2019 nCoV Data Processing

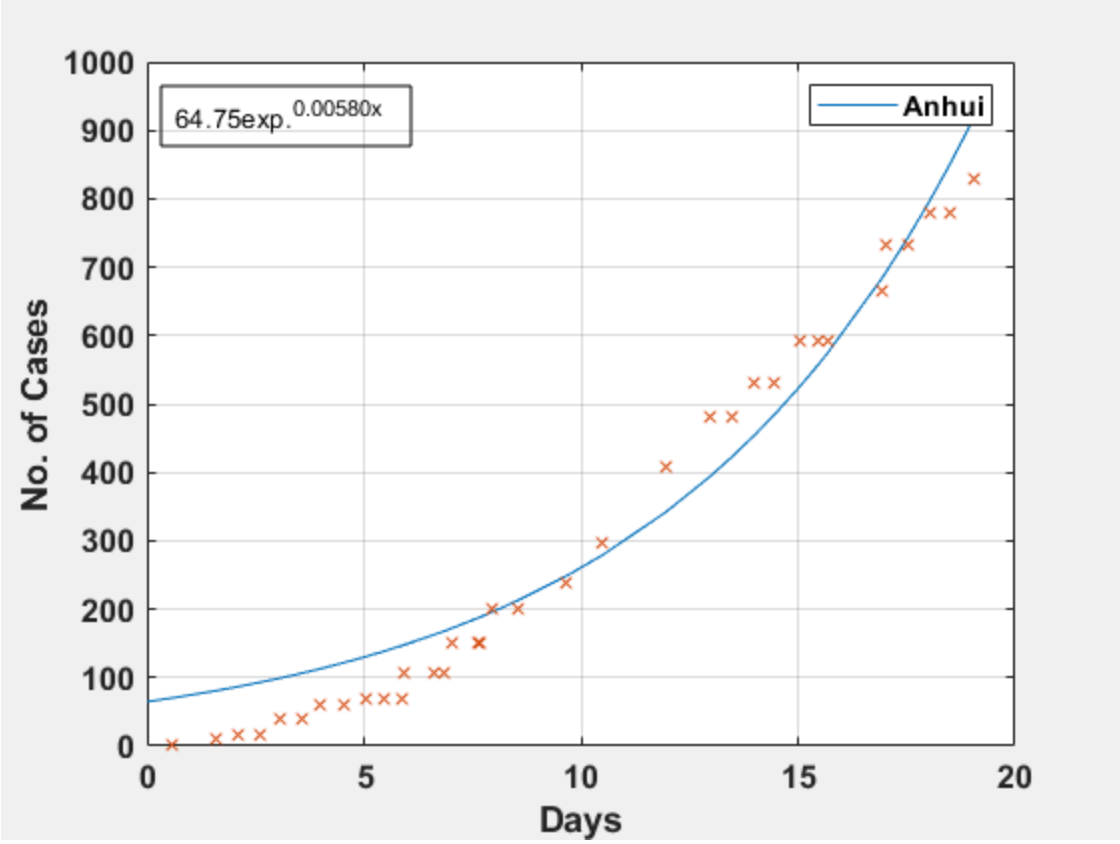
```
clc;clear;close all
% Import Data from Excel as Table
    % When Updating extend rows as needed.

% ncovdat = imptablefn("C:\Users\Danial Soorty\OneDrive - ChemStaff
\matlab\2019CoN\time_series_2019-ncov-Confirmed_Automatot.xlsx",
 "time_series_2019-ncov-Confirmed", [1, 73]);
ncovdat = imptablefn("time_series_2019-ncov-
Confirmed_Automatot.xlsx", "time_series_2019-ncov-Confirmed", [1,
 73]);

% Extract Data
Times=fillmissing(datetime(ncovdat(1,5:end)),'linear');
varnames=struct('Province_State',ncovdat(2:end,1),'Country_Region',ncovdat(2:end,2

  % Time vector
    Timevec=cumsum([0,(hours(diff(Times)))]);
% Replace blanks with NaNs
Data=ncovdat(2:end,5:end);
empty=cellfun('isempty',Data);
Data(empty)={NaN};
Datanum=cell2mat(Data); % Convert to numeric/mat

Varnamestable=struct2table(varnames); %
Province_State=cellstr(Varnamestable.Province_State);
Country_Region=cellstr(Varnamestable.Country_Region);

blanks=cellfun(@isempty,Province_State);
blanksin=find(blanks);

Province_State(blanks)=Country_Region(blanksin);


% Construct Table
datatype=repmat("double",72,1);

% Table=table(Data,'VariableNames',Province_State);\
Table=table('Size',[36,72],'VariableTypes', datatype);
Table.Properties.VariableNames=Province_State;
Table(:,:)=Data';

% Add Time to rows;

T2=addvars(Table,Times','Before','Anhui','NewVariableName','DateTime');
T2=addvars(T2,Timevec,'Before','Anhui','NewVariableName','Time
 Elapsed');
```

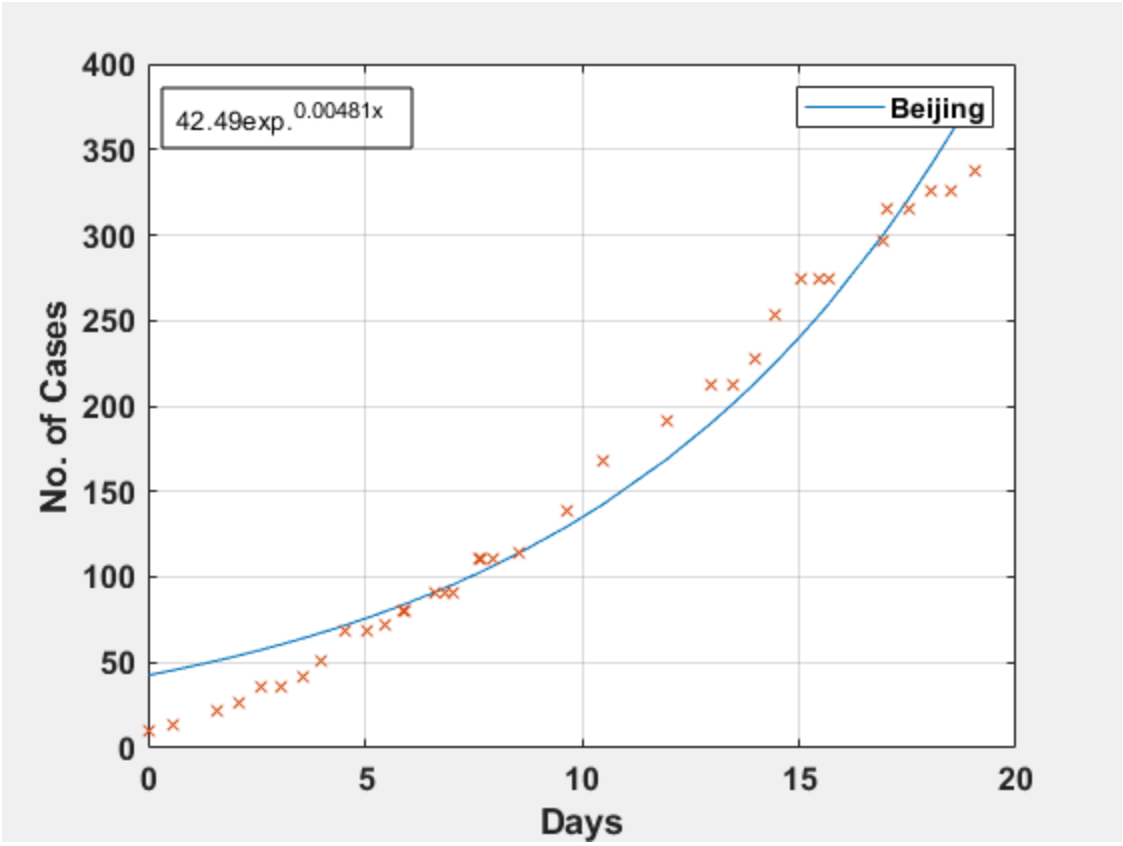
Generate Fits

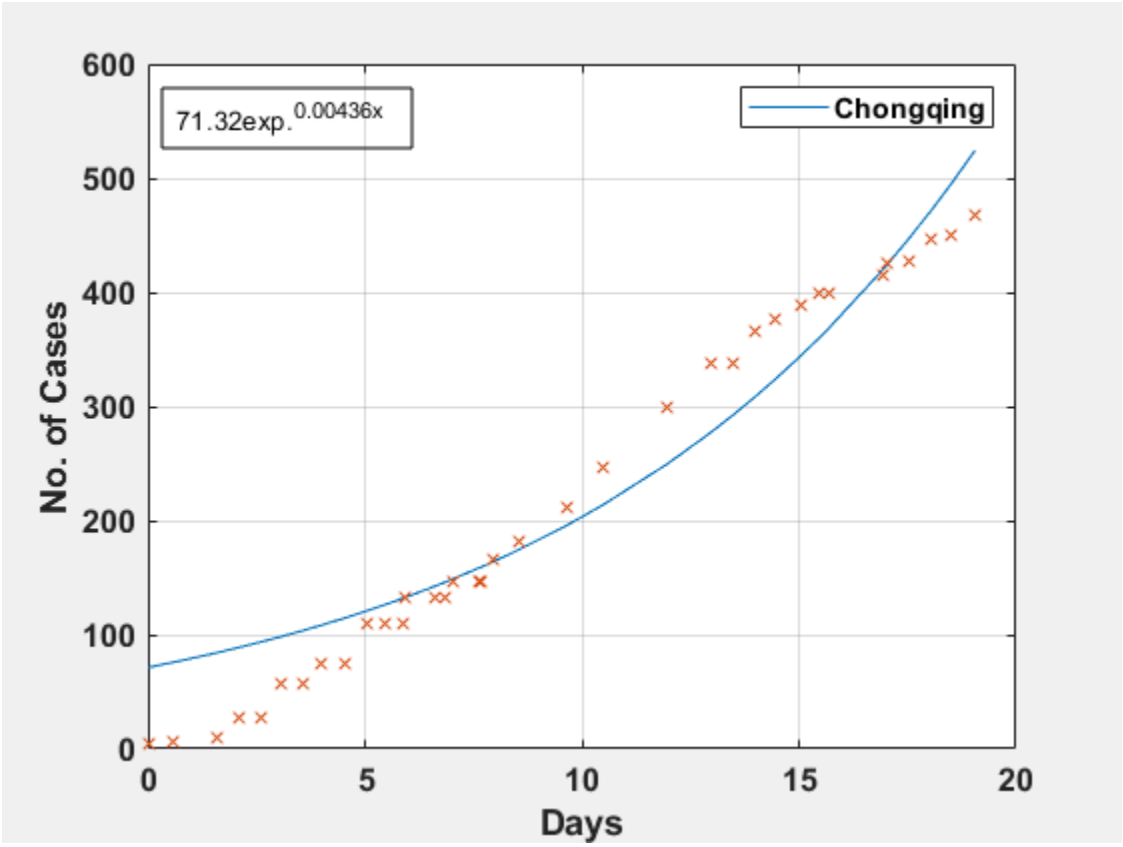
```
% Preallocate
```

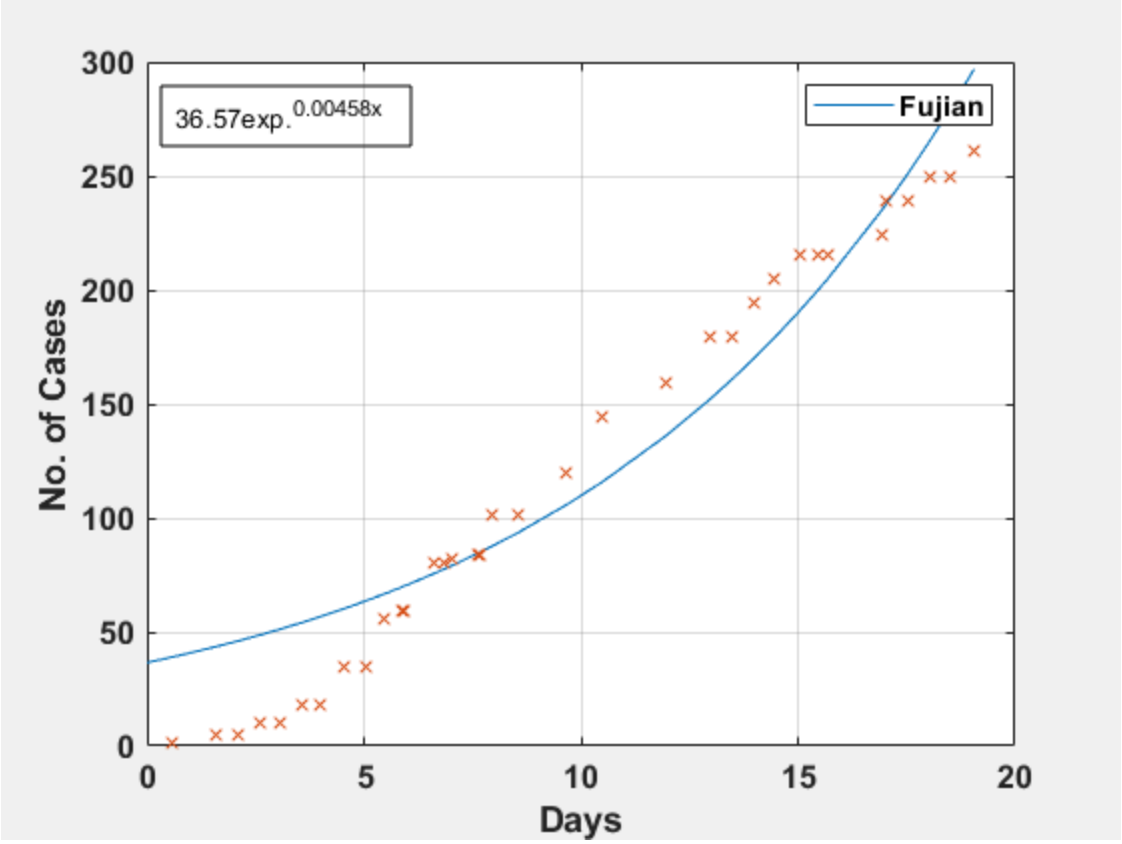
```
as=zeros(size(T2,1),1);
bs=zeros(size(T2,1),1);
fitteddat=zeros(size(T2));
notdet=cell(size(T2,2),1);

for i=3:size(T2,2)
    dat=table2array(T2(:,i));          % Extract data
    [datcln,I]=rmmissing(dat);          % Remove NaN
    ttimevec=Timevec(~I);
    datcln=[ttimevec datcln];
    [dat,ia] =unique(datcln(:,2));    % Remove repeatd entries to for
 data fitting
    ttimevec=datcln(ia,1);
    datcln=[ttimevec dat];

    if size(datcln,1)<2
         Country=T2.Properties.VariableNames(i);
         notdet(i-2)=Country;

    else
    fitdat=fit(datcln(:,1),datcln(:,2),'exp1');
    as(i-2)=fitdat.a;
    bs(i-2)=fitdat.b;
    end
end
% Post Processing
notdetindex=cellfun(@isempty,notdet);
notdet=notdet(~notdetindex);

% General Exponential Model
expfn= @(a,b,x) a.*exp(b.*x);

for i=3:size(T2,2)
fitteddat(:,i-2)=expfn(as(i-2),bs(i-2),Timevec);
end

% Plots
for i=3:size(T2,2)
    figure;
    p1=plot(Timevec./24,fitteddat(:,i-2));
    hold on; plot(Timevec./24,table2array(T2(:,i)),'x');
    ylabel('No. of Cases')
    xlabel('Days')
    name=T2.Properties.VariableNames(i);
    legend(name)
    astr=string(as(i-2));
    bstr=string(bs(i-2));
    streq='exp';
    if as(i-2)==0
        annotation('textbox',[0.142857142857143 0.814285714285716
 0.332142857142857 0.0833333333333355],'String','Single number
 reported');
    else
    equation=sprintf('%.2fexp.^{%.5fx}',as(i-2),bs(i-2));
```

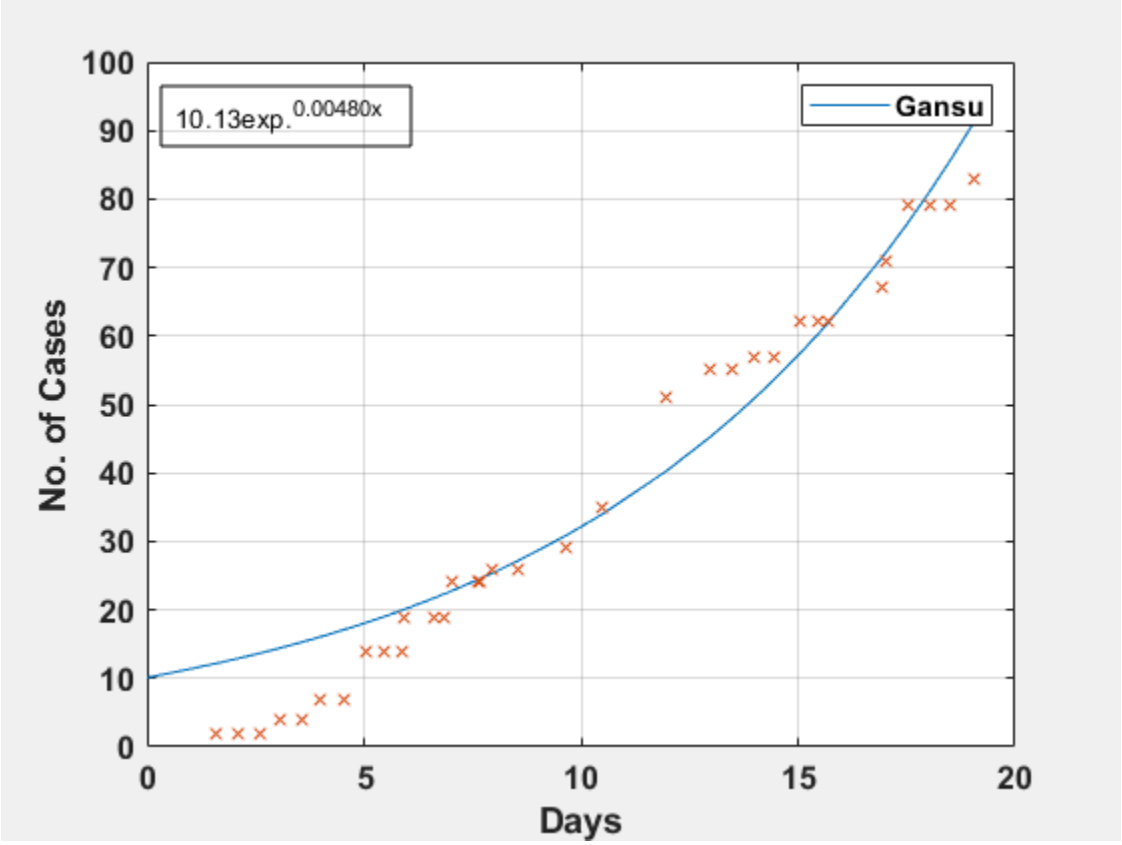
```
    annotation('textbox',[0.142857142857143 0.814285714285716
 0.332142857142857
 0.0833333333333355],'String',equation,'FitBoxToText','on')
    end
end
```

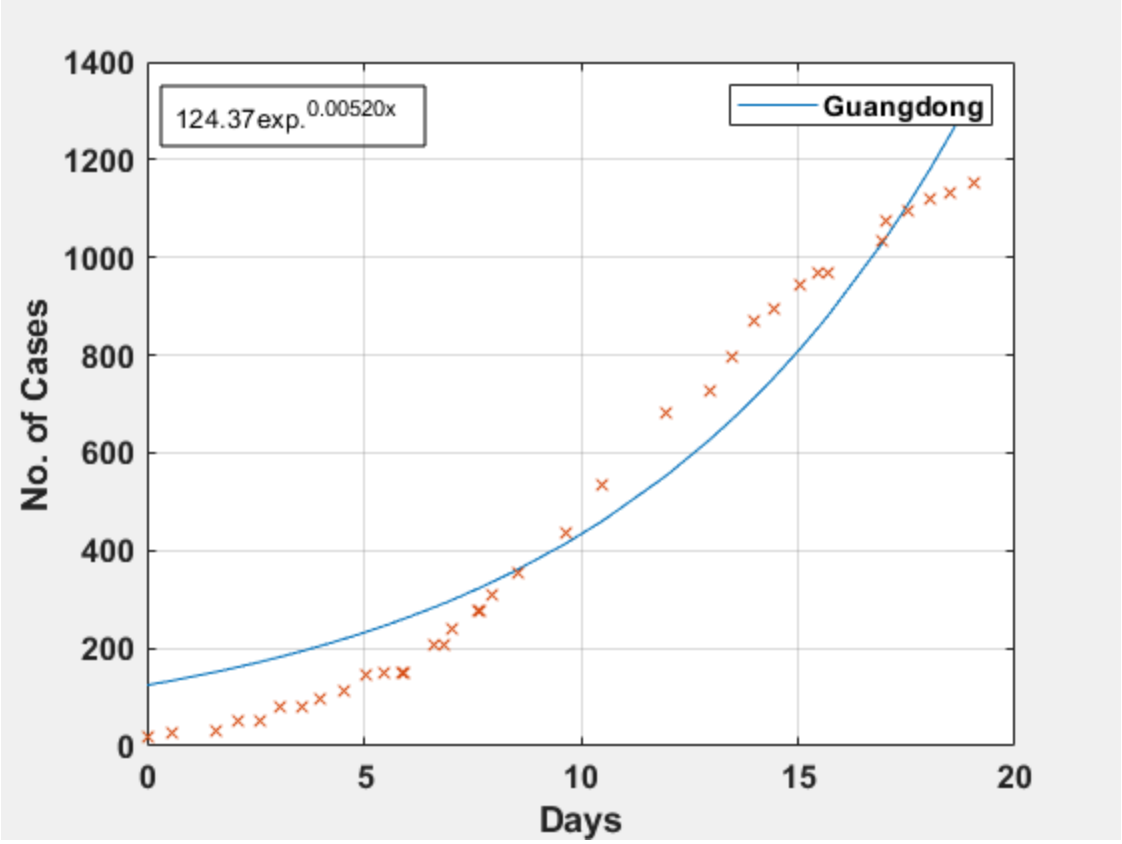


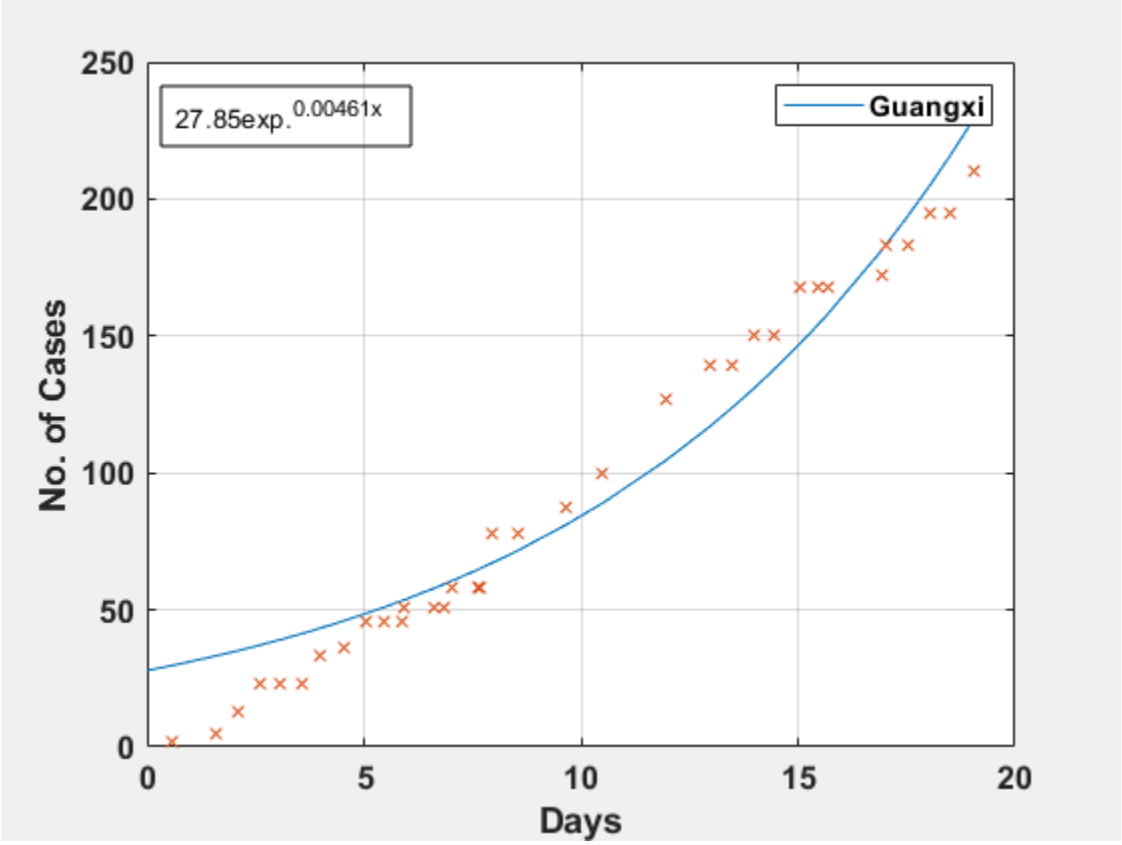

42.49exp.0.00481x
Beijing
No. of Cases
Days
0
50
100
150
200
250
300
350
400
0
5
10
15
20

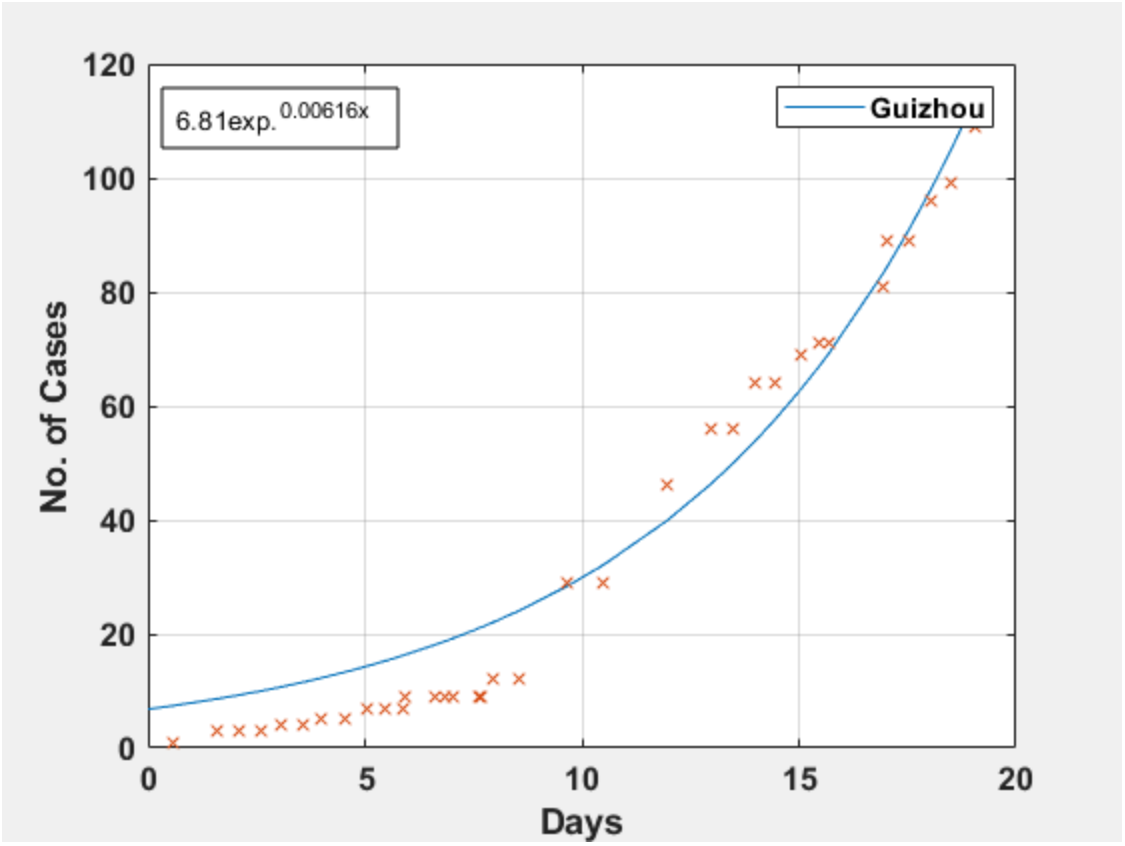

71.32exp.0.00436x
Chongqing
No. of Cases
Days
0
100
200
300
400
500
600
0
5
10
15
20

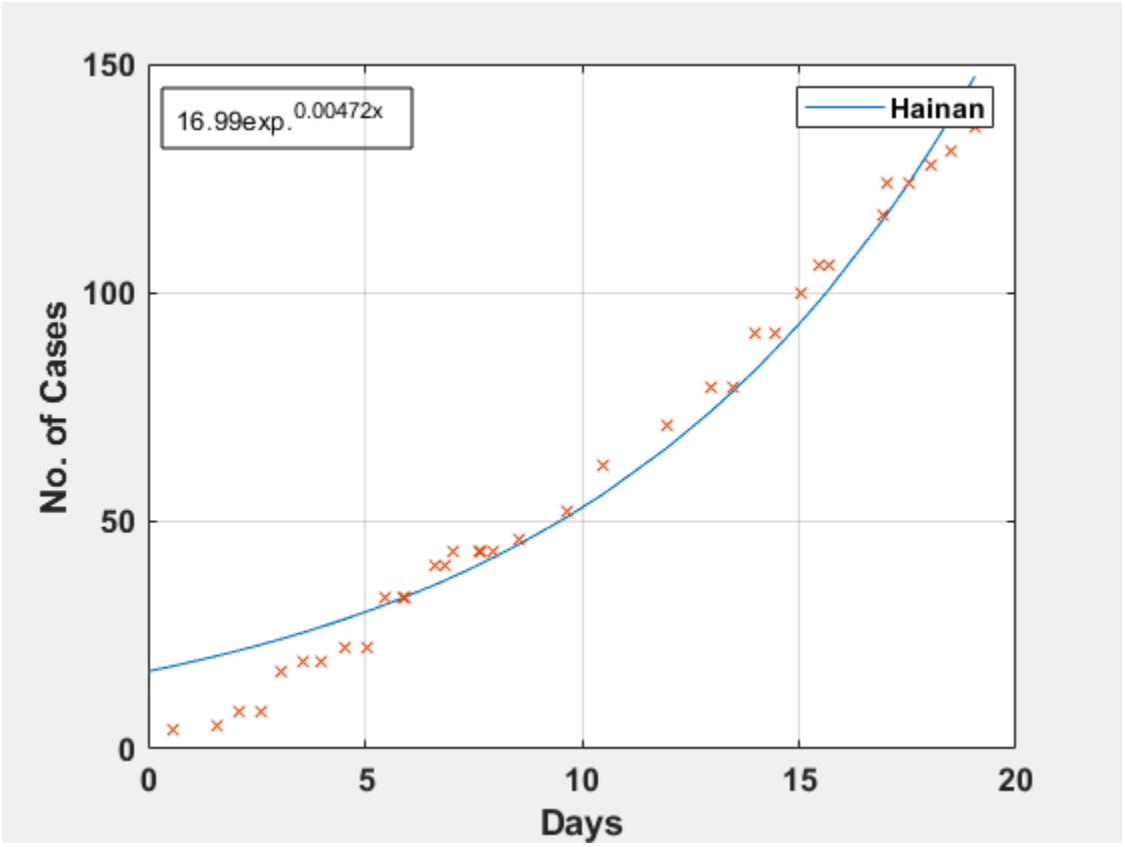

36.57exp.0.00458x
Fujian
No. of Cases
Days
0
50
100
150
200
250
300
0
5
10
15
20

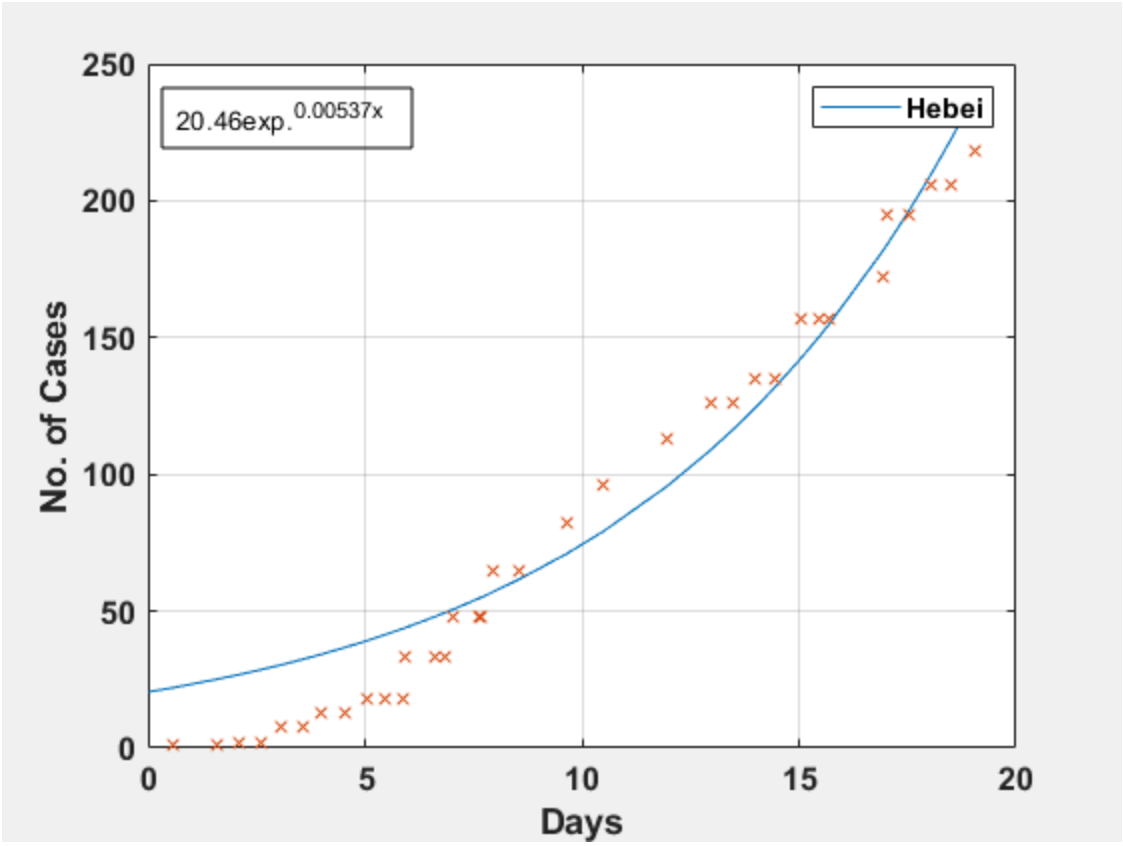

10.13exp.0.00480x
Gansu
No. of Cases
Days
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20

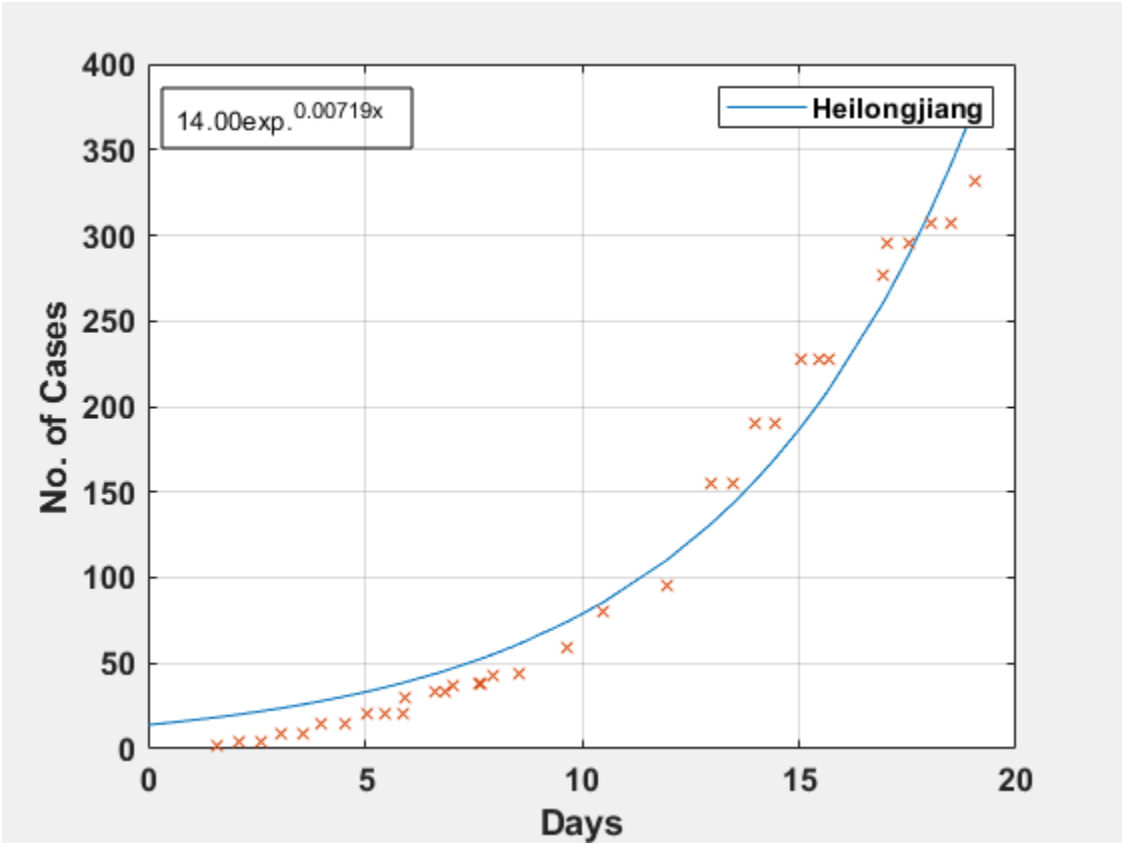

124.37exp.0.00520x
Guangdong
No. of Cases
Days
0
200
400
600
800
1000
1200
1400
0
5
10
15
20

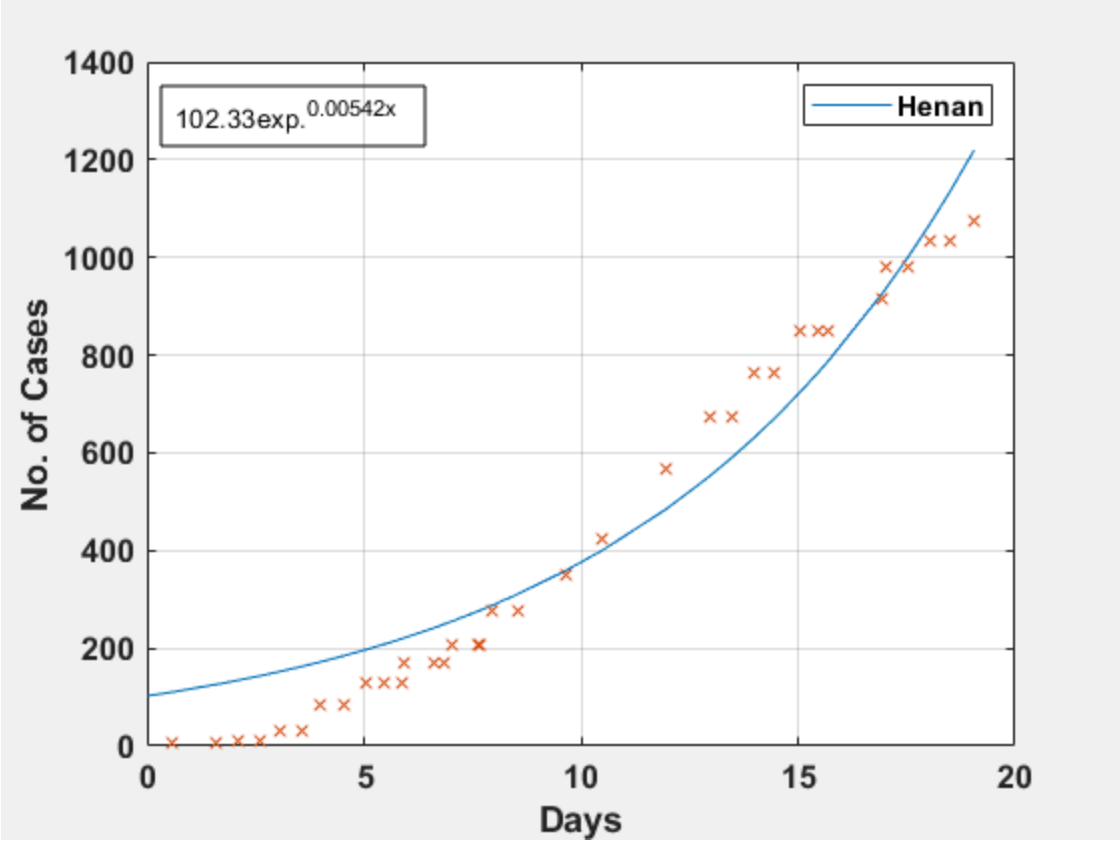

27.85exp.0.00461x
Guangxi
No. of Cases
Days
0
50
100
150
200
250
0
5
10
15
20

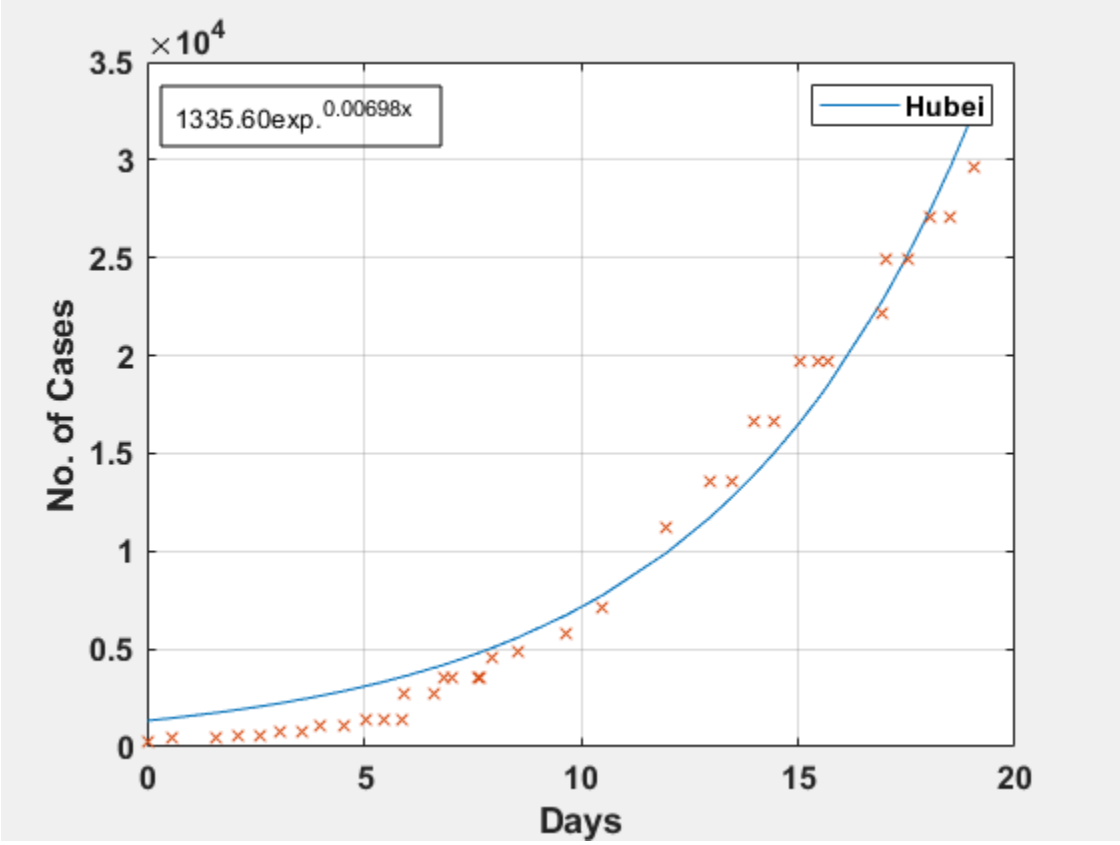

6.81exp.0.00616x
Guizhou
No. of Cases
Days
0
20
40
60
80
100
120
0
5
10
15
20

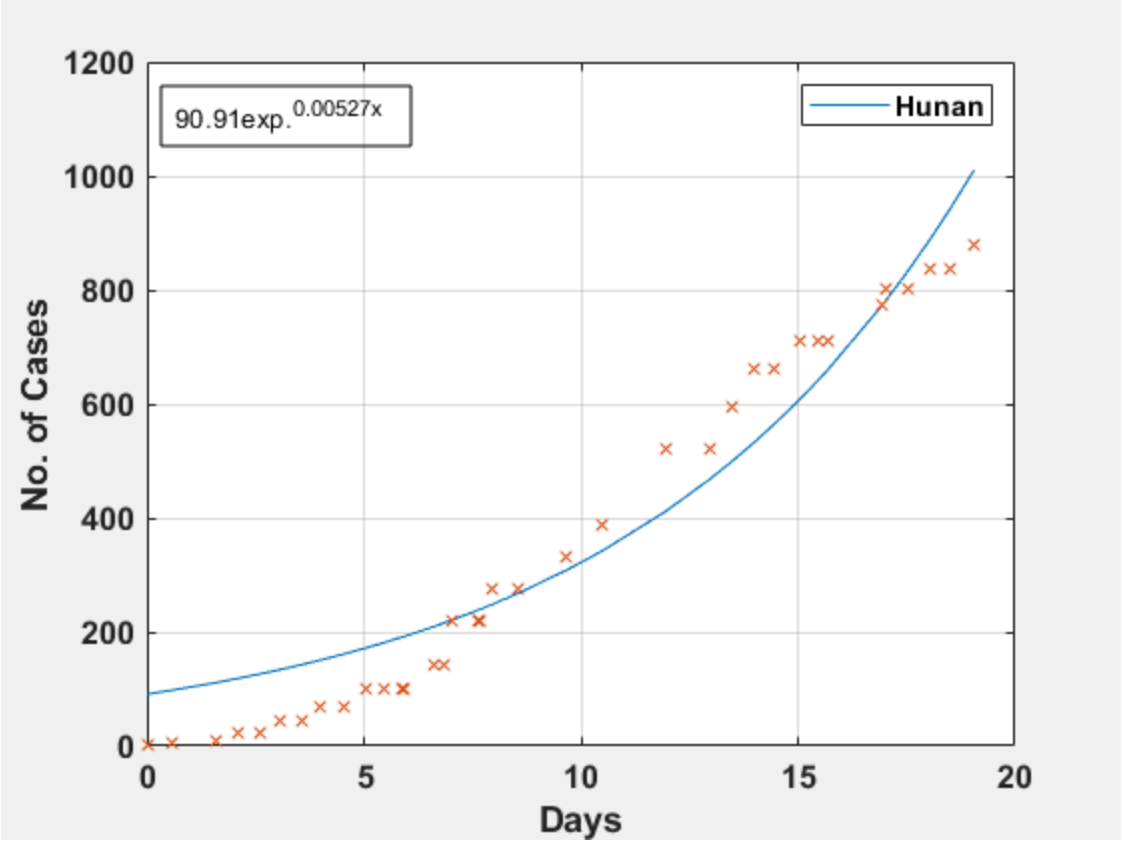

16.99exp.0.00472x
Hainan
No. of Cases
Days
0
50
100
150
0
5
10
15
20

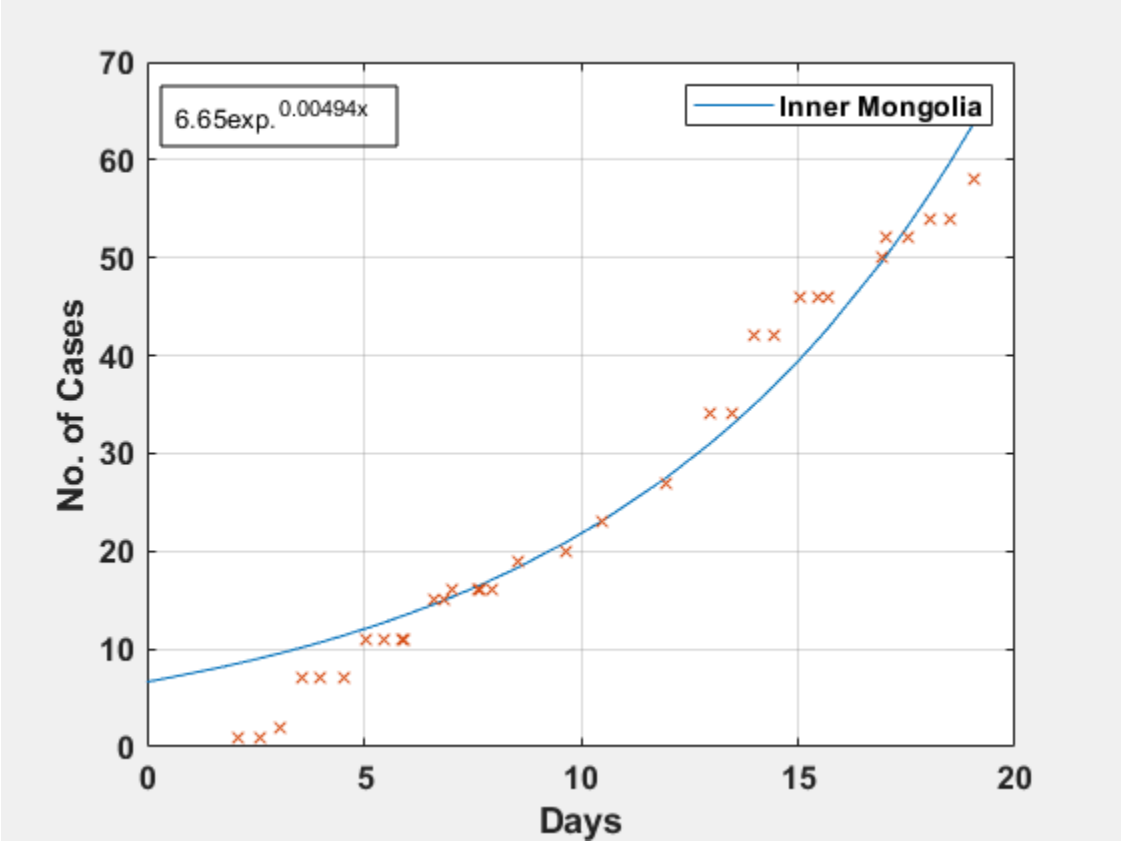

20.46exp.0.00537x
Hebei
No. of Cases
Days
0
50
100
150
200
250
0
5
10
15
20

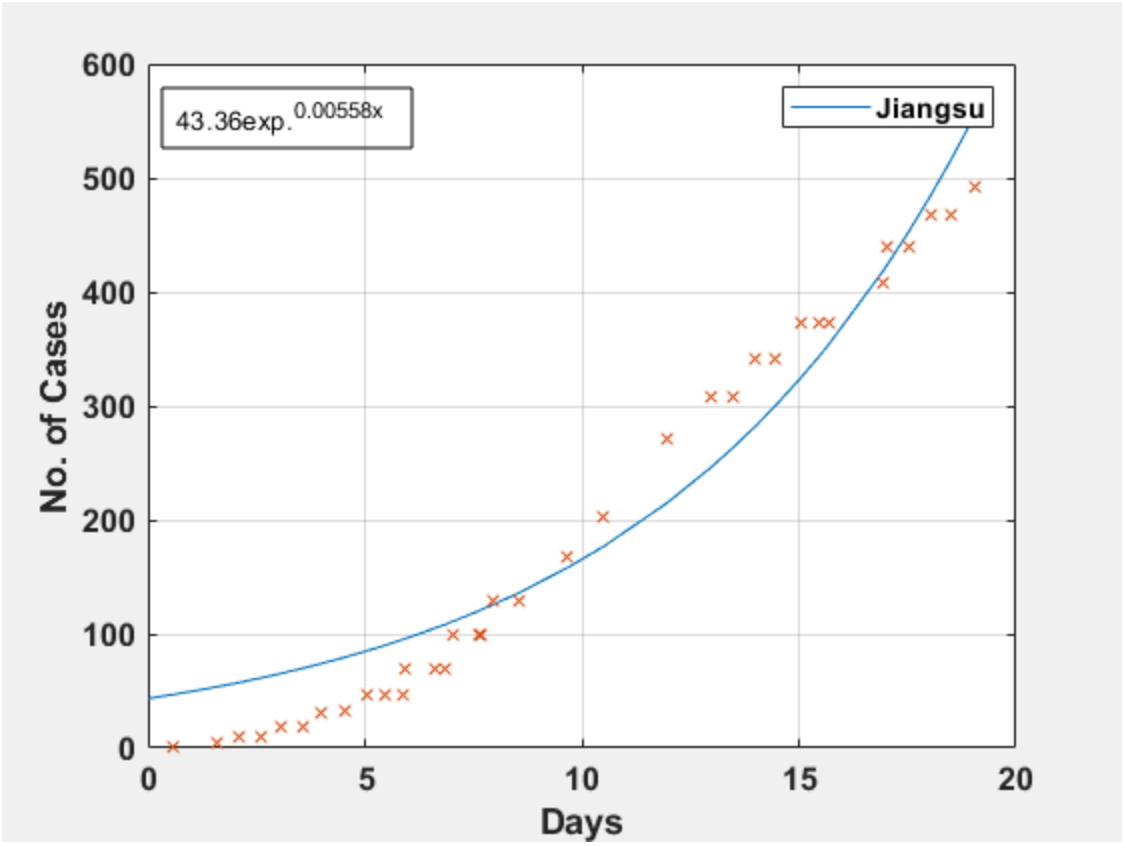

14.00exp.0.00719x
Heilongjiang
No. of Cases
Days
0
50
100
150
200
250
300
350
400
0
5
10
15
20

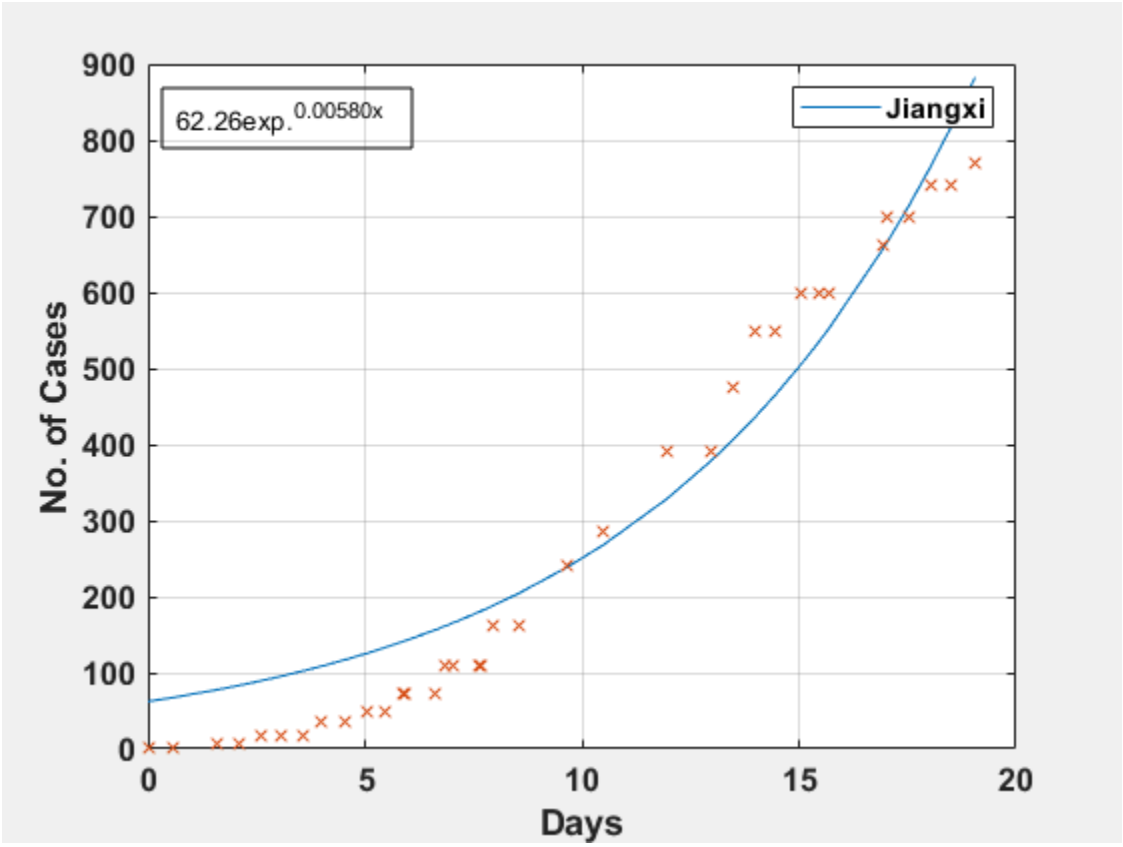

102.33exp.0.00542x
Henan
No. of Cases
Days
0
200
400
600
800
1000
1200
1400
0
5
10
15
20

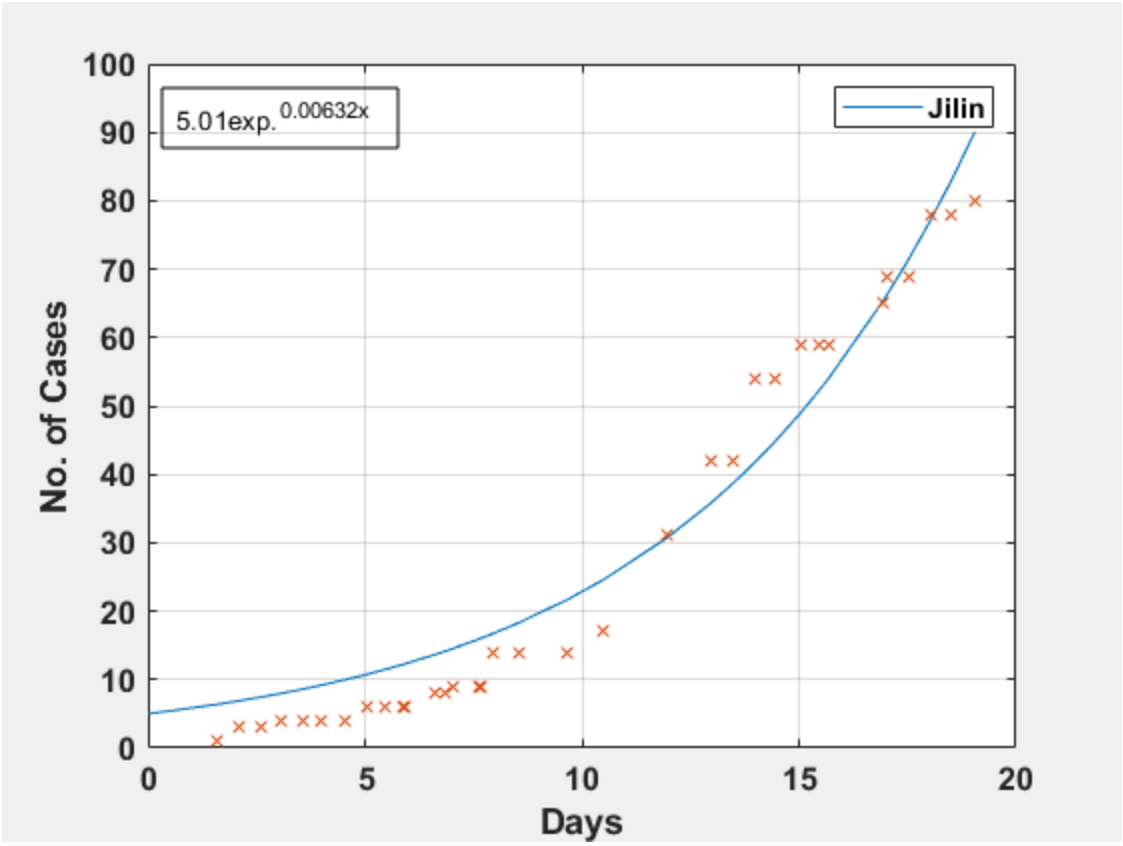

×10^4
1335.60exp.0.00698x
Hubei
No. of Cases
Days
0
0.5
1
1.5
2
2.5
3
3.5
0
5
10
15
20

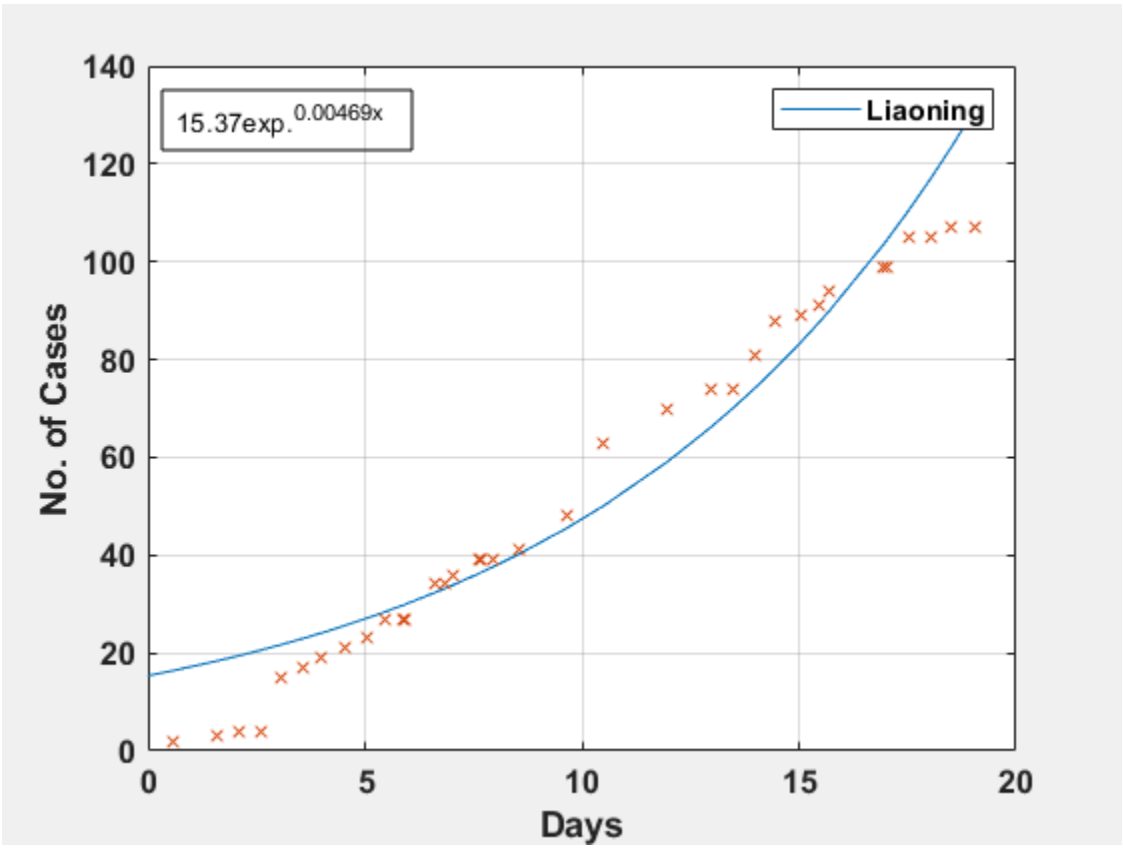

90.91exp.0.00527x
Hunan
No. of Cases
Days
0
200
400
600
800
1000
1200
0
5
10
15
20

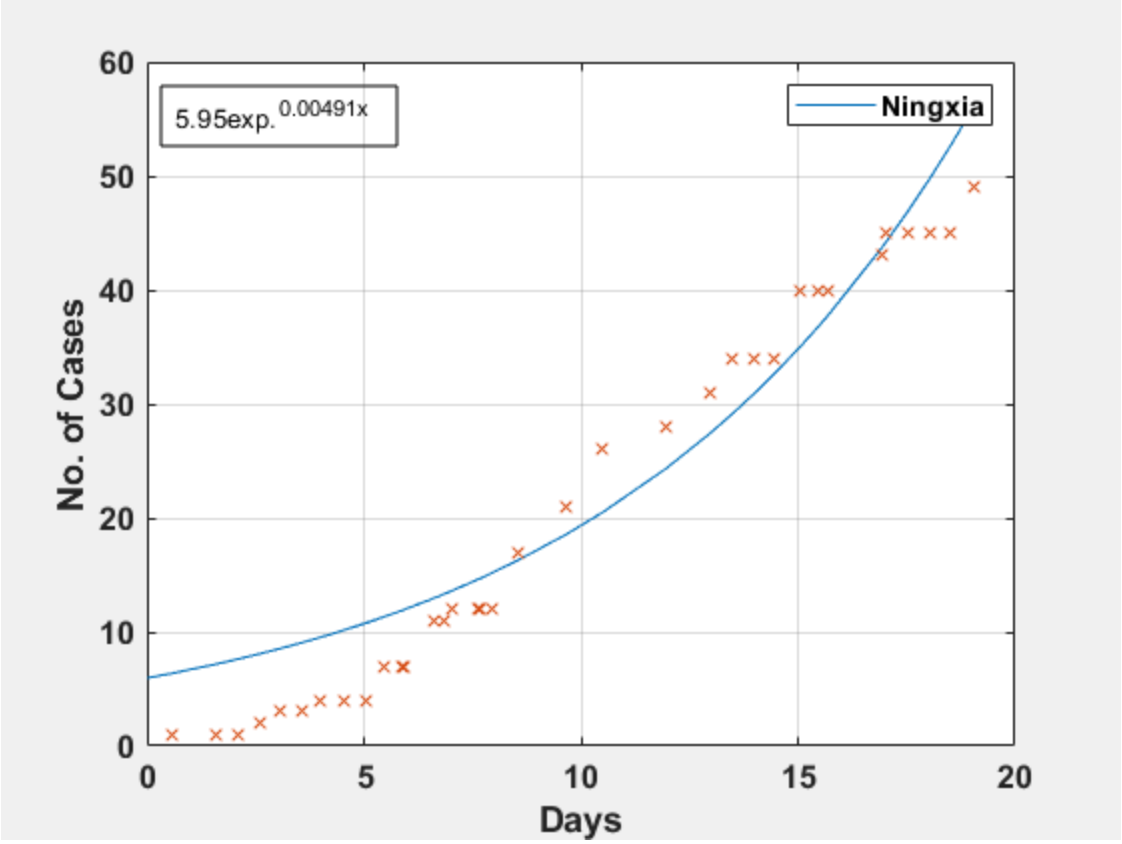

6.65exp.0.00494x
Inner Mongolia
No. of Cases
Days
0
10
20
30
40
50
60
70
0
5
10
15
20

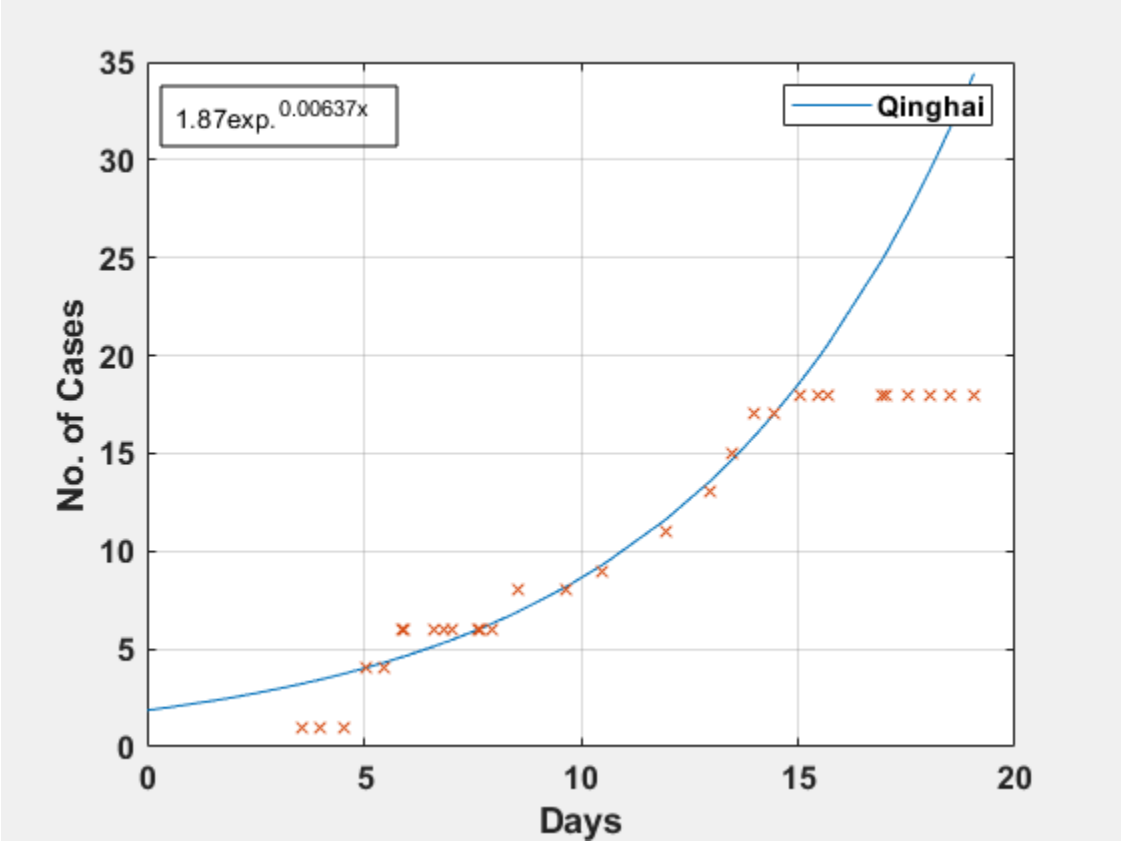

43.36exp.0.00558x
Jiangsu
No. of Cases
Days
0
100
200
300
400
500
600
0
5
10
15
20

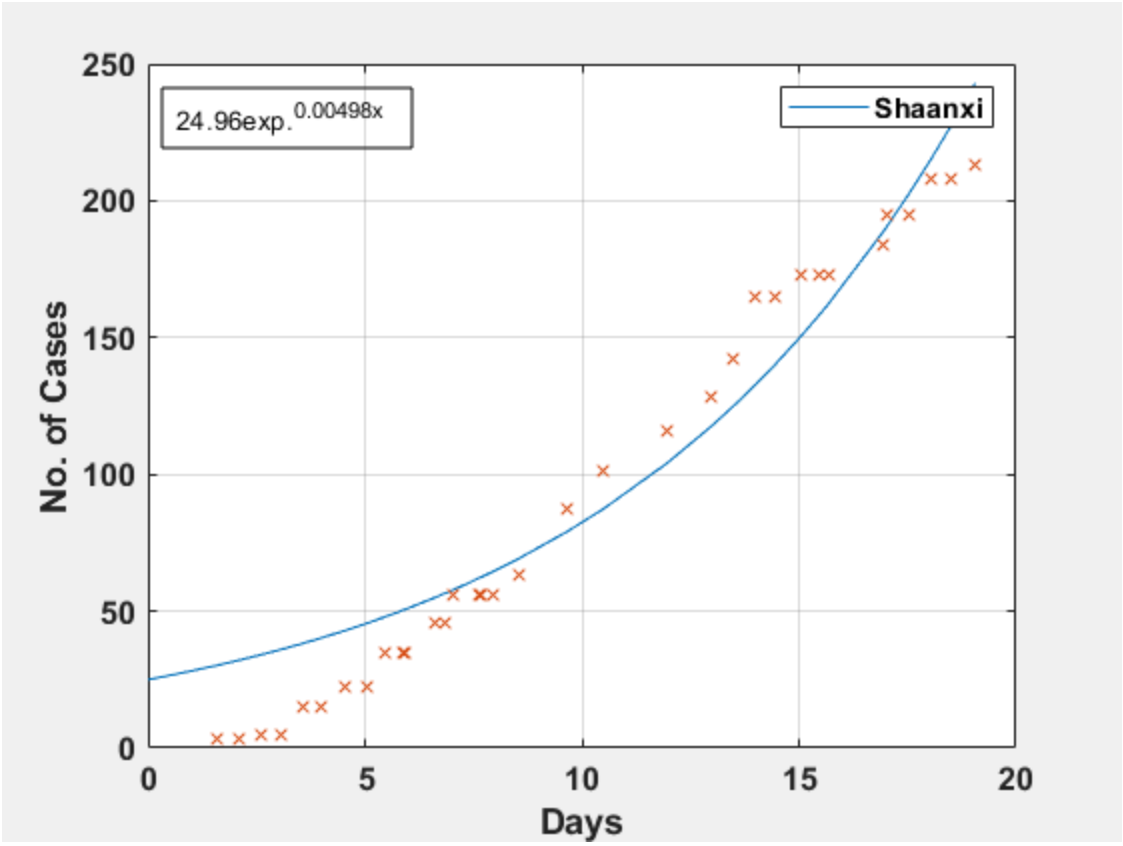

62.26exp.0.00580x
Jiangxi
No. of Cases
Days
0
100
200
300
400
500
600
700
800
900
0
5
10
15
20

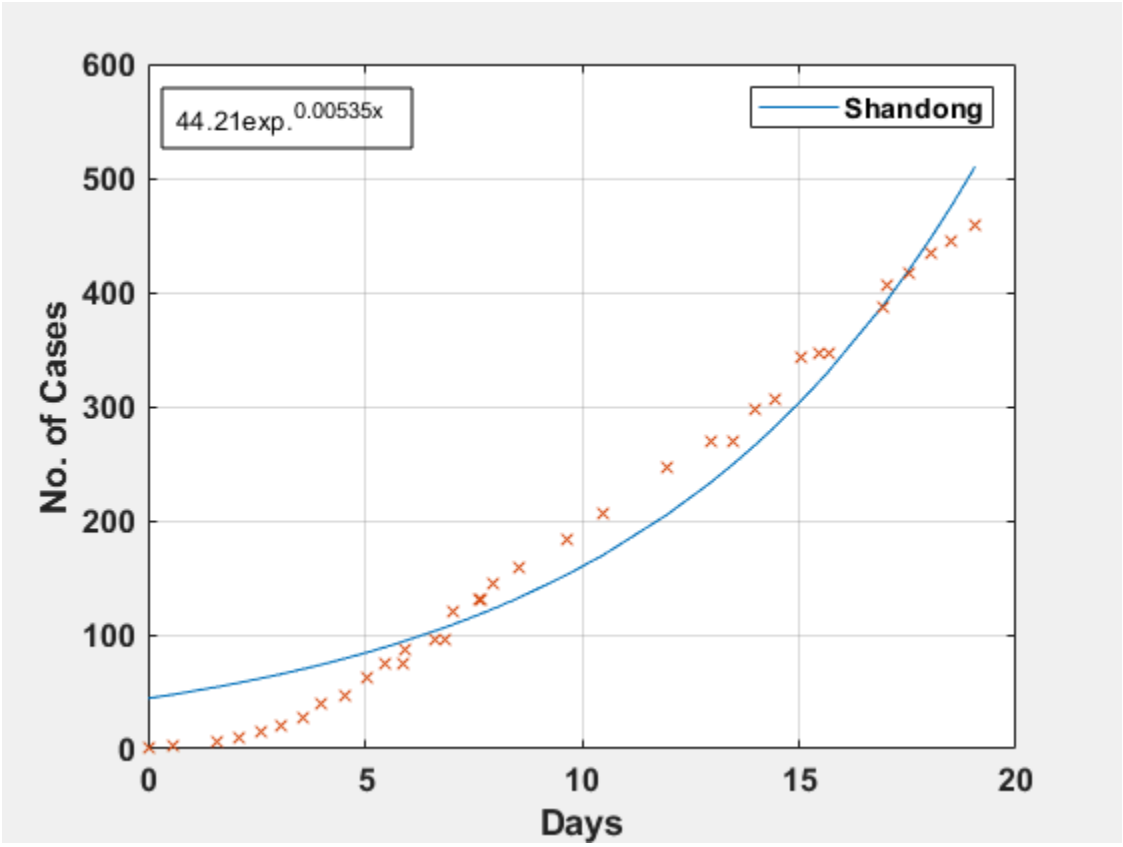

5.01exp.0.00632x
Jilin
No. of Cases
Days
0
10
20
30
40
50
60
70
80
90
100
0
5
10
15
20

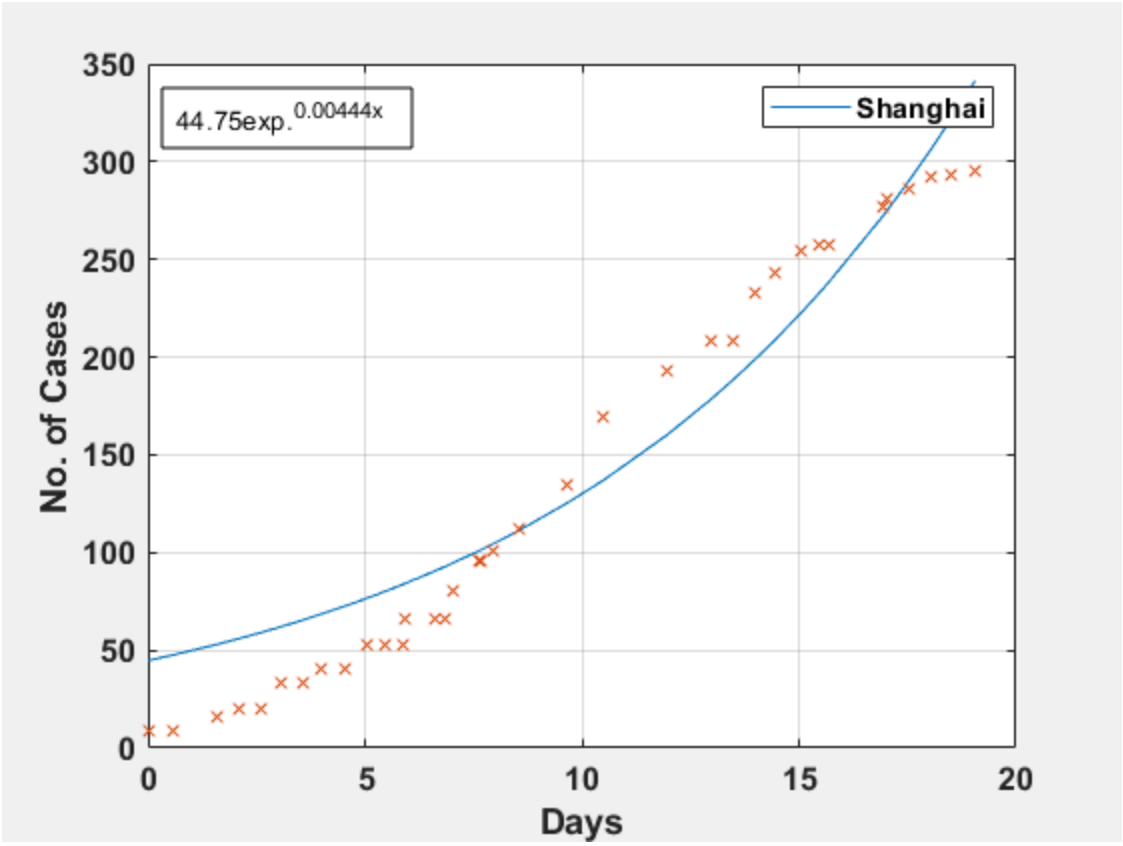

15.37exp.0.00469x
Liaoning
No. of Cases
Days
0
20
40
60
80
100
120
140
0
5
10
15
20

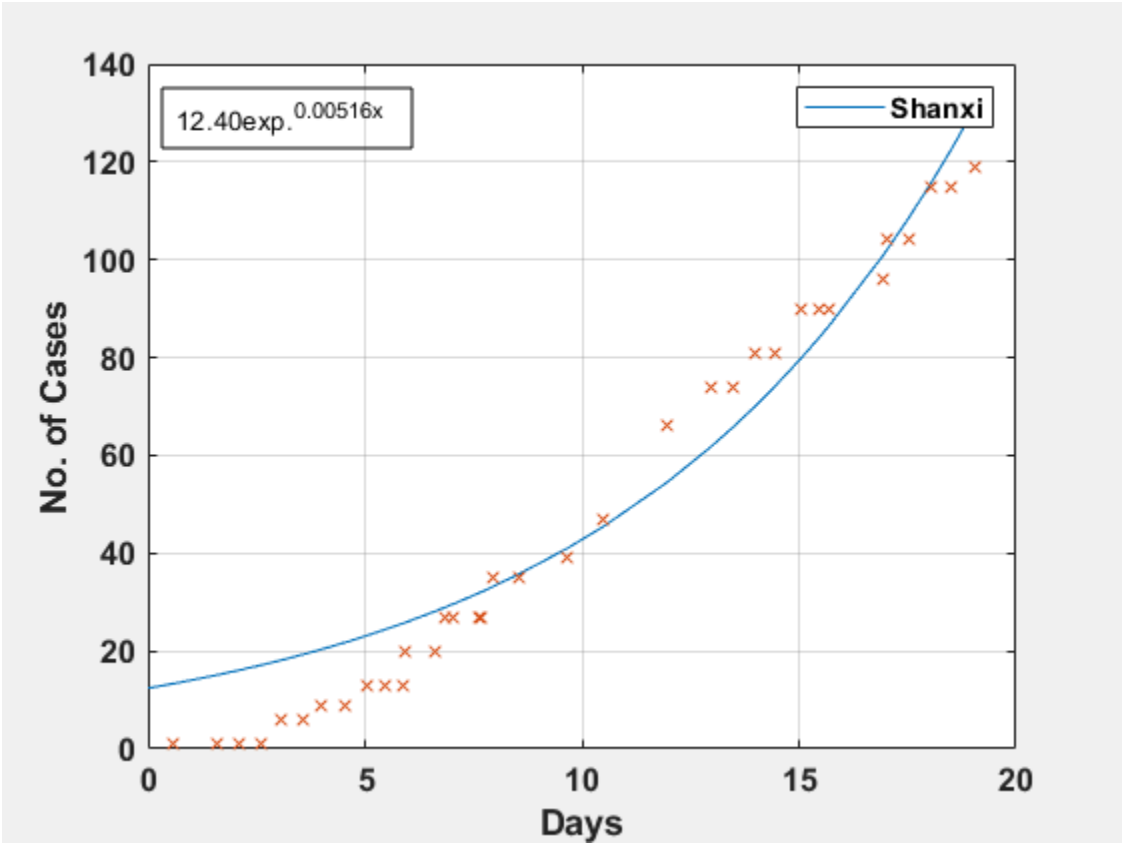

5.95exp.0.00491x
Ningxia
No. of Cases
Days
0
10
20
30
40
50
60
0
5
10
15
20

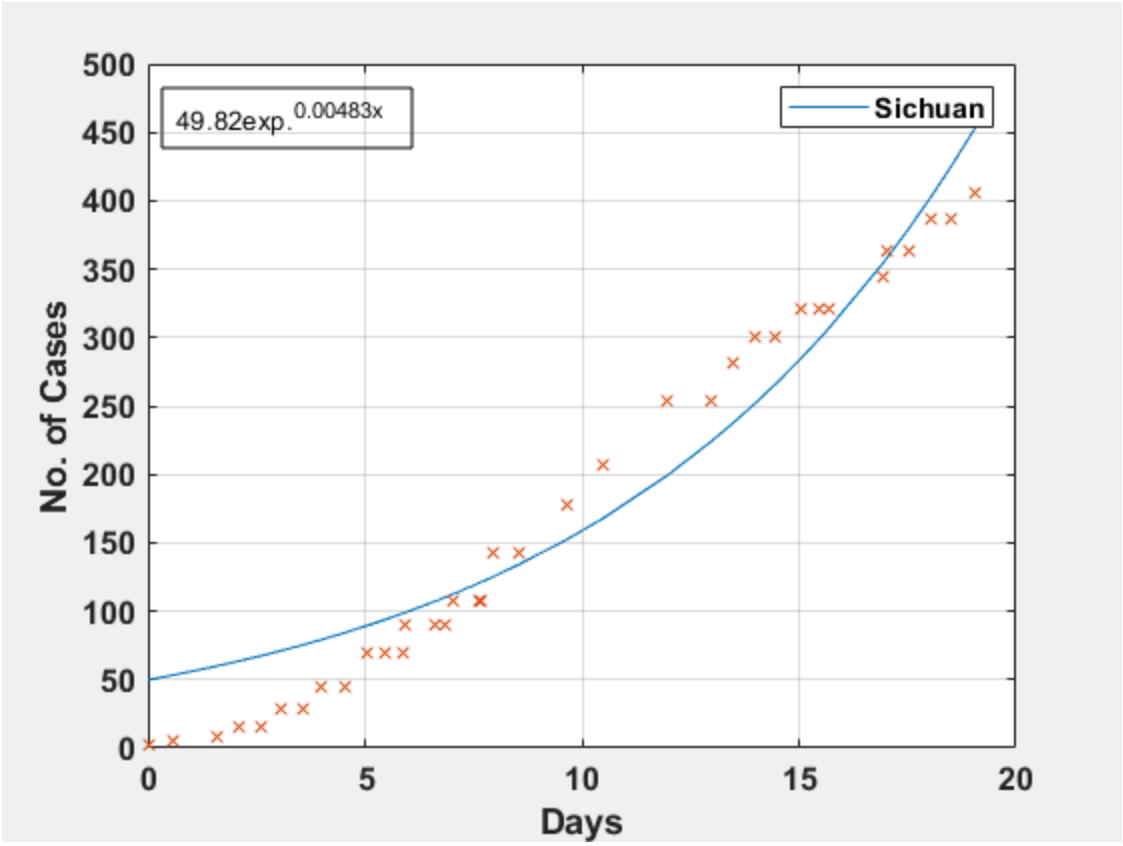

1.87exp.0.00637x
Qinghai
No. of Cases
Days
0
5
10
15
20
25
30
35
0
5
10
15
20

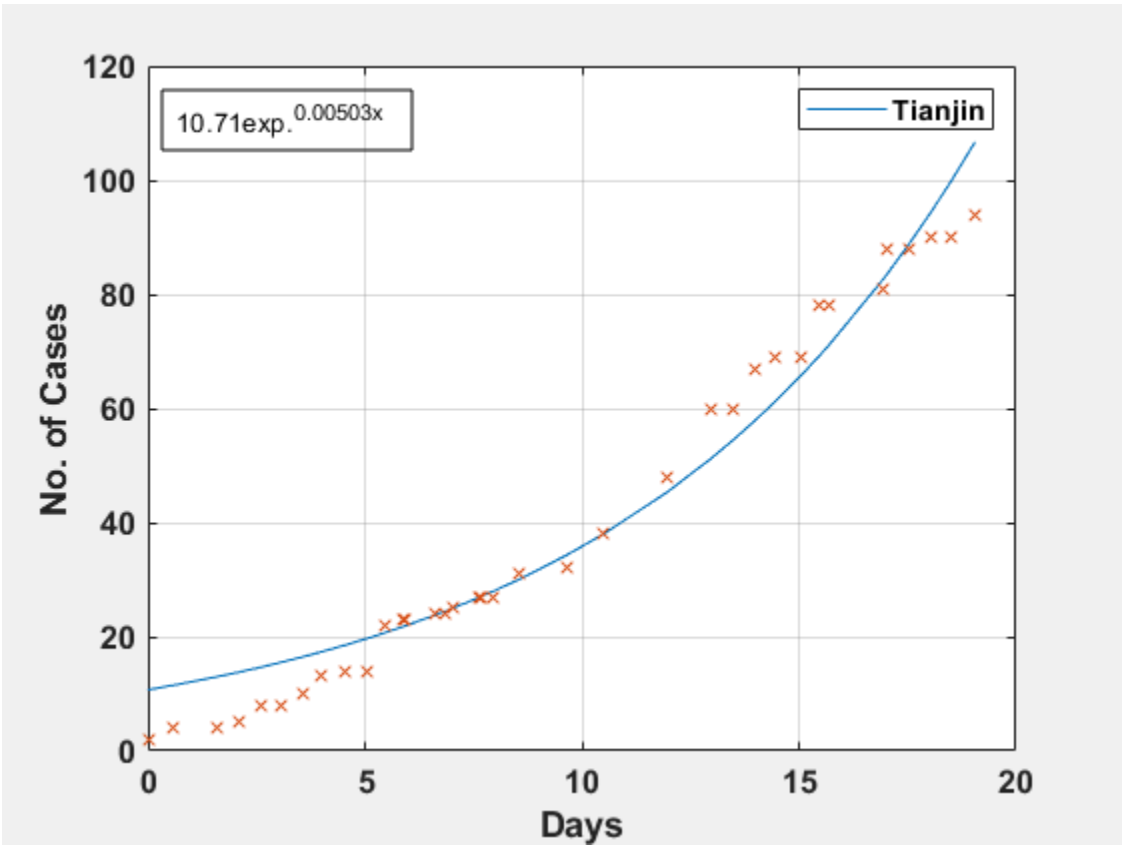

24.96exp.0.00498x
Shaanxi
No. of Cases
Days
0
50
100
150
200
250
0
5
10
15
20

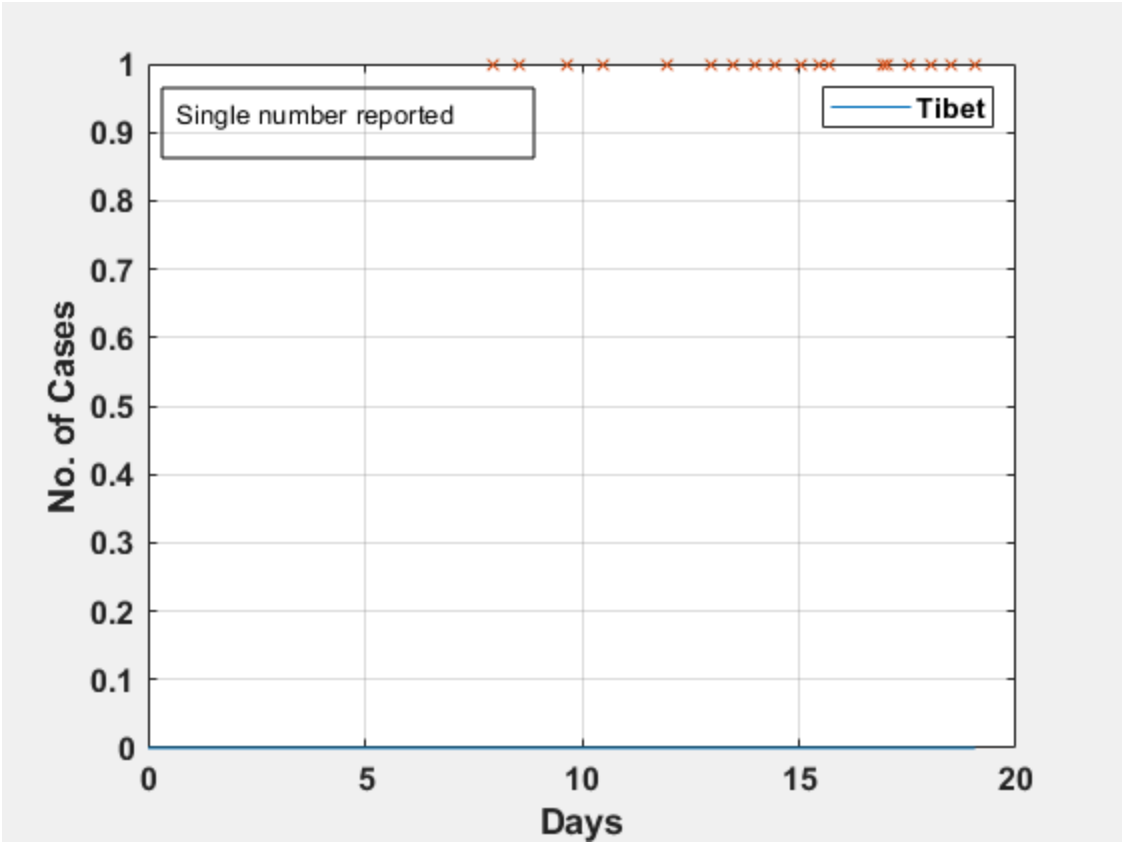

44.21exp.0.00535x
Shandong
No. of Cases
Days
0
100
200
300
400
500
600
0
5
10
15
20

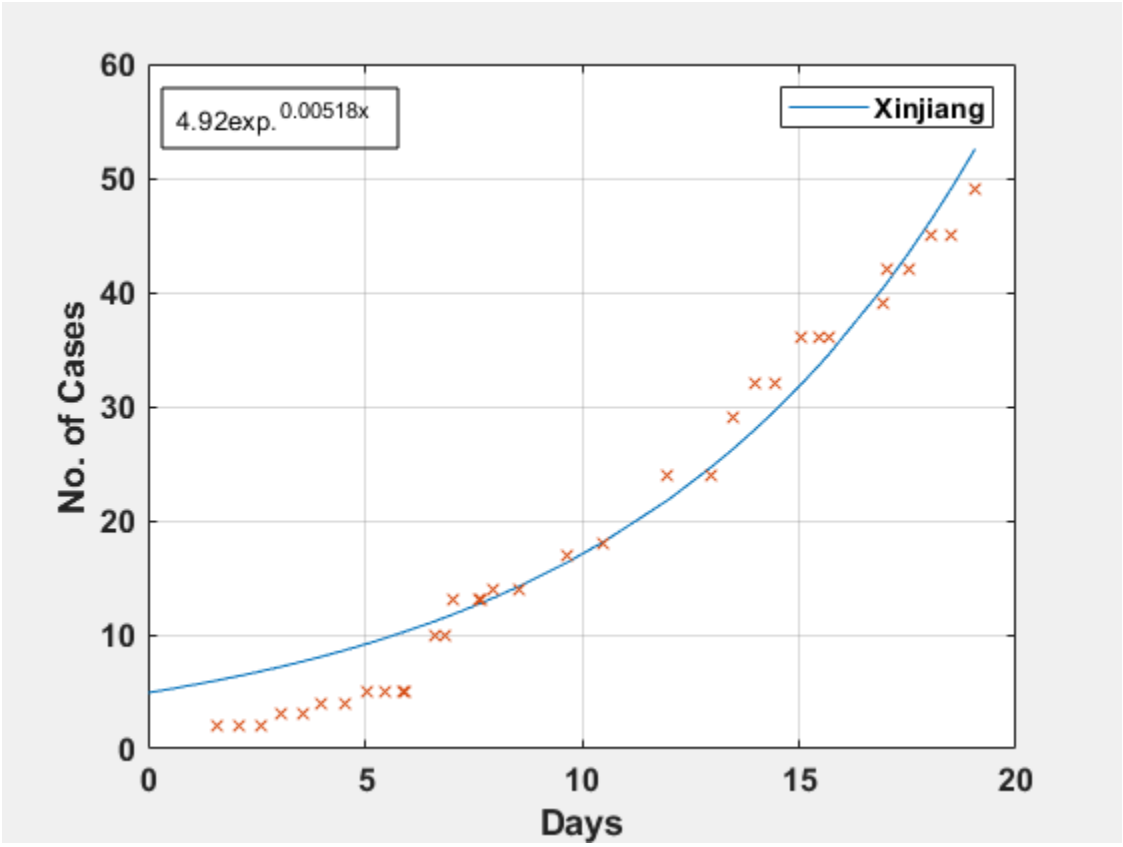

44.75exp.0.00444x
Shanghai
No. of Cases
Days
0
50
100
150
200
250
300
350
0
5
10
15
20

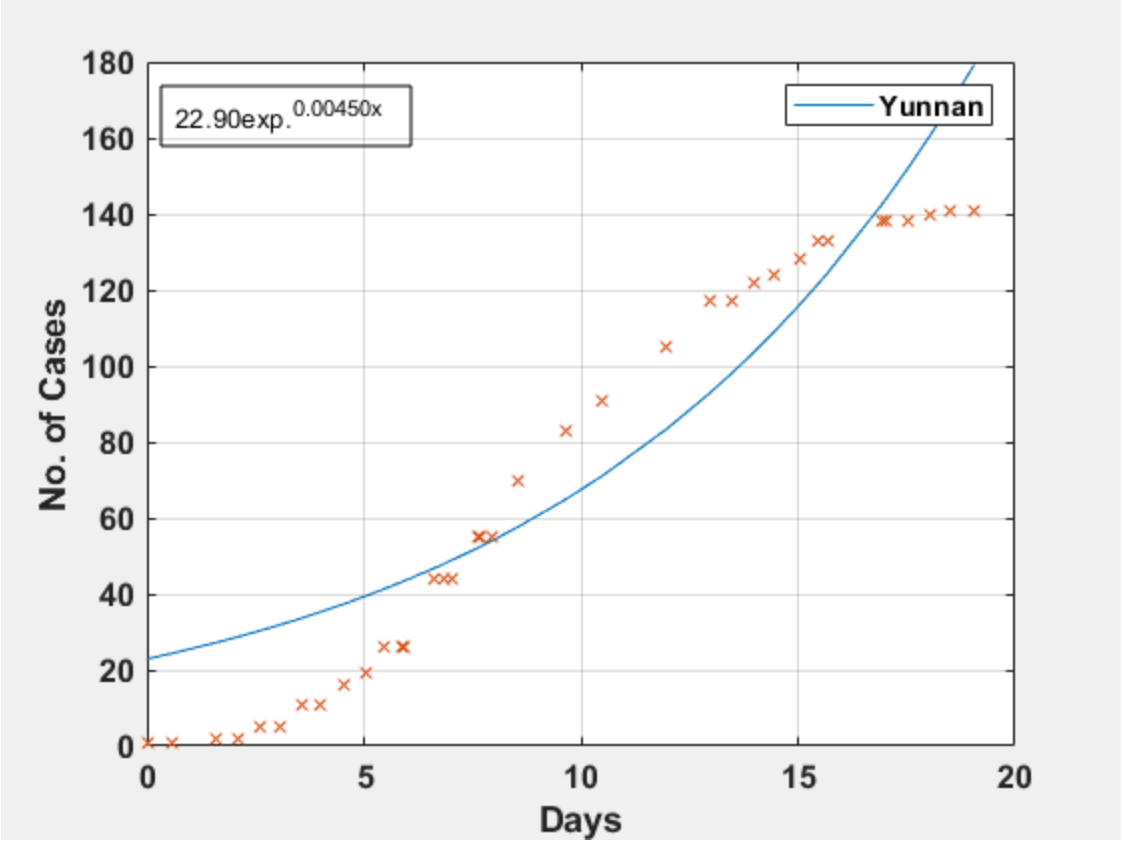

12.40exp.0.00516x
Shanxi
No. of Cases
Days
0
20
40
60
80
100
120
140
0
5
10
15
20

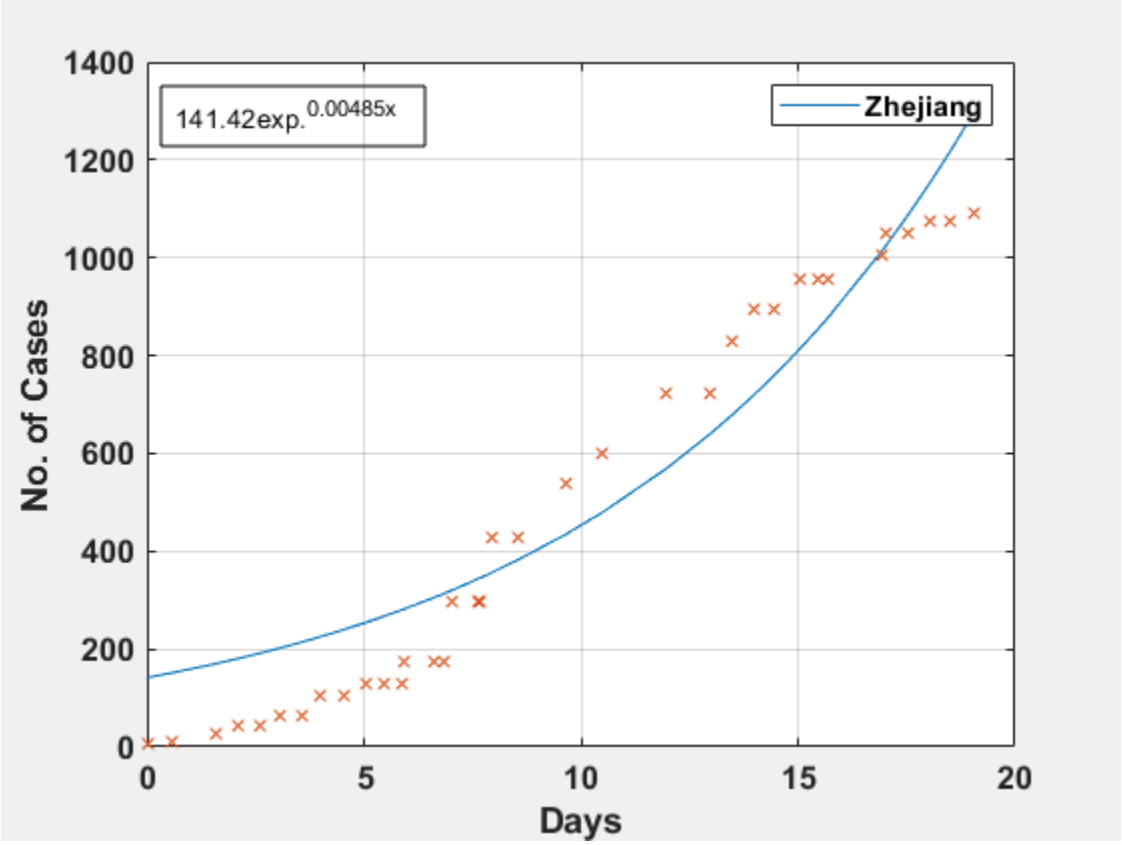

49.82exp.0.00483x
Sichuan
No. of Cases
Days
0
50
100
150
200
250
300
350
400
450
500
0
5
10
15
20

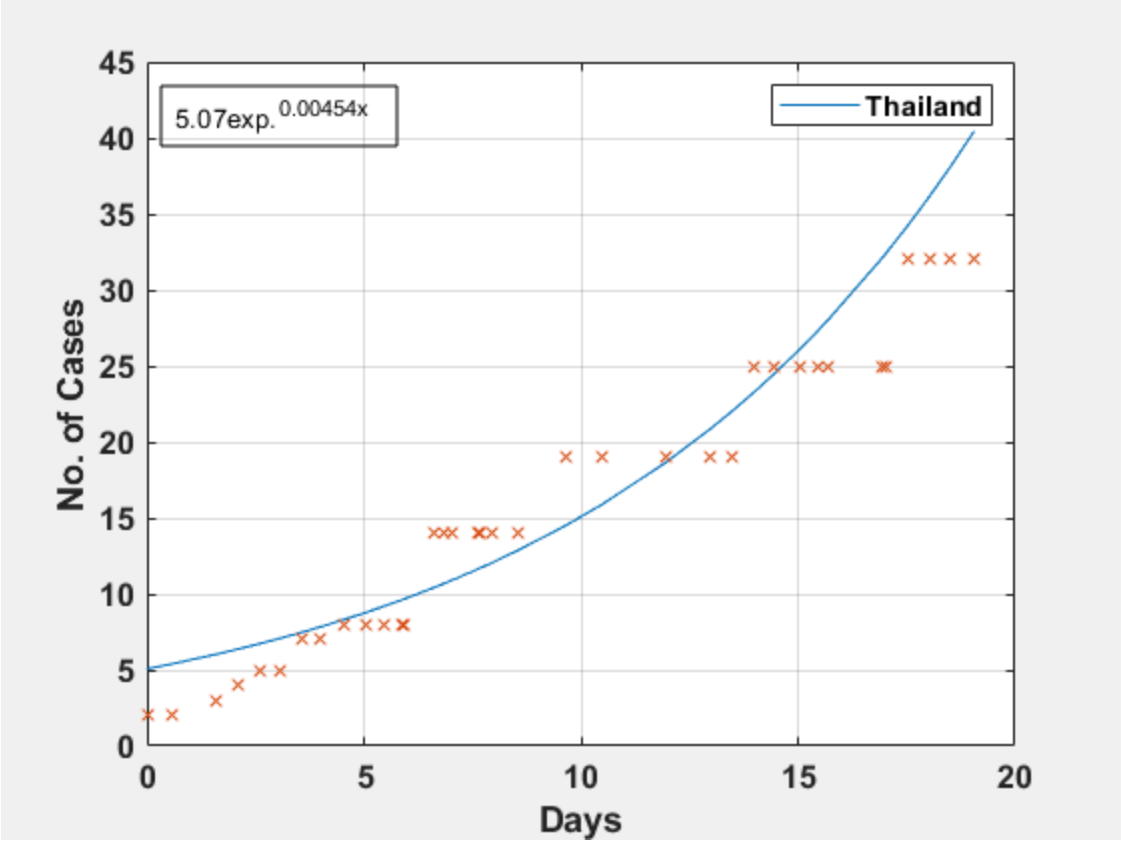

10.71exp.0.00503x
Tianjin
No. of Cases
Days
0
20
40
60
80
100
120
0
5
10
15
20

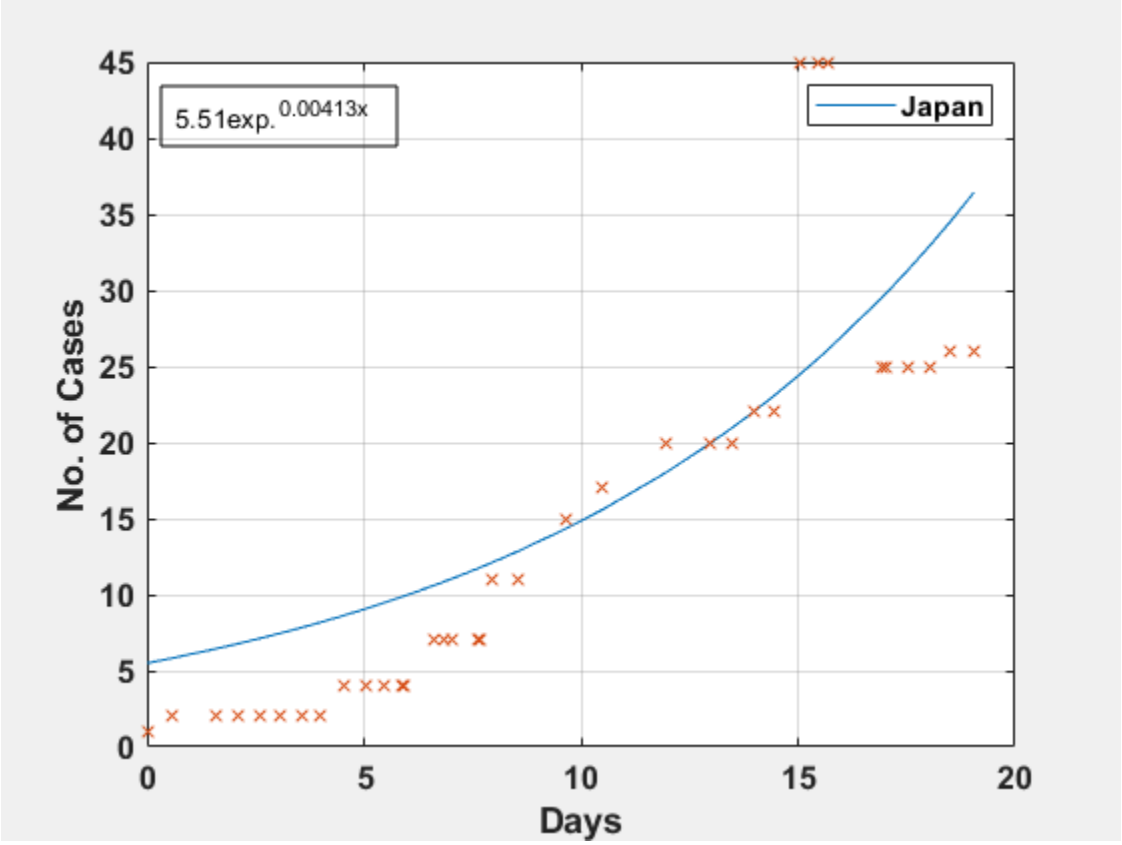

Single number reported
Tibet
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

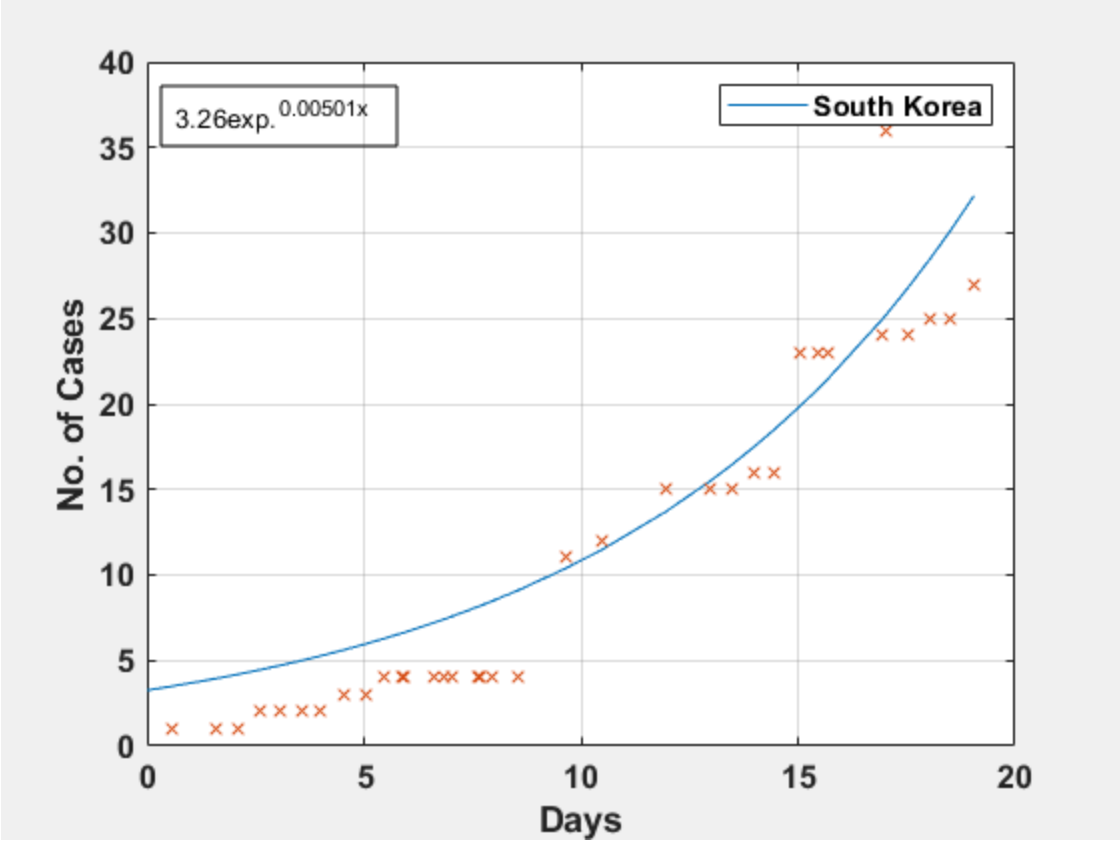

4.92exp.0.00518x
Xinjiang
No. of Cases
Days
0
10
20
30
40
50
60
0
5
10
15
20

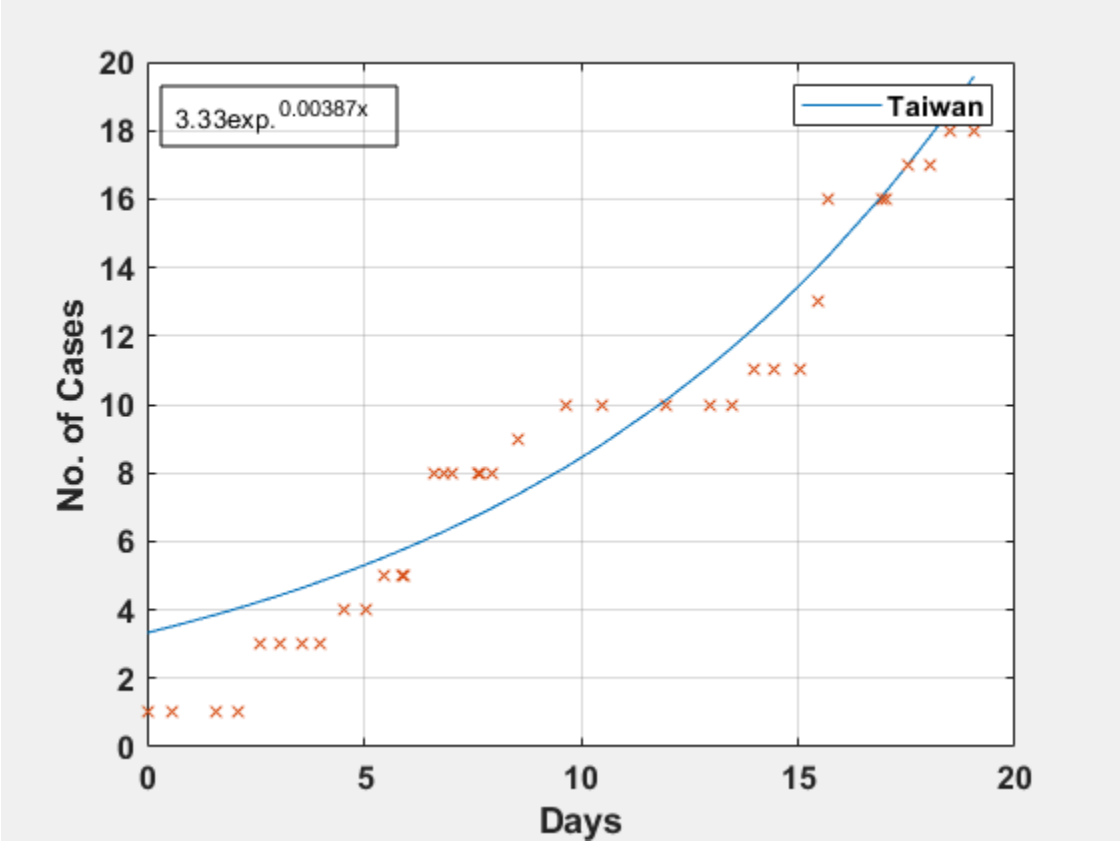

22.90exp.0.00450x
Yunnan
No. of Cases
Days
0
20
40
60
80
100
120
140
160
180
0
5
10
15
20

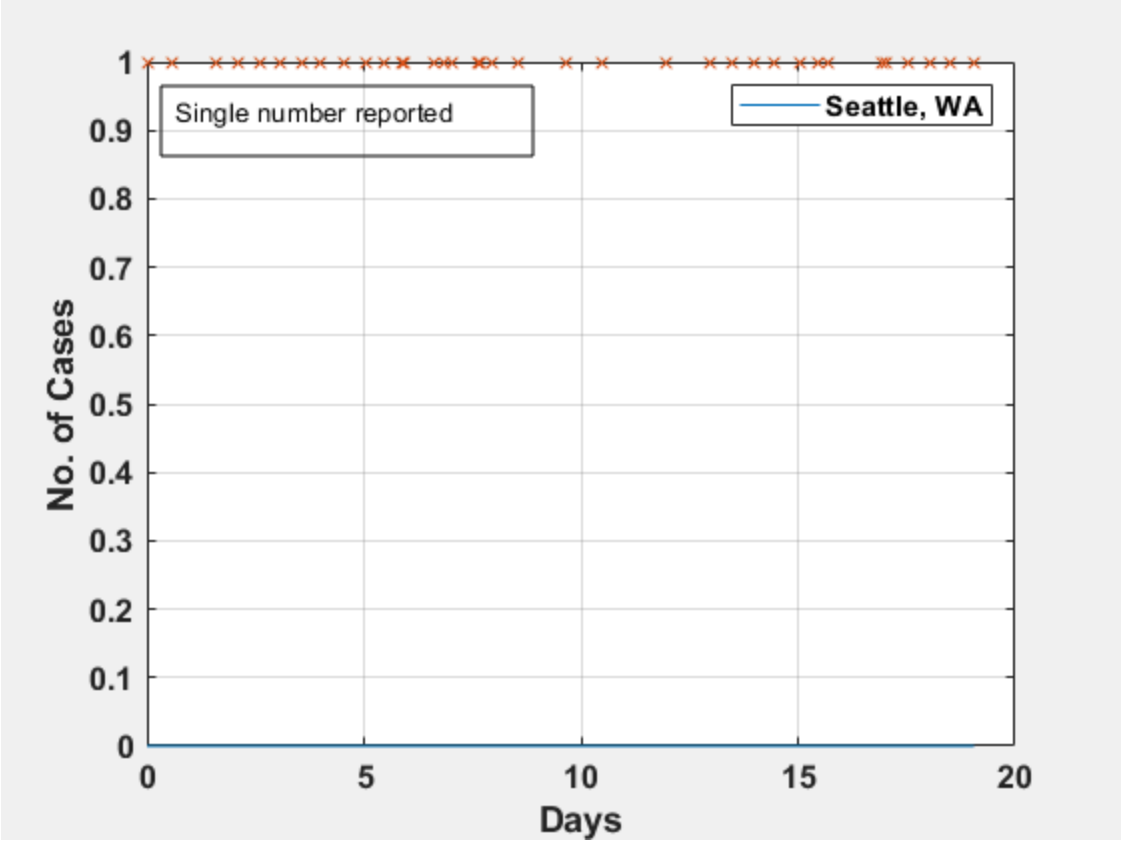

141.42exp.0.00485x
Zhejiang
No. of Cases
Days
0
200
400
600
800
1000
1200
1400
0
5
10
15
20

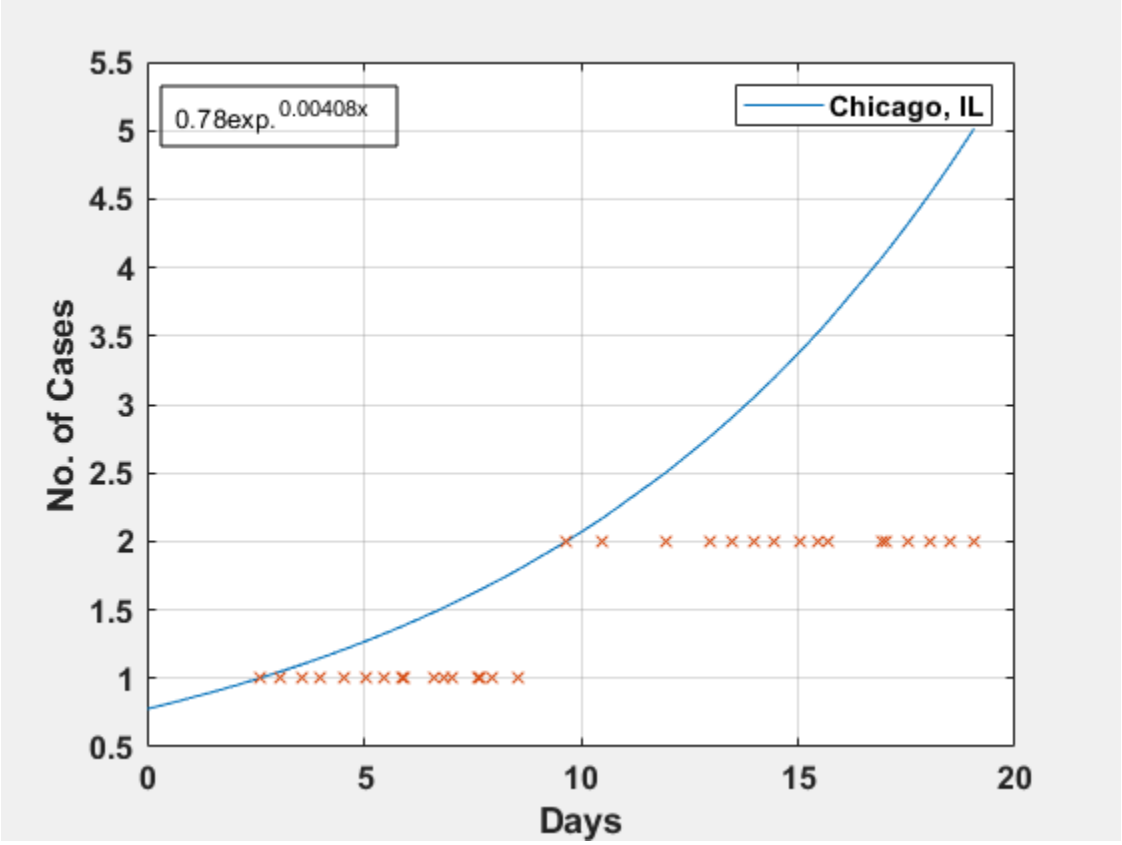

5.07exp.0.00454x
Thailand
No. of Cases
Days
0
5
10
15
20
25
30
35
40
45

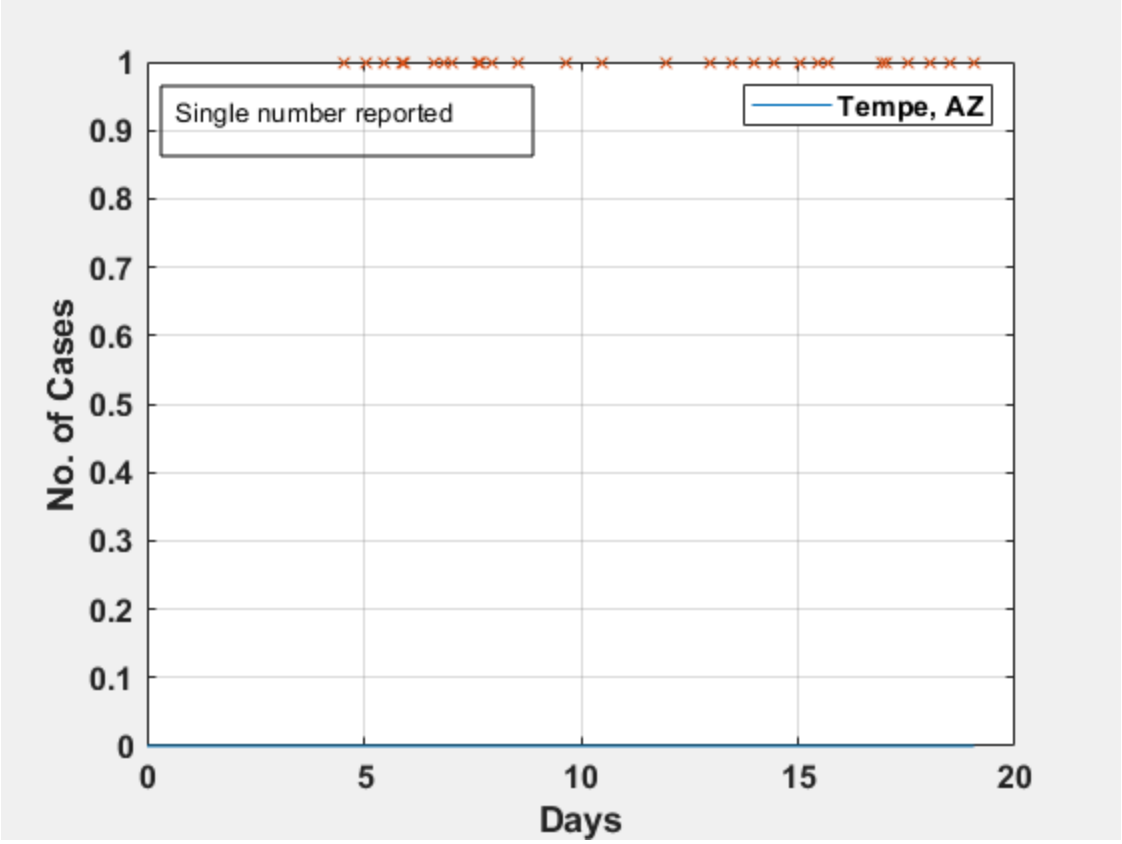

5.51exp.0.00413x
Japan
No. of Cases
Days
0
5
10
15
20
25
30
35
40
45

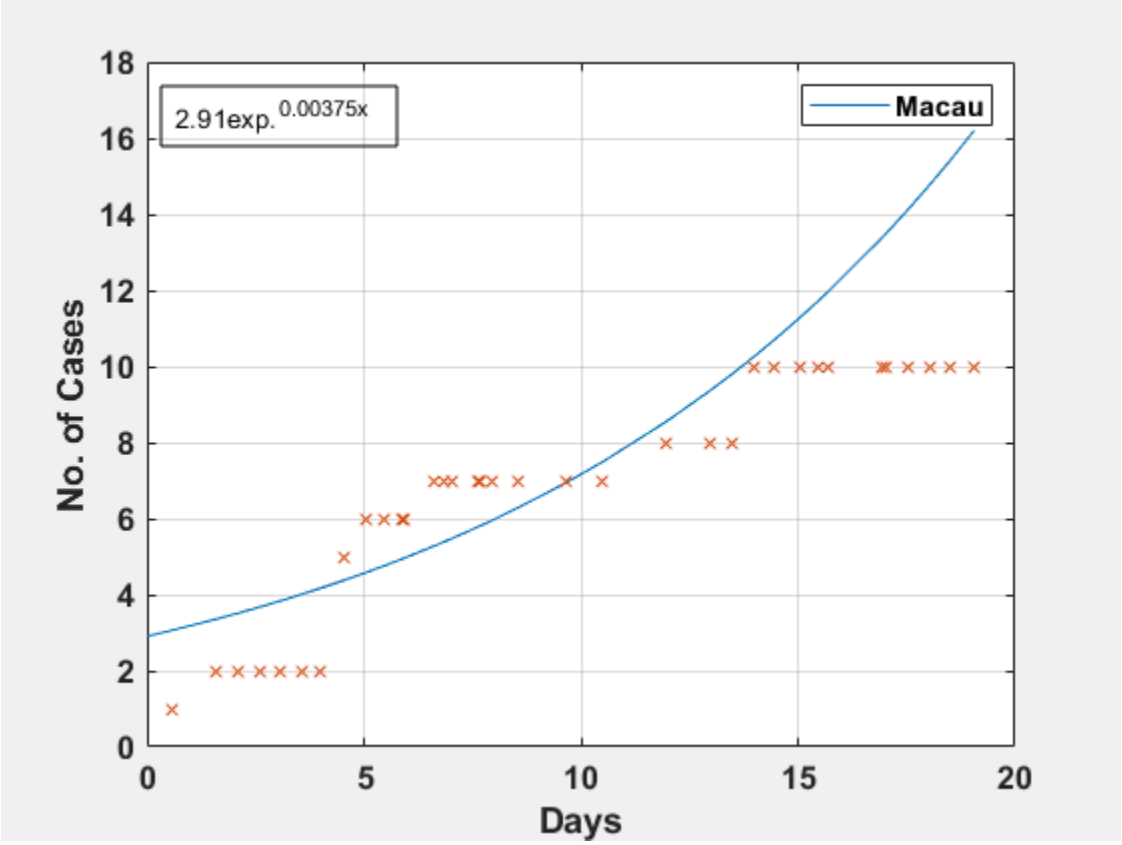

3.26exp.0.00501x
South Korea
No. of Cases
Days
0
5
10
15
20
25
30
35
40

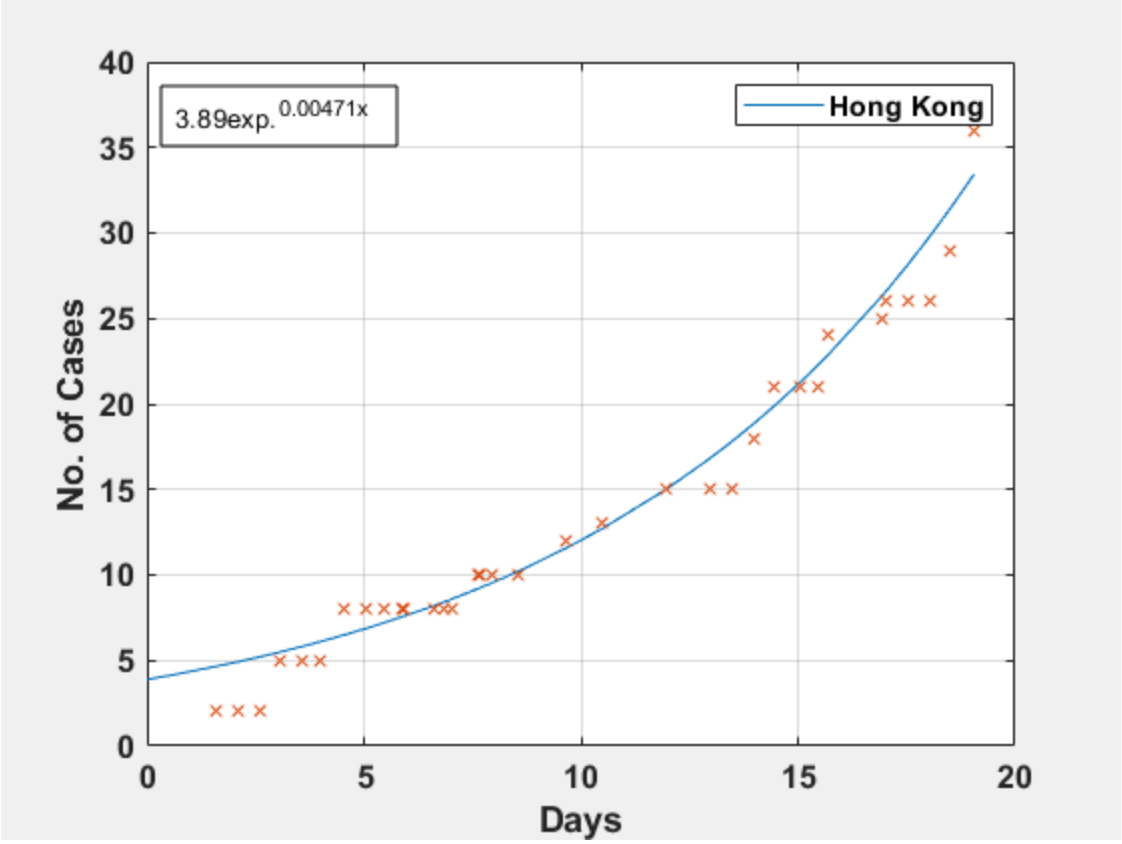

3.33exp.0.00387x
Taiwan
No. of Cases
Days
0
2
4
6
8
10
12
14
16
18
20

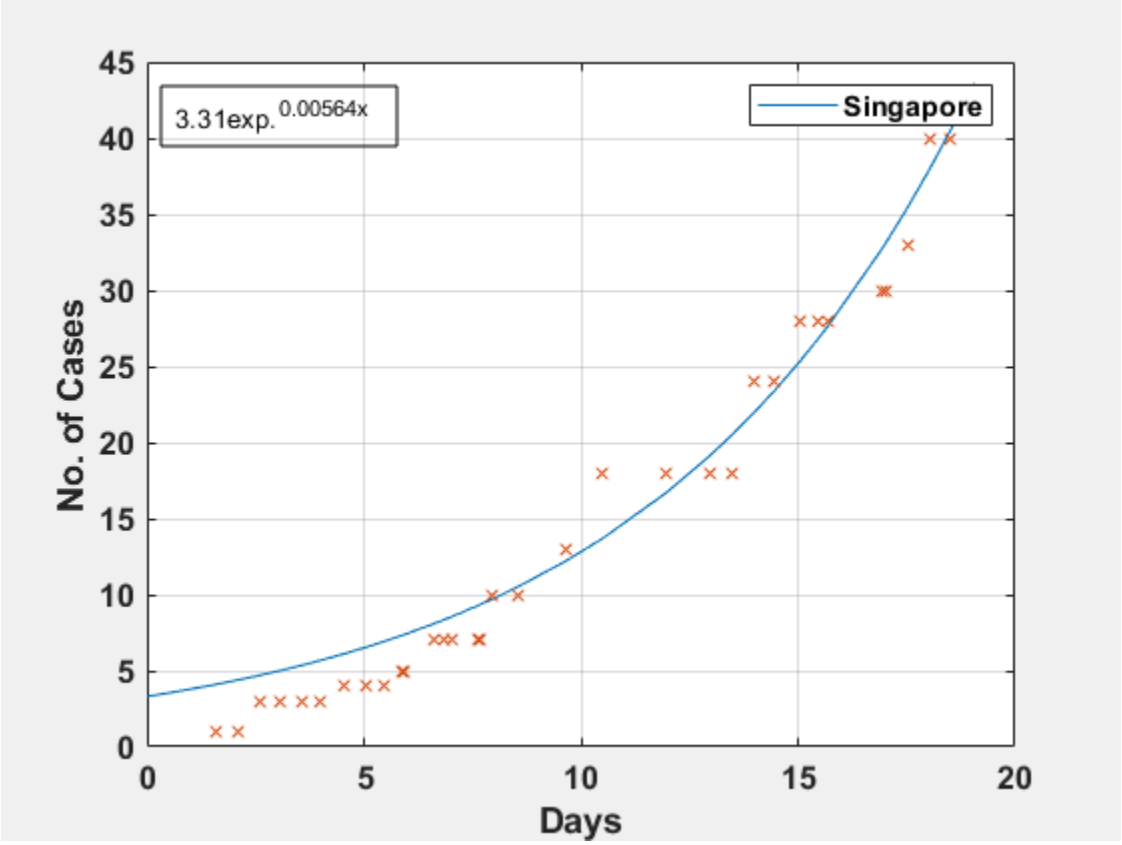

Single number reported
Seattle, WA
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

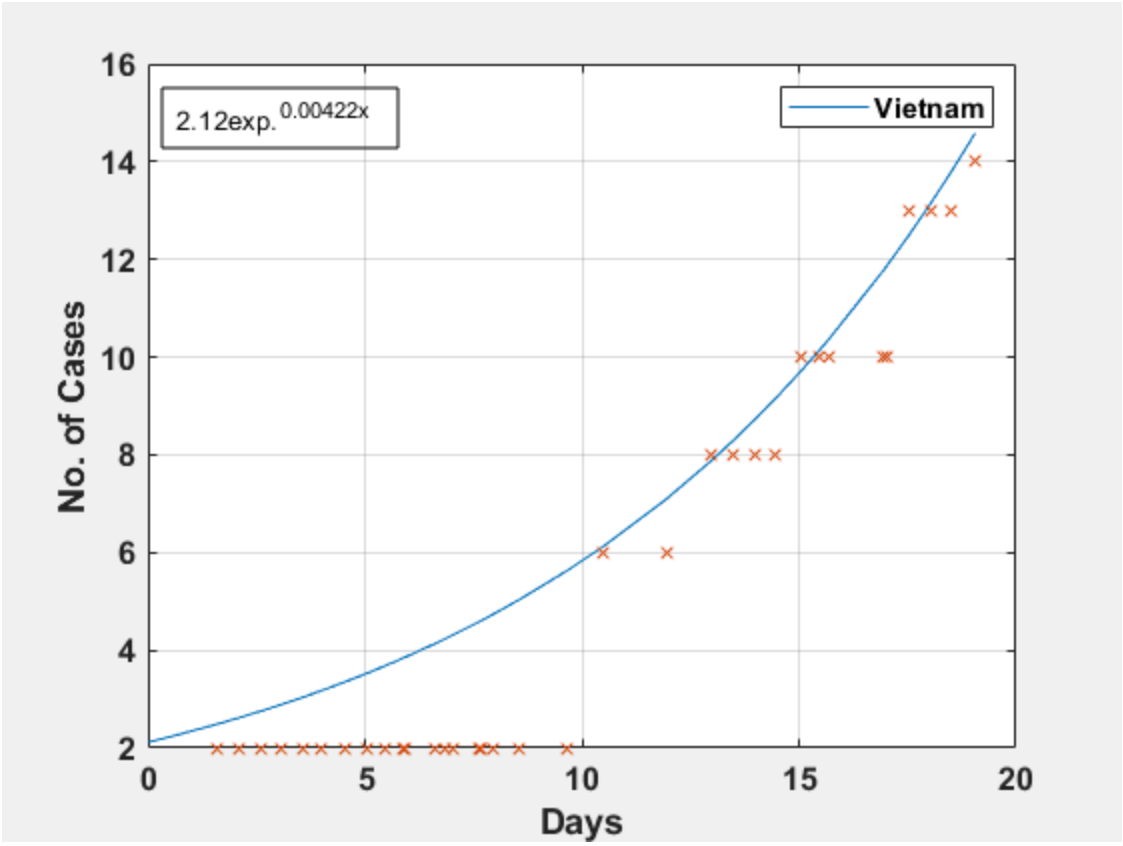

0.78exp.0.00408x
Chicago, IL
No. of Cases
Days
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
5.5
0
5
10
15
20

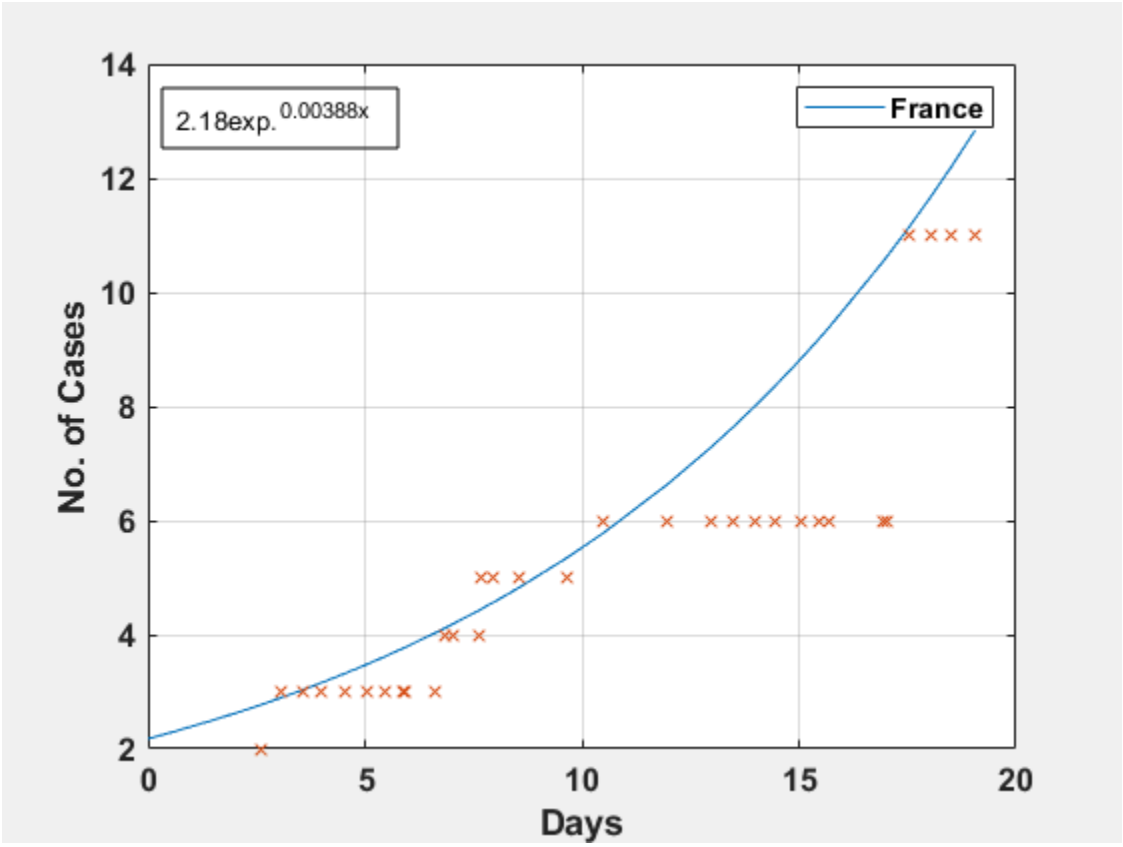

Single number reported
Tempe, AZ
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

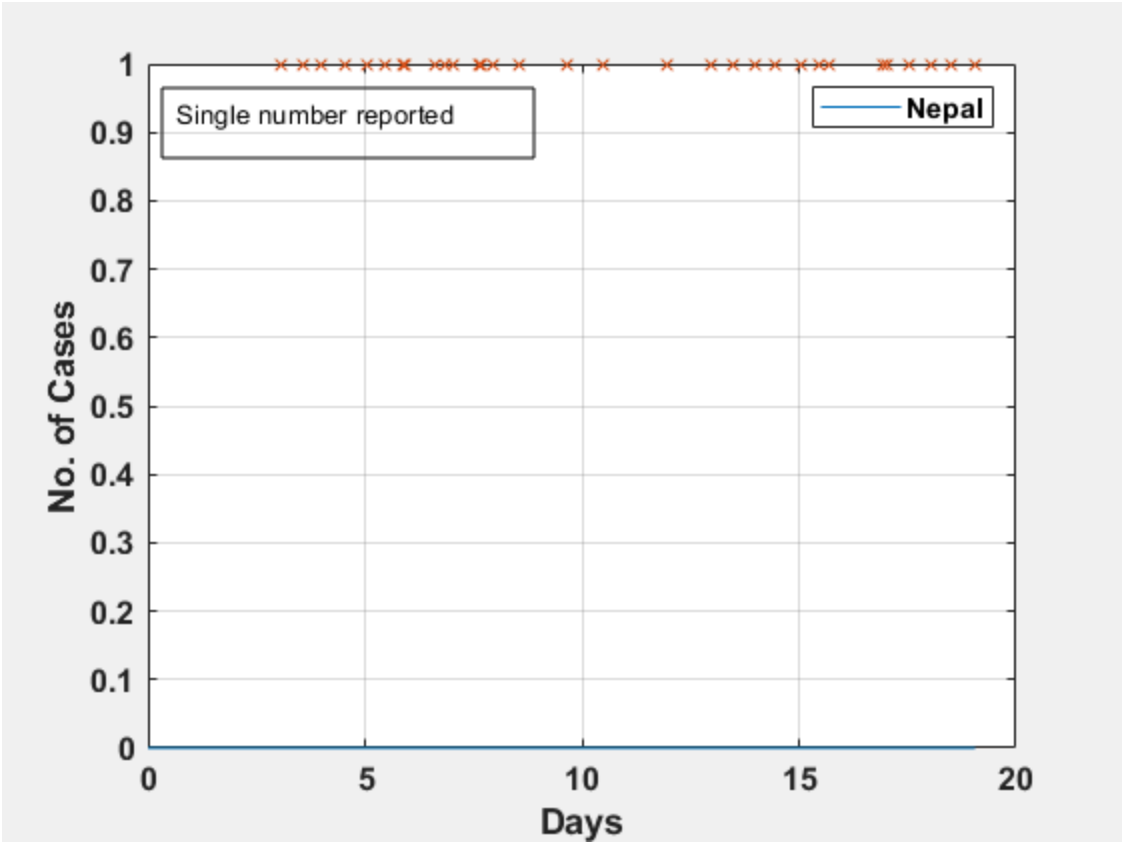

2.91exp.0.00375x
Macau
No. of Cases
Days
0
2
4
6
8
10
12
14
16
18
0
5
10
15
20

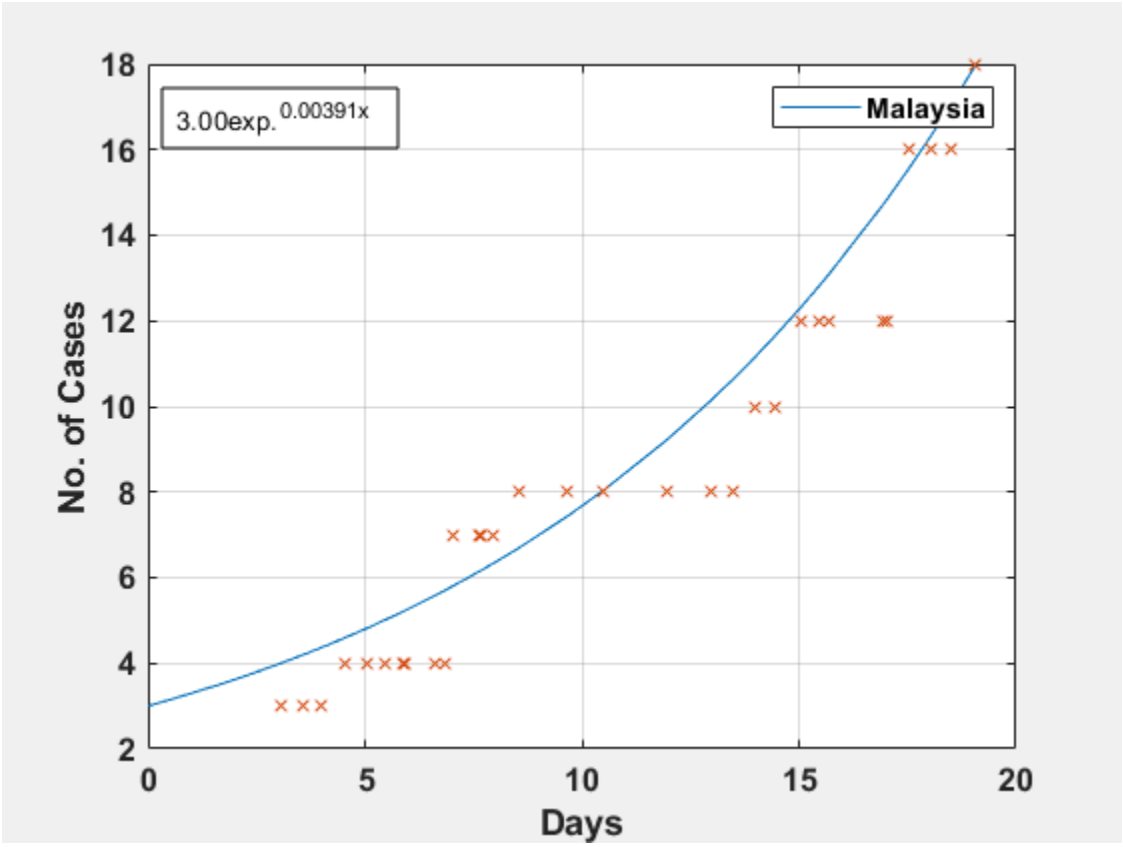

3.89exp.0.00471x
Hong Kong
No. of Cases
Days
0
5
10
15
20
25
30
35
40

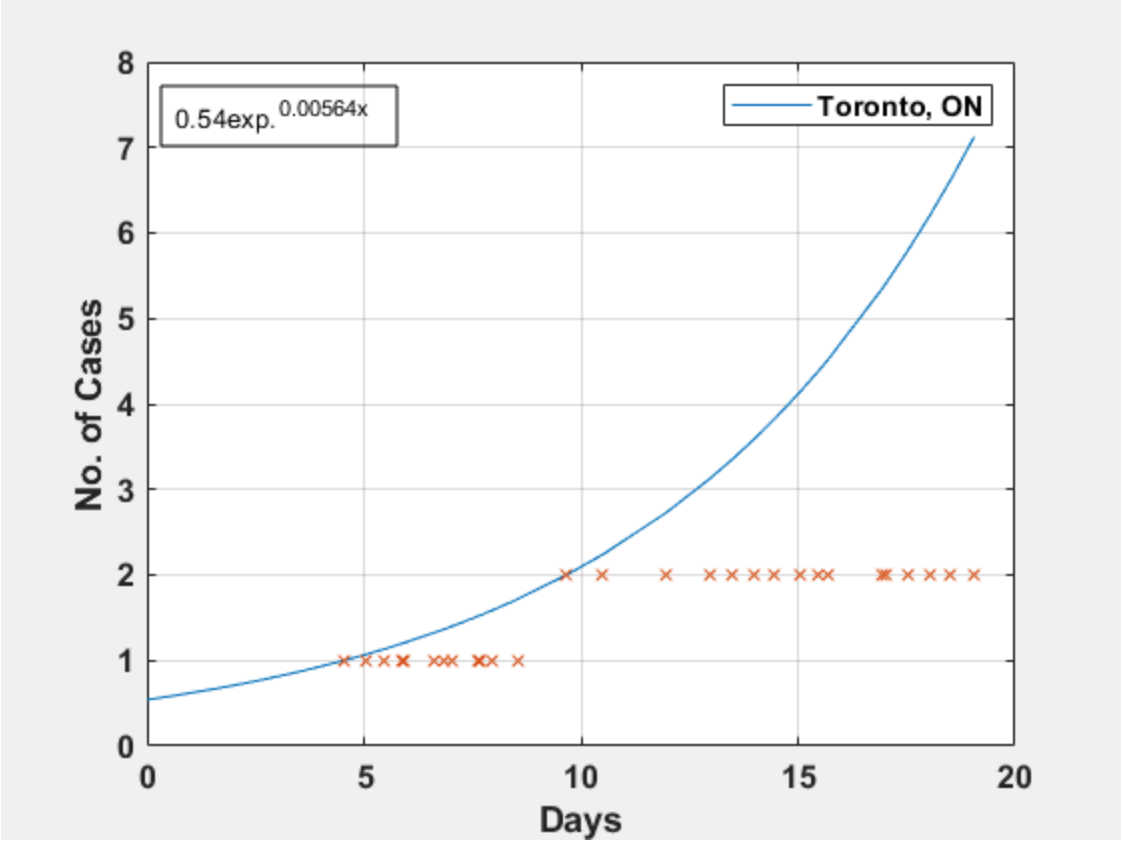

3.31exp.0.00564x
Singapore
No. of Cases
Days
0
5
10
15
20
25
30
35
40
45

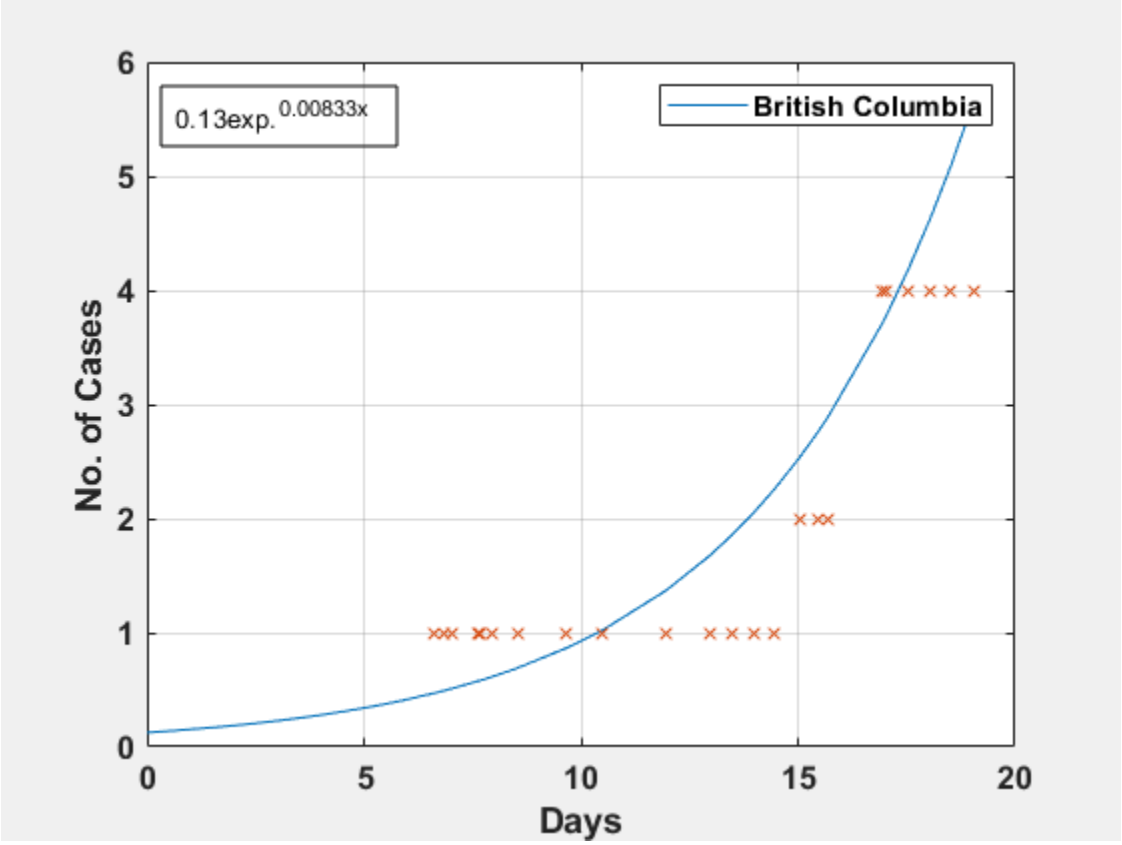

2.12exp.0.00422x
Vietnam
No. of Cases
Days
16
14
12
10
8
6
4
2
0
5
10
15
20

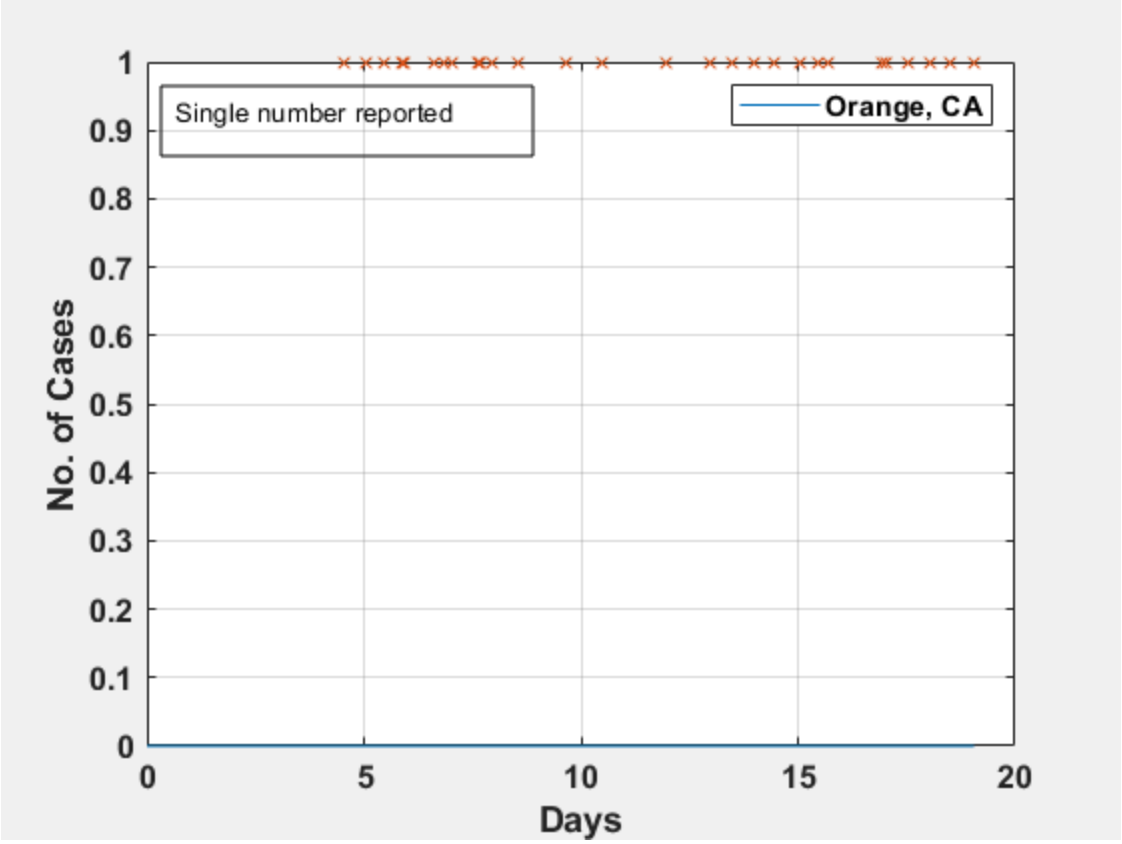

2.18exp.0.00388x
France
No. of Cases
Days
14
12
10
8
6
4
2
0
5
10
15
20

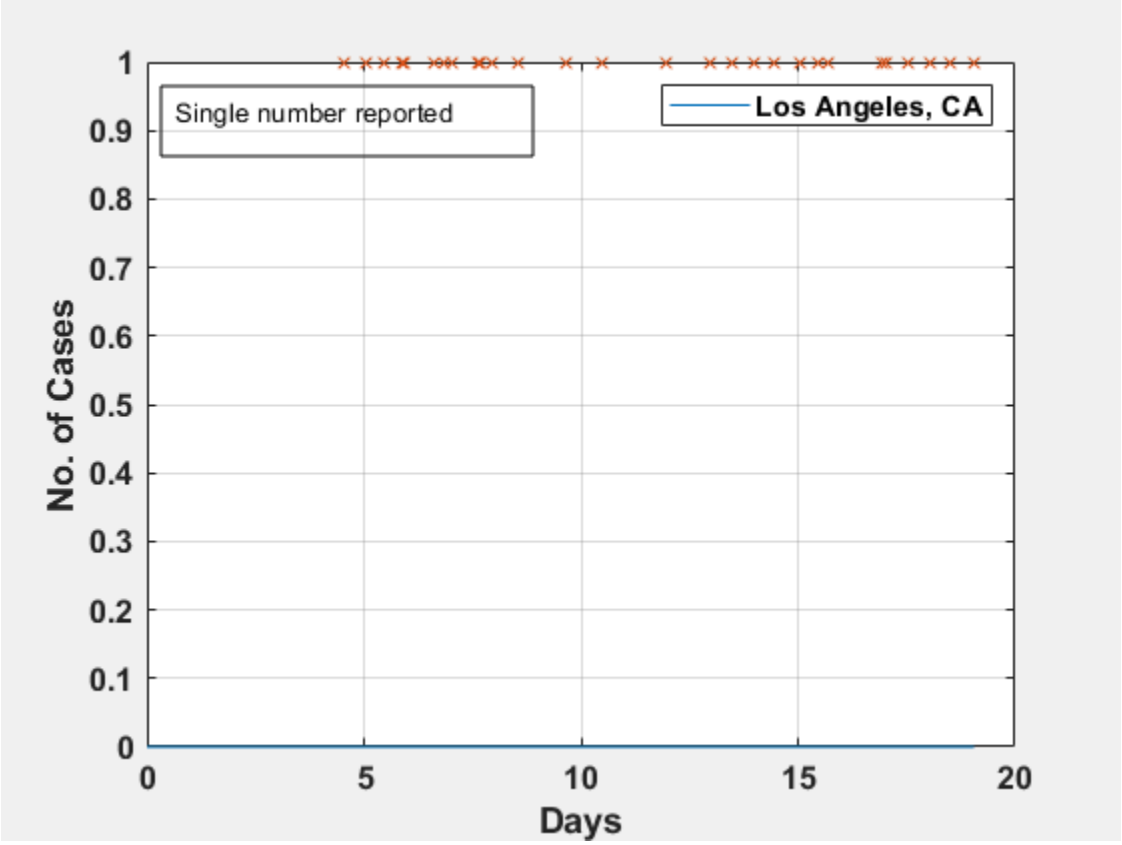

Single number reported
Nepal
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

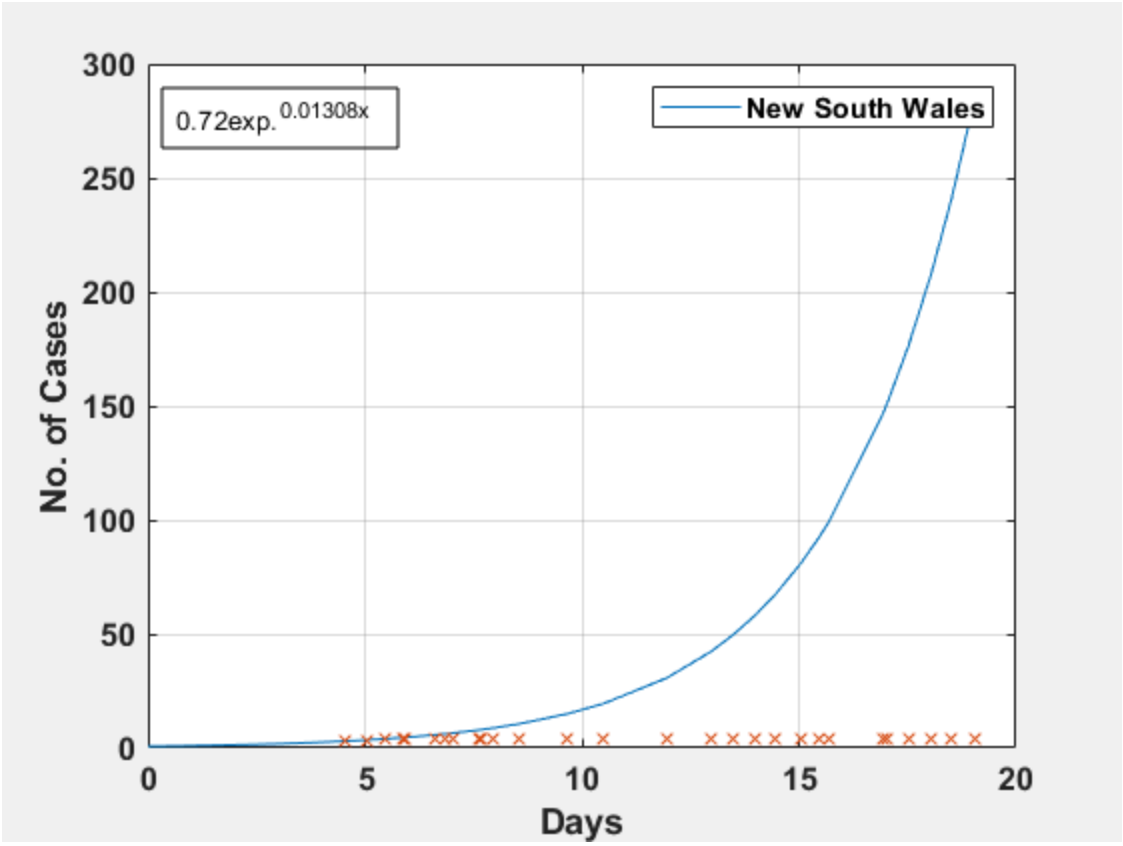

3.00exp.0.00391x
Malaysia
No. of Cases
Days
2
4
6
8
10
12
14
16
18
0
5
10
15
20

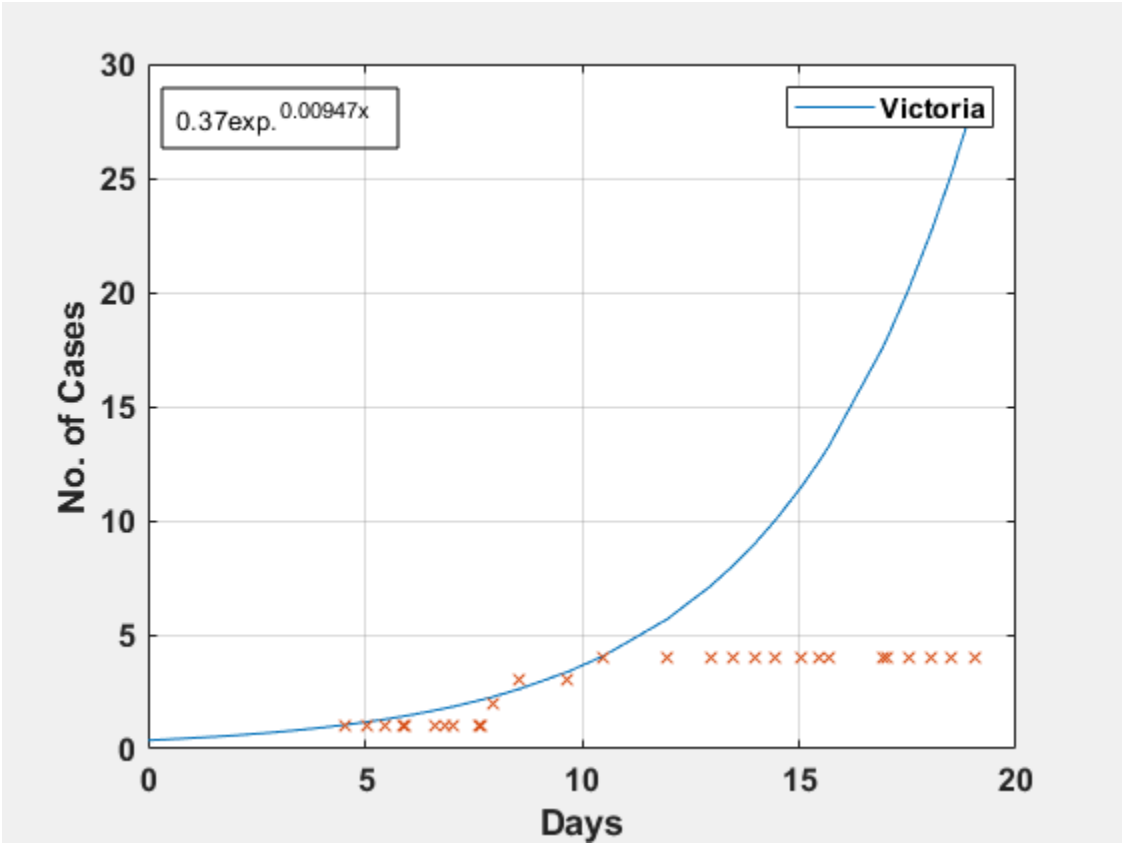

0.54exp.0.00564x
Toronto, ON
No. of Cases
Days
0
1
2
3
4
5
6
7
8
0
5
10
15
20

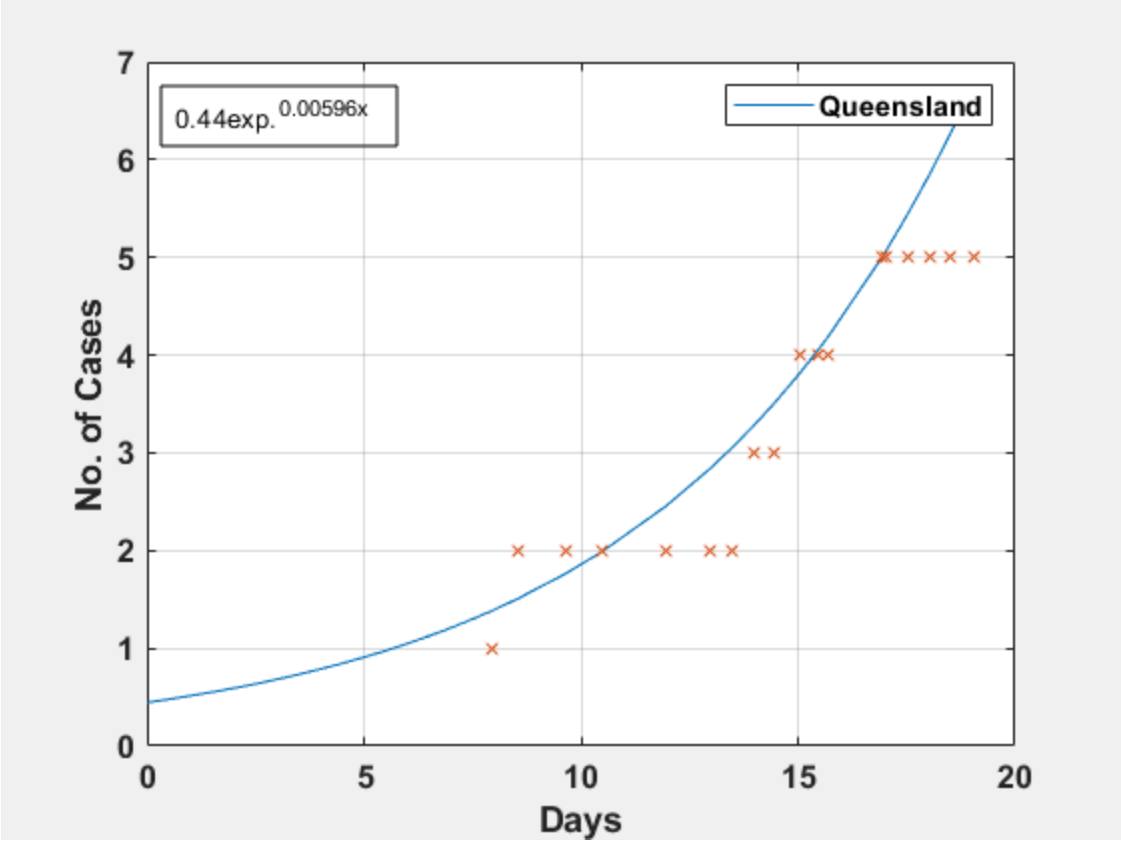

0.13exp.0.00833x
British Columbia
No. of Cases
Days
0
1
2
3
4
5
6
0
5
10
15
20

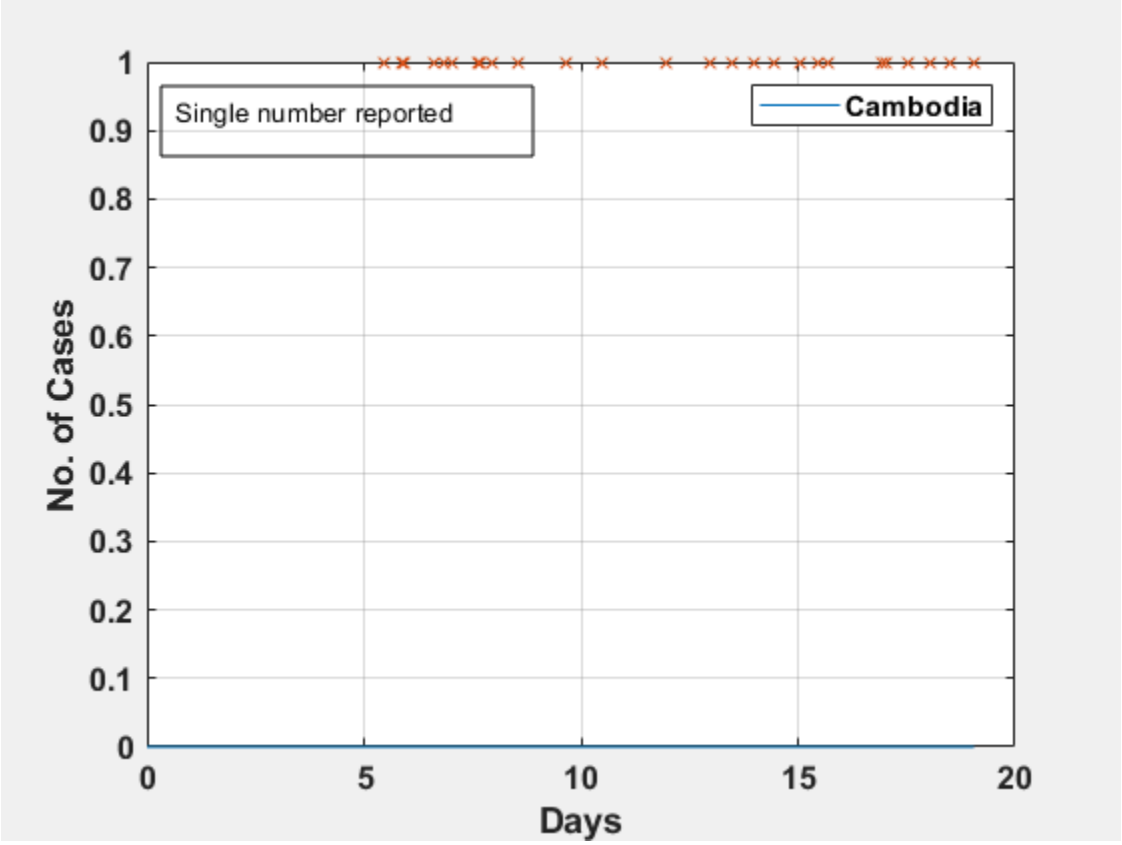

Single number reported
Orange, CA
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

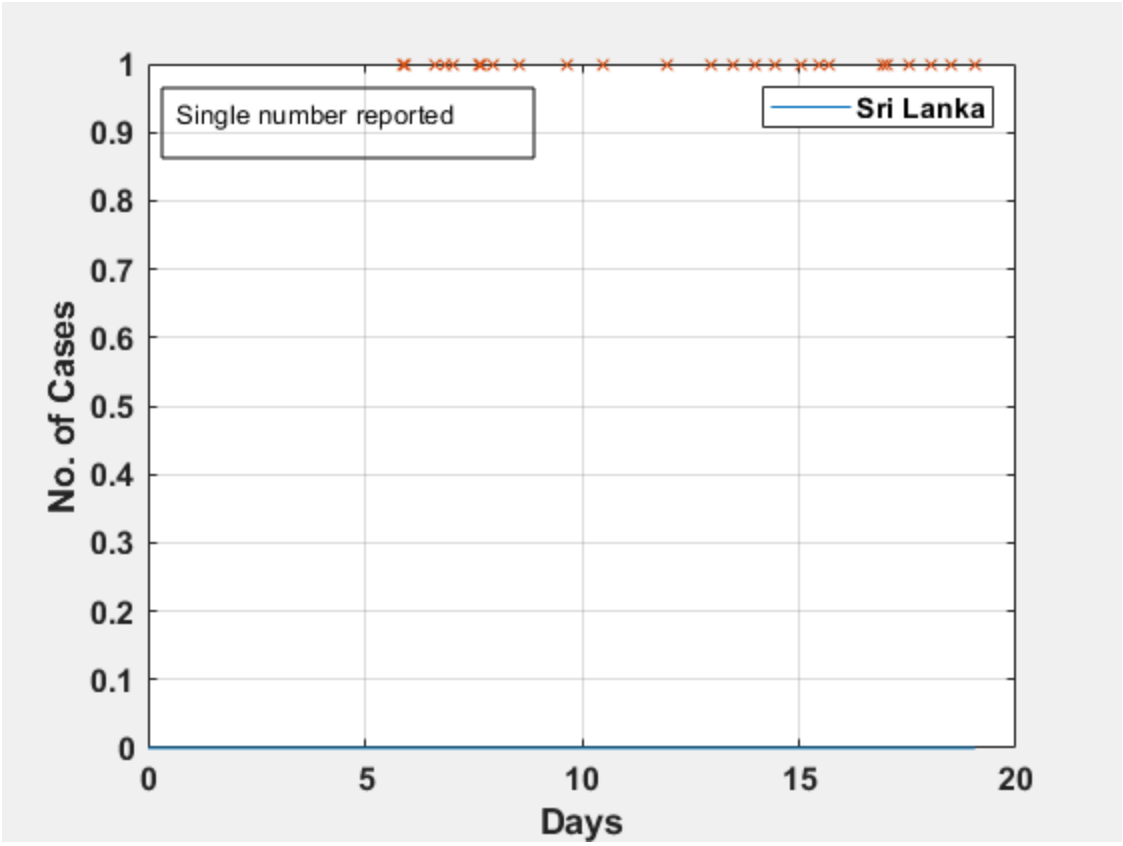

Single number reported
Los Angeles, CA
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

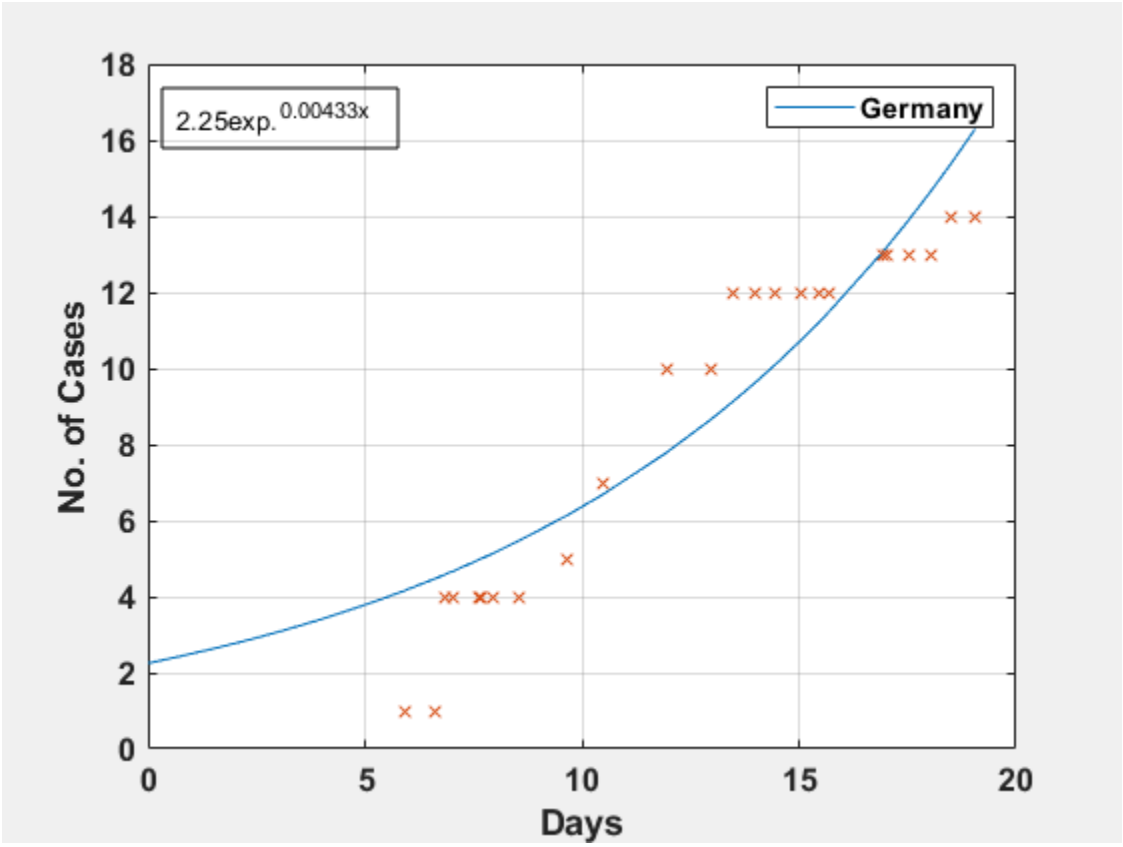

0.72exp.0.01308x
New South Wales
No. of Cases
Days
300
250
200
150
100
50
0
0
5
10
15
20

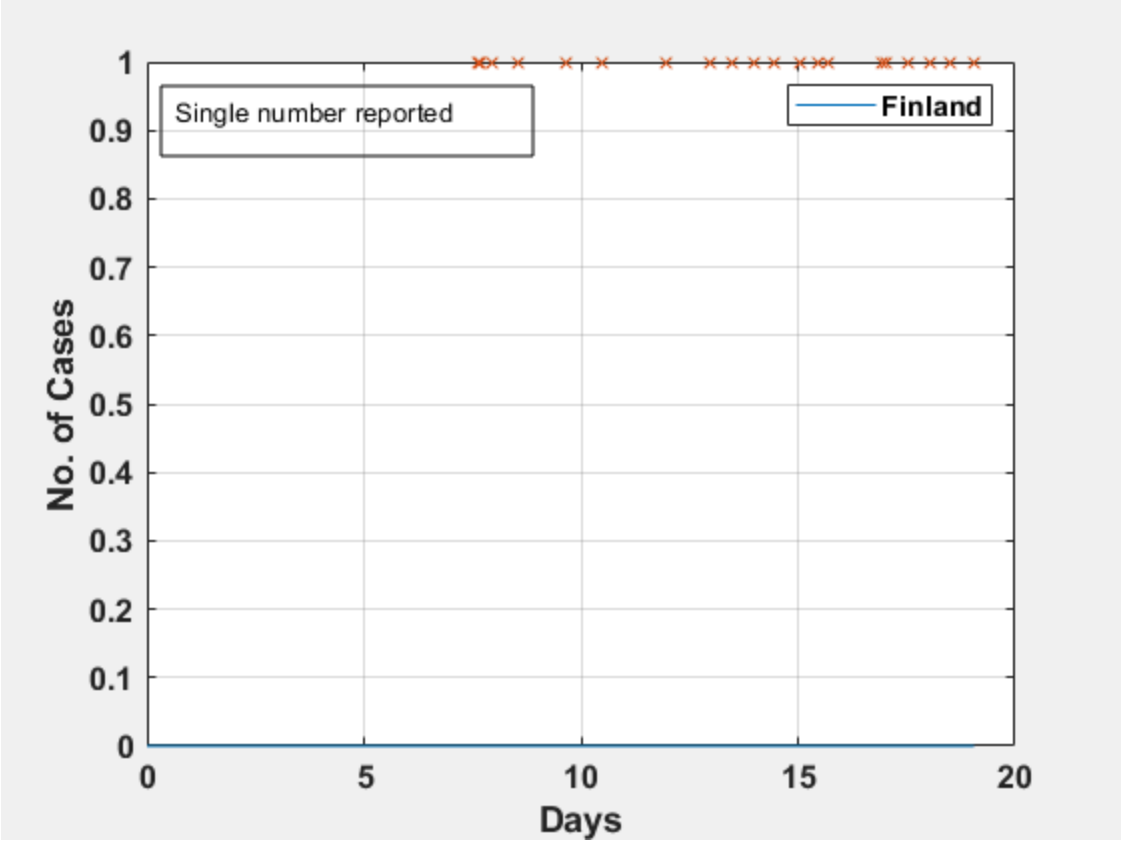

0.37exp.0.00947x
Victoria
No. of Cases
Days
30
25
20
15
10
5
0
0
5
10
15
20

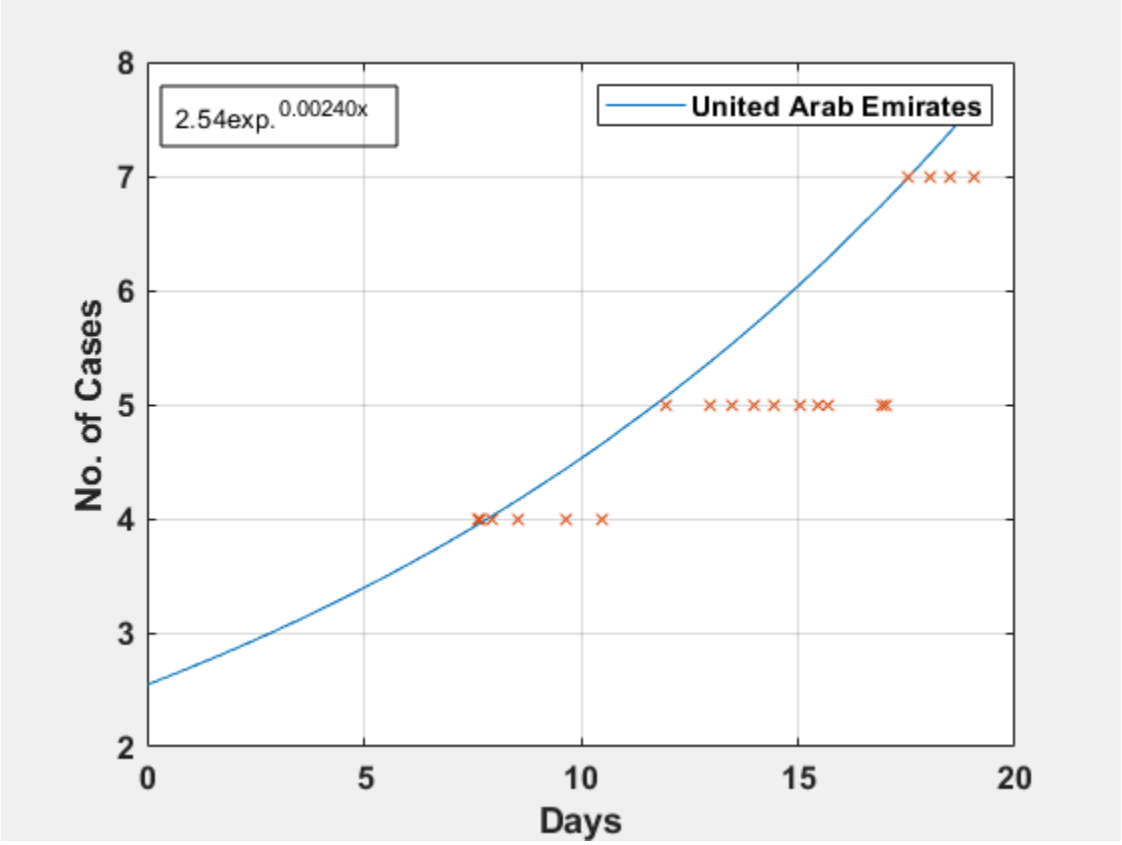

0.44exp.0.00596x
Queensland
No. of Cases
Days
0
1
2
3
4
5
6
7
0
5
10
15
20

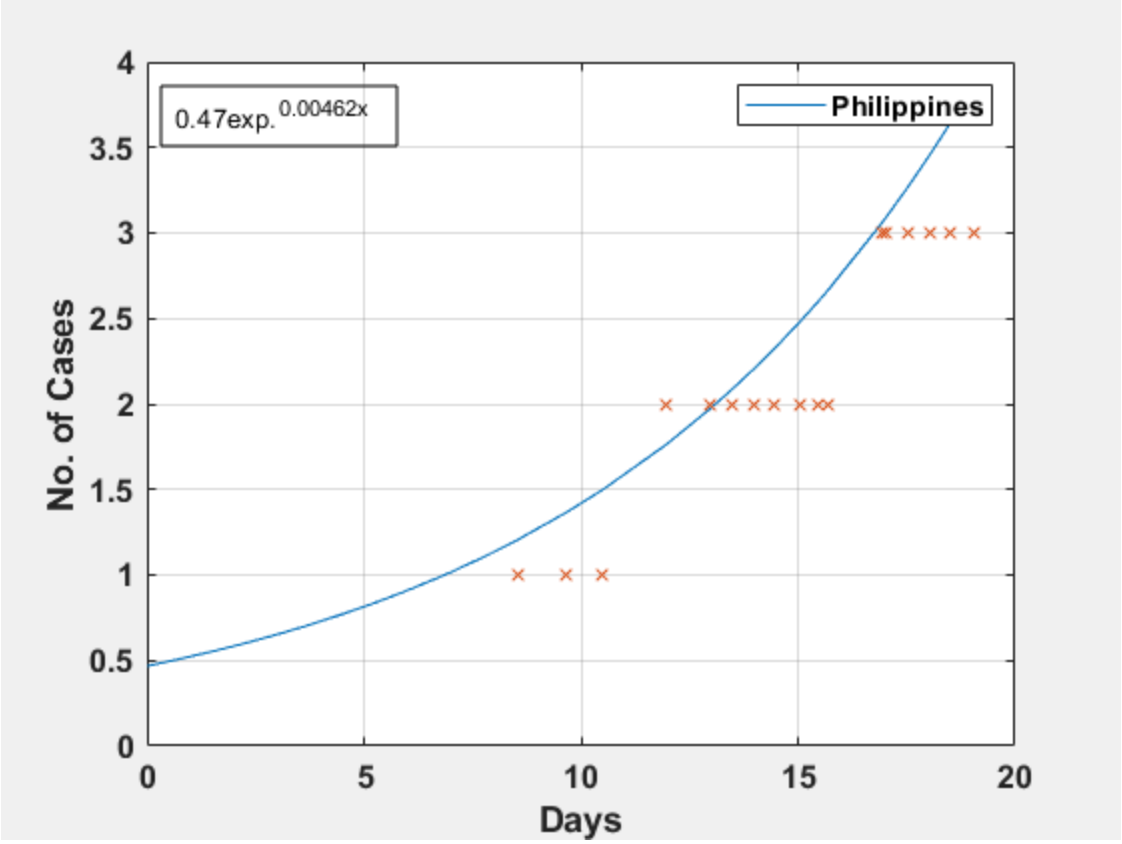

Single number reported
Cambodia
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

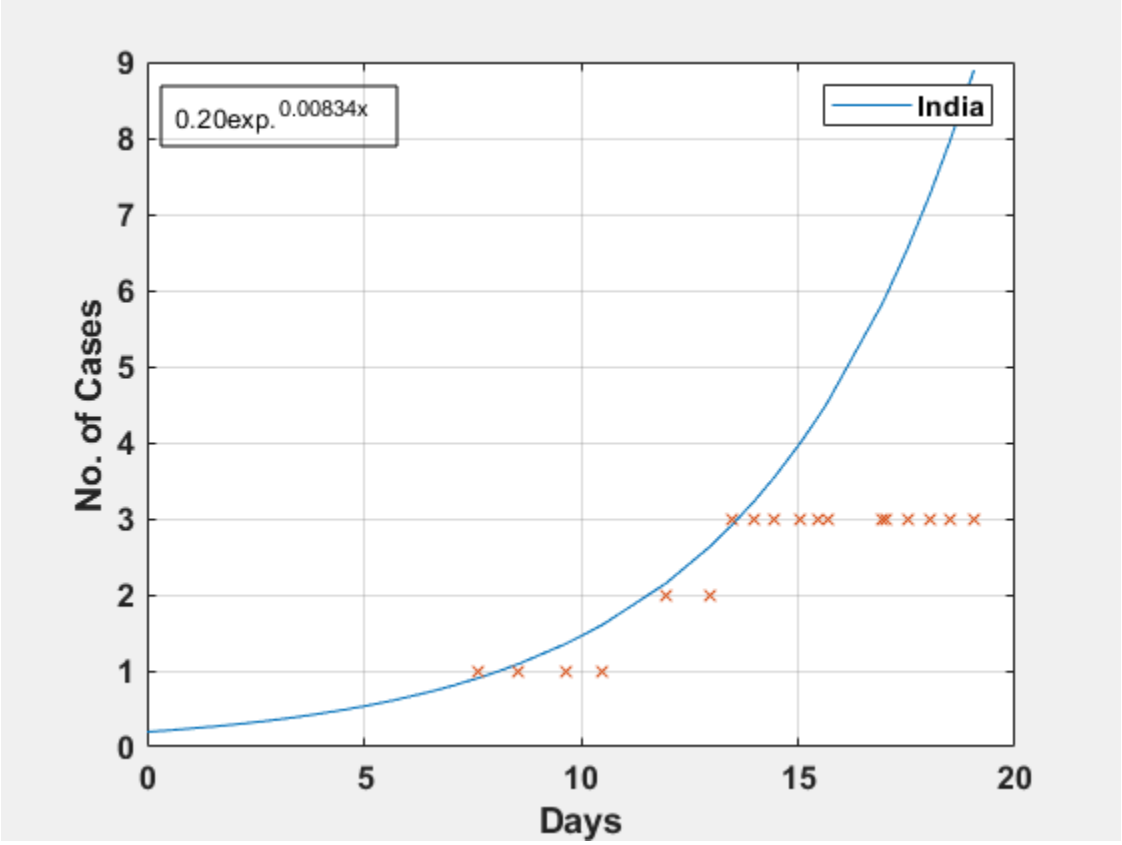

Single number reported
Sri Lanka
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

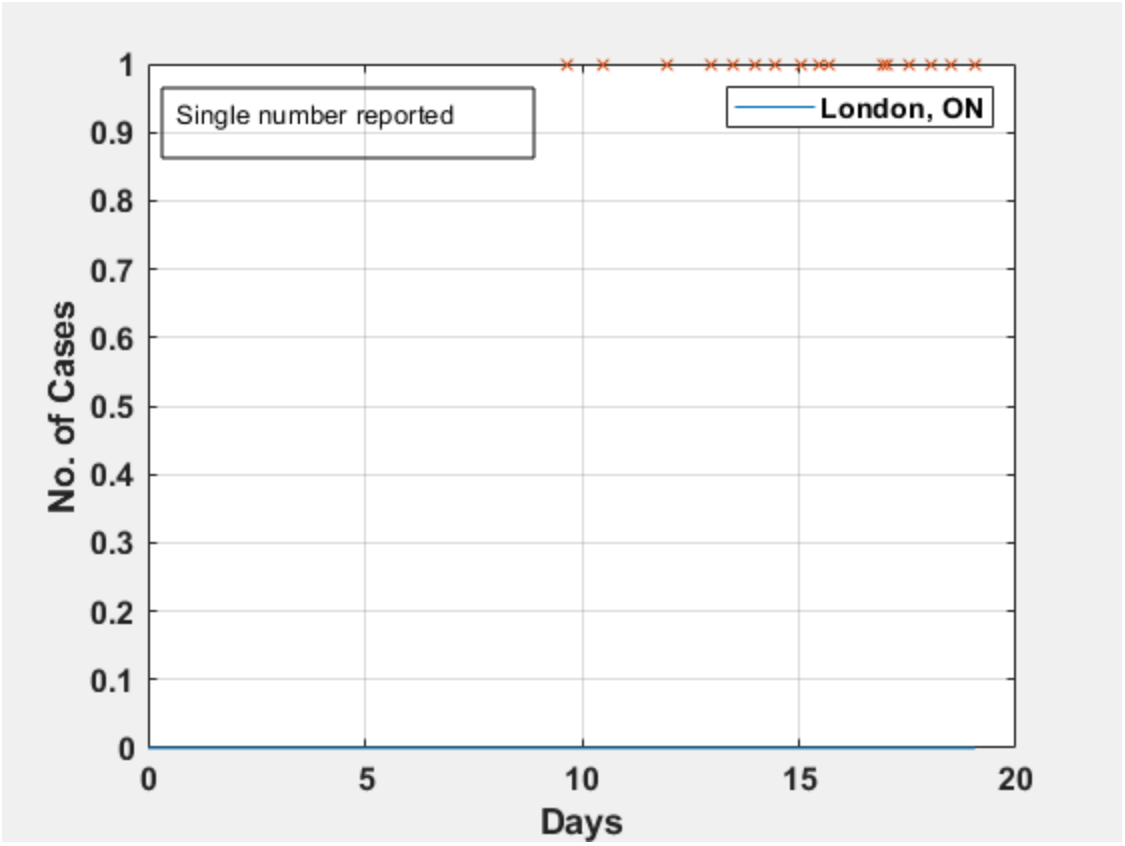

2.25exp.0.00433x
Germany
No. of Cases
Days
0
2
4
6
8
10
12
14
16
18
0
5
10
15
20

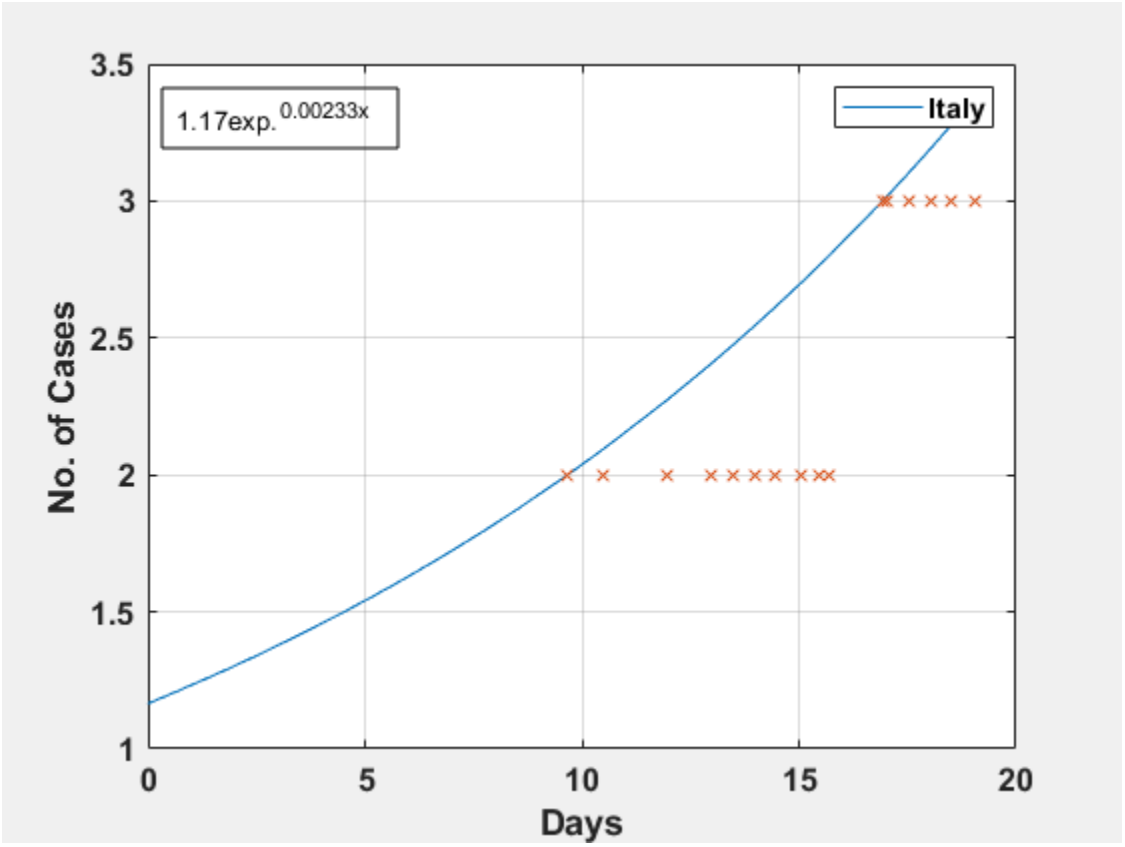

Single number reported
Finland
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

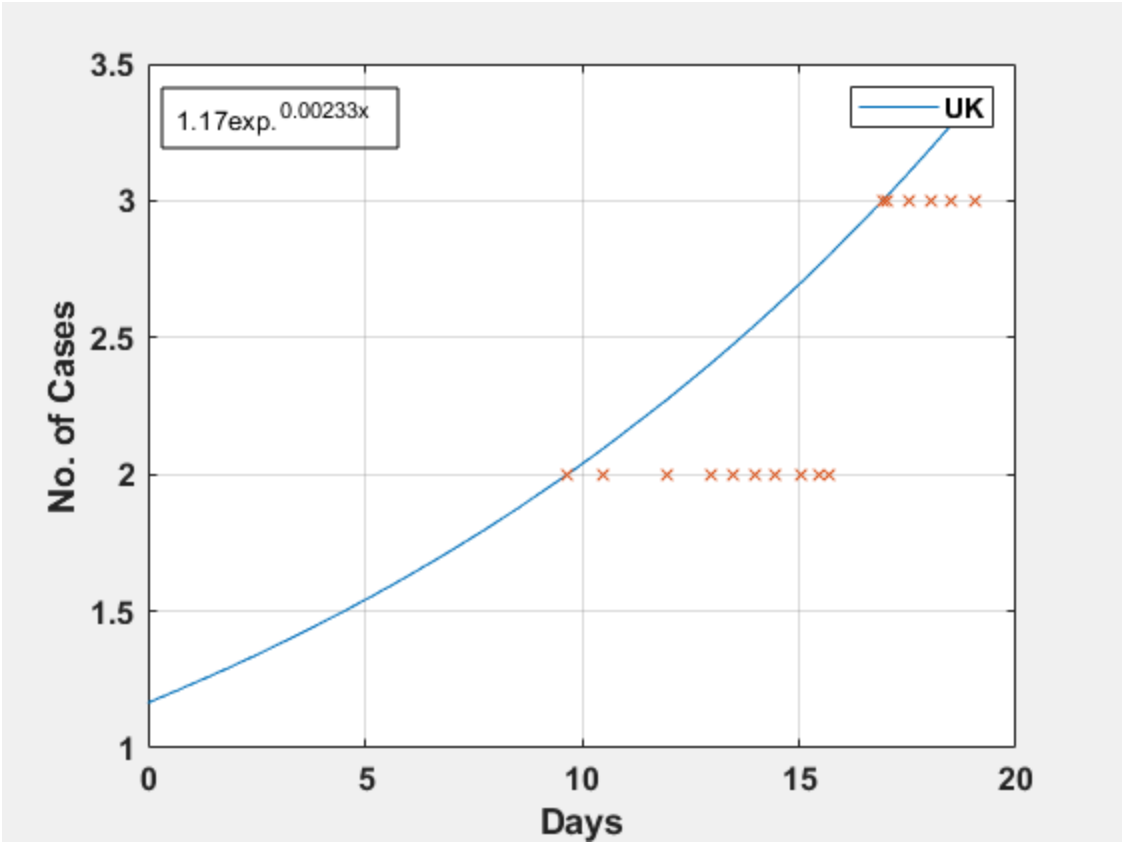

2.54exp.0.00240x
United Arab Emirates
No. of Cases
Days
2
3
4
5
6
7
8
0
5
10
15
20

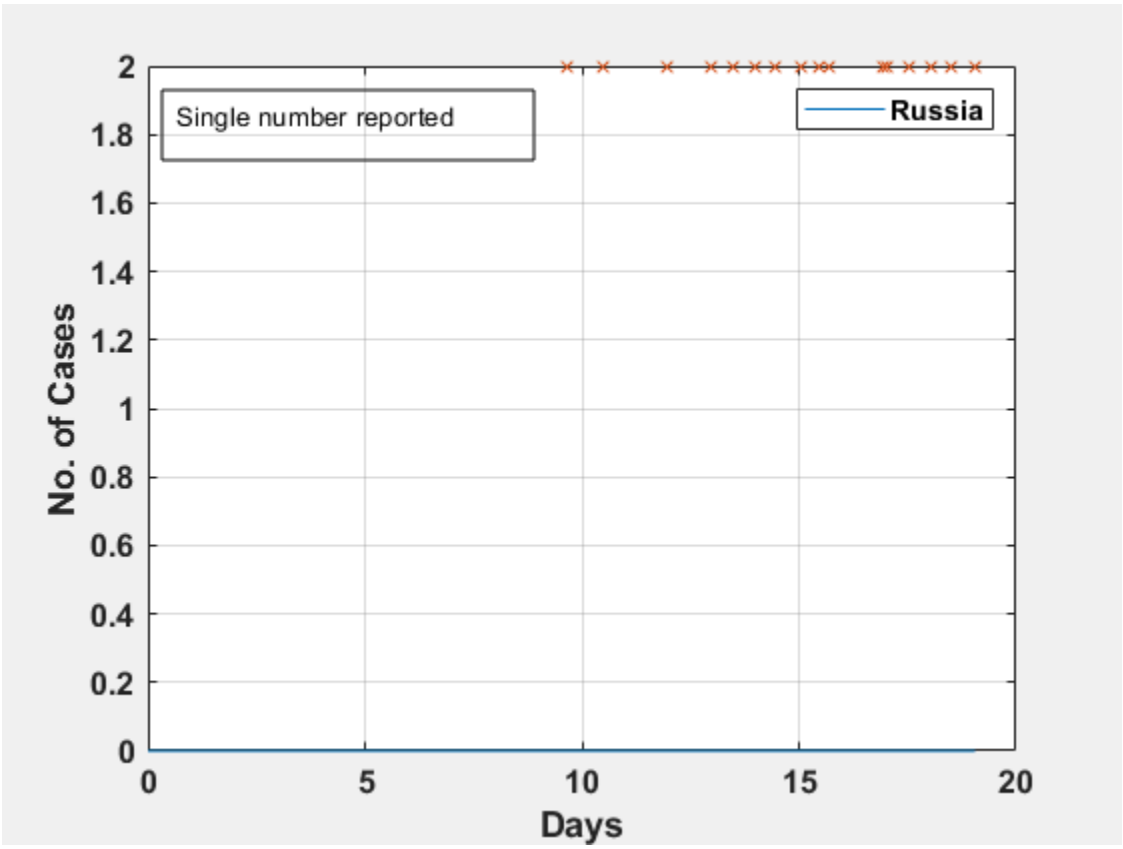

0.47exp.0.00462x
Philippines
No. of Cases
Days
0
0.5
1
1.5
2
2.5
3
3.5
4
0
5
10
15
20

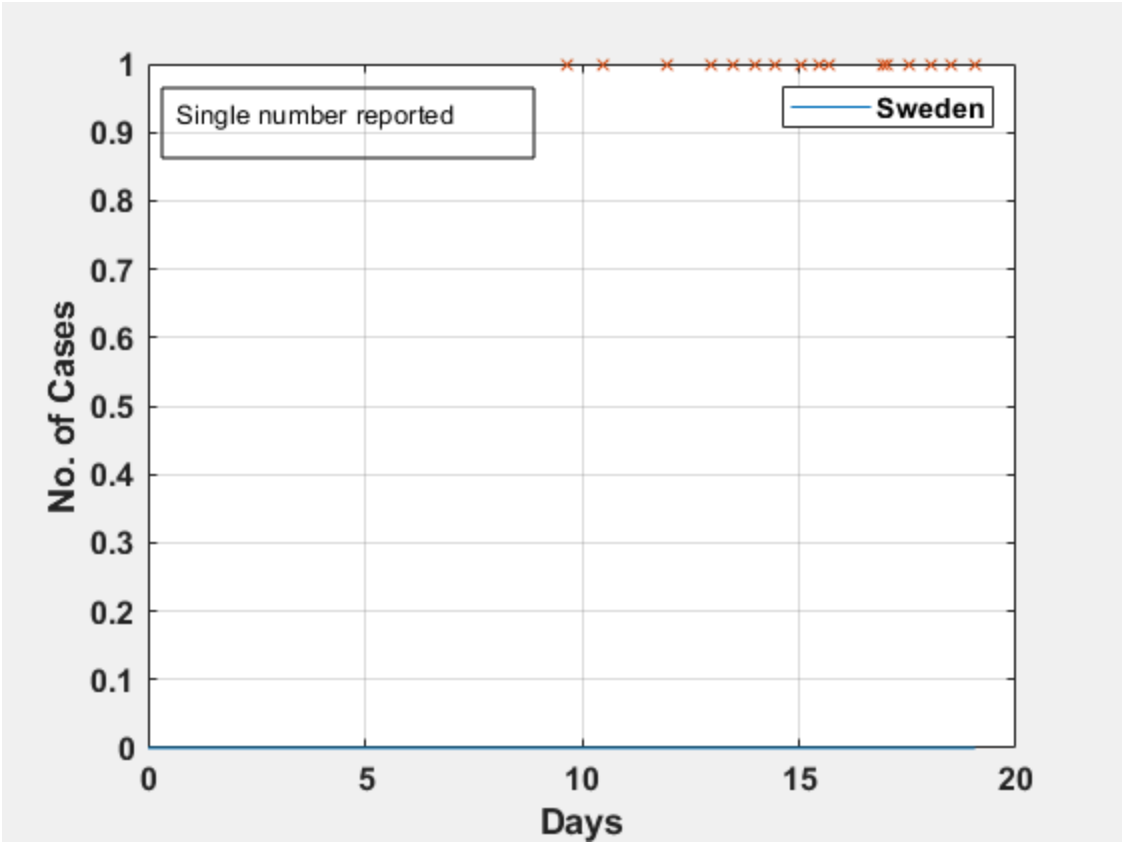

0.20exp.0.00834x
India
No. of Cases
Days
0
1
2
3
4
5
6
7
8
9
0
5
10
15
20

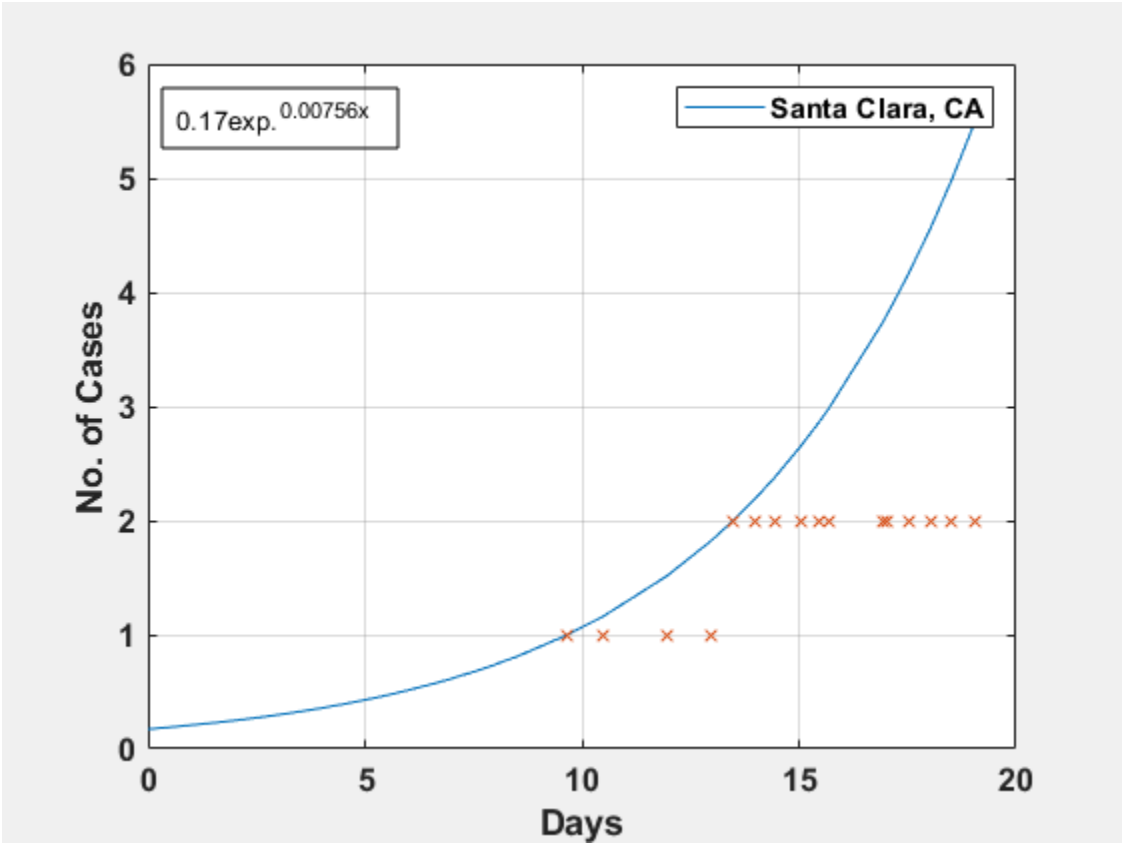

Single number reported
London, ON
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

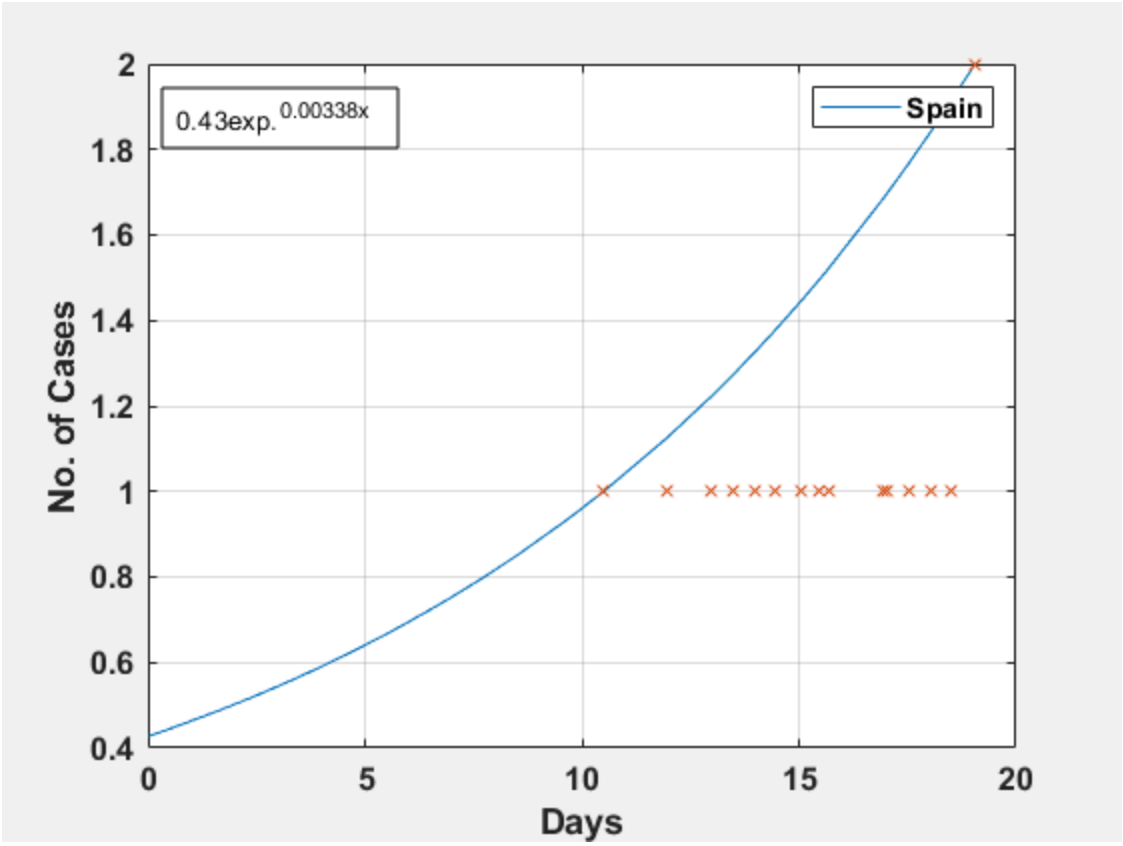

1.17exp.0.00233x
Italy
No. of Cases
Days
1
1.5
2
2.5
3
3.5
0
5
10
15
20

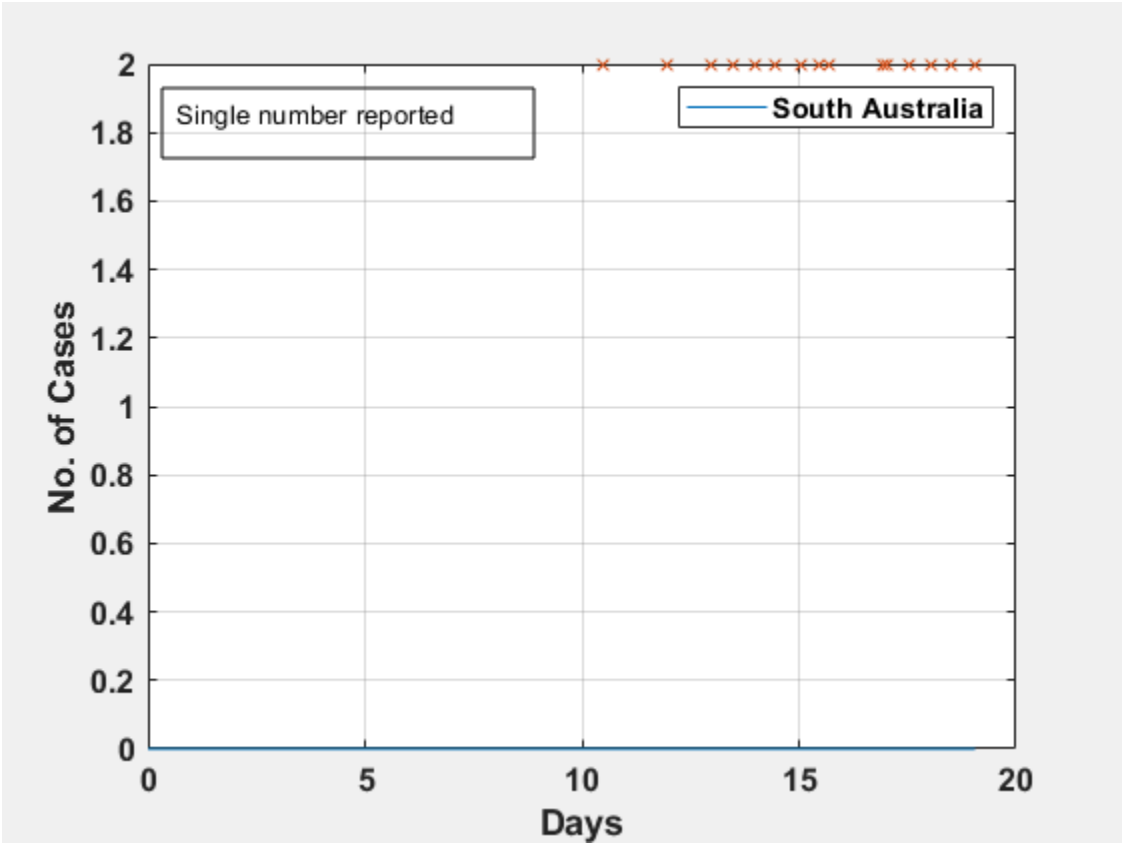

1.17exp.0.00233x
UK
No. of Cases
Days
3.5
3
2.5
2
1.5
1
0
5
10
15
20

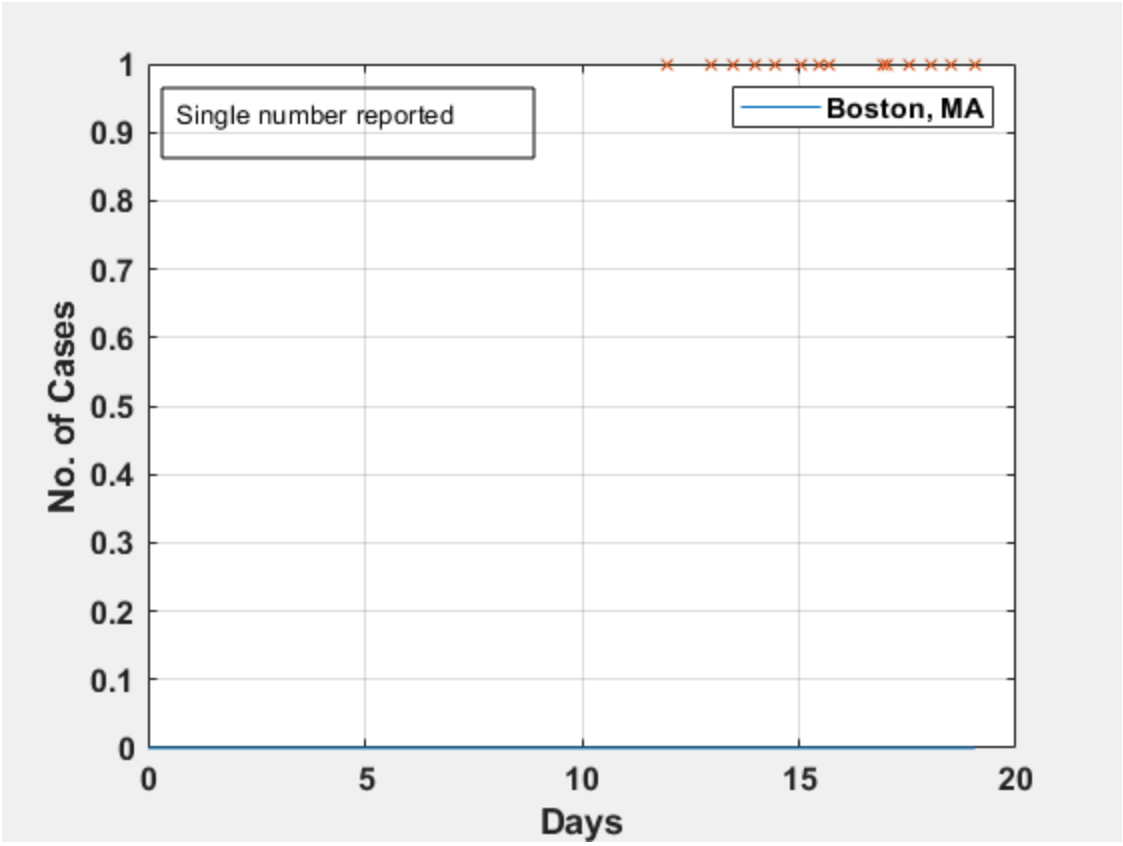

Single number reported
Russia
No. of Cases
Days
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20

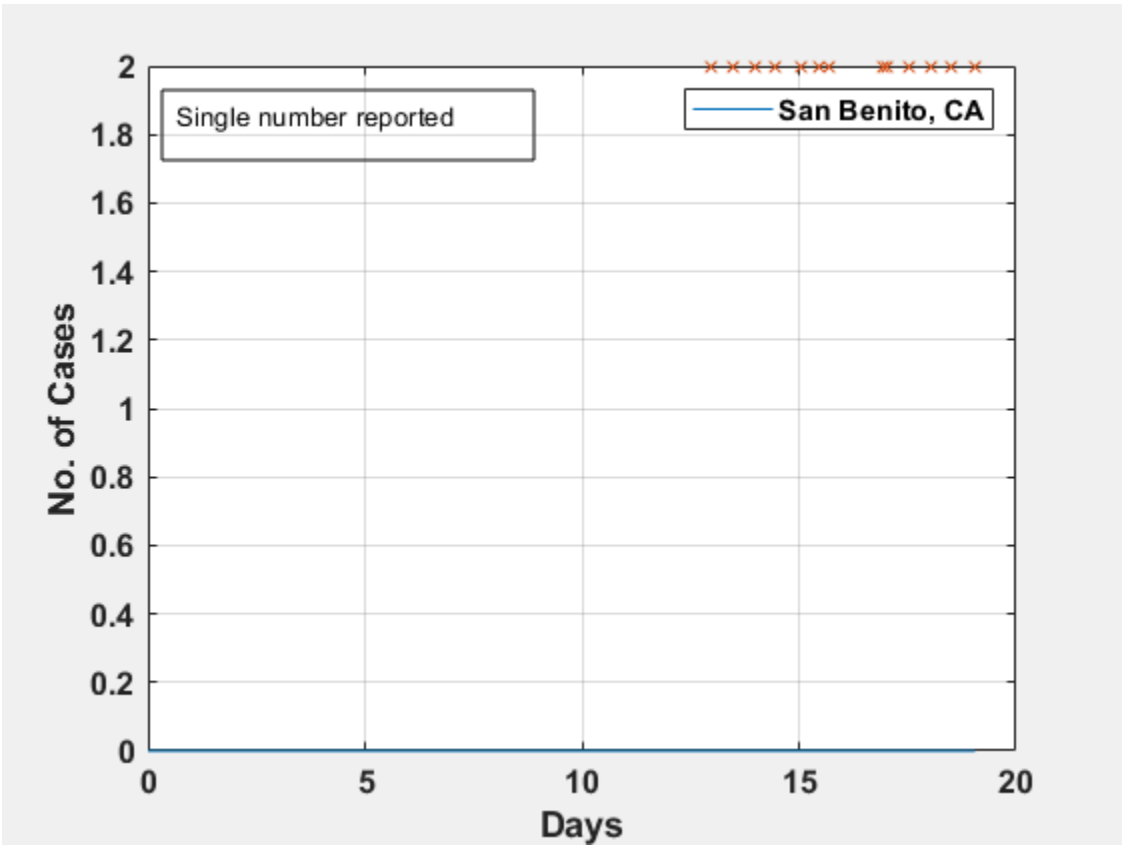

Single number reported
Sweden
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20

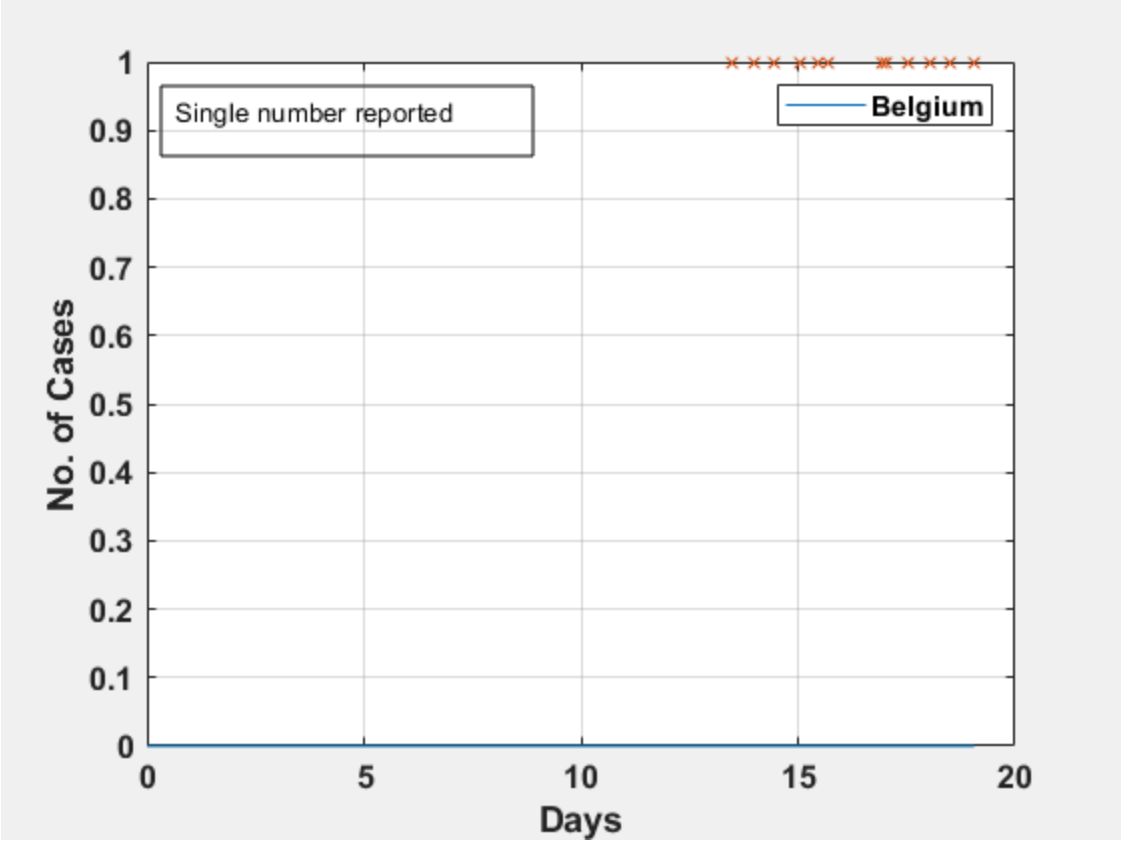

0.17exp.0.00756x
Santa Clara, CA
No. of Cases
Days
0
1
2
3
4
5
6
0
5
10
15
20

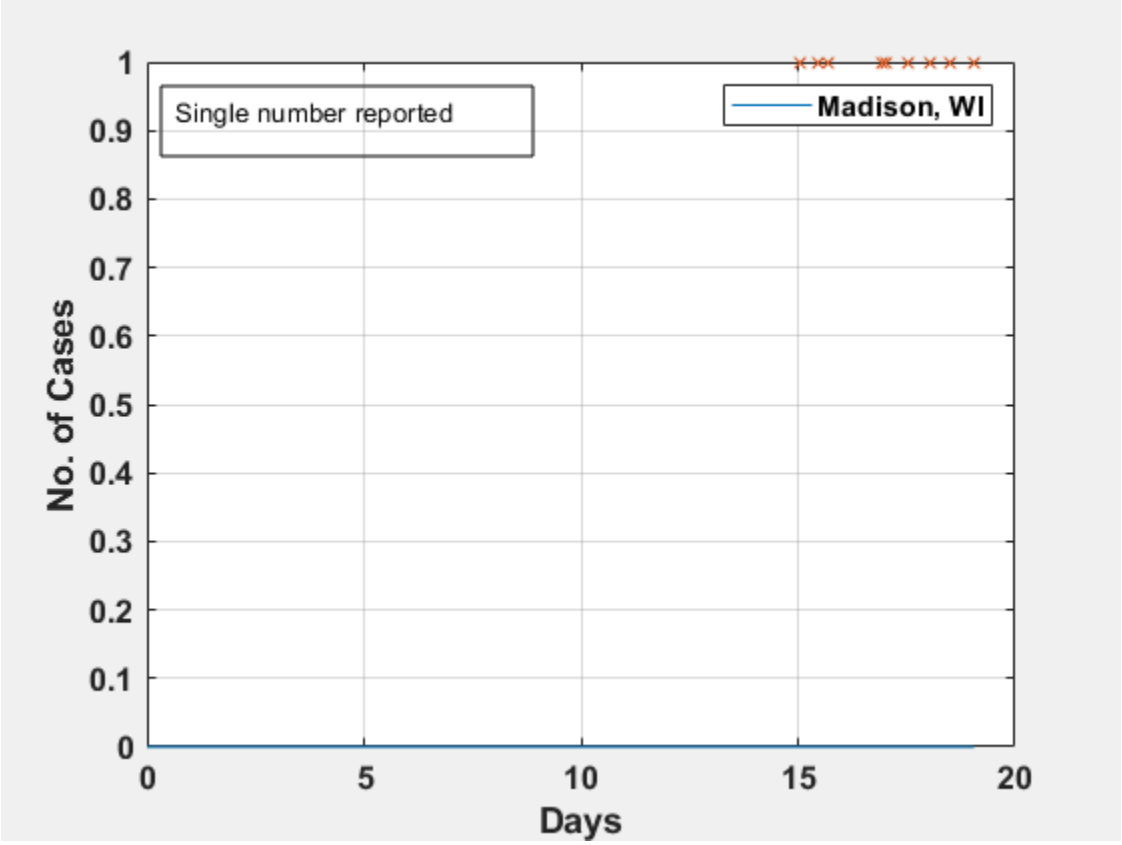

0.43exp.0.00338x
Spain
No. of Cases
Days
0
5
10
15
20
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2

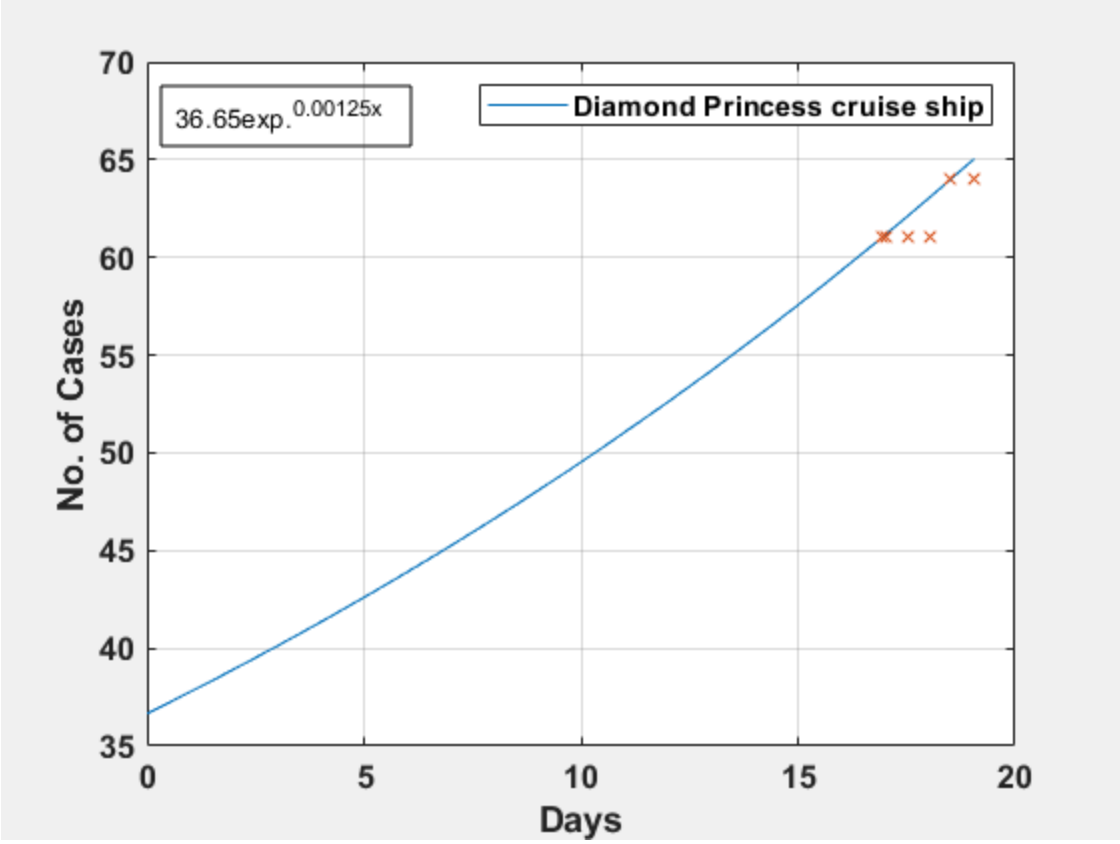

Single number reported
South Australia
No. of Cases
Days
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
5
10
15
20


Single number reported
Boston, MA
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20


Single number reported
San Benito, CA
No. of Cases
Days
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
0
5
10
15
20


Single number reported
Belgium
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20


Single number reported
Madison, WI
No. of Cases
Days
0
0.1
0.2
0.3
0.4
0.5
0.6
0.7
0.8
0.9
1
0
5
10
15
20



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