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```
close all; clear all
```

# 1: Enter and run the script below. Change the values of sigma and

```
%subplots 3 and 4 you will have to design a complementary low-pass
%filter (using sigma=5) and plot it and its frequency response.
%Recall that the way to create a high pass filter is to add a central
%delta function to the negative values of the low pass FIR filter.

figure(1); subplot(2,2,1) % low-pass gaussain spatial filter
sigma = 5;
m = 17; n = 17;
flow = fspecial('gaussian',[n m],[sigma]);
mesh(0:m-1,0:n-1,flow);
title('gaussian 2-D low pass filter')
subplot(2,2,2) % and its frequency response
flow_fft = abs(fft2(flow));
mesh(0:m-1,0:n-1,flow_fft);
title('gaussian 2-D filter amplitude response')


subplot(2,2,3) % create high pass filter from the gaussian

flow_high = -flow;
flow_high(9,9) = flow_high(9,9)+1;
mesh(0:m-1,0:n-1,flow_high)
title('high pass filter gaussian')


subplot(2,2,4) % derive the amplitude response from above
title('high pass filter amplitude response')
fhigh_noshift = abs(fft2(flow_high));
fhigh_fft = fftshift(fhigh_noshift);
mesh(0:m-1,0:n-1,fhigh_fft)
title('high pass filter amplitiude response')
```
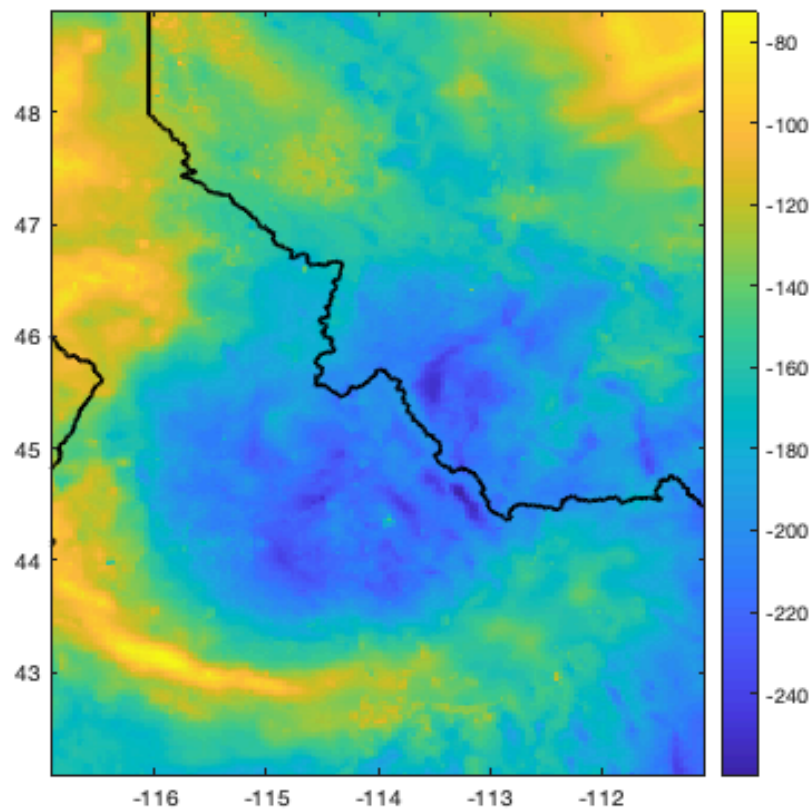
gaussian 2-D low pass filter

gaussian 2-D filter amplitude response

high pass filter gaussian

high pass filter amplitiude response
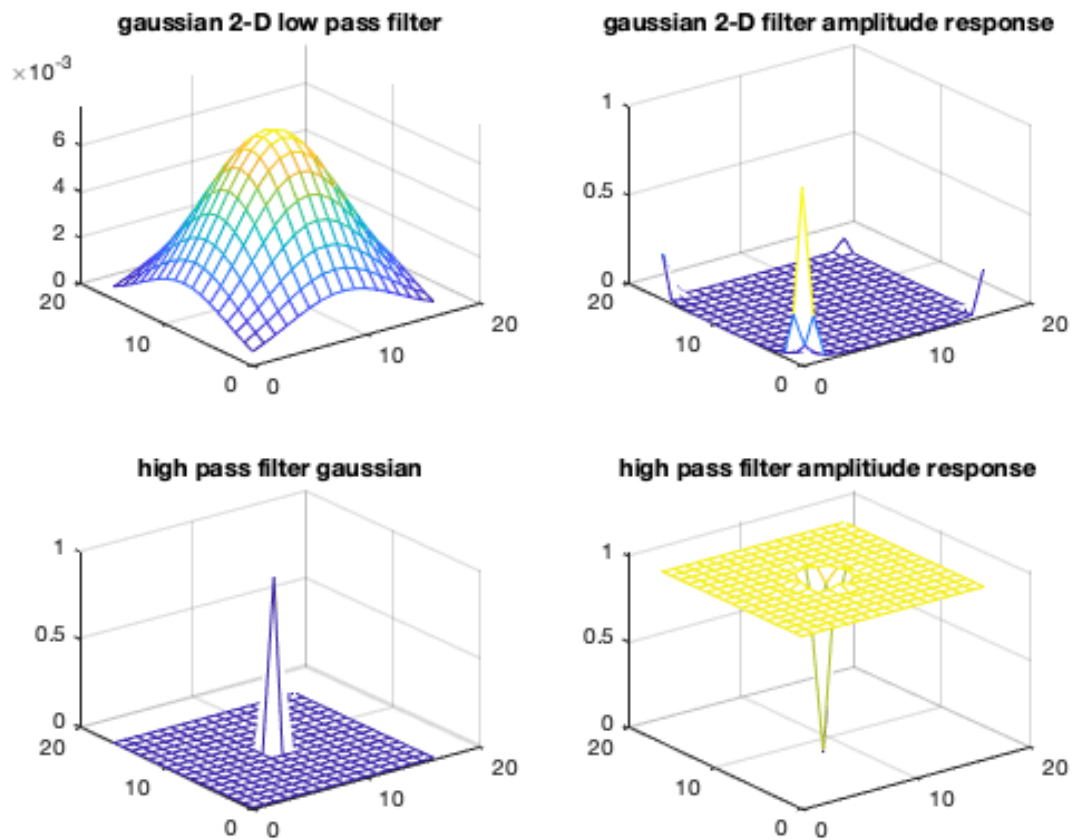
Problem 2 :

```
load('Idaho_grav_grid.mat')
load('grav_data.mat')

figure(2)
imagesc(lons,lats,grav);hold on
plot(Idaho.Lon, Idaho.Lat,'k', 'LineWidth',2)
set(gca, 'ydir', 'normal')
daspect([1 1 1])
c = colorbar;
```
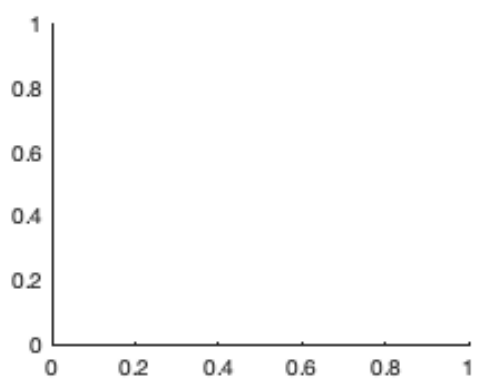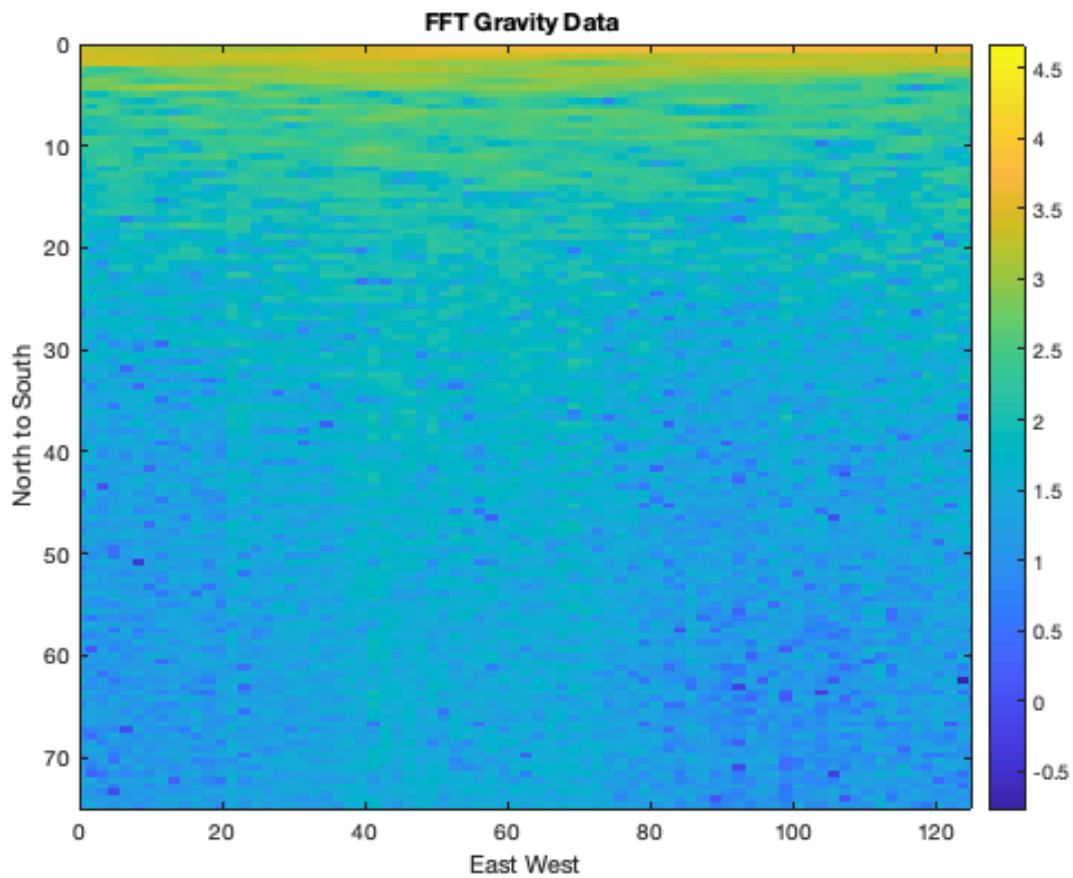
Problem 3

```
amp = abs(fft(grav));
gspec = log10(amp);
f1 = 0:length(grav(:,1)-1);
f2 = 0:length(grav(1,:)-1);
subplot(2,2,1) % 2D fft
figure(3)
imagesc(f1,f2, gspec)
title('FFT Gravity Data ')
xlabel('East West')
ylabel('North to South')
xlim([0 125]) % this is the nyquist (east to west)
ylim([0 75]) %this is nyquist for lat (north to south)
colorbar
```

FFT Gravity Data

```
lp = conv2(flow, gspec);
hp = conv2(flow_high, gspec);

figure(4); clf
subplot(2,1,1)
imagesc(f1,f2,lp); % low pass
title('Low Pass Filtered FFT')
xlabel('Cycles per km by Latitude')
ylabel('Cycles per km by Longitude')

xlim([1 125])
ylim([0 75])


subplot(2,1,2)

imagesc(f1,f2,hp); %high pass
title('High Pass Filtered FFT')
xlabel('Cycles per km by Latitude')
ylabel('Cycles per km by Longitude')
xlim([1 125])
ylim([0 75])
```
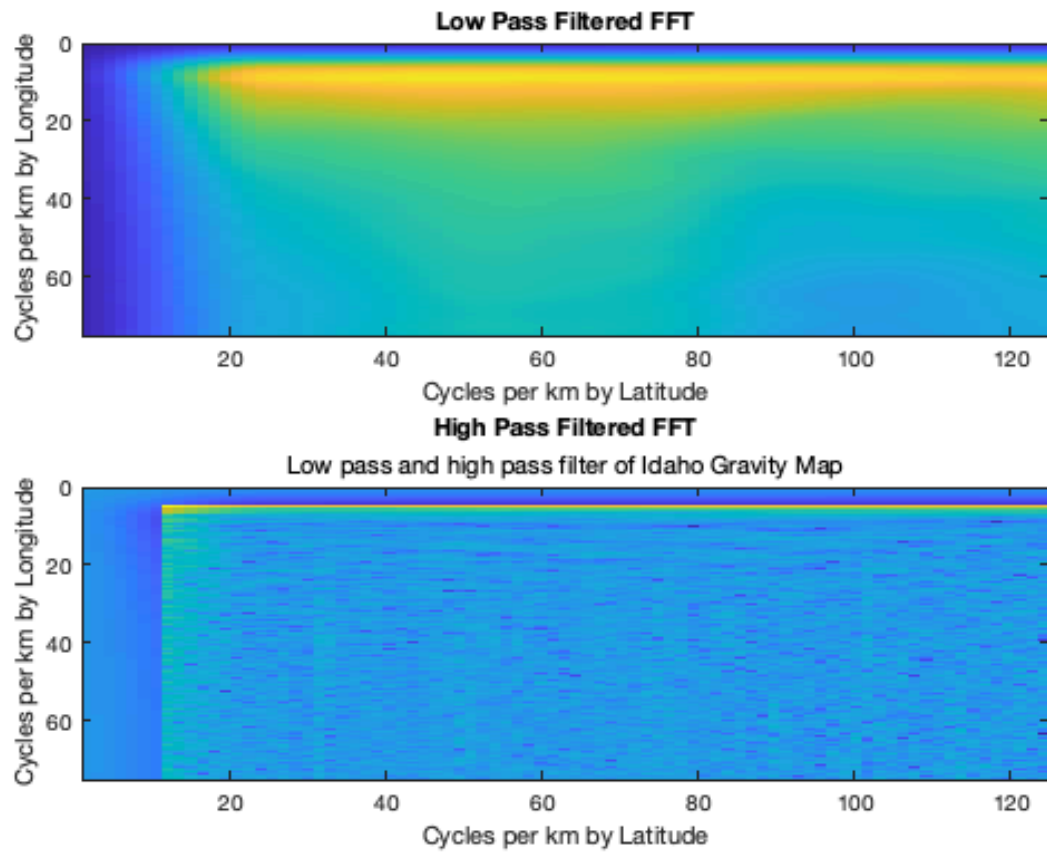
```
subtitle('Low pass and high pass filter of Idaho Gravity Map')
```

Low Pass Filtered FFT

Cycles per km by Longitude

Cycles per km by Latitude

High Pass Filtered FFT

Low pass and high pass filter of Idaho Gravity Map

Cycles per km by Longitude

Cycles per km by Latitude

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