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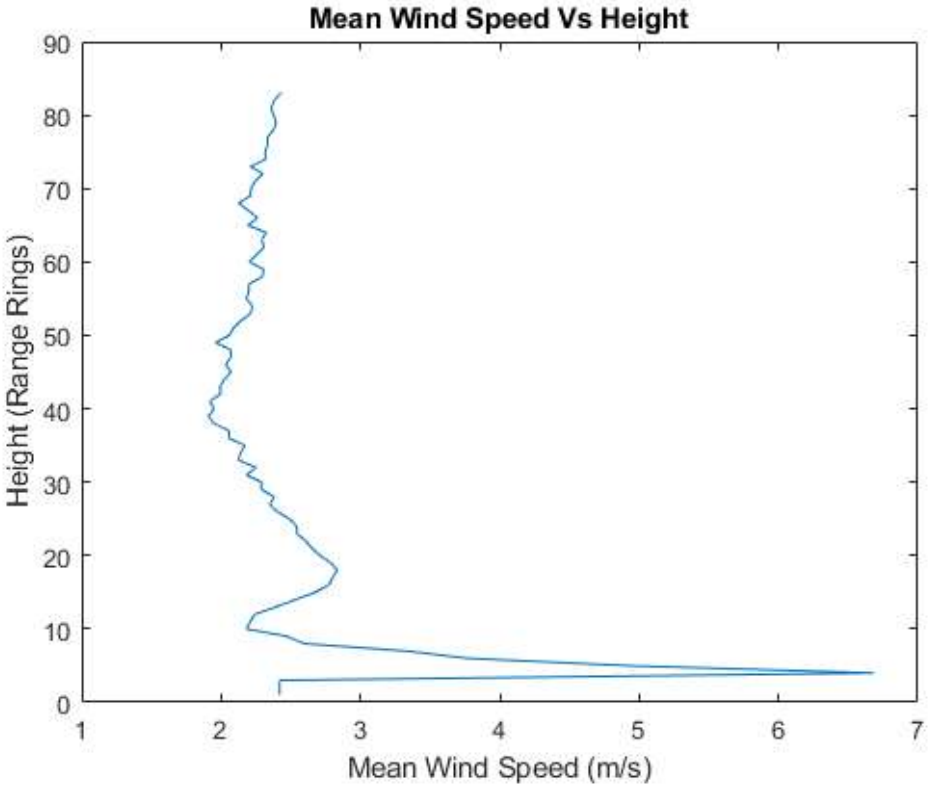
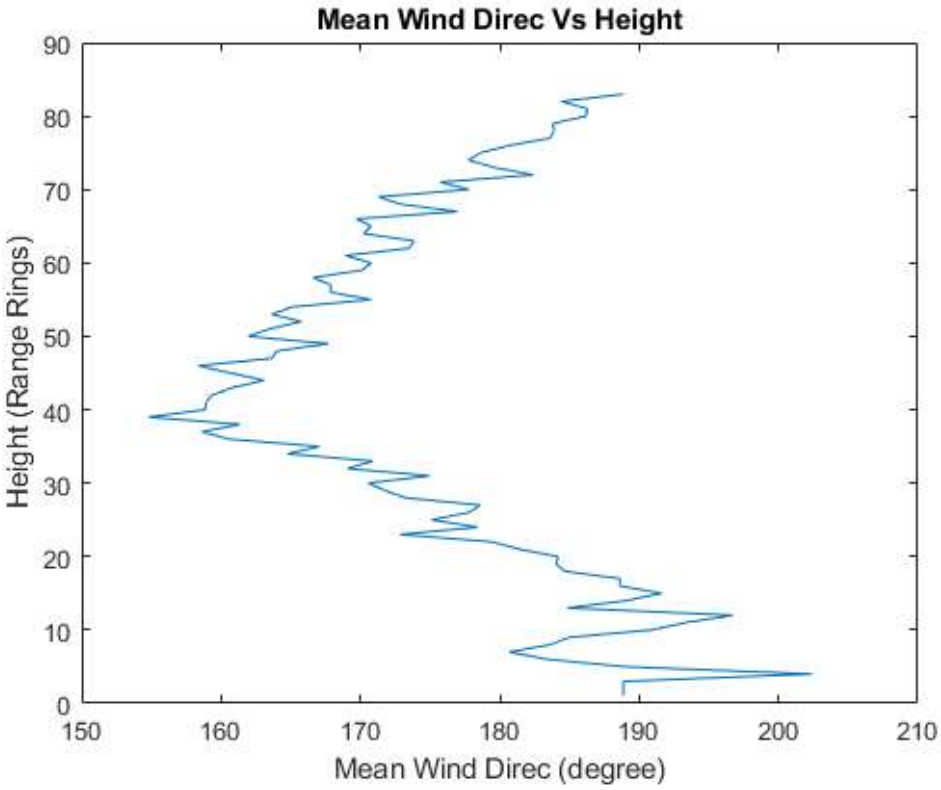
```
clear all;
close all;
clc;

% % Wind Energy HW 3 - VAD Algorithm On Given Wind Data

% % Import wind data

    load('Data_for_VAD.mat');

    %     Rv = U*sin(phi)*cos(theta) + V*cos(phi)*cos(theta);
```

VAD Calculation

```
    clc;

    A = zeros(133,2);
    B = zeros(133,1);
    T = length(Data);
    U = zeros(83,T);
    height = 1:83;
    theta = zeros(83,T);


    for t=1:T

        range = Data(t).range;
        az = Data(t).az;
        el = Data(t).el;
        rv = Data(t).rv;
        rvnan = ~isnan(Data(t).rv);

        for i = 1:size(Data(t).rv,1) % 1 to 83
        %     i=24;
            count = 0;
            for j = 1:size(Data(t).rv,2) % 1 to 133
                if rvnan(i,j) == 1
                    count = count+1;
                    A(count,1) = sind(az(i,j))*cosd(el(i,j));  %
                    A(count,2) = cosd(az(i,j))*cosd(el(i,j));
                    B(count,1) = rv(i,j);
                end
            end
            output = pinv(A)*B;
            vh = sqrt(output(1,1)^2 + output(2,1)^2);

            U(i,t) = vh;


            if output(1,1) > 0 && output(2,1) > 0
                theta(i,t) = 270 - atand(abs((output(2,1)/output(1,1)))) ;
                else if output(1,1) > 0 && output(2,1) < 0
                    theta(i,t) = 90 + atand(abs((output(2,1)/output(1,1)))) ;
                    else if output(1,1) < 0 && output(2,1) < 0
```

```
                    theta(i,t) = 270 + atand(abs((output(2,1)/output(1,1)))) ;
                    else if output(1,1) < 0 && output(2,1) > 0
                        theta(i,t) = 90 - atand(abs((output(2,1)/output(1,1))));
                    end
                end
            end
        end
    end
end



WindSpeed_Mean = mean(U,2);
WindDirec_Mean = mean(theta,2);

figure(1)
plot(WindSpeed_Mean,height)
xlabel("Mean Wind Speed (m/s)")
ylabel("Height (Range Rings)")
title('Mean Wind Speed Vs Height')

figure(2)
plot(WindDirec_Mean,height)
xlabel("Mean Wind Direc (degree)")
ylabel("Height (Range Rings)")
title('Mean Wind Direc Vs Height')
```

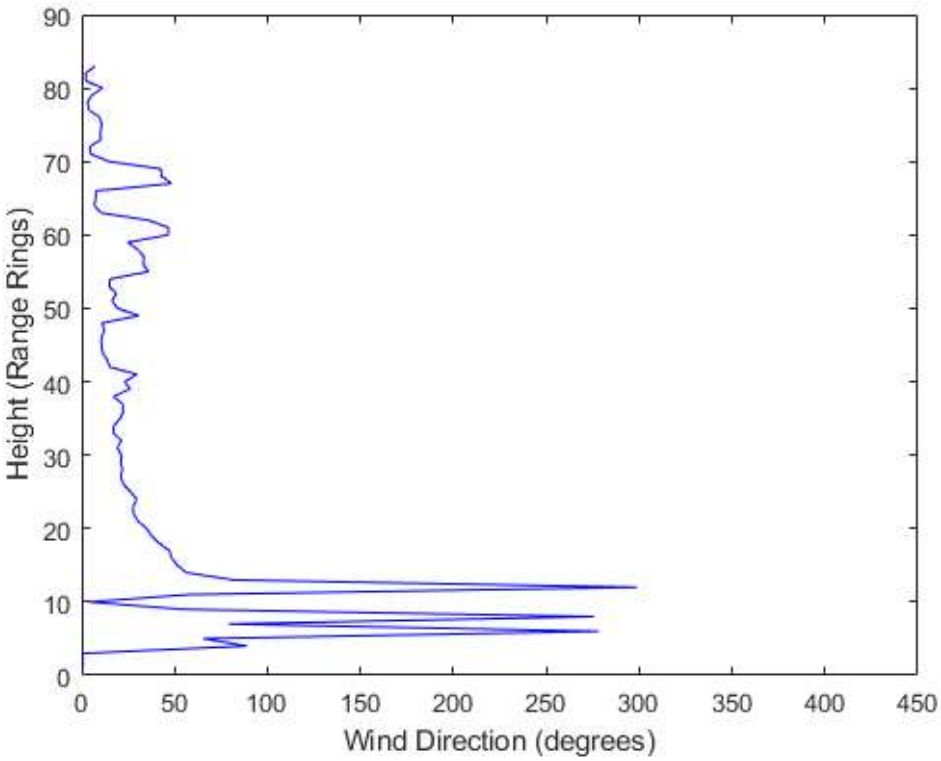




Animation

```
% Wind Speed
WindSpeed_vid = VideoWriter('E:\ASU Classes\MAE 597 Wind Energy\HW3\HW3Result\Wind_Speed_Profile.mp4','MPEG-4');
column=1;
while column<=516
    plot(U(:,column),height,'b');
```

```
    xlabel('Wind Speed (m/s)');
    ylabel('Height (Range Rings)');
    xlim([0 20]);
    pause (0.05);
    Vd1=getframe(gcf);
    open(WindSpeed_vid)
    writeVideo(WindSpeed_vid,Vd1)
column = column+1;
end
close(WindSpeed_vid)

%Wind Direction
WindDirec_vid = VideoWriter('E:\ASU Classes\MAE 597 Wind Energy\HW3\HW3Result\Wind_Direction.mp4','MPEG-4');
column=1;
while column<=516
    plot(theta(:,column),height,'b');
    xlabel('Wind Direction (degrees)');
    ylabel('Height (Range Rings)');
    xlim([0 450]);
    pause (0.05);
    Vd2=getframe(gcf);
    open(WindDirec_vid)
    writeVideo(WindDirec_vid,Vd2)
column = column+1;
end
close(WindDirec_vid)
```



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