GEOG210A Assignment Week1

Question1

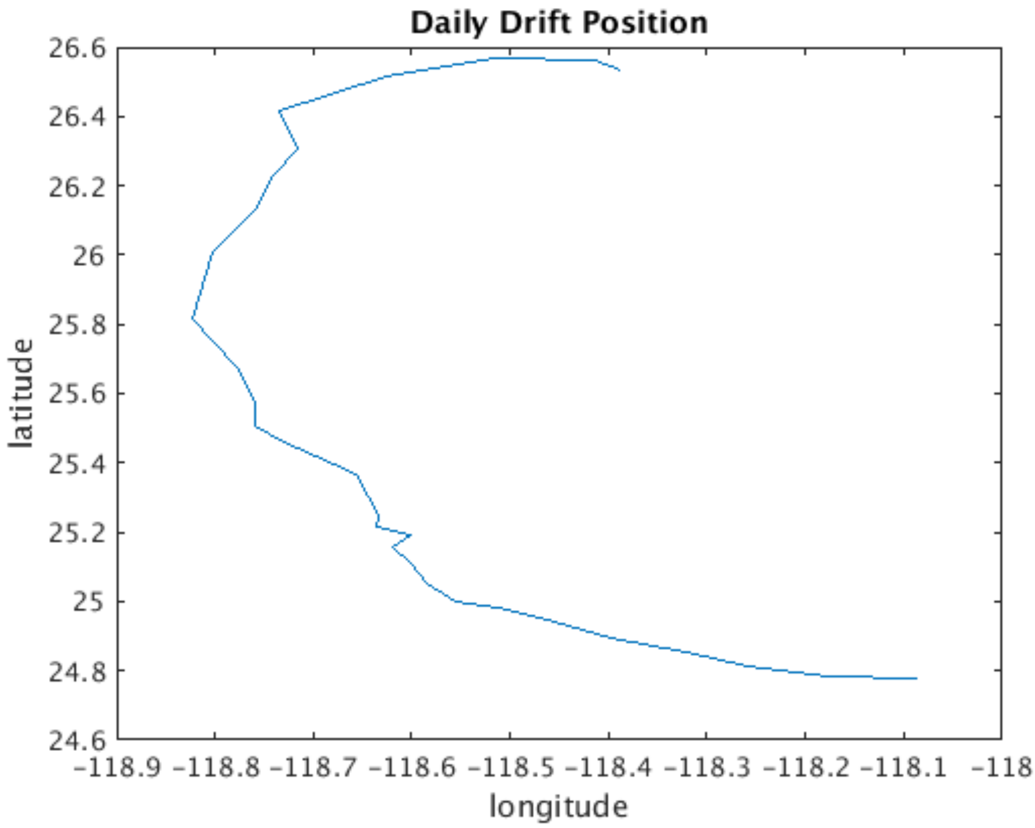
Download the daily drifter data from the GauchoSpace website. Open the data set in MATLAB.

First import the daily drifter data into the MATLAB by executing the following code:

```
fid = fopen('drifter_46926_aug2014_daily.csv');

data = textscan(fid,'%f%{MMM d, yyyy hh:mm a}D%f%f','HeaderLines',1,'Delimiter',',');

fclose(fid);

t = data{2}; % the second column is the date/time

lon = data{3}; % the third column in longitude

lat = data{4}; % the fourth column is latitude

time_elapsed_hours = 24*day(t)+hour(t)-24*day(t(1));
```

(a)In order to plot the position of the drifter at each day, I plot longitude on the x-axis and plot latitude on the y-axis (see Plot #1).

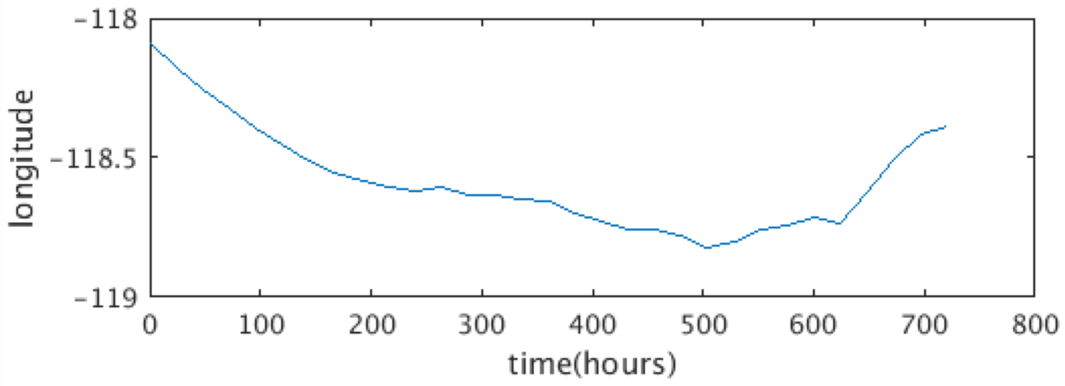
```
figure(1)

plot(lon,lat)

xlabel('longitude')

ylabel('latitude')

title('Daily Drift Position')
```



Plot#1

(b) Use subplot to split a figure into an upper and lower plot window. In the upper plot window, plot the longitude (x-coordinate) of the drifter as a function of time (in hours).

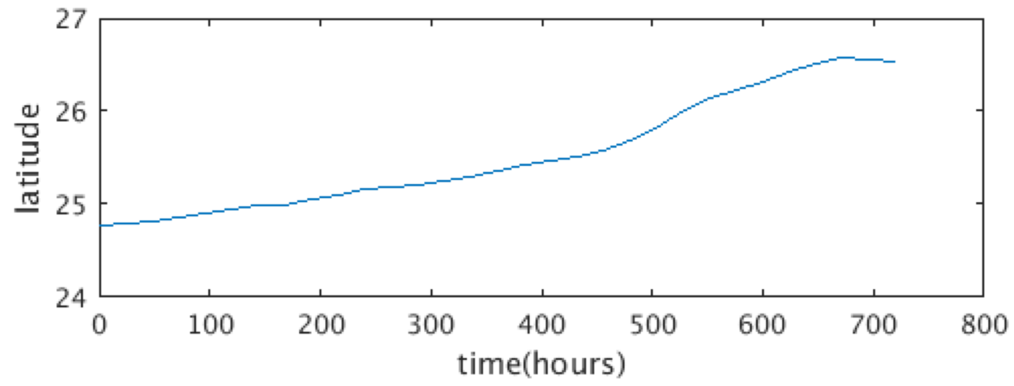
```
figure(2)

subplot(2,1,1)

plot(time_elapsed_hours,lon)

xlabel('time(hours)')

ylabel('longitude')
```



Plot#2

(c) Use subplot to split a figure into an upper and lower plot window. In the upper plot window, plot the latitude (y-coordinate) of the drifter as a function of time (in hours).

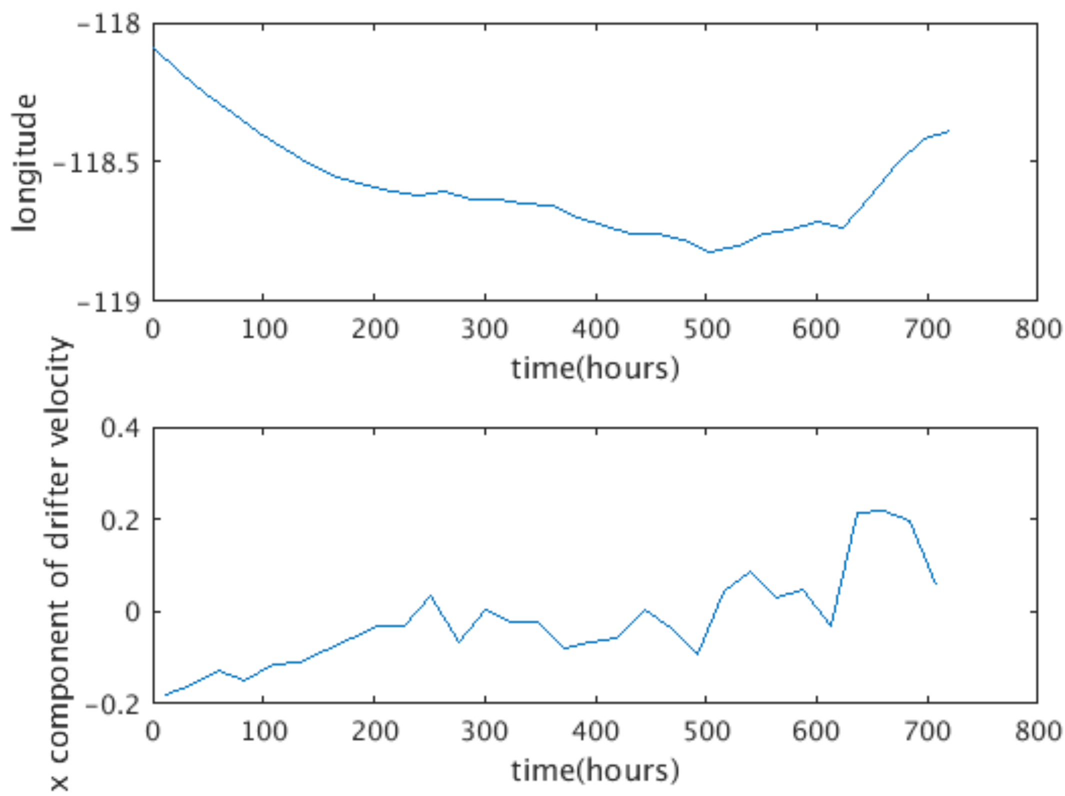
```
figure(3)
subplot(2,1,1)
plot(time_elapsed_hours,lat)
xlabel('time(hours)')
ylabel('latitude')
```



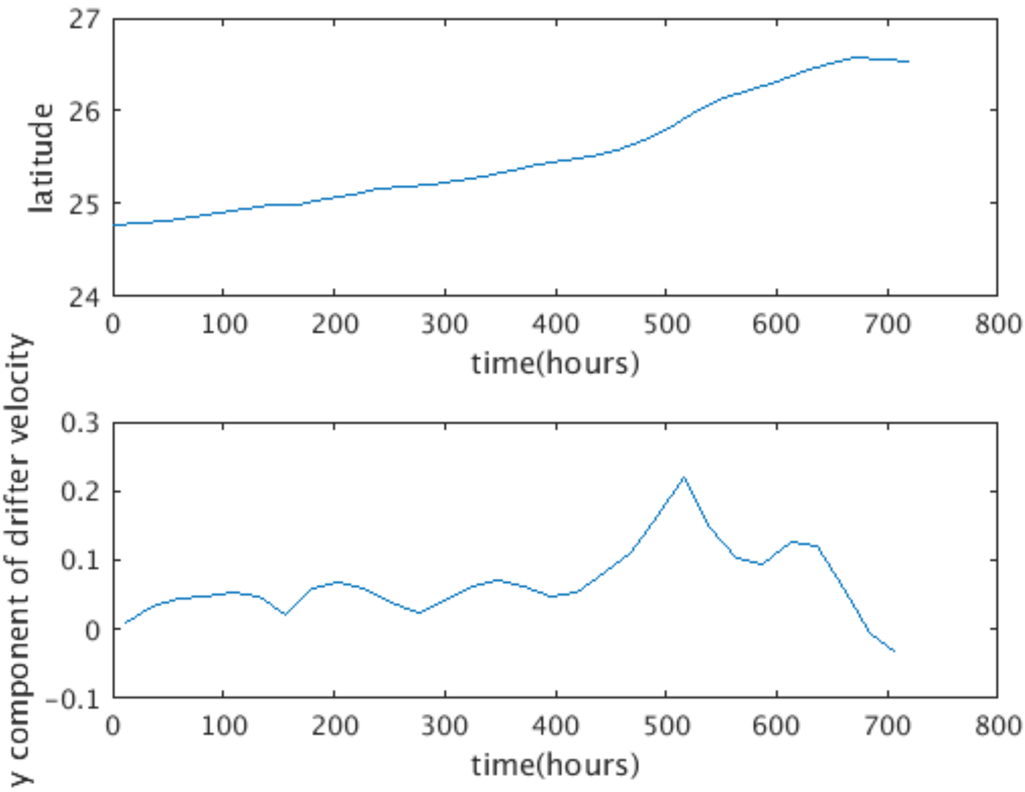
(d) Calculate the x-component and y-component of the drifter velocity in cm/s. In the lower window of Plot #2, plot the x-component of the drifter velocity as a function of time (in hours). In the lower window of Plot #3, plot the y-component of the drifter velocity as a function of time (in hours).

```
x = cos(lon*2*pi/360)*111.2*1000*100;  %longitude

y = lat*1000*100;%latitude

nx = length(x);

dx = x(2:nx)- x(1:nx-1);% x, longitude difference

dy = (y(2:nx)- y(1:nx-1)); % y, latitude difference

dt = 60*60*24; %in second

v_x = dx./dt;

v_y = dy./dt;

t1 = 0.5*(time_elapsed_hours(2:nx)+time_elapsed_hours(1:(nx-1)));
```

```
% d(1)

figure(2)

subplot(2,1,2)

plot(t1,v_x)

xlabel('time(hours)')

ylabel('x component of drifter velocity')

% d(2)

figure(3)

subplot(2,1,2)

plot(t1,v_y)

xlabel('time(hours)')

ylabel('y component of drifter velocity')
```



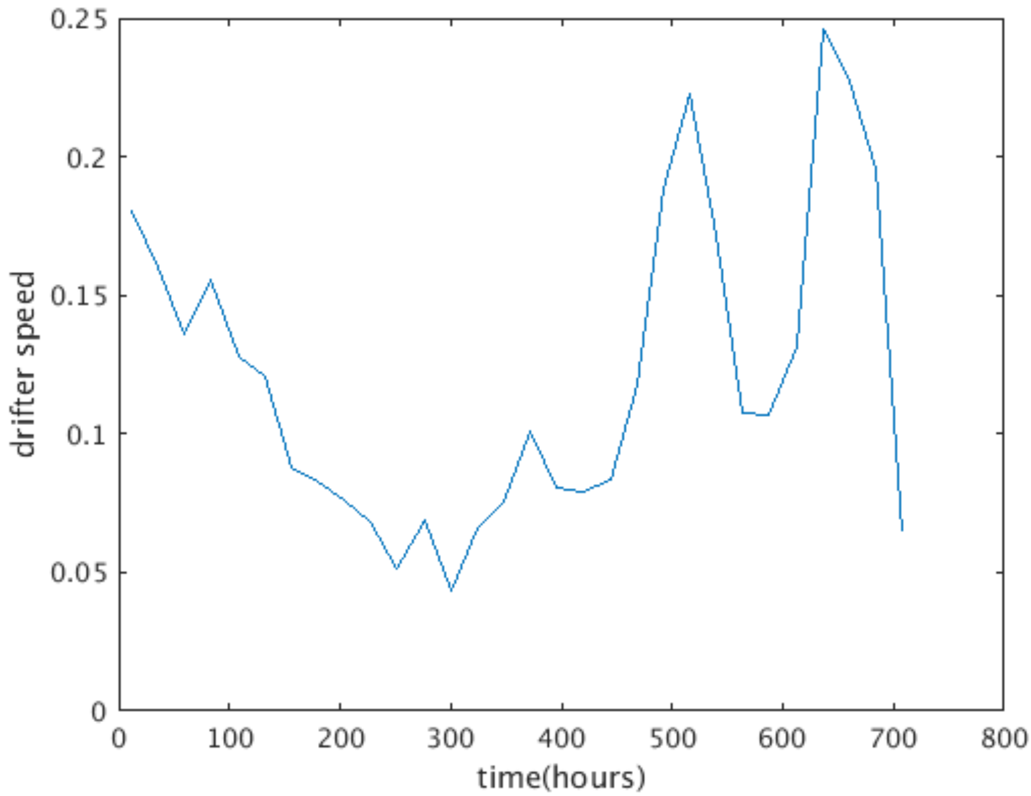
Plot #2



Plot#3

(e) Calculate the speed of the drifter (use the Pythagorean Theorem). Plot #4: plot the drifter speed (in cm/s) as a function of time (in hours). What is the average speed of the drifter over the month?

```
speed = (v_x.^2 + v_y.^2).^(1/2); %  speed of the drifter

figure(4)

plot(t1,speed)

month = 30;

xlabel('time(hours)');

ylabel('drifter speed');
```



Plot #4

The average speed over the month is calculated by the following code:

```
speed_month = sum(speed)/month

speed_month = 0.1208
```

The average speed over the month is 0.1208 m/s.

(f) Compare the plots of position and velocity (upper and lower panels of plots #2 and #3).

Identify the maxima and minima of the position plots. What is the velocity at these points?

In order to get the position of maxima and minima points in the plot #2 and plot#3, the following code is executed:

```
lon_max = max(lon)

lon_max = -118.0870
```

```
lon_min = min(lon)

lon_min = -118.8230

lat_max =max(lat)

lat_max = 26.56

lat_min =min(lat)

lat_min =24.777090
```

In plot#2, the time of the maximam position in the upper plot is 0, which correspond to 0 m/s of the x component of the drifter velocity; the time of the minimum position in the upper plot is 500h, which correspond to the x component of drifter velocity to be around -0.1m/s .

In plot#3, the time of the maximam position in the upper plot is around 670h, which correspond to around 0m/s of the y component of the drifter velocity; the time of the minimum position in the upper plot is 0, which correspond to the 0m/s of the y component of the drifter velocity

Question2

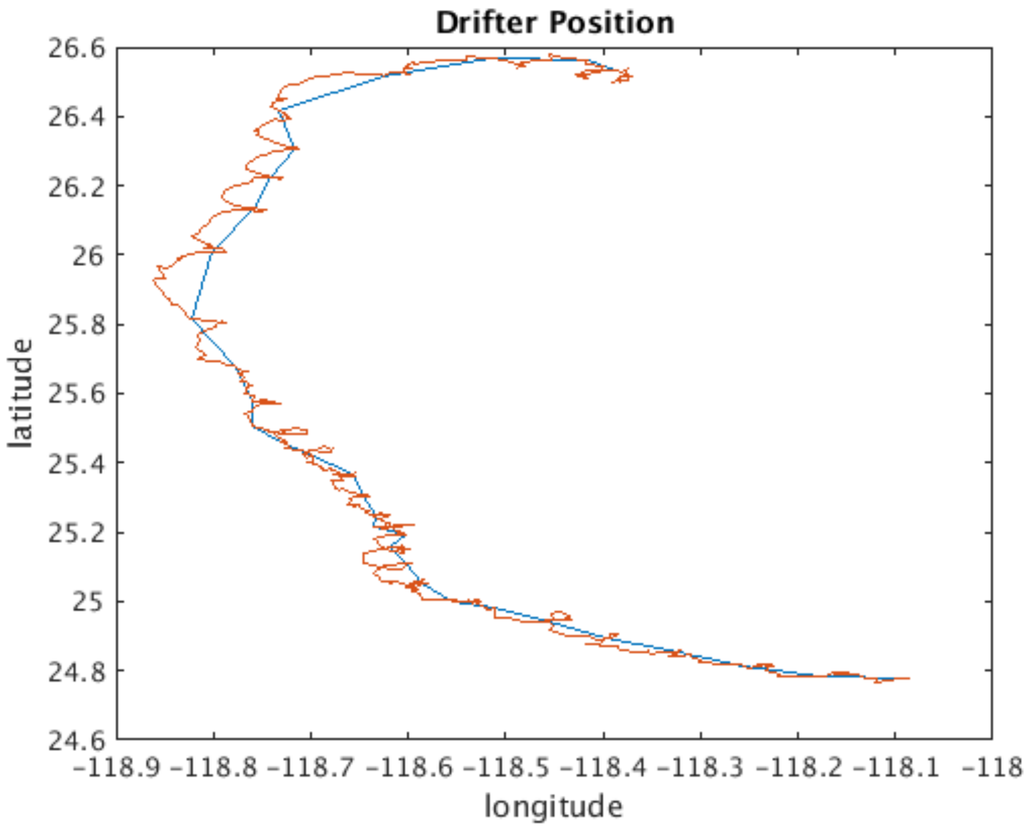
Load file:

```
% load the daily drifter data

fid_h = fopen('drifter_46926_aug2014_hourly.csv');

data_h = textscan(fid_h,'%f%{MMM d, yyyy hh:mm a}D%f%f','HeaderLines',1,'Delimiter',',');

fclose(fid_h);


% extract the data

t_h = data_h{2}; % the second column is the date/time

lon_h = data_h{3}; % the third column in longitude

lat_h = data_h{4}; % the fourth column is latitude
```

```
% calculate the time elapsed in hours

% want to make the first time = 0

time_elapsed_hours_h = 24*day(t_h)+hour(t_h)-24*day(t_h(1));


x_h = cos(lon_h*2*pi/360)*111.2*1000*100;  %longitude

y_h = lat_h*1000*100;%latitude

nx_h = length(x_h);

dx_h = x_h(2:nx_h)- x_h(1:nx_h-1);% x, longitude difference

dy_h = (y_h(2:nx_h)- y_h(1:nx_h-1)); % y, latitude difference

dt_h = 60*60; %in second

v_x_h = dx_h./dt_h;

v_y_h = dy_h./dt_h;

t1_h = 0.5*(time_elapsed_hours_h(2:nx_h)+time_elapsed_hours_h(1:(nx_h-1)));
```

(a) In order to plot the position of the drifter at each day, I plot longitude on the x-axis and plot latitude on the y-axis (see Plot # 1).

```
figure(1)

plot(lon,lat)

hold on

plot(lon_h,lat_h)


xlabel('longitude')

ylabel('latitude')

title('Drifter Position')
```

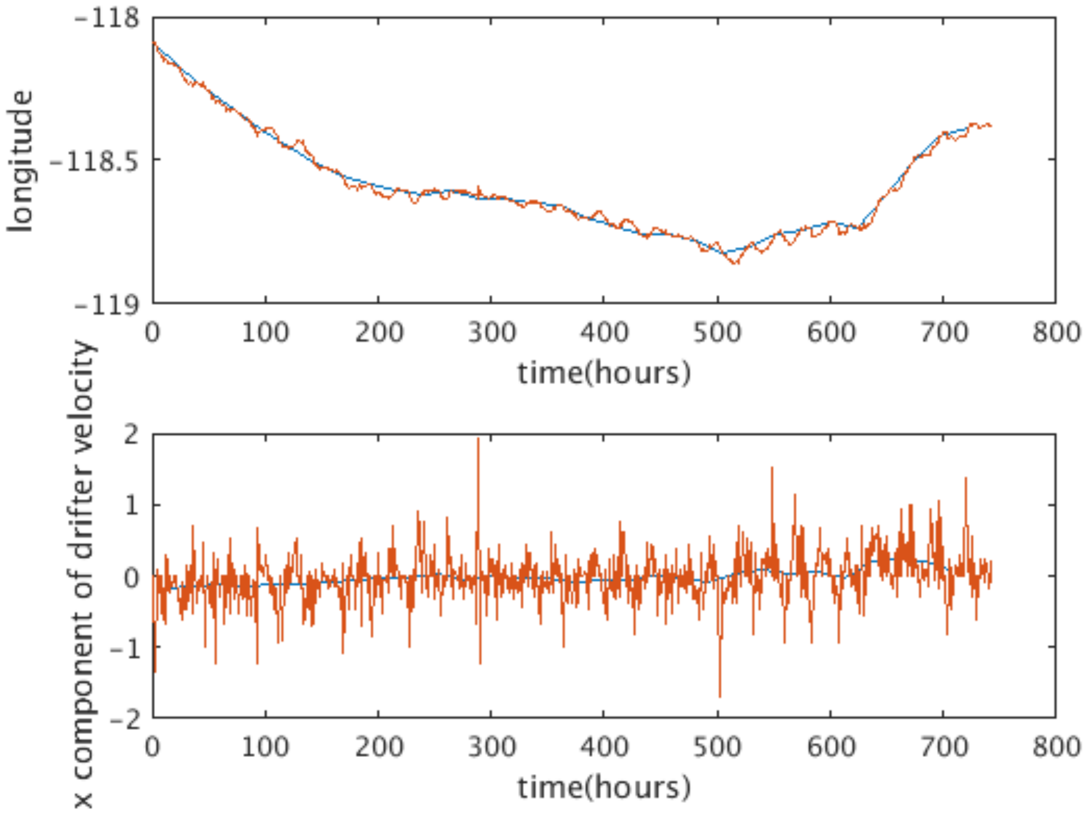


Plot #1

(b) Use subplot to split a figure into an upper and lower plot window. In the upper plot window, plot the longitude (x-coordinate) of the drifter as a function of time (in hours).

```
figure(2)

subplot(2,1,1)

plot(time_elapsed_hours,lon)

hold on

plot(time_elapsed_hours_h,lon_h)

xlabel('time(hours)')

ylabel('longitude')

subplot(2,1,2)

plot(t1,v_x)

hold on

plot(t1_h,v_x_h)
```

```
xlabel('time(hours)')

ylabel('x component of drifter velocity')
```

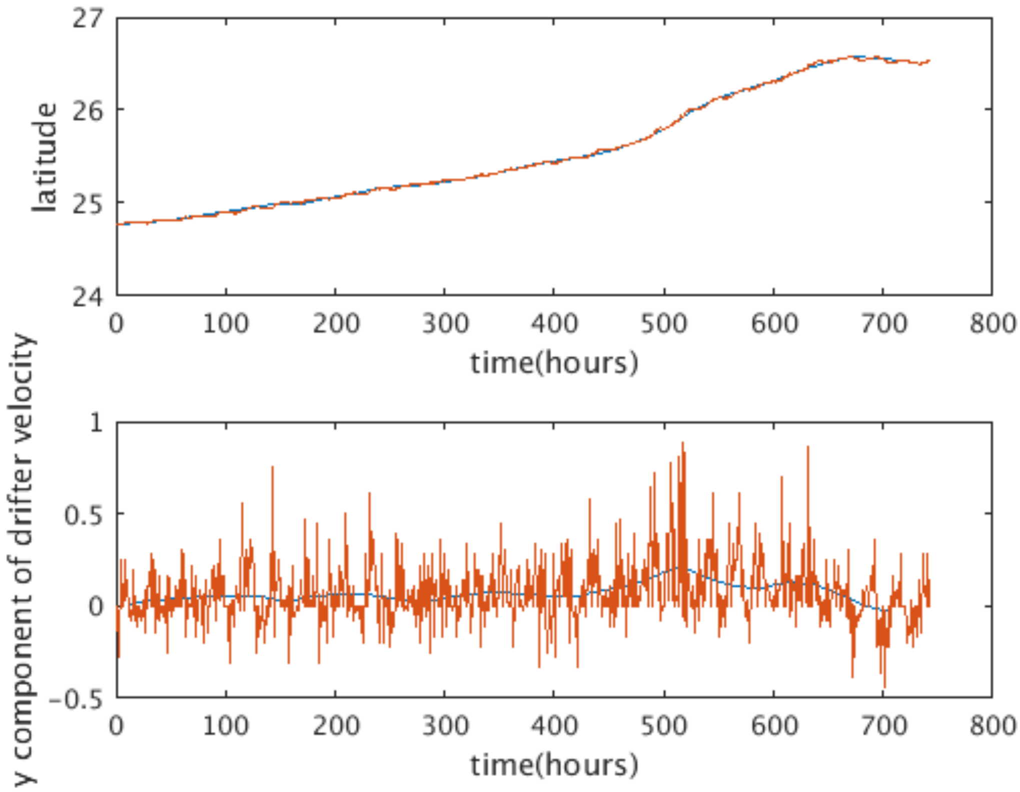


Plot #2

(c) Use subplot to split a figure into an upper and lower plot window. In the upper plot window, plot the latitude (y-coordinate) of the drifter as a function of time (in hours).

```
figure(3)

subplot(2,1,1)

plot(time_elapsed_hours,lat)

hold on

plot(time_elapsed_hours_h,lat_h)

xlabel('time(hours)')

ylabel('latitude')

subplot(2,1,2)
```

```
plot(t1,v_y)

hold on

plot(t1_h,v_y_h)

xlabel('time(hours)')

ylabel('y component of drifter velocity')
```

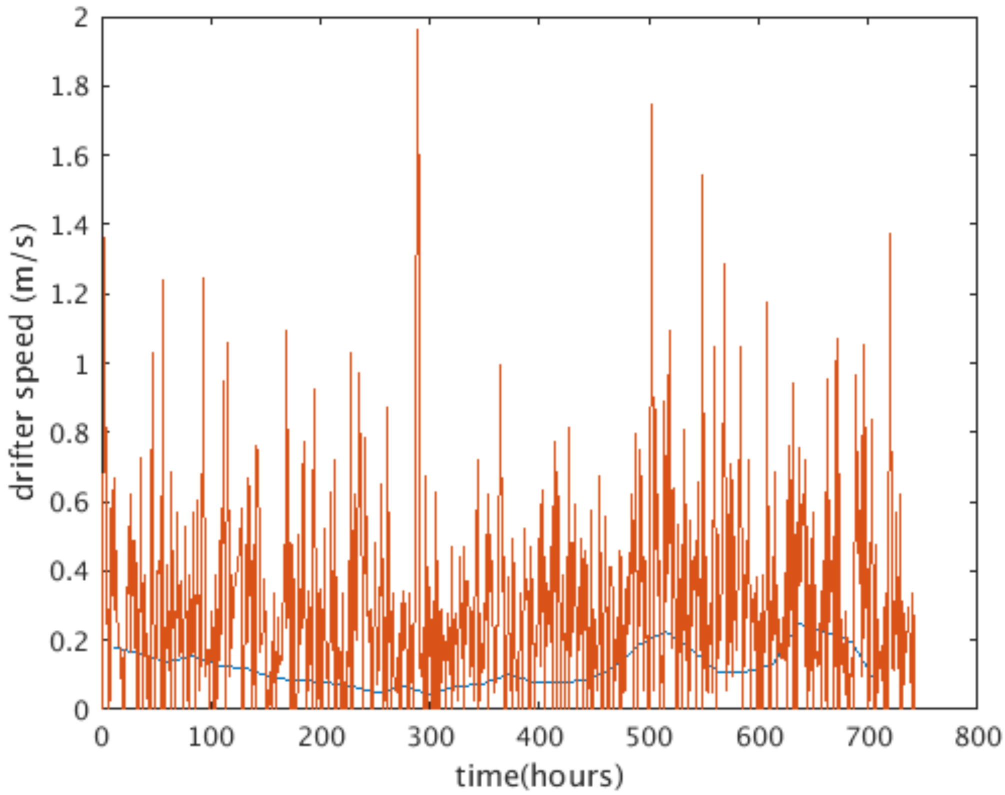


Plot#3

(e) Calculate the speed of the drifter (use the Pythagorean Theorem). Plot #4: plot the drifter speed (in cm/s) as a function of time (in hours). What is the average speed of the drifter over the month?

```
speed = (v_x.^2 + v_y.^2).^(1/2); %  speed of the drifter

speed_h = (v_x_h.^2 + v_y_h.^2).^(1/2);

figure(4)

plot(t1,speed)
```

```
hold on

plot(t1_h,speed_h)

xlabel('time(hours)');

ylabel('drifter speed (m/s)');
```



Plot#4

We calculate the speed over the month by executing the following code:

```
month_h = 30*24;

speed_month_h = sum(speed_h)/month_h

speed_month_h =    0.2761
```

So, the speed over the month is 0.2761 m/s.

(f) Compare the plots of position and velocity (upper and lower panels of plots #2 and #3).

Identify the maxima and minima of the position plots. What is the velocity at these points?

In order to get the position of maxima and minima points in the plot #2 and plot#3, the following code is executed:

```
lat_min =min(lat)

lat_min =24.7770

lon_h_max = max(lon_h)

lon_h_max = -118.0870

lat_h_max = max(lat_h)

lat_h_max =26.5770

lat_h_min = min(lat_h)

lat_h_min = 24.7670
```

In plot#2, the time of the maximam position in the upper plot is 0, which correspond to -1.3 m/s of the x component of the drifter velocity; the time of the minimum position in the upper plot is 510h, which correspond to the x component of drifter velocity to be around -0.2m/s.

In plot#3, the time of the maximam position in the upper plot is around 680h, which correspond to around 0.3m/s of the y component of the drifter velocity; the time of the minimum position in the upper plot is 0, which correspond to the -0.25m/s of the y component of the drifter velocity.

Other questions:

(a)Compare the drifter velocities calculated in Questions 1 and 2 at time t = 240 hours. Which is closer to the true velocity? Why?

I think the drifter velocities in Question2 is closer to the true velocity, because the velocity is less generalized at that specific time point (hourly).

(b)How does the average speed of the drifter computed using hourly data compare to the average speed of the drifter computed using daily data? Why?

The average speed of the drifter computed using daily data is 0.1208m/s while using hourly data is 0.2761m/s. The hourly data file provides more data during the same time period (one month) and will be a more thoroughly record than the daily one. The daily data has been generalized with 24 hours so it tends to be smaller than the daily data.

(3) What do you think causes the oscillations in the position of the drifter over the course of a day?

I think the factor that cause the oscillations could be the gravity between earth and sun during the day and the weather (rainy, cloudy, sunny, etc.) stability.