

Ground Track

MATLAB Implementation

Tamas Kis | kis@stanford.edu

TAMAS KIS
<https://github.com/tamaskis>

Copyright © 2021 Tamas Kis

Permission is hereby granted, free of charge, to any person obtaining a copy of this software and associated documentation files (the "Software"), to deal in the Software without restriction, including without limitation the rights to use, copy, modify, merge, publish, distribute, sublicense, and/or sell copies of the Software, and to permit persons to whom the Software is furnished to do so, subject to the following conditions:

The above copyright notice and this permission notice shall be included in all copies or substantial portions of the Software.

THE SOFTWARE IS PROVIDED "AS IS", WITHOUT WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, INCLUDING BUT NOT LIMITED TO THE WARRANTIES OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE AND NONINFRINGEMENT. IN NO EVENT SHALL THE AUTHORS OR COPYRIGHT HOLDERS BE LIABLE FOR ANY CLAIM, DAMAGES OR OTHER LIABILITY, WHETHER IN AN ACTION OF CONTRACT, TORT OR OTHERWISE, ARISING FROM, OUT OF OR IN CONNECTION WITH THE SOFTWARE OR THE USE OR OTHER DEALINGS IN THE SOFTWARE.



Contents

ground_track	4
Syntax	4
Description	4
Links	4
Example Plots	5
Default Ground Track	5
Ground Tracks Using Optional Inputs	5
Earth (With Clouds)	5
Earth (No Clouds)	6
Earth (Night, With Clouds)	6
Earth (Night, No Clouds)	7
Moon	7
Sun	8
Mercury	8
Venus	9
Mars	9
Jupiter	10
Saturn	10
Uranus	11
Neptune	11
Pluto	12
Image Sources	13
References	13

ground_track

Plots the ground track of an orbit given its planetodetic coordinates (i.e. planetodetic latitude and longitude).

Syntax

```
ground_track(lat,lon)
ground_track(lat,lon,color)
ground_track(lat,lon,[],line_width)
ground_track(lat,lon,color,line_width)
ground_track(__,planet)
```

Description

`ground_track(lat,lon)` plots the ground track of an orbit around the Earth, superimposed on a map of the Earth, where the map just shows the continental outlines. `lat` and `lon` are vectors of geodetic latitude and longitude values. By default, the ground track is drawn in blue with a line width of 1.5.

`ground_track(lat,lon,color)` does the same as the syntax above, but draws the ground track with the color specified by `color`. By default, a line width of 1.5 is used.

`ground_track(lat,lon,color,line_width)` does the same as the previous syntaxes, but draws the ground track with the line width specified by `line_width`. If you would only like to specify the line width, but not the color, use the syntax `ground_track(lat,lon,[],line_width)`.

`ground_track(__,planet)` draws the ground track of an orbit around the celestial body specified by `planet`. `planet` can be specified as 'Sun', 'Moon', 'Mercury', 'Venus', 'Earth', 'Earth Cloudy', 'Earth Night', 'Earth Night Cloudy', 'Earth Continents Outline', 'Mars', 'Jupiter', 'Saturn', 'Uranus', 'Neptune', or 'Pluto'. Note that if you are specifying `planet`, but choosing not to specify some other parameters, you have to replace the variables you skipped over with "[]". For example, if you wanted to specify the color but not the line width, you would use `ground_track(lat,lon,color,[],planet)`.

Links

MATLAB® Central's File Exchange:

GitHub®:

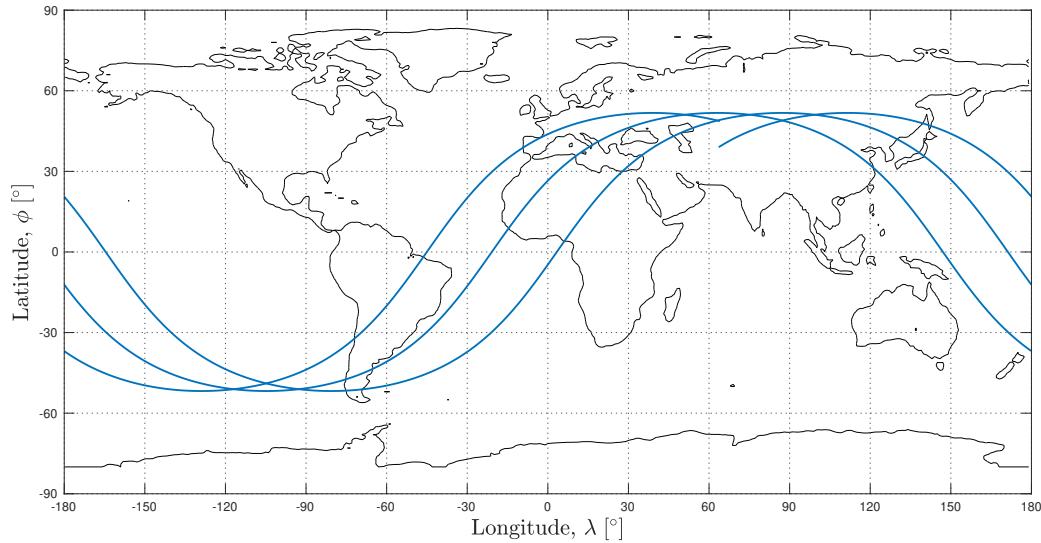
https://github.com/tamaskis/ground_track-MATLAB

Example Plots

All of the ground tracks shown below use the orbital data from `SAMPLE_ORBIT_DATA.xlsx`.

Default Ground Track

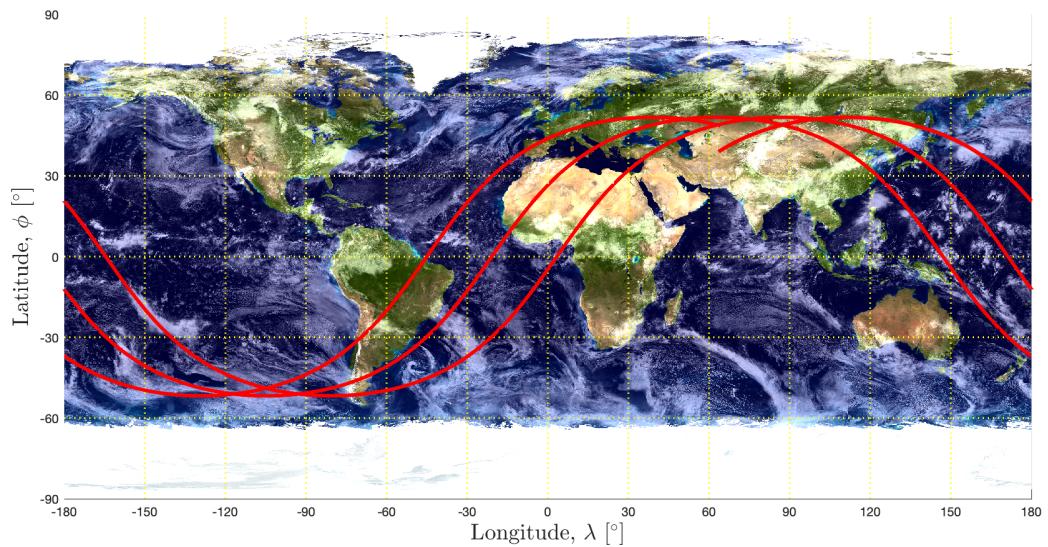
```
figure('position',[300,300,1000,500]);
ground_track(lat,lon);
```



Ground Tracks Using Optional Inputs

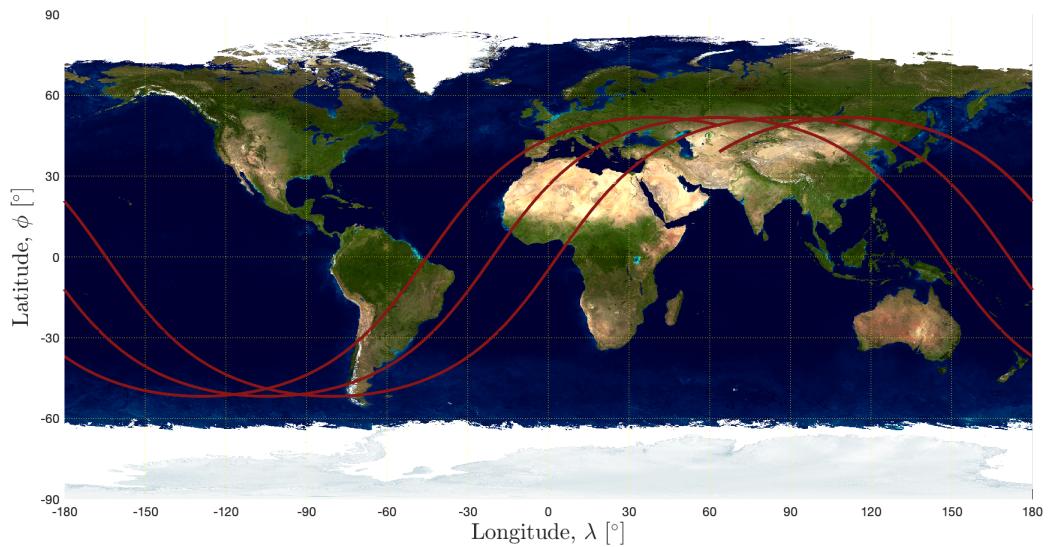
Earth (With Clouds)

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,'r',3,'Earth Cloudy');
```



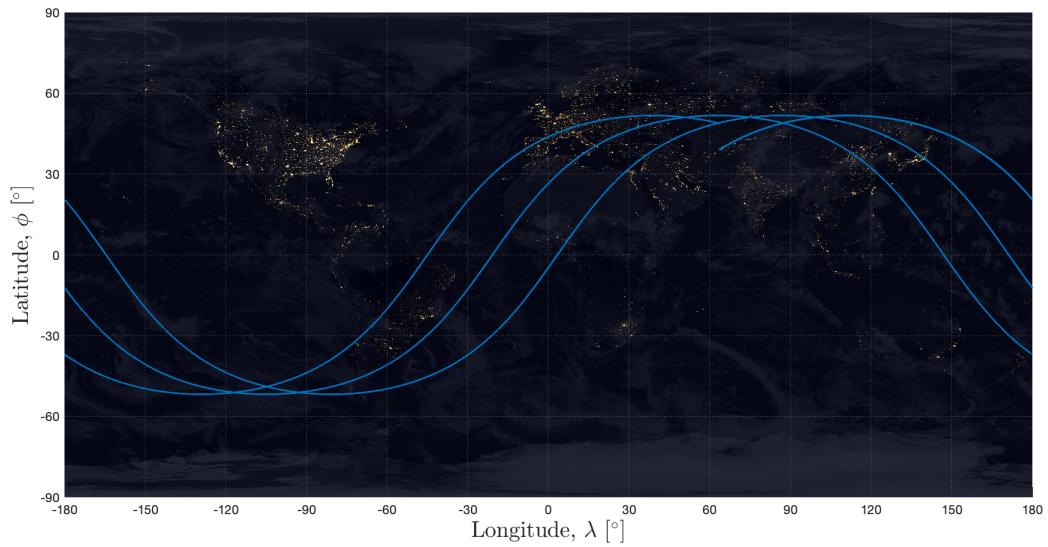
Earth (No Clouds)

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[140,21,21]/255,2.5,'Earth');
```



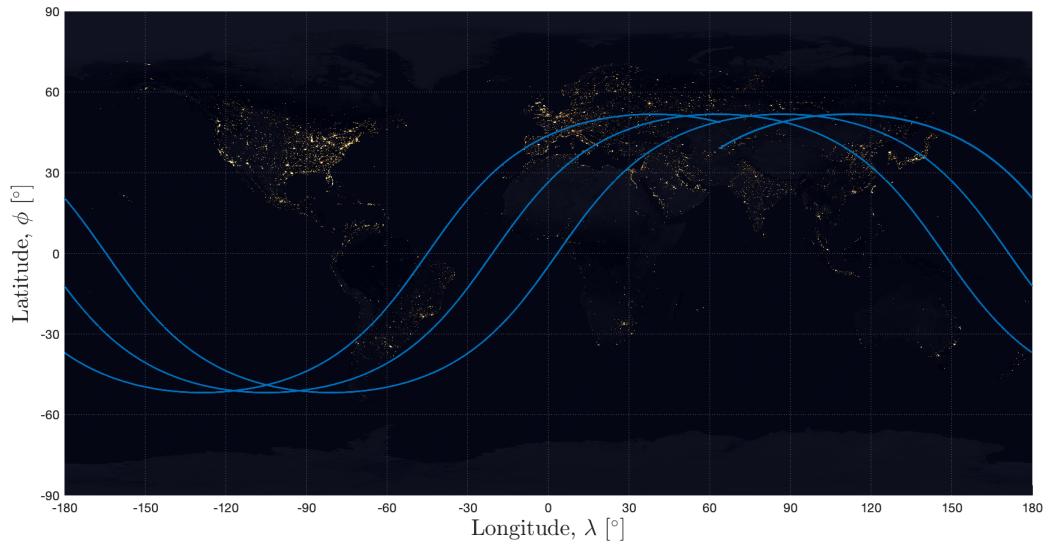
Earth (Night, With Clouds)

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[],[],'Earth Night Cloudy');
```



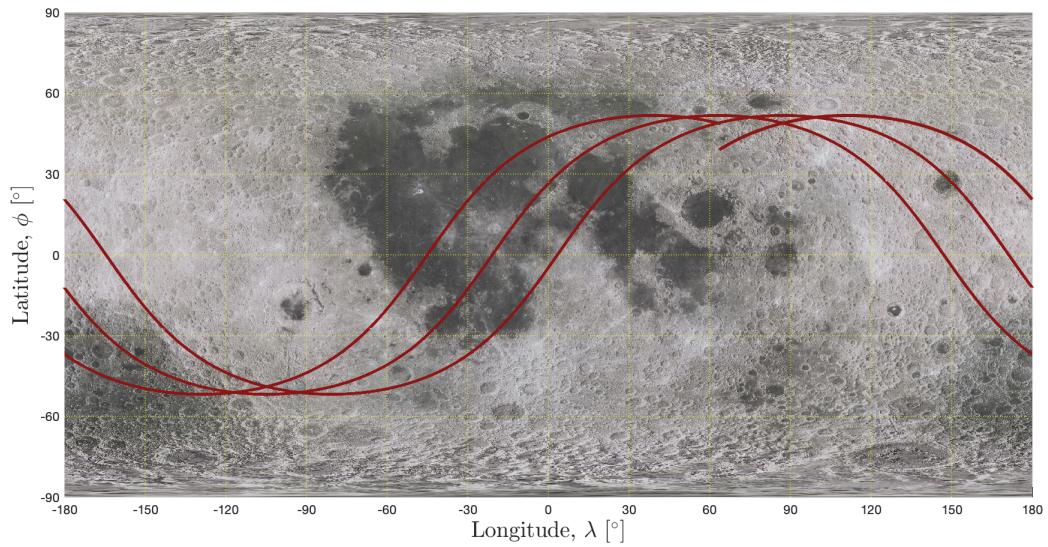
Earth (Night, No Clouds)

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[],[],'Earth Night');
```



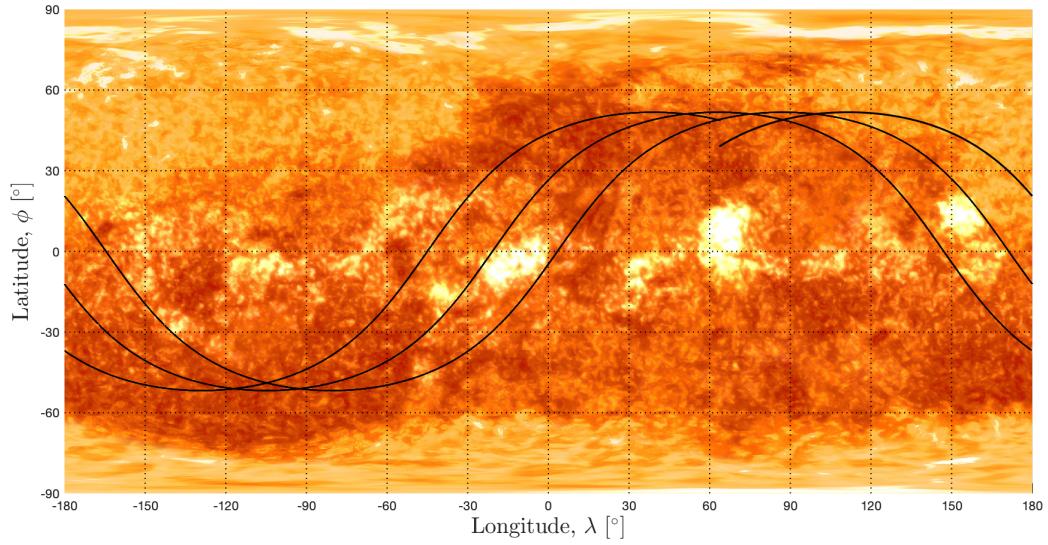
Moon

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[140,21,21]/255,2.5,'Moon');
```



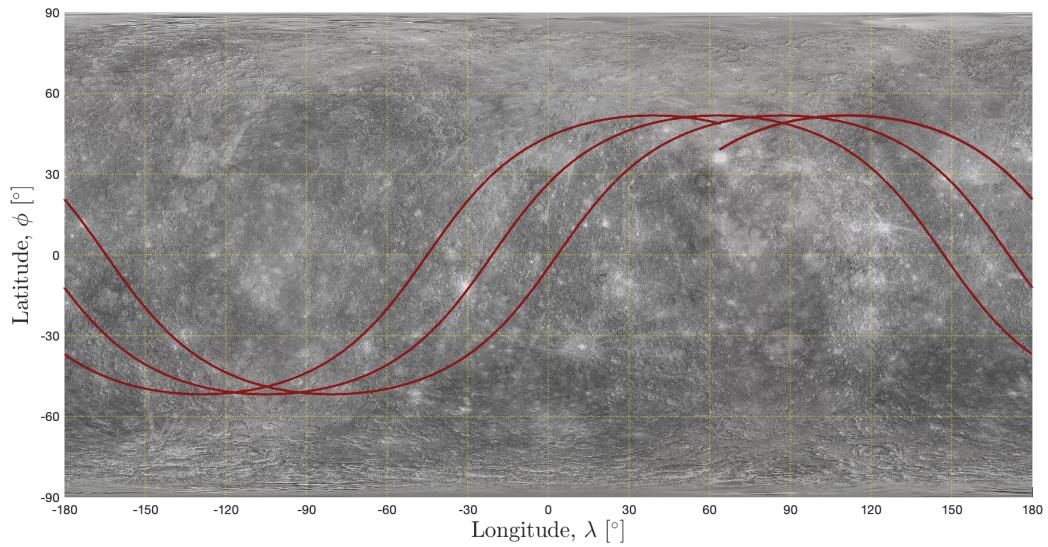
Sun

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,'k',[],'Sun');
```



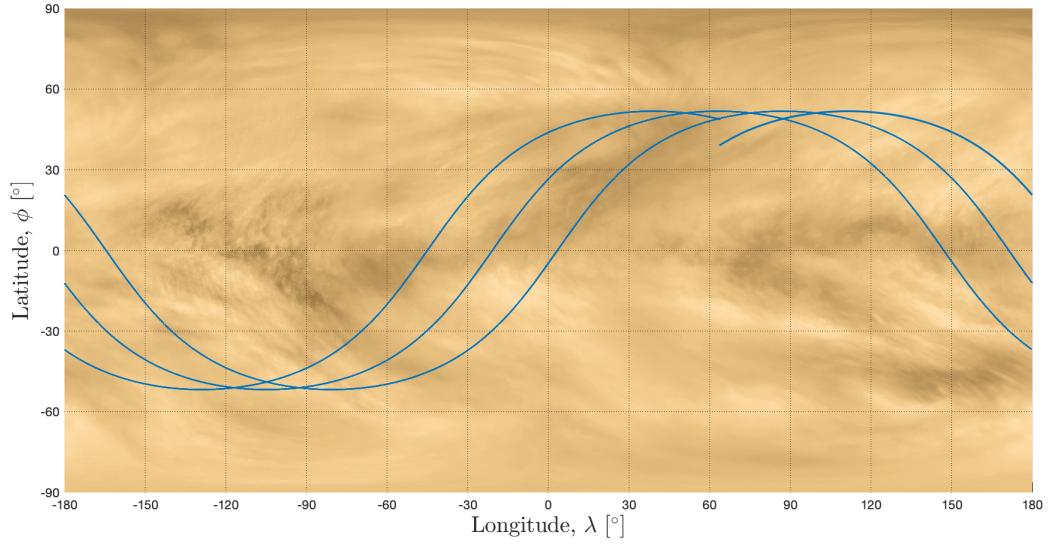
Mercury

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[140,21,21]/255,2,'Mercury');
```



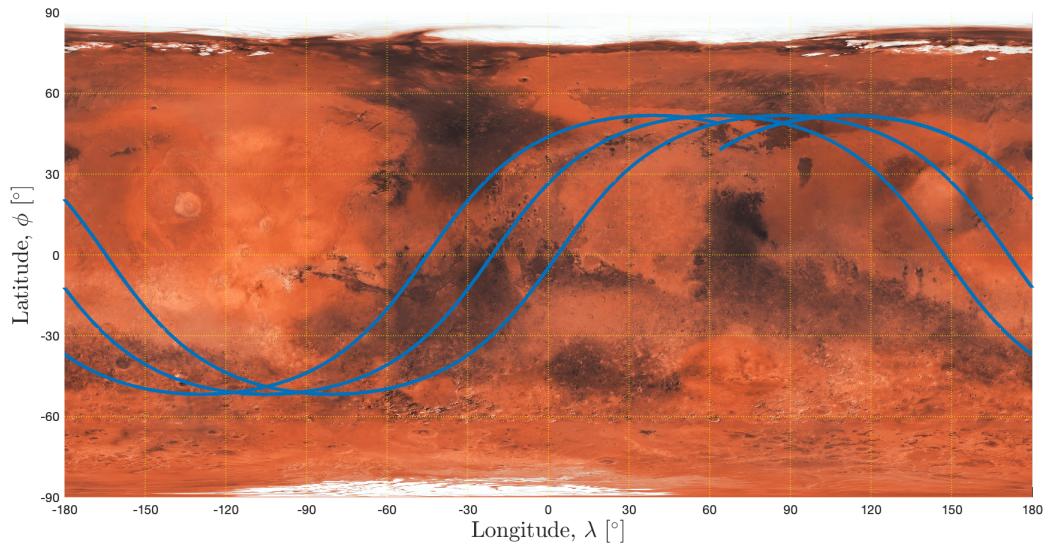
Venus

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[],[],'Venus');
```



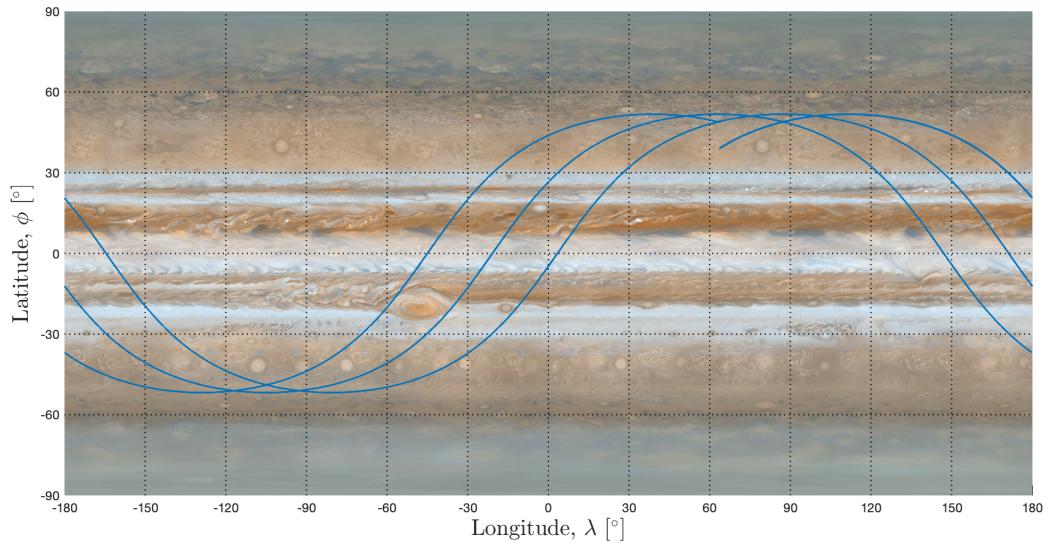
Mars

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[],3,'Mars');
```



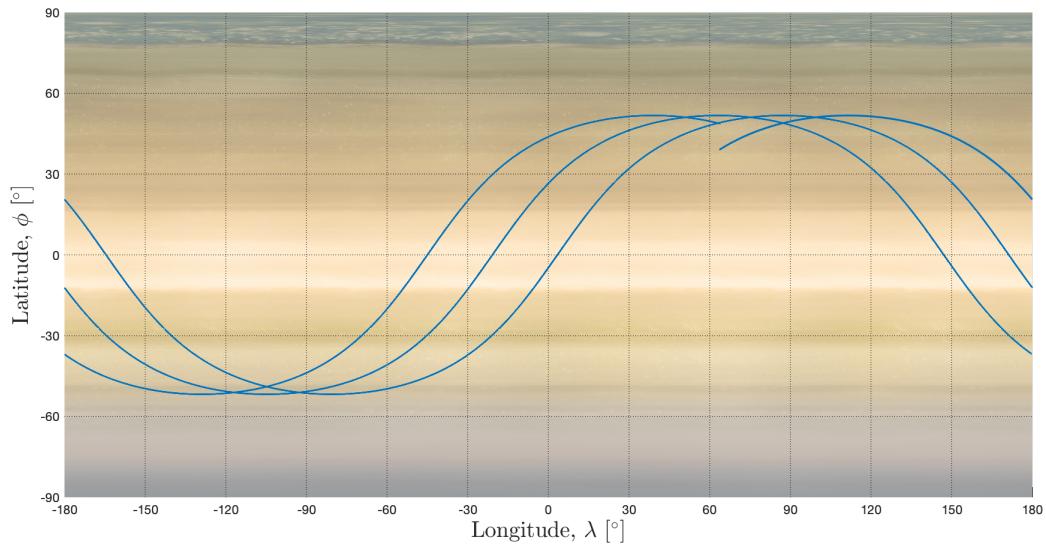
Jupiter

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[],[],'Jupiter');
```



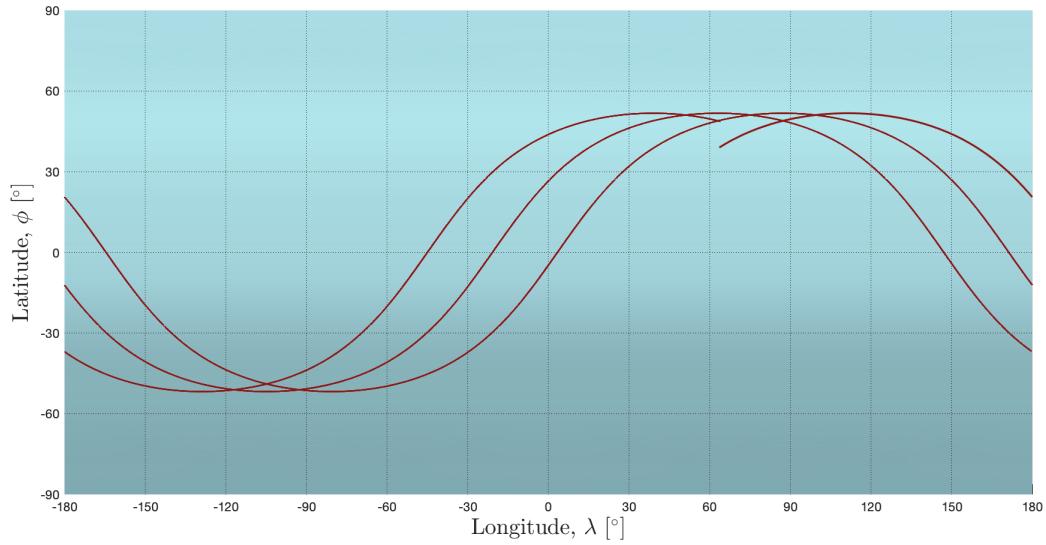
Saturn

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[],[],'Saturn');
```



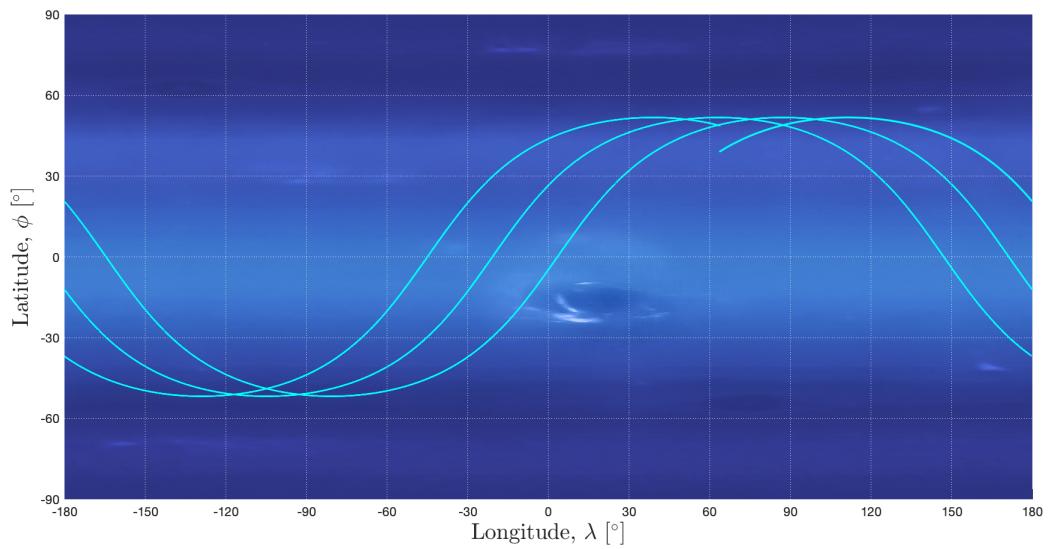
Uranus

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[140,21,21]/255,[],'Uranus');
```



Neptune

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,'c',[],'Neptune');
```



Pluto

```
figure('position',[300,300,1000,500]);
ground_track(lat,lon,[],2.5,'Pluto');
```

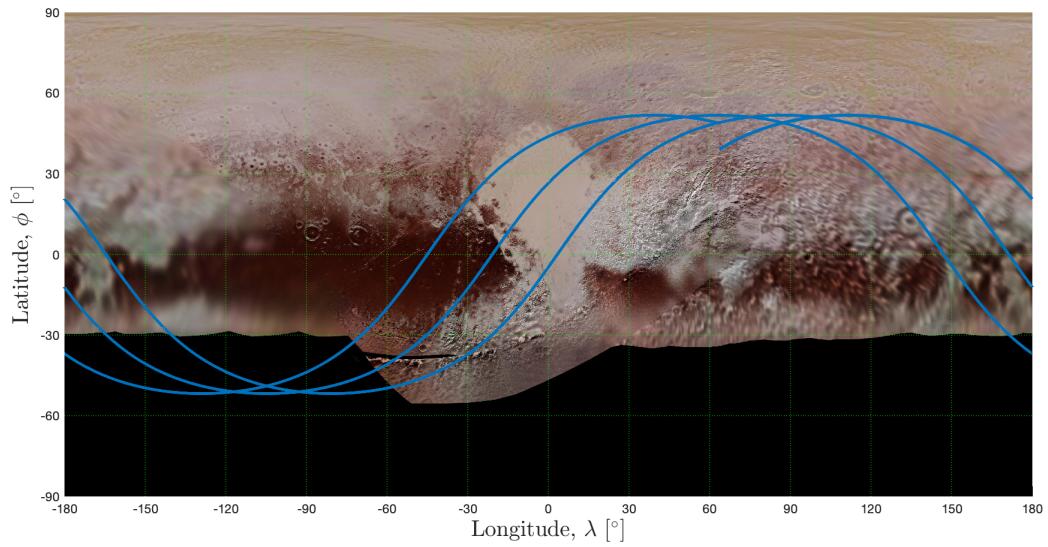


Image Sources

Image	File Name	Source	Copyright/License
Sun	Sun.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Moon	Moon.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Mercury	Mercury.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Venus	Venus.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Earth (Day)	Earth.png	[5]	none [2, 5]
Earth (Night)	Earth Night.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Clouds	Clouds.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Mars	Mars.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Jupiter	Jupiter.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Saturn	Saturn.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Uranus	Uranus.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Neptune	Neptune.png	[4]	CC Attribution 4.0 International (CC BY 4.0) [1, 4]
Pluto	Pluto.png	[3]	none [3]

References

- [1] *Attribution 4.0 International (CC BY 4.0)*. creative commons. <https://creativecommons.org/licenses/by/4.0/>. (accessed: January 27, 2021).
- [2] *Image Use Policy*. NASA visible earth. <https://visibleearth.nasa.gov/image-use-policy>. (accessed: January 23, 2021).
- [3] *Pluto Color Map*. NASA Jet Propulsion Laboratory. <https://www.jpl.nasa.gov/images/pluto-color-map/>. (accessed: January 23, 2021).
- [4] *Solar Textures*. Solar System Scope. <https://www.solarsystemscope.com/textures/>. (accessed: January 22, 2021).
- [5] *The Blue Marble: Land Surface, Ocean Color and Sea Ice*. NASA visible earth. <https://visibleearth.nasa.gov/images/57730/the-blue-marble-land-surface-ocean-color-and-sea-ice/577311>. (accessed: January 22, 2021).