

```

clc
clear all

pi=3.141593;
s0 = 1367;

for dj=1:365 %day loop
    fe=1+0.033*cos(2*pi*dj/365); %the eccentricity factor
    delta=0.4093*sin(2*pi*dj/365.0-1.405); %the solar declination in radians

    for k=1:361
        phi=(90-(k-1)*0.5)*pi/180; %latitude in radians
        qtot=0;
        for ih=1:24 %hour loop (1 to 24)
            t=ih-0.5; %the hour of day
            h=pi*(t-12.0)/12.0; %the hour angle in radians
            q=s0*fe*(sin(phi)*sin(delta)+cos(phi)*cos(delta)*cos(h));
            if q<0
                q=0; %negative means Sun is below horizon, set to zero
            end
            qtot = qtot + q*(60*60); %get daily cumulative
        end
        qdaily (k,dj) = qtot/10^6; %daily mean
    end

end

%%% draw the figuer like P46 Fig4.8 in Bonan's EC
grid on
[X,Y] = meshgrid(1:365,361:-1:1);
[C,h]=contour(X,Y,qdaily,5:5:45,'linewidth',1.3);
hold on
clabel(C,h);
set(gca,'xtick',[1,32,60,91,121,152,182,213,244,274,305,335],'xticklabel',...
{'          JAN','          FEB','          MAR','
APR','          MAY','          JUN',...
'          JUL','          AUG','          SEP','
OCT','          NOV','          DEC'});
set(gca,'ytick',1:20:361,'yticklabel',-90:10:90)
set(gca,'tickdir','out');
hold on
for dj=1:364
    for k=361:-1:2
        if qdaily(362-k,dj)<0.0001
            fill([dj dj dj+1 dj+1],[k k-1 k-1 k],'b')
        end
    end
end
grid on
ylabel('Latitude')

```

```
title('Daily Solar Radiation at Top of Atmosphere (MJ\cdotm^{\rm-2})')  
gtext('0')  
gtext('0')  
gtext('0')
```