Part 1

```
clear all
clc
close all
%read data from files
[wlno2,csno2] =textread('NO2_DIFFXSECTION_2014.DAT','%f%f','headerlines',17);
%[pixel,dk1] = textread('darkin_1.DAT','%f%f','headerlines',16);
%[pixel,dk2] =textread('darkin_2.DAT','%f%','headerlines',16);
%[pixel,dk3] =textread('darkin_3.DAT','%f%','headerlines',16);
%[pixel,dk4] =textread('darkin_4.DAT','%f%','headerlines',16);
%dk=zeros(1024,100);
%writing loop for dark measurement data
dk=zeros(1024,100);
for i=1:4;
   n=i+0;
   cell_dk = strcat('darkin_', num2str (n),'.dat');
   [pixel,dk_all] = textread(cell_dk,'%f%f','headerlines',16);
    dk(:,i)= dk_all;
end
%writing loop for data measurement with cell
I=zeros(1024,100);
for i=1:100;
  n= i+0;
  incell = strcat('incell_', num2str (n),'.dat');
  [pixel,Iin] = textread(incell, '%f%f','headerlines' ,16);
  I(:,i) = Iin;
end
I0=zeros(1024,100);
for i=1:100;
    n=i+0;
    outcell = strcat('outcell_', num2str (n),'.dat');
    [pixel,Iout] = textread(outcell,'%f%f','headerlines',16);
    I0(:,i) = Iout;
end

%substracting the dark current from measurements
for j=1:100
    for i=1:1024
    I0(i,j)=I0(i,j)-dk(i);
    I(i,j)=I(i,j)-dk(i);
    end
end
%wavelength calibration
a0 = 429.494;
a1 = 93.112
a2 = -6.050;
N = 1024;
for i=37:402
    wl(i-36) =a0*((i-1)/(N-1))^0 + a1*((i-1)/(N-1))^1 + a2*((i-1)/(N-1))^2;
end
%wavelength 432.5 -> 37 ; 465 -> 402 (1->366)
for j=1:100
    for i=37:402
        l(i-36,j) = log (I0(i,j)/I(i,j));
    end
```

```
end
%fitting polynomy to data and generating differential optical depth
for j=1:100
    p(:,j)= polyfit (transpose(wl),l(:,j),3);
    pV(:,j)= polyval(p(:,j),wl);
    dp(:,j)= l(:,j)-pV(:,j);
end
figure(1)
plot(wl,dp)
Xlabel('Wavelength(nm)');
ylabel('Differential optical depth');
title('NO2 cell Measurements');
measurement=int2str(transpose(1:100));
leg=legend(measurement);
set(leg,'FontSize',5,'Location','Eastoutside');
csno2i = interp1(wlno2,csno2,wl);
%NO2 cross-section
figure(2)
plot(wl,csno2i)
xlabel('Wavelength(nm)')
ylabel('Differential NO2 cross-section (molec/cm^2)')
title('NO2 reference')
for j=1:100;
 [dofi(:,j),stdy(:,j)] = lscov(transpose(csno2i),dp(:,j));
end
h=10.5;
conc=dofi/h;
st=stdy./h;
time1 = zeros(1,100);
    for i = 1:100
       % num = num2str(i);

        % Loading files with NO2 cell:

            in_file = strcat('incell_',num2str(i),'.dat');
            fid = fopen(in_file,'r');
                    textscan(fid,'%s%s%s%s%f','headerlines',1);
                    time_str = fgets(fid,8);
                    time1(1,i) = datenum(time_str);
                    frewind(fid);
            fclose(fid);
    end
figure(3)
hold on;
plot(time1,conc)
errorbar(time1,conc,st,'xr')
datetick('x','HH:MM:SS');
xlabel('Time')
ylabel('Concentration (molec/cm^3)' )
title('NO2 concentration in cell' )
legend('Bremen, May 13th(Morning), 2015' );
```

Part 2

```
clear all
clc
%close all
%read data from files
[wlno2,csno2]=textread('NO2_DIFFXSECTION_2014.DAT','%f%f','headerlines',17);
%[pixel,dk1] = textread('darkin_1.DAT','%f%f','headerlines',16);
%[pixel,dk2] =textread('darkin_2.DAT','%f%','headerlines',16);
%[pixel,dk3] =textread('darkin_3.DAT','%f%','headerlines',16);
%[pixel,dk4] =textread('darkin_4.DAT','%f%','headerlines',16);
%dk=zeros(1024,100);
%writing loop for dark measurement data
dk=zeros(1024,100);
for i=1:4;
   n=i+0;
   cell_dk = strcat('darkin_', num2str (n),'.dat');
   [pixel,dk_all] = textread(cell_dk,'%f%f','headerlines',16);
    dk(:,i)= dk_all;
end
%writing loop for data measurement without cell
I=zeros(1024,100);
for i=2:100;
  n= i+0;
  outcell = strcat('outcell_', num2str (n),'.dat');
  [pixel,Iout] = textread(outcell, '%f%f','headerlines',16);
  I(:,i-1) = Iout;
end
[pixel,I0(:,1)]=textread('outcell_1.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,2)]=textread('outcell_2.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,3)]=textread('outcell_3.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,4)]=textread('outcell_4.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,5)]=textread('outcell_5.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,6)]=textread('outcell_6.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,7)]=textread('outcell_7.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,8)]=textread('outcell_8.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,9)]=textread('outcell_9.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,10)]=textread('outcell_10.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel, I(:,11)]=textread('outcell_11.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,12)]=textread('outcell_12.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,13)]=textread('outcell_13.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,14)]=textread('outcell_14.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,15)]=textread('outcell_15.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,16)]=textread('outcell_16.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,17)]=textread('outcell_17.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,18)]=textread('outcell_18.DAT' , ' %f%f' , 'headerlines' ,16);
% [pixel,I(:,19)]=textread('outcell_19.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,20)]=textread('outcell_20.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,21)]=textread('outcell_21.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,22)]=textread('outcell_22.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,23)]=textread('outcell_23.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,24)]=textread('outcell_24.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,25)]=textread('outcell_25.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:, 26)]=textread('outcell_26.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,27)]=textread('outcell_27.DAT' , '%f%f' , 'headerlines' ,16);
```

```
% [pixel,I(:,28)]=textread('outcell_28.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,29)]=textread('outcell_29.DAT' , '%f%f' , 'headerlines' , 16);
% [pixel,I(:,30)]=textread('outcell_30.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,31)]=textread('outcell_31.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,32)]=textread('outcell_32.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,33)]=textread('outcell_33.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,34)]=textread('outcell_34.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,35)]=textread('outcell_35.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,36)]=textread('outcell_36.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,37)]=textread('outcell_37.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,38)]=textread('outcell_38.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,39)]=textread('outcell_39.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,40)]=textread('outcell_40.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,41)]=textread('outcell_41.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,42)]=textread('outcell_42.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,43)]=textread('outcell_43.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,44)]=textread('outcell_44.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,45)]=textread('outcell_45.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,46)]=textread('outcell_46.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,47)]=textread('outcell_47.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,48)]=textread('outcell_48.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,49)]=textread('outcell_49.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,50)]=textread('outcell_50.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,51)]=textread('outcell_51.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,52)]=textread('outcell_52.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,53)]=textread('outcell_53.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,54)]=textread('outcell_54.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,55)]=textread('outcell_55.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,56)]=textread('outcell_56.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,57)]=textread('outcell_57.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,58)]=textread('outcell_58.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,59)]=textread('outcell_59.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,60)]=textread('outcell_60.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,61)]=textread('outcell_61.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,62)]=textread('outcell_62.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,63)]=textread('outcell_63.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,64)]=textread('outcell_64.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,65)]=textread('outcell_65.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,66)]=textread('outcell_66.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,67)]=textread('outcell_67.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,68)]=textread('outcell_68.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,69)]=textread('outcell_69.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,70)]=textread('outcell_70.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,71)]=textread('outcell_71.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,72)]=textread('outcell_72.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,73)]=textread('outcell_73.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,74)]=textread('outcell_74.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,75)]=textread('outcell_75.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,76)]=textread('outcell_76.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,77)]=textread('outcell_77.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,78)]=textread('outcell_78.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,79)]=textread('outcell_79.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,80)]=textread('outcell_80.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,81)]=textread('outcell_81.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,82)]=textread('outcell_82.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,83)]=textread('outcell_83.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,84)]=textread('outcell_84.DAT' , '%f%f' , 'headerlines' ,16);
```

```
% [pixel,I(:,85)]=textread('outcell_85.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,86)]=textread('outcell_86.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,87)]=textread('outcell_87.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,88)]=textread('outcell_88.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,89)]=textread('outcell_89.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,90)]=textread('outcell_90.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,91)]=textread('outcell_91.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,92)]=textread('outcell_92.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,93)]=textread('outcell_93.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,94)]=textread('outcell_94.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,95)]=textread('outcell_95.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel, I(:,96)]=textread('outcell_96.DAT' , '%f%f' , 'headerlines',16);
% [pixel,I(:,97)]=textread('outcell_97.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,98)]=textread('outcell_98.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,99)]=textread('outcell_99.DAT' , '%f%f' , 'headerlines' ,16);
% [pixel,I(:,100)]=textread('outcell_100.DAT' , '%f%f' , 'headerlines',16);

%substracting the dark current from measurements
for j=1:100
    for i=1:1024
    I(i,j)=I(i,j)-dk(i);
    end
end

%wavelength calibration
a0 = 429.494;
a1 = 93.112;
a2 = -6.050;
N = 1024;
for i=37:402
    wl(i-36) = a0*((i-1)/(N-1))^0 + a1*((i-1)/(N-1))^1 + a2*((i-1)/(N-1))^2;
end
%wavelength 432.5 -> 37 ; 465 -> 402 (1->366)
for j=1:100
    for i=37:402
        l(i-36,j) = log (I0(i,1)/I(i,j));
    end
end
%fitting polynomy to data and generating differential optical depth
for j=1:100
    p(:,j)= polyfit (transpose(wl),l(:,j),3);
    pV(:,j)= polyval(p(:,j),wl);
    dp(:,j)= l(:,j)-pV(:,j);
end
csno2i = interp1(wlno2,csno2,wl);
for j=1:100
    [dofi(:,j),stdv(:,j)] = lscov(transpose(csno2i),dp(:,j));
end
% conc = dofi;
% st=stdv

time = zeros(1,100);

    for i = 1:100
        num = num2str(i);

        % Loading files with NO2 cell:
```

```
            in_file = strcat('outcell_',num,'.dat');
            fid = fopen(in_file,'r');
                    textscan(fid,'%s%s%s%s%f','headerlines',1);
                    time_str = fgets(fid,8);
                    time(1,i) = datenum(time_str);
                    frewind(fid);
            fclose(fid);
    end
% time1 = {'09:12:15:87','09:15:33:26','09:17:08:85','09:18:47:37',...
%     '09:20:22:90','09:21:41:73','09:22:50:00','09:24:10:84',...
%     '09:25:44:53','09:27:07:27','09:28:21:13','09:29:31:50',...
%     '09:30:47:36','09:32:05:45','09:33:30:88','09:34:54:62',...
%     '09:36:16:07','09:37:27:91','09:38:27:92','09:39:49:51',...
%     '09:41:07:86','09:42:11:98','09:43:10:40','09:44:21:00',...
%     '09:45:18:80','09:46:11:70','09:47:52:14','09:48:48:81',...
%     '09:49:55:75','09:50:55:53','09:52:03:13','09:53:08:47',...
%     '09:54:13:15','09:55:10:62','09:56:14:43','09:57:15:39',...
%     '09:58:22:11','09:59:26:73','10:00:17:77','10:01:15:51',...
%     '10:02:14:85','10:03:08:00','10:04:14:94','10:05:20:37',...
%     '10:06:20:73','10:07:17:92','10:08:20:38','10:09:14:53',...
%     '10:10:19:33','10:11:12:67','10:12:03:94','10:12:50:85',...
%     '10:14:20:65','10:15:21:02','10:16:20:05','10:17:36:04',...
%     '10:18:26:29','10:19:15:00','10:20:12:09','10:21:08:46',...
%     '10:22:36:18','10:23:25:03','10:24:22:62','10:25:19:11',...
%     '10:26:16:49','10:27:09:90','10:28:00:14','10:28:48:00',...
%     '10:30:21:94','10:31:12:84','10:32:02:28','10:32:51:72',...
%     '10:33:37:04','10:34:23:62','10:35:17:70','10:36:06:19',...
%     '10:36:50:91','10:37:39:73','10:38:37:79','10:39:30:34',...
%     '10:39:30:34','10:41:05:86','10:41:48:29','10:42:32:11',...
%     '10:43:23:80','10:44:14:11','10:45:16:15','10:46:55:55',...
%     '10:47:39:67','10:48:32:07','10:49:19:77','10:50:03:91',...
%     '10:50:54:34','10:51:42:00','10:52:32:92','10:53:23:39',...
%     '10:54:06:78','10:54:52:15','10:55:32:98','10:56:20:79'};

% n=100;
% time=zeros(1,n);
% for i= 1:100
%     [~,~,~,mid_time]=textread(strcat('outcell_',num2str(i),'.DAT'),'%s%s%s
%s','headerlines',1);
%     mid_time=mid_time{1};
%     mid_time=mid_time(1:8);
%     [~,~,~,hour,min,sec]=datevec(mid_time);
%     time(1,i)=3600*hour+60*min+sec;
% end
%
% time=time-time(1);
% time2 = time(2:end);
%
%  time1=char(time1);
%  time2=datenum(time1(:,1:9));
plot(time,dofi)
hold on;
errorbar(time,dofi,stdv,'xr')
datetick('x' , 'HH:MM:SS' )
xlabel('Time (s)')
ylabel('NO2 Slant Column(molec/cm^2)' )
```

```
title('NO2 concentration in the atmosphere' )
legend('Bremen, May 13th(Morning), 2015');
```

Part 3

```
clear all
clc
%read data from files
[wlno2,csno2] =textread('NO2_DIFFXSECTION_2014.DAT' , '%f%f' , 'headerlines' ,
17);
%[pixel,dk] =textread('darkin_.DAT' , '%f%f' , 'headerlines' ,16);
dk=zeros(1024,15);
for i=1:4;
   n=i+0;
   cell_dk = strcat('darkin_', num2str (n),'.dat');
   [pixel,dk_all] = textread(cell_dk,'%f%f','headerlines',16);
   dk(:,i)= dk_all;
end
I=zeros(1024,15);
for i=1:15
 [ pixel, I(:,i)]= textread ([ 'Horizon_' ,num2str(i), '.DAT' ], '%f%f' ,
'headerlines' ,16);
end
 [pixel, I0]= textread ('outcell_100.DAT' , '%f%f' , 'headerlines' ,16);
%substracting the dark current from the measurements
for j=1:15
 for i=1024:1
 I0(i,j)=I0(i,j) -dk(i);
 I(i,j)=I(i,j) -dk(i);
 end
end
% wavelength calibration
a0 = 429.494;
a1 = 93.112;
a2 = -6.050;
N = 1024;
for i=37:402
 wl(i-36) = a0*((i-1)/(N-1))^0 + a1*((i-1)/(N-1))^1 + a2*((i-1)/(N-1))^2;
end
%wavelength 432.5 -> 37 ; 465 -> 402 (1->366)
for j=1:15;
 for i=37:402
 l(i-36,j) = log (I0(i,1)/I(i,j));
 end
```

```
end
%fitting the polynomy to the data and generating the differential optical
%depth
for j=1:15;
 p(:,j)= polyfit(transpose(wl),l(:,j),3);
 pV(:,j) = polyval(p(:,j),wl);
 dp(:,j) = l(:,j) -pV(:,j);
end
csno2i = interp1(wlno2,csno2,wl);
for j=1:15;
 [dofi(:,j),stdy(:,j)] = lscov(transpose(csno2i),dp(:,j));
end
h=10.5
conc=dofi/h;
st=stdy./h;
angle=[1:15];
time = {'11:15:14:48','11:17:20:06','11:21:31:32','11:24:59:62',...
    '11:25:44:30','11:26:27:13','11:27:07:20','11:27:47:54',...
    '11:28:24:91','11:29:05:45','11:29:55:46','11:30:59:89',...
    '11:31:51:56','11:32:33:79','11:33:12:45'};
time1 = char(time);
time2 = datenum(time1(:,1:9));
figure(1)
hold on;
plot(angle,conc)
errorbar(angle,conc,st, 'xr' )
xlabel('elevation angle' )
ylabel('NO2-SC(molec/cm^2)' )
title('NO2 SC concentration vs. elevation angle')
legend('Bremen, May 13th(Morning), 2015' );
```

Part 4

```
clear
clc
[wlno2,csno2] =textread('NO2_DIFFXSECTION_2014.DAT' , '%f%f' , 'headerlines' ,
17);
%[pixel,dk] =textread('dark_cell.DAT' , '%f%f' , 'headerlines' ,16);
for i=1:4;
   cell_dk = strcat('darkin_', num2str (i),'.dat');
   [pixel,dk_all] = textread(cell_dk,'%f%f','headerlines',16);
   dk(:,i)= dk_all;
end
%I=zeros(1024,15);
for i=1:15
 [ pixel, I(:,i)]= textread ([ 'Horizon_' ,num2str(i), '.DAT' ], '%f%f' ,
'headerlines' ,16);
end
```

```
 [pixel, I0]= textread ('outcell_100.DAT' , '%f%f' , 'headerlines' ,16);
for i=1:1024
 I0(i) = I0(i) -dk(i);
 I(i) = I(i) - dk(i);
end
a0 = 429.204;
a1 = 94.016;
a2 = -6.770;
N = 1024;
for i=37:402
 wl(i-36) = a0*((i-1)/(N-1))^0 + a1*((i-1)/(N-1))^1 + a2*((i-1)/(N-1))^2;
end
%wavelength 432.5 -> 37 ; 465 -> 402 (1->366)
for i=37:402
 l(i-36) = log (I0(i)/I(i));
end
p = polyfit(wl,l,3);
pV = polyval(p,wl);
dp = l-pV;
csno2i = interp1(wlno2,csno2,wl);
[dofi,stdy] = lscov(transpose(csno2i),transpose(dp));
[axis,v1,v2]=plotyy(wl,dp,wl,csno2i)
xlabel('Wavelength(nm)' )
set(get(axis(1), 'YLabel' ), 'String' , 'Measurement differential optical
depth' )
set(get(axis(2), 'YLabel' ), 'String' , 'Differential NO2 Cross-
section(cm^2/molec)' )
legend('Optical depth','NO2 cross section')
title('Differential optical depth and Absorption cross section' )
```

Part 5

```
clear all
clc
% Simulated trace gas columns above Bremen
[wl1,I] = textread ('TG_DATA_20.dat' , '%f%f' , 'headerlines' ,6);
[wl2,I0] = textread ('TG_DATA_80.dat' , '%f%f' , 'headerlines' ,6);
[wl3,O3cs] = textread ('O3_DIFFXSECTION.DAT' , '%f%f' , 'headerlines' ,6);
[wl4,BROcs] = textread ('BRO_DIFFXSECTION.DAT' , '%f%f' , 'headerlines' ,6);
[wl5, HCHOcs] = textread ('HCHO_DIFFXSECTION.DAT' , '%f%f' , 'headerlines' ,
4);
[alf, amfo3] = textread ('O3_AMF.DAT' , '%f%f' , 'headerlines' ,7);
%limiting the data with which we work to the 336-357 nm range
wl_nd1=(wl1>=336 & wl1<=357);
I=I(wl_nd1);
wl_nd2=(wl2>=336 & wl2<=357);
I0=I0(wl_nd2);
wl_nd3=(wl3>=336 & wl3<=357);
O3cs=O3cs(wl_nd3);
```

```
wl_nd4=(wl4>=336 & wl4<=357);
BROcs=BROcs(wl_nd4);
wl_nd5=(wl5>=336 & wl5<=357);
HCHOcs=HCHOcs(wl_nd5);
l = log (I./I0);
p = polyfit (wl1(wl_nd1),l,3);
pV = polyval(p,wl1(wl_nd1)) ;
dp = l-pV;
figure(1);
[axis,v1,v2]=plotyy (wl1(wl_nd1),dp,wl1(wl_nd1),O3cs);
set(get(axis(1), 'YLabel' ), 'String' , 'Measurement differential optical
depth' );
set(get(axis(2), 'YLabel' ), 'String' , 'Differential O3 Cross-
section(cm^2/molec)' );
xlabel('Wavelength (nm)' );
legend('Data' , 'O3 Cross-section' );
figure(2);
[axis,v1,v2]=plotyy (wl1(wl_nd1),dp,wl1(wl_nd1),BROcs);
set(get(axis(1), 'YLabel' ), 'String' , 'Measurement differential optical
depth' );
set(get(axis(2), 'YLabel' ), 'String' , 'Differential BrO Cross-
section(cm^2/molec)' );
xlabel('Wavelength (nm)' );
legend('Data' , 'BrO cross-section' );
figure(3);
[axis,v1,v2]=plotyy (wl1(wl_nd1),dp,wl1(wl_nd1),HCHOcs);
set(get(axis(1), 'YLabel' ), 'String' , 'Measurement differential optical
depth' );
set(get(axis(2), 'YLabel' ), 'String' , 'Differential HCHO Cross-
section(cm^2/molec)' );
xlabel('Wavelength (nm)' );
legend('Data' , 'HCHO Cross-section' );
%alf(1) for 20 degrees and alf(7) for 80 degrees
[dofi,st] = lscov(O3cs, -dp);
amfo3low = amfo3(1);
amfo3high = amfo3(7);
VC = dofi/(amfo3low-amfo3high)
stvc = st/(-amfo3low)
```