Table of Contents

```
%Initial Conditions:
S_0 = 1000; % Susceptible
I_0=1; % Infected
R 0=0; % Recovered
N = S_0 + I_0 + R_0;
b=0.1; % birth rate into susceptible
D=0.1; % death rate (independent of disease)
detTime = 50;
endTime = 150;
T1 = 0:detTime;
T2 = detTime+1:endTime;
totalT=0:endTime;
nu=0.2; % Recovery rate
beta=0.0004; % Transmission rate
```

0:50 - pre MDT: burn-in

```
det=0;

[t, class]=ode45(@(t, class) simpModDet(t, class, N, beta, nu, b, D,
    det), T1,[S_0 I_0 R_0]);
S=class(:,1);
I=class(:,2);
R=class(:,3);
```

50:150 - post MDT: after burn-in

```
DetVec=[1, 0.5, 0.11, 0.09, 0.009, 0.0009, 0.0001, 0];
Names=string(DetVec);
n = length(DetVec);
figure(1)
for i = 1:n
    det = DetVec(i);
    sigma=0.5;
    deltaI=0.2;
    [t, class2]=ode45(@(t, class) simpModDet(t, class, N, beta, nu, b, D, det), T2, class(size(class,1),:));
    S=class2(:,1);
    I=class2(:,2);
```

```
R=class2(:,3);
     subplot(0.5*n,2,i)
     pl=plot(t,S,'g','LineWidth',2); hold on
     p2=plot(t,I,'r','LineWidth',2); hold on
     p3=plot(t,R,'b','LineWidth',2); hold on
     %axis([0 150 0 3000])
     ylabel('Incidence')
     title(sprintf('$d_{k}= %s
', Names \{i\}), 'Interpreter', 'latex', 'FontSize', 12, 'FontName', 'Times'
 New Roman');
     R_nought=(beta*b)/(D*(D + nu + det));
     text(100, max(S)*0.8, sprintf('$R {0}= %.4f
$',R_nought),'Interpreter','latex', 'FontSize', 12, 'FontName', 'Times
 New Roman')
     grid on
end
suplabel('Years');
hL = legend([p1,p2,p3], {'Susceptible (S)', 'Infected (I)', 'Recovered
 (R)'}, 'Orientation', 'horizontal');
newPosition = [0.4 \ 0.87 \ 0.2 \ 0.2];
newUnits = 'normalized';
set(hL, 'Position', newPosition, 'Units',
 newUnits, 'color', 'none', 'Box', 'off');
                           Susceptible (S)
                                           Infected (I)

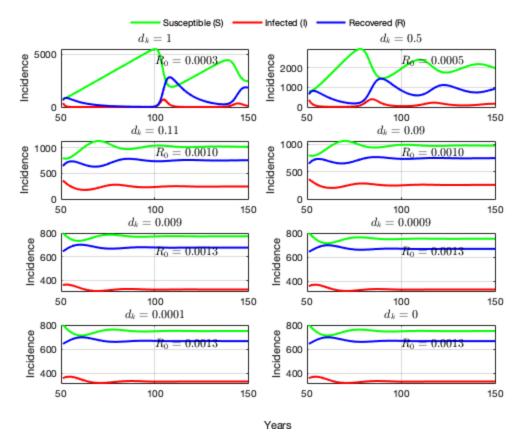
    Recovered (R)

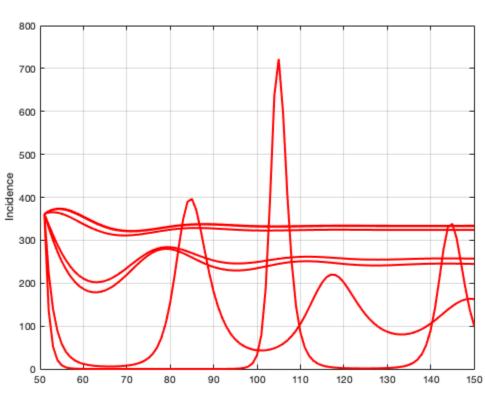
                       d_k = 1
                                                             d_k = 0.5
       5000
     Incidence
                             = 0.0003
                                           Incidence
                                                                    0.0005
                                             2000
                                             1000
          0
                                                0
                                       150
          50
                         100
                                                 50
                                                                              150
                      d_b = 0.11
                                                             d_b = 0.09
                                              1000
       1000
     Incidence
                          R_0 = 0.0010
                                                                 R_0 = 0.0010
                                           Incidence
        500
                                               500
          0
                                                0
                                       150
                                                 50
                                                                              150
          50
                         100
                                                                100
                      d_k = 0.009
                                                            d_k = 0.0009
                                              800
        800
                                            lucidence
600
400
     Incidence
                          R_0 = 0.0013
                                                                 R_0 = 0.0013
        600
        400
                         100
                                       150
                                                 50
                                                                100
                                                                              150
          50
                     d_k = 0.0001
                                                              d_k = 0
        800
                                              800
                                            Incidence
        600
                                              600
        400
                                              400
                                       150
                                                 50
          50
                         100
                                                                100
                                                                              150
```

DetVec=[1, 0.5, 0.11, 0.09, 0.009, 0.0009, 0.0001, 0];

Years

```
Names=string(DetVec);
n = length(DetVec);
figure(2)
for i = 1:n
    det = DetVec(i);
    sigma=0.5;
    deltaI=0.2;
    [t, class2]=ode45(@(t, class) simpModDet(t, class, N, beta, nu, b,
 D, det), T2, class(size(class,1),:) );
    S=class2(:,1);
    I=class2(:,2);
    R=class2(:,3);
    %pl=plot(t,S,'g','LineWidth',2); hold on
    p2=plot(t,I,'r','LineWidth',2); hold on
    %p3=plot(t,R,'b','LineWidth',2); hold on
    %axis([0 150 0 3000])
    ylabel('Incidence')
    grid on
end
suplabel('Years');
hL = legend([p1,p2,p3], {'Susceptible (S)', 'Infected (I)', 'Recovered
 (R)'}, 'Orientation', 'horizontal');
newPosition = [0.4 \ 0.87 \ 0.2 \ 0.2];
newUnits = 'normalized';
set(hL,'Position', newPosition,'Units',
newUnits, 'color','none','Box','off');
```



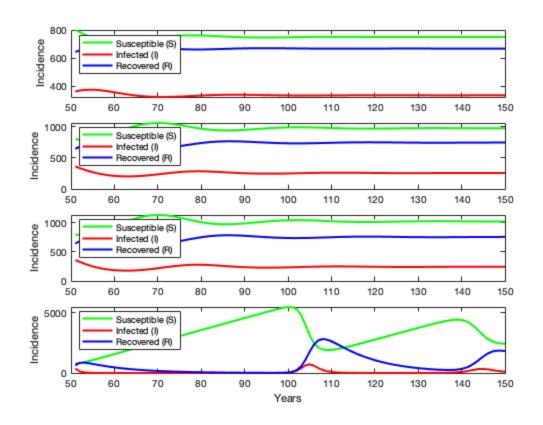


Years

Plotting entire time span 0-150

rbind class and class2 figure(4) classes=vertcat(class,class2); S=classes(:,1); I=classes(:,2); R=classes(:,3);

```
p1=plot(totalT,S,'g','LineWidth',2); hold on
           p2=plot(totalT,I,'r','LineWidth',2); hold on
           p3=plot(totalT,R,'b','LineWidth',2); hold on
DetVec = [0, 0.09, 0.11, 1];
n = length(DetVec);
figure(3)
for i = 1:n
    det = DetVec(i);
    sigma=0.5;
    deltaI=0.2;
    [t, class2]=ode45(@(t, class) simpModDet(t, class, N, beta, nu, b,
 D, det), T2, class(size(class,1),:) );
    S=class2(:,1);
    I=class2(:,2);
    R=class2(:,3);
    subplot(n,1,i)
    plot(t,S,'g','LineWidth',2); hold on
    plot(t,I,'r','LineWidth',2); hold on
    plot(t,R,'b','LineWidth',2); hold on
    %axis([0 50 0 500])
    ylabel('Incidence')
    h=legend('Susceptible (S)', 'Infected (I)', 'Recovered
 (R)','Location','northwest');
end
xlabel('Years')
```



50:150 - post MDT: after burn-in

```
DetVec=[1, 0.5, 0.11, 0.09, 0.009, 0.0009, 0.0001, 0];
Names=string(DetVec);
n = length(DetVec);
figure(4)
for i = 1:n
    det = DetVec(i);
    sigma=0.5;
    deltaI=0.2;
    [t, class2]=ode45(@(t, class) simpModDet(t, class, N, beta, nu, b,
 D, det), T2, class(size(class,1),:) );
    classes=vertcat(class,class2);
    S=classes(:,1);
    I=classes(:,2);
    R=classes(:,3);
    subplot(0.5*n,2,i)
    pl=plot(totalT,S,'g','LineWidth',2); hold on
    p2=plot(totalT,I,'r','LineWidth',2); hold on
    p3=plot(totalT,R,'b','LineWidth',2); hold on
    x1=50;
    xline(x1,'--');
    %axis([0 150 0 3000])
    ylabel('Incidence')
```

```
title(sprintf('$d_{k}= %s
$',Names{i}),'Interpreter','latex', 'FontSize', 12, 'FontName', 'Times
 New Roman');
     R nought=(beta*b)/(D*(D + nu + det));
     text(100, max(S)*0.8, sprintf('$R_{0}= %.4f
$',R_nought),'Interpreter','latex', 'FontSize', 12, 'FontName', 'Times
 New Roman')
     grid on
end
suplabel('Years');
hL = legend([p1,p2,p3],{'Susceptible (S)', 'Infected (I)', 'Recovered
 (R)'}, 'Orientation', 'horizontal');
newPosition = [0.4 \ 0.87 \ 0.2 \ 0.2];
newUnits = 'normalized';
set(hL, 'Position', newPosition, 'Units',
 newUnits, 'color', 'none', 'Box', 'off');
                            Susceptible (S)
                                            Infected (I)

    Recovered (R)

                        d_k = 1
                                                                d_k = 0.5
       5000
     Incidence
                                   = 0.00
                                                                            = 0.0005
                                             Incidence
                                               2000
                                               1000
          0
                     50
                                                             50
                                         150
                                                                       100
                               100
                                                                                 150
                       d_k = 0.11
                                                               d_k = 0.09
                                             2000
1000
       2000
     Incidence
                                R_0 = 0.0010
                                                                        R_0 = 0.0010
       1000
          0
                     50
                               100
                                         150
                                                             50
                                                                       100
                                                                                 150
                      d_k = 0.009
                                                              d_k = 0.0009
       2000
                                               2000
                                             Incidence
     Incidence
                                R_0 = 0.0013
                                                                        R_0 = 0.0013
       1000
                                               1000
           0
                     50
                               100
                                         150
                                                             50
                                                                                 150
                      d_k = 0.0001
                                                                d_k = 0
       2000
                                               2000
                                             Incidence
     Incidence
                                R_0 = 0.0013
                                                                        R_0 = 0.0013
       1000
                                               1000
          0
                                                  0
           0
                     50
                               100
                                         150
                                                   0
                                                                       100
                                                                                 150
                                             Years
```

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