## Contents



## This script calculates the TDS, SVM and CNN dust impact rates

### 1 - Read Dust Count Data

```
TDS_data = readtable('TDS_ddc.txt');
SVM_data = readtable('SVM_ddc.txt');
CNN_data = readtable('CNN_ddc.txt');

TDS_ddc = TDS_data.daily_dust_count;
SVM_ddc = SVM_data.daily_dust_count;
CNN_ddc = CNN_data.daily_dust_count;
```

### 2 - Read TDS, SVM and CNN fit data (with eq. from Zaslavsky et al. (2021))

```
fit_data = readtable('fits');
dcycle = fit_data.dutyCycle_day_;
TDS_fit = fit_data.tds_fit__day_;
SVM_fit = fit_data.svm_fit__day_;
CNN_fit = fit_data.cnn_fit__day_;

% Read time data and convert ti datetime format
fit_years = fit_data.year;
fit_months = fit_data.month;
fit_days = fit_data.day;
days_plot = datetime(fit_years,fit_months,fit_days);
```

```
Warning: Column headers from the file were modified to make them valid MATLAB
identifiers before creating variable names for the table. The original column
headers are saved in the VariableDescriptions property.
Set 'VariableNamingRule' to 'preserve' to use the original column headers as
table variable names.
```

### 3 - Read the RPW-TDS duty cycle data if correct mode is used (non nans)

```
numdays = length(CNN_ddc); % days with data

% Loop over all days
j = 1;
for i = 1:numdays
    number = CNN_ddc(i); % daily dust count (DDC) number
    if ~isnan(number)
        % if DDC is not nan, assign the duty cycle value
        dcycle(i) = fit_data.dutyCycle_day_(j);
        j = j + 1;
    else
        % if DDC is nan, assign nan to duty cycle value
        dcycle(i) = nan;
    end
end
```

### 4 - Convert from daily dust count to dust impact rates using duty cycle values

```
% Calculate medain of duty cycle values
dcm = median(dcycle(~isnan(dcycle)));

% Loop over all days
id = 1;
for i = 1:numdays
    dc = dcycle(i);

    % Ignore days without duty cycle values
    if isnan(dc)
        continue
    end

    % Ignore days without dust count values
    if isnan(CNN_data.daily_dust_count(i))
        continue
    else

        % Only consider days where the duty cycle is within 10 % of the median
        if dc < dcm*0.9 || dc < dcm*1.1

            % Convert day to datetime format
            day_str = cell2mat(CNN_data.days(i));
            day_datetime(id) = datetime([day_str(1:4),'-',day_str(6:7),'-',day_str(9:10)]);

            % Convert from daily dust count to dust impact rates using duty cycle values
            TDS_day(:,id) = TDS_data.daily_dust_count(i)/dc;
            SVM_day(:,id) = SVM_data.daily_dust_count(i)/dc;
            CNN_day(:,id) = CNN_data.daily_dust_count(i)/dc;
            id = id +1;
        else
            % If duty cycke is not within 10 %, continue
            continue
        end
    end
end
```

#### 5 - Mark days at aphelion and perihelion

```
% Aphelion days: 10-Feb-2021   12-Sep-2021
aphelion1 = cell2mat(CNN_data.days(241));
aphelion2 = cell2mat(CNN_data.days(455));

% Perihelion days: 13-Oct-2020   03-Jun-2021
perihelion1 = cell2mat(CNN_data.days(121));
perihelion2 = cell2mat(CNN_data.days(354));

% Convert to datetime format
aphelion = [datetime([aphelion1(1:4),'-',aphelion1(6:7),'-',aphelion1(9:10)]), ...
    datetime([aphelion2(1:4),'-',aphelion2(6:7),'-',aphelion2(9:10)])];
perihelion = [datetime([perihelion1(1:4),'-',perihelion1(6:7),'-',perihelion1(9:10)]), ...
    datetime([perihelion2(1:4),'-',perihelion2(6:7),'-',perihelion2(9:10)])];
```

#### 6 - Plot the dust impact rates and the fit to the data

```
% Define figure properities
FIG = figure('units','centimeters','position',[1,1,24.0,36.0]);
sx = 0.07;
sy = 0.08;
fz = 14;
mkz = 50;
mz = 5;
lw = 3;
lwr = 2;
ystart = 0;
ystop = 700;
```

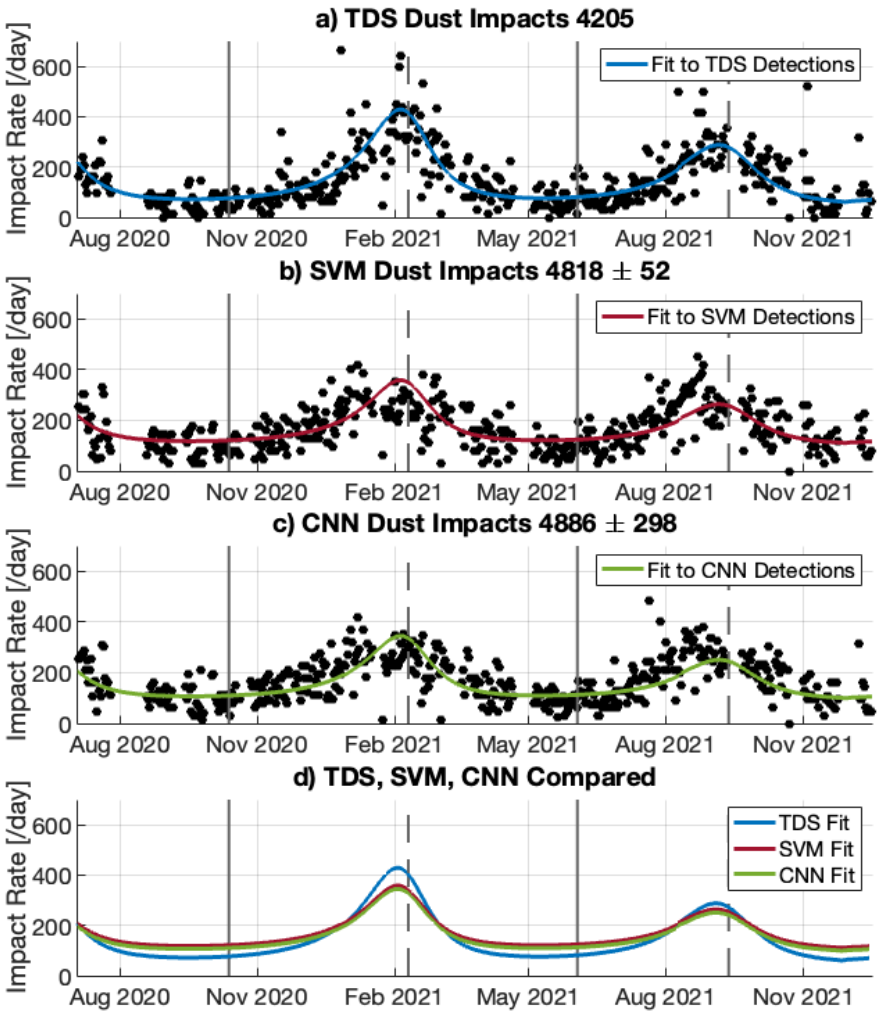
```
% Plot TDS dust detction rates and fit
subplot_tight(4,1,1,[sx sy])
hold on
scatter(day_datetime,TDS_day,mkz,'black','filled')
xlim([datetime('4-Jul-2020'); datetime('17-Dec-2021')])
ylim([ystart ystop])
plot([aphelion(1), aphelion(1)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','--','LineWidth',lwr)
plot([aphelion(2), aphelion(2)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','--','LineWidth',lwr)
plot([perihelion(1), perihelion(1)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','-','LineWidth',lwr)
plot([perihelion(2), perihelion(2)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','-','LineWidth',lwr)
a = plot(TDS_fit,'color',[0 0.4470 0.7410],'LineWidth',lw);
xticks(datetime('Aug-2020') : calmonths(3) : datetime('Dec-2021'))
title('a) TDS Dust Impacts 4205')
ylabel('Impact Rate [/day]')
legend(a,'Fit to TDS Detections')
grid on

% Plot SVM dust detction rates and fit
subplot_tight(4,1,2,[sx sy])
hold on
scatter(day_datetime,SVM_day,mkz,'black','filled')
xlim([datetime('4-Jul-2020'); datetime('17-Dec-2021')])
ylim([ystart ystop])
plot([aphelion(1), aphelion(1)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','--','LineWidth',lwr)
plot([aphelion(2), aphelion(2)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','--','LineWidth',lwr)
plot([perihelion(1), perihelion(1)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','-','LineWidth',lwr)
plot([perihelion(2), perihelion(2)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','-','LineWidth',lwr)
b = plot(SVM_fit,'color',[0.6350 0.0780 0.1840],'LineWidth',lw);
xticks(datetime('Aug-2020') : calmonths(3) : datetime('Dec-2021'))
title('b) SVM Dust Impacts 4818 \pm 52')
ylabel('Impact Rate [/day]')
legend(b,'Fit to SVM Detections')
grid on

% Plot CNN dust detction rates and fit
subplot_tight(4,1,3,[sx sy])
hold on
scatter(day_datetime,CNN_day,mkz,'black','filled')
xlim([datetime('4-Jul-2020'); datetime('17-Dec-2021')])
ylim([ystart ystop])
plot([aphelion(1), aphelion(1)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','--','LineWidth',lwr)
plot([aphelion(2), aphelion(2)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','--','LineWidth',lwr)
plot([perihelion(1), perihelion(1)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','-','LineWidth',lwr)
plot([perihelion(2), perihelion(2)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','-','LineWidth',lwr)
c = plot(CNN_fit,'color',[0.4660 0.6740 0.1880],'LineWidth',lw);
xticks(datetime('Aug-2020') : calmonths(3) : datetime('Dec-2021'))
title('c) CNN Dust Impacts 4886 \pm 298')
ylabel('Impact Rate [/day]')
legend(c,'Fit to CNN Detections')
grid on

% Compare the TDS, SVM and CNN fits
subplot_tight(4,1,4,[sx sy])
hold on
plot([aphelion(1), aphelion(1)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','--','LineWidth',lwr)
plot([aphelion(2), aphelion(2)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','--','LineWidth',lwr)
plot([perihelion(1), perihelion(1)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','-','LineWidth',lwr)
plot([perihelion(2), perihelion(2)],[ystart ystop],'color',[0.4 0.4 0.4],'LineStyle','-','LineWidth',lwr)
a = plot(days_plot,TDS_fit,'color',[0 0.4470 0.7410],'LineWidth',lw);
b = plot(days_plot,SVM_fit,'color',[0.6350 0.0780 0.1840],'LineWidth',lw);
c = plot(days_plot,CNN_fit,'color',[0.4660 0.6740 0.1880],'LineWidth',lw);
xlim([datetime('4-Jul-2020'); datetime('17-Dec-2021')])
ylim([ystart ystop])
xticks(datetime('Aug-2020') : calmonths(3) : datetime('Dec-2021'))
title('d) TDS, SVM, CNN Compared')
legend([a, b, c],{'TDS Fit','SVM Fit','CNN Fit'})
```

```
ylabel('Impact Rate [/day]')
grid on
```

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