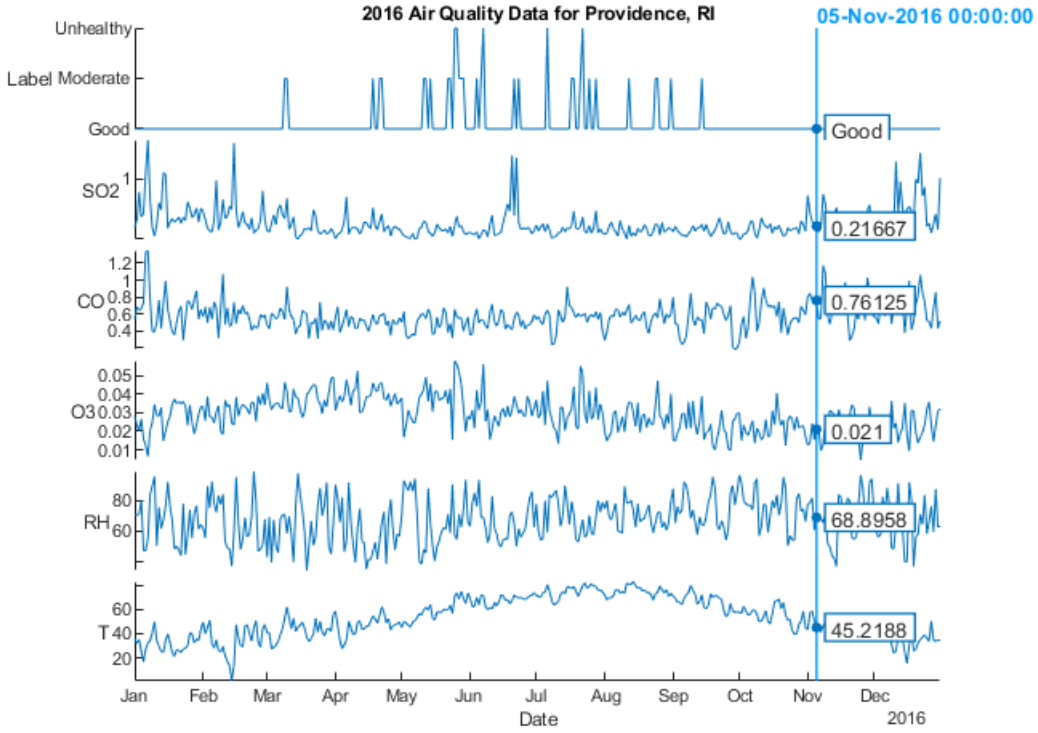
Figure 3
File Edit View Insert Tools Desktop Window Help
X 1.63
Y 6490
A
B
F
G
K
M
Stellar Temperature (K)
8000
7000
6000
5000
4000
3000
Interact directly with charts
Explore charts using the scroll wheel, click-and-drag, and touch gestures.
Pan, zoom, and data tips are active by default. Learn More

New Visualizations

- `scatterhistogram` to create a scatter plot with marginal histograms



- `stackedplot` for visualizing several variables from a table or timetable



R2018b

Geographic Plots

- Three new geographic plots
  - Line plot: **`geoplot`**
  - Scatter plot: **`geoscatter`**
  - Density plot: **`geodensityplot`**

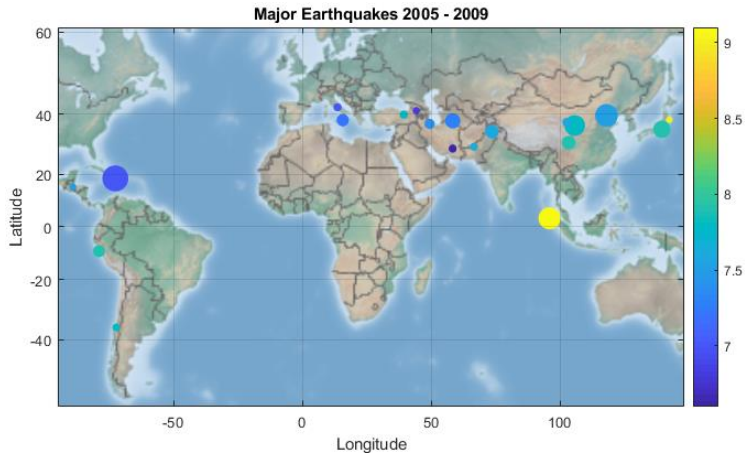
- New **`geoaxes`** object

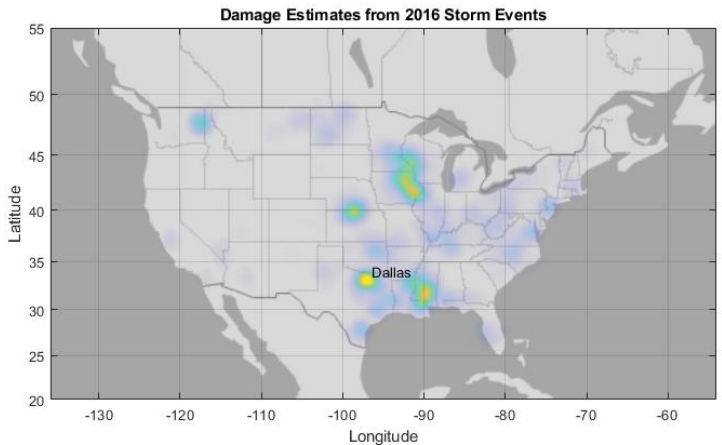
```
gx =

  GeographicAxes with properties:

     Basemap: 'darkwater'
    Position: [0.1300 0.1100 0.7750 0.8150]
       Units: 'normalized'

  Show all properties
```



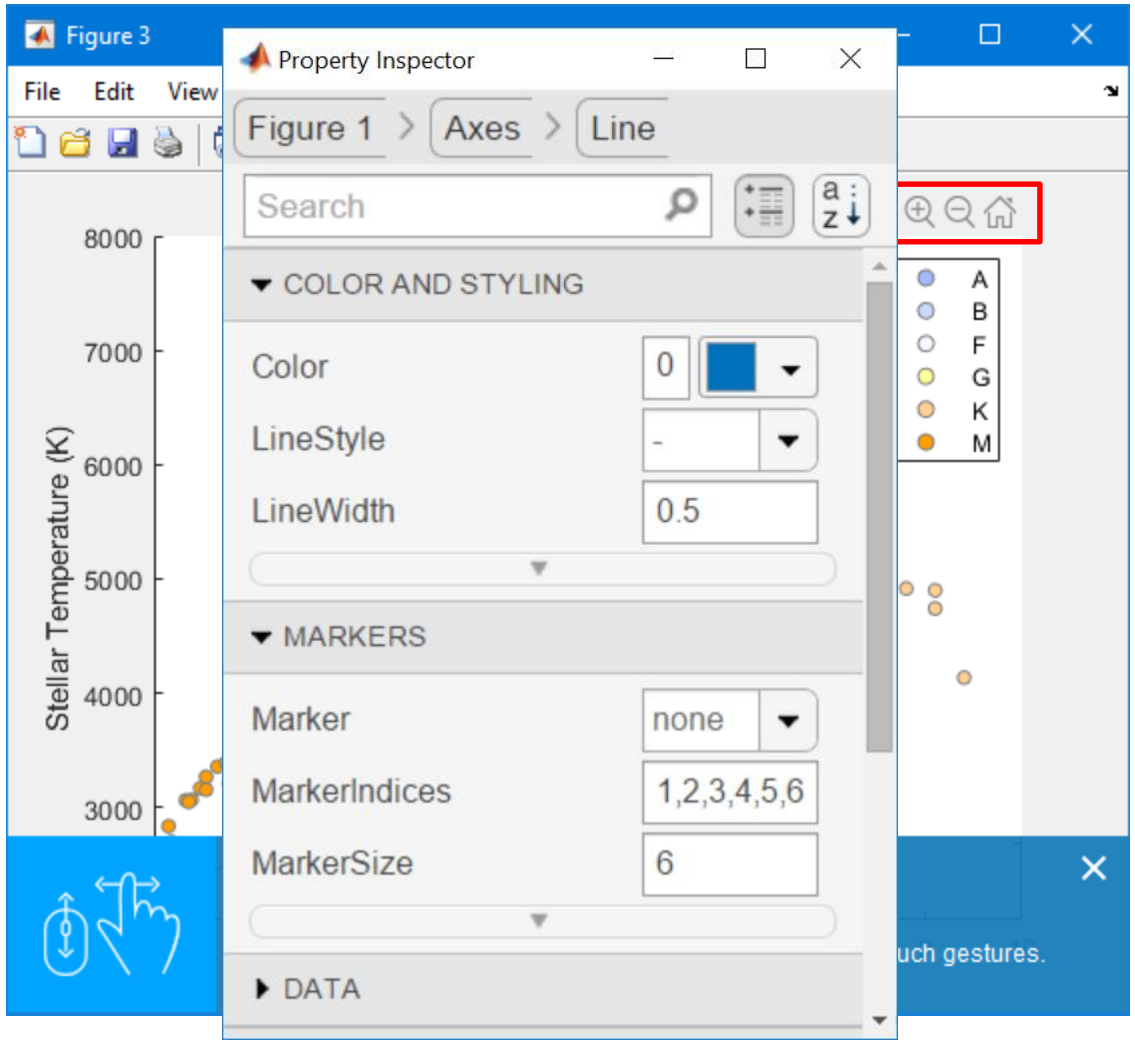


R2018b

Plot Interactions

- Axes interactions enabled by default
  - Panning
  - Zooming
  - Data tips
  - 3-D rotation
- Access and customize data exploration toolbar for each axes object
- Opens Property Inspector
- Can still use plot tools:

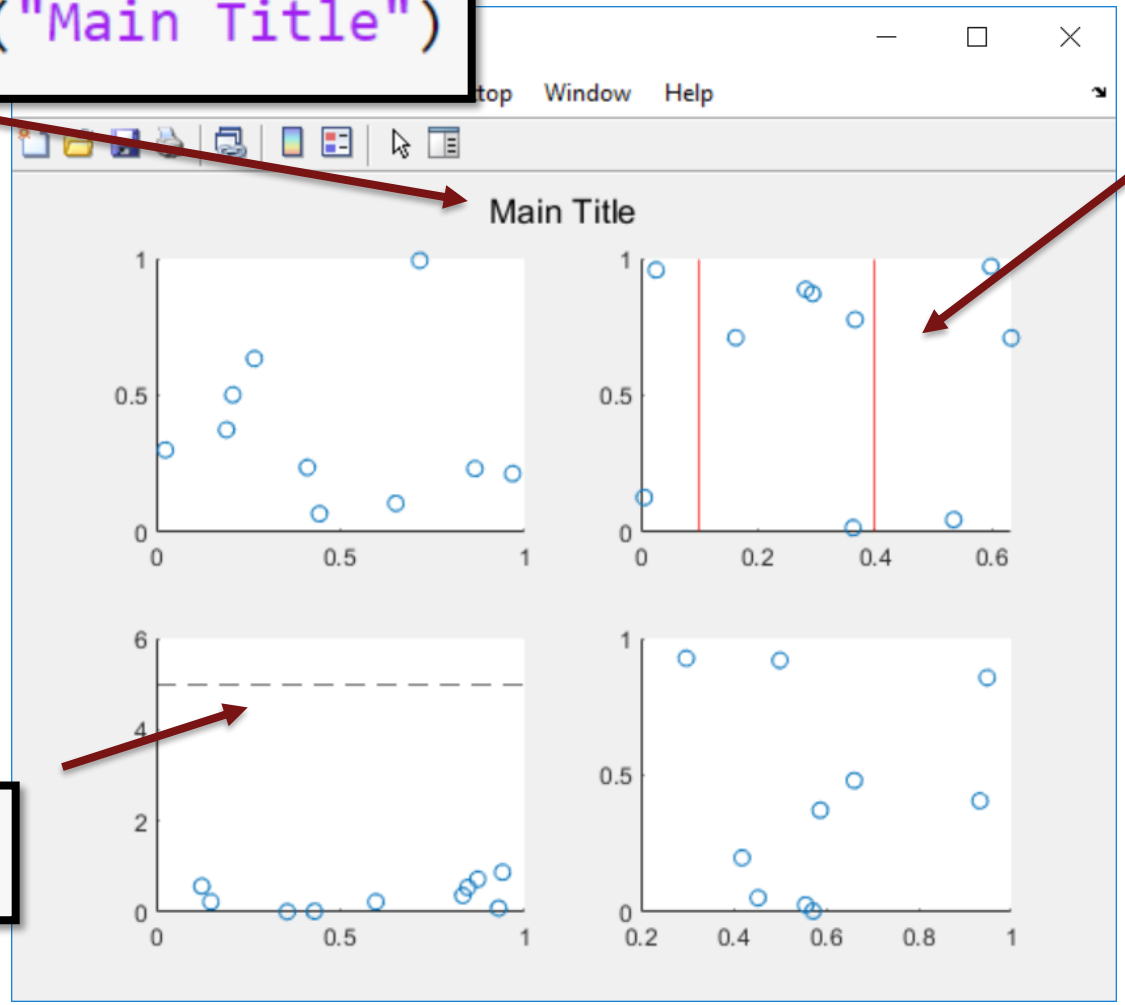
```
plottools("on")
```



Graphics Conveniences

```
subplottitle("Main Title")
```

```
xline(0.1,"r")
xline(0.4,"r")
```

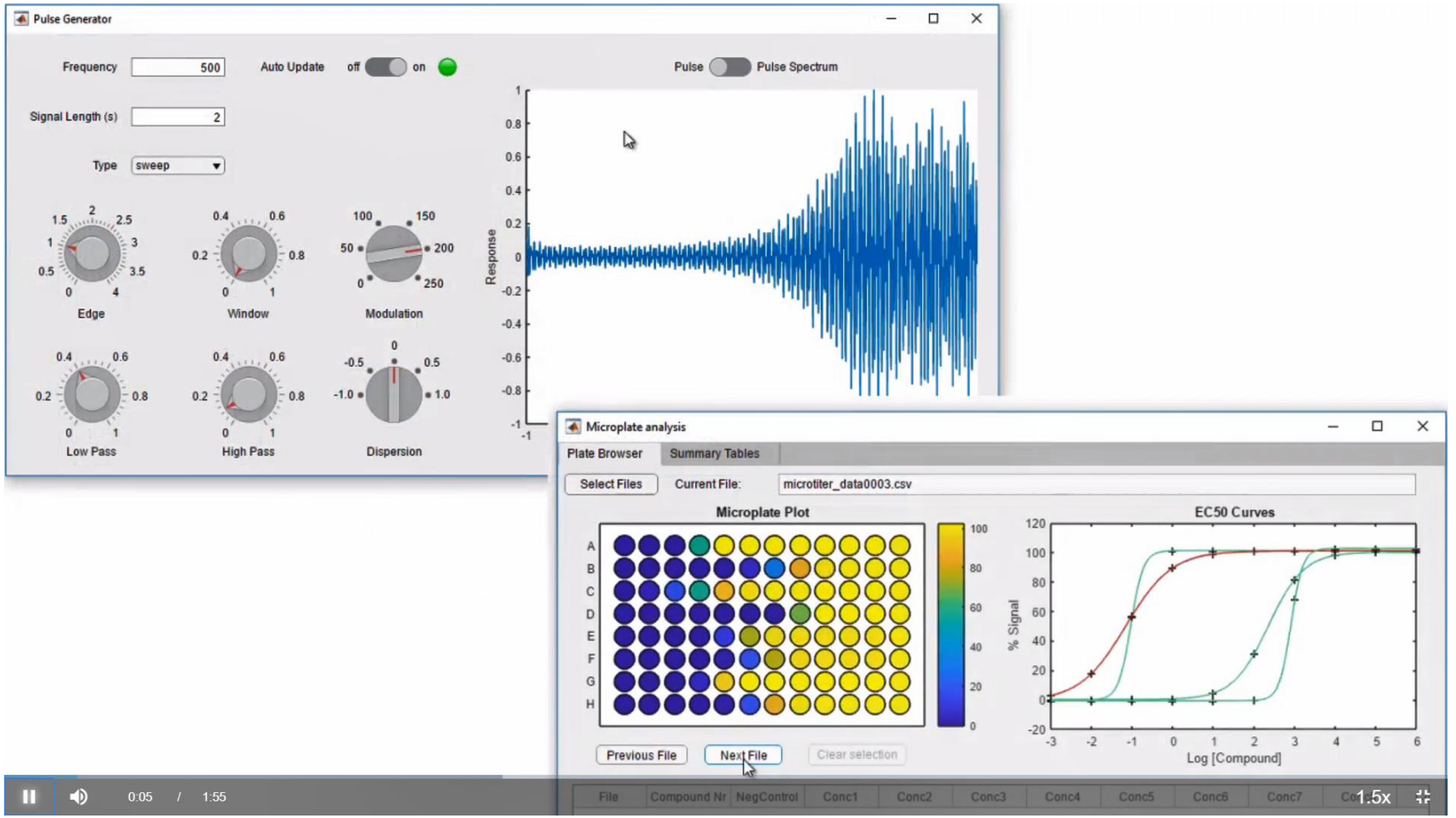



```
yline(5,"--")
```

App Building

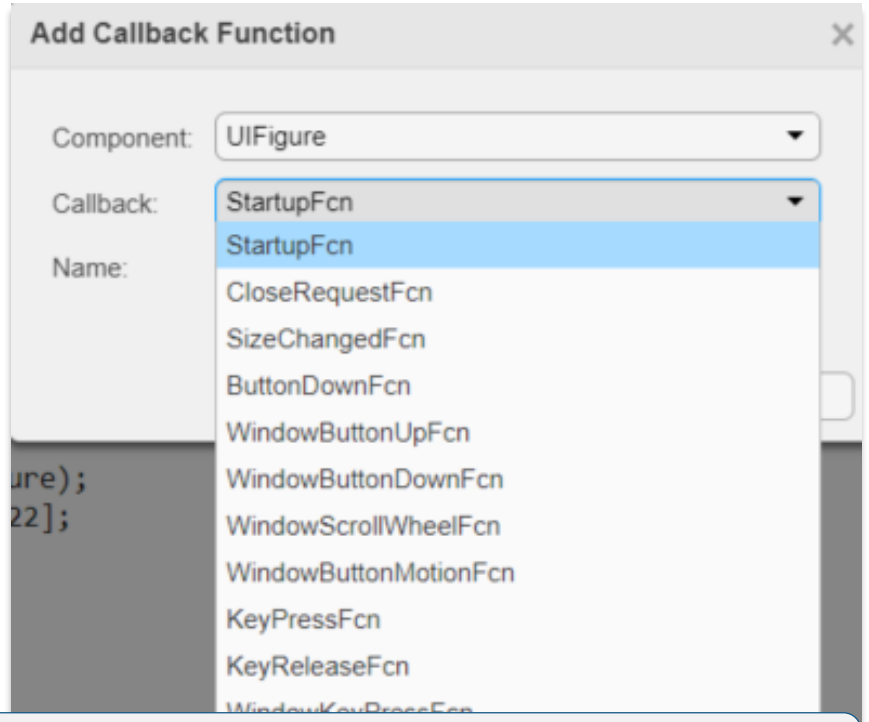
App Designer

App Designer lets you create modern professional looking apps in MATLAB!

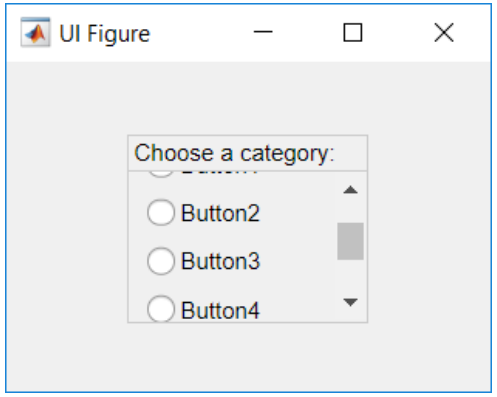


App Building

- Custom mouse and keyboard interactions using figures created with the `uifigure` function
- Custom tooltips for UI components in apps
  - Available for UI components in App Designer apps and in figures created with the `uifigure` function



- Scrolling enabled for the following containers:
  - Figure
  - Panel
  - Tab
  - Button group



- Scrolling works only in:
  - App Designer apps
  - Figures created with the `uifigure` function
  - Child containers within those figures
- Scrolling is not available for `axes` objects
  - In this case, you can parent to `uipanel`

R2018b

App Building

Graphics Support

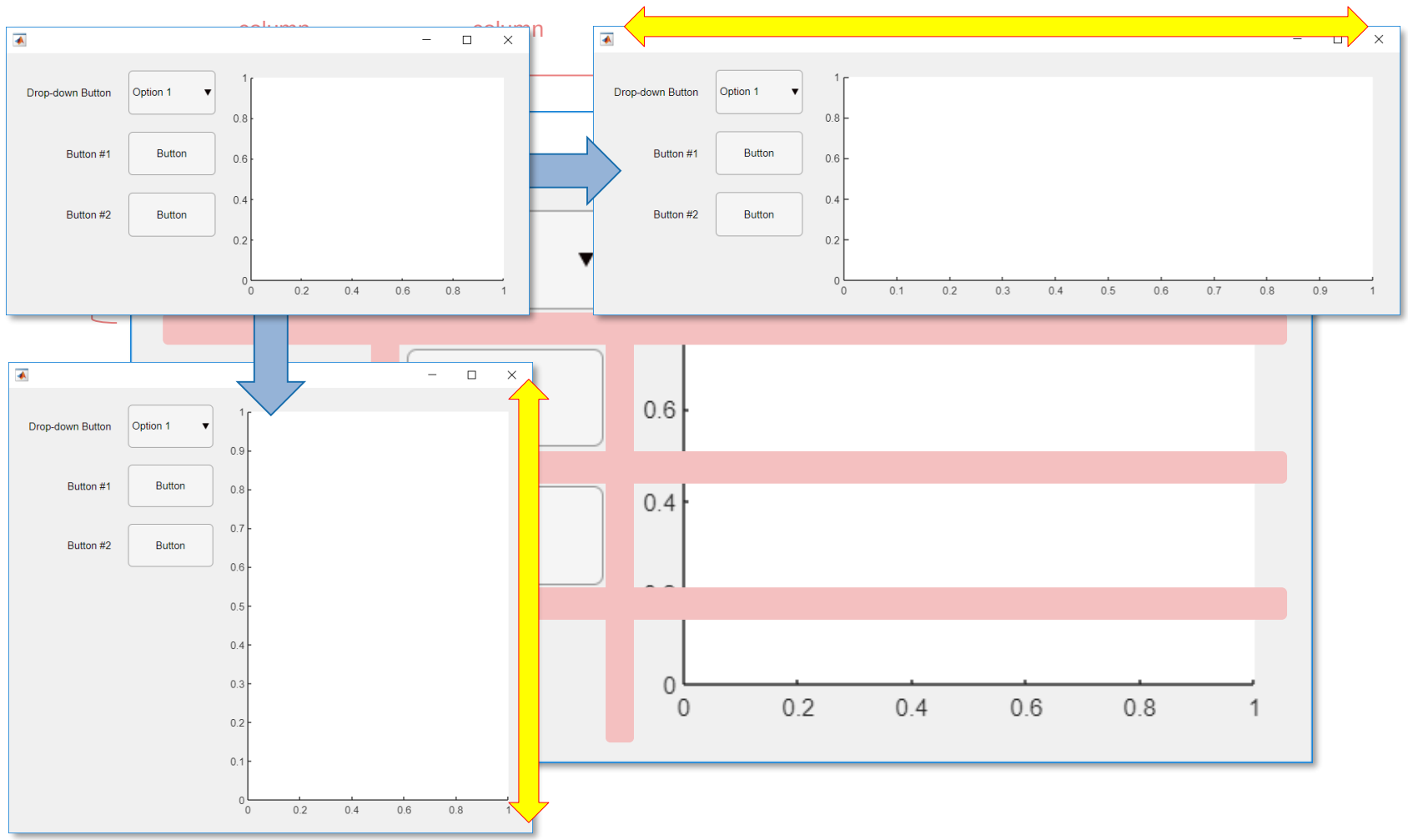
- `uifigure` now supports `uiaxes` AND `axes` objects
  - Integrate plots into an app using the `axes`, `polaraxes`, and `geoaxes` functions
    (See example in the R2018b doc)
  - This allows you to display more types of plots
    See Displaying Graphics in App Designer

App Building

Grid Layout Manager using `uigridlayout`

Notes

- Only available in apps created with the **uifigure** function
- Not available directly in App Designer; could include the code as part of the startup function




```
% Create figure
F=uifigure;
F.Position = [0 0 600 300];
movegui(F,'center');

% Create grid layout
g = uigridlayout(F,[4,3]);
g.RowHeight = {50,50,50,'1x'};
g.ColumnWidth = {100,100,'3x'};
g.Padding = [20 20 20 20];
g.ColumnSpacing = 20;
g.RowSpacing = 20;

b1.Layout.Row = [2];
b1.Layout.Column = [2];
b1label = uilabel(g);
b1label.Layout.Row = b1.Layout.Row;
b1label.Layout.Column = b1.Layout.Column - 1;
b1label.HorizontalAlignment = 'right';
b1label.Text = {'Button #1'};

b2 = uibutton(g);
b2.Layout.Row = [3];
b2.Layout.Column = [2];
b2label = uilabel(g);
b2label.Layout.Row = b2.Layout.Row;
b2label.Layout.Column = b2.Layout.Column - 1;
b2label.HorizontalAlignment = 'right';
b2label.Text = {'Button #2'};

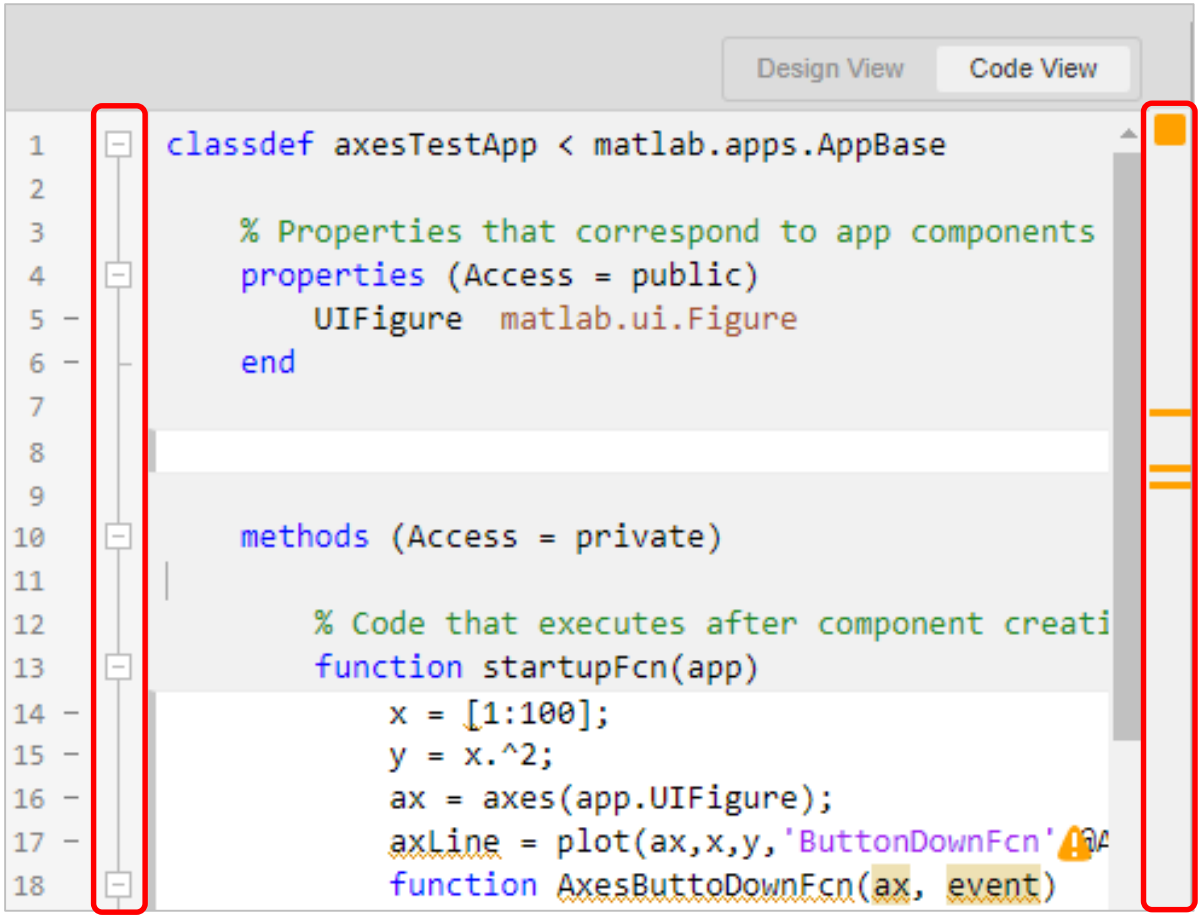
ax = uiaxes(g);
ax.Layout.Row = [1 size(g.RowHeight,2)];
ax.Layout.Column = [3];
```

R2018b

App Designer

Code View

- Code folding
- Code analyzer message bar
- Export apps as .m files
  - Enables you to change it outside of App Designer
  - NOTE - there is no option for importing changes back into App Designer



Performance

Performance

Start faster:

- Increased speed of MATLAB startup time
  - 18a: general start time improvement
  - 18b: focus on network concurrent configurations
- Create new and open existing Live Scripts faster
- Startup Apps faster

Execute code faster:

- Index into large arrays with improved performance when using `:` operator
- Faster calls to built-in functions due to reduced overhead
- Improved set function performance with enumerations