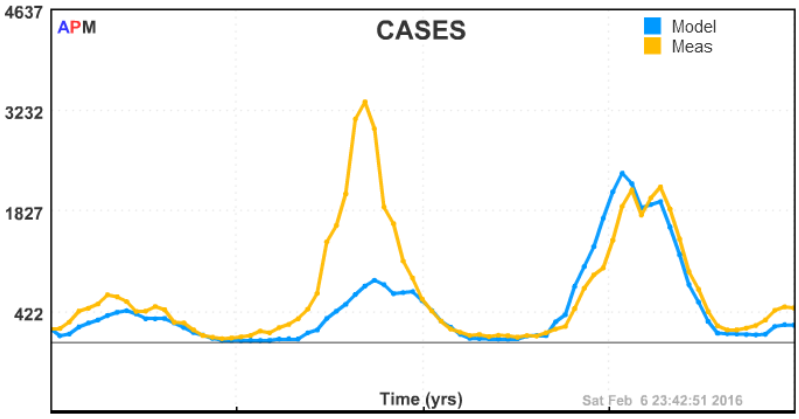
Problem 3

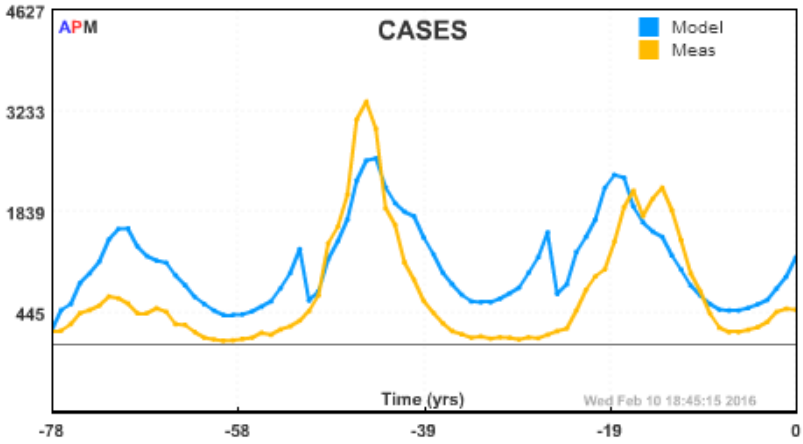
Part A)

Gamma = 0.07



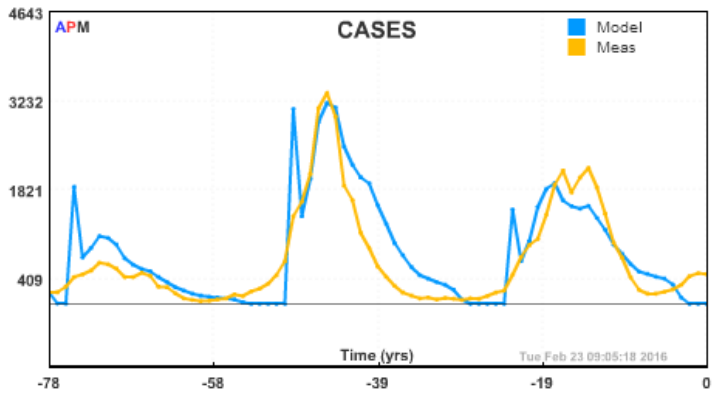
Not optimal, Gamma = 0.558806

Objective = 7.64269857e8



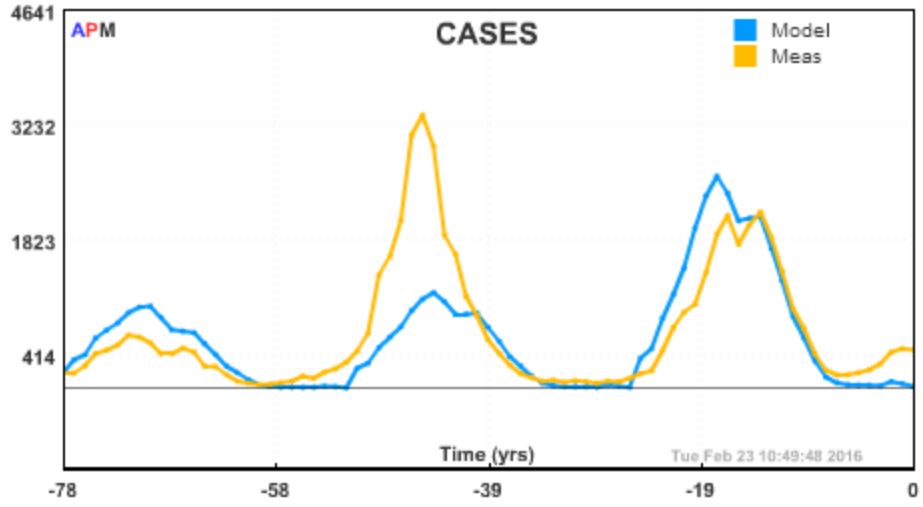
Not optimal, Gamma = 1.0

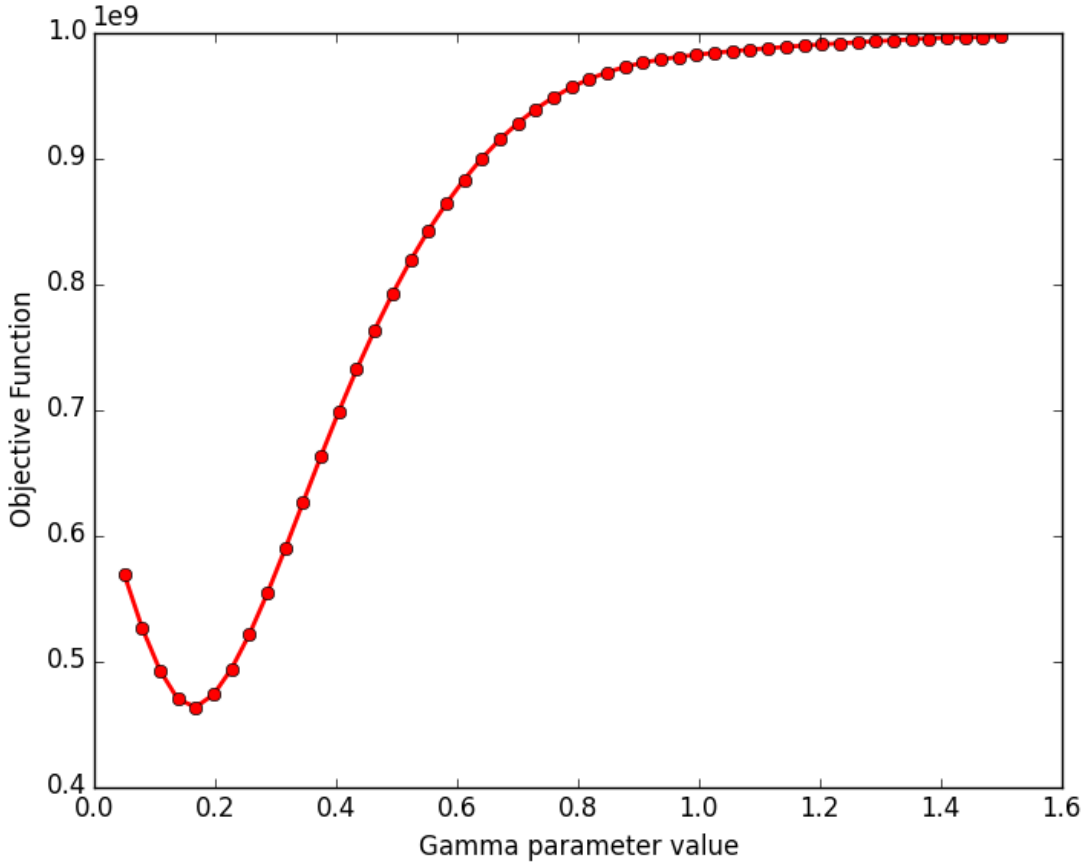
Obejective = 4.99972432e8



Optimal Gamma = 0.163045

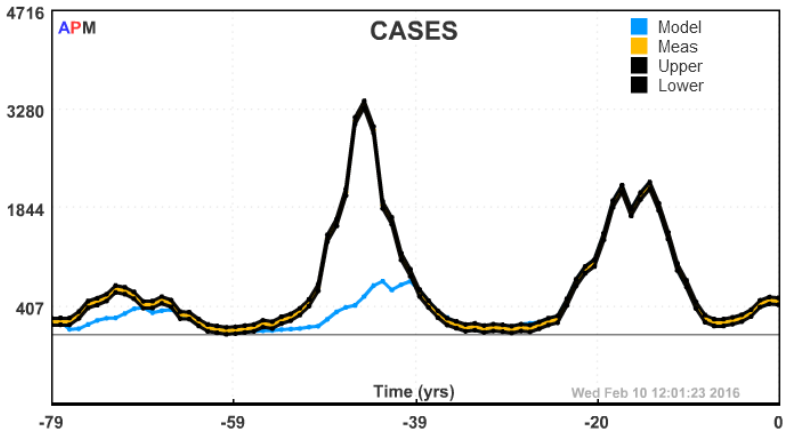
Obejective = 4.63027555e8





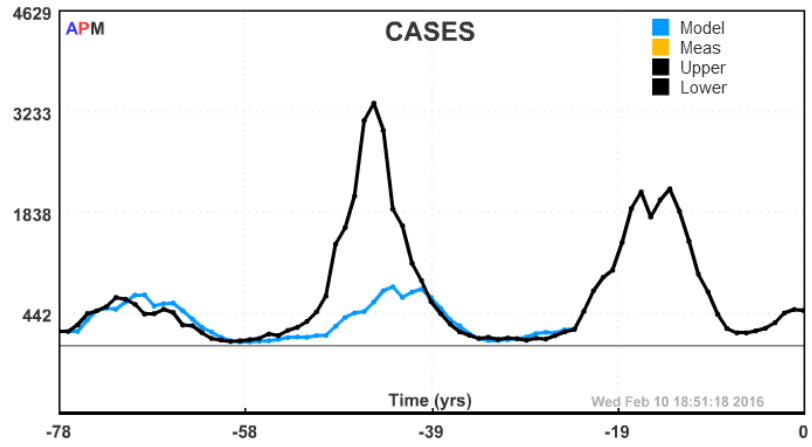
Part B)

Gamma = 0.07



Gamma = 0.181448 with WMODEL =0 and default meas_gap

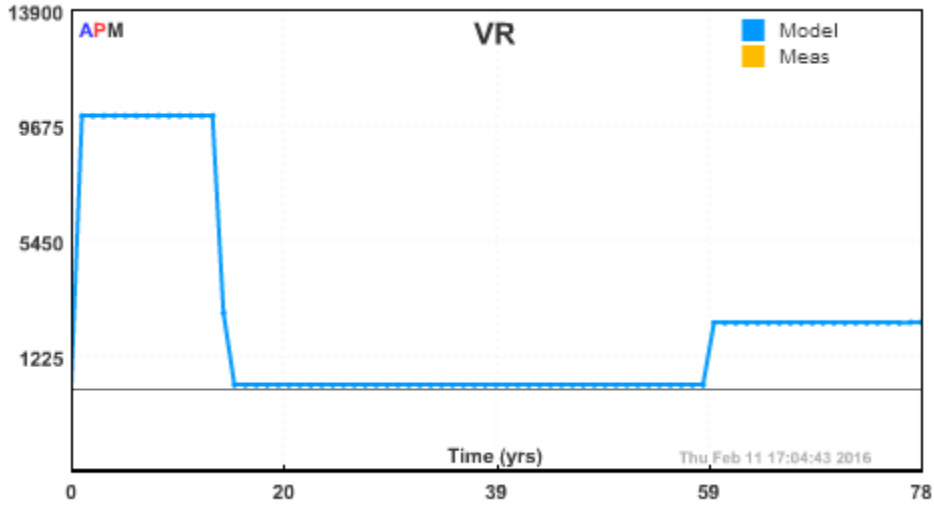
Gamma = 0.151772 with WMODEL = 0 and meas_gap = 100

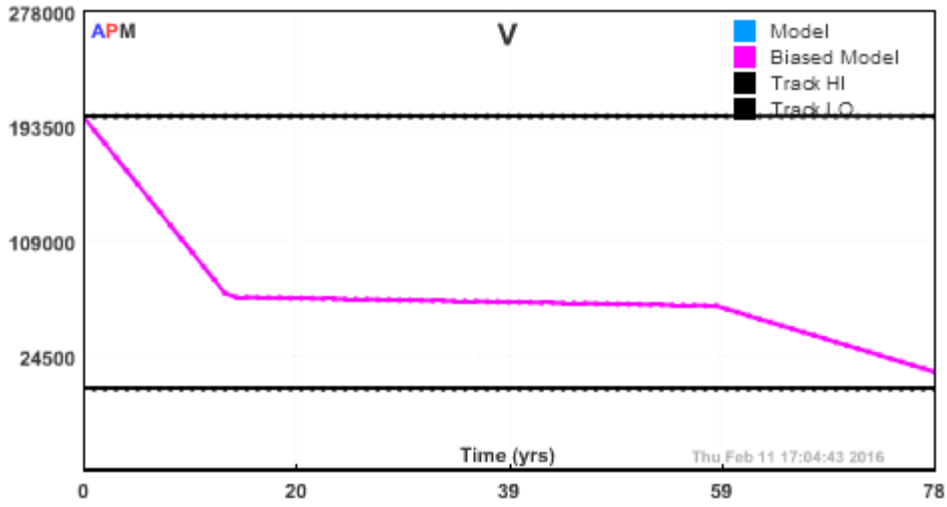


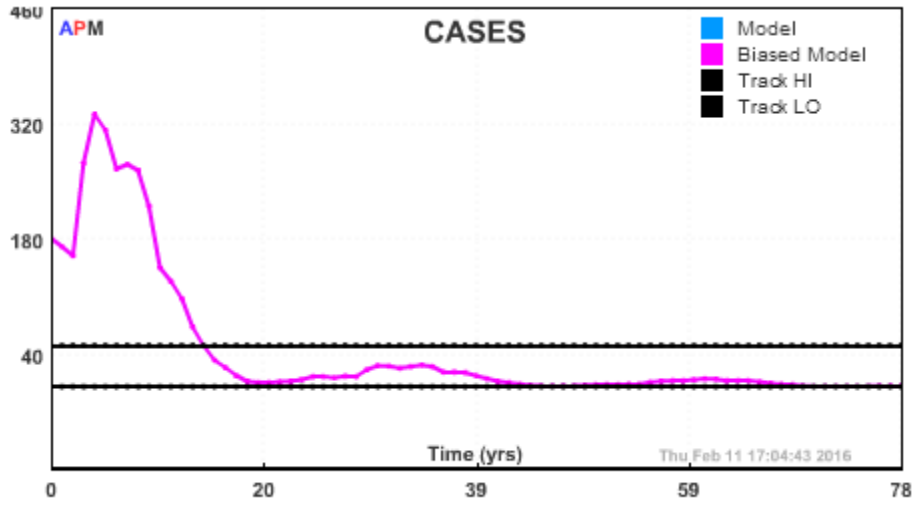
Part C)

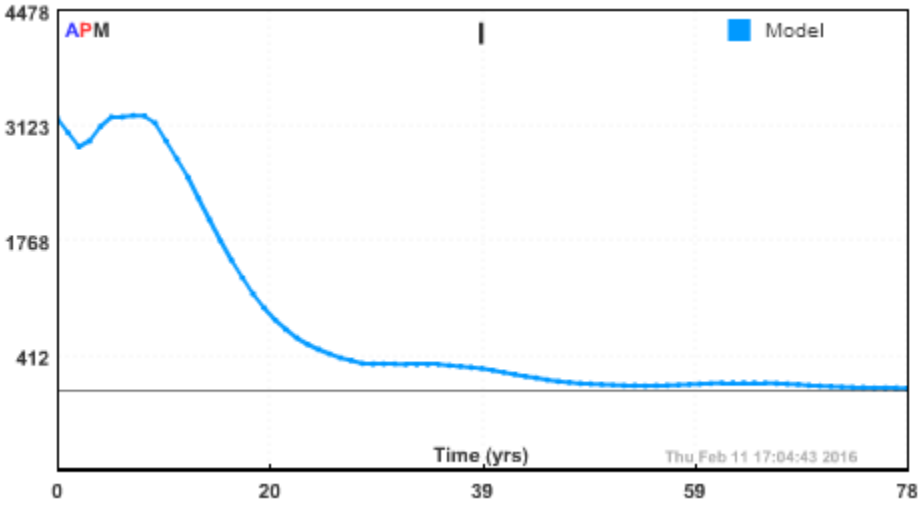
```
! APMonitor Modeling Language
!
! Publication Source:
!
! Daniel P. Word, George H. Abbott, Derek Cummings, and Carl D. Laird, [2010],
!   "Estimating Seasonal Drivers in Childhood Infectious Diseases with Continuous
!   Time and Discrete-Time Models", in Proceedings, 2010 American Control Conference,
!   Baltimore, MD, June 29 - July 2, 2010, p. 5137-5142.
!
! Data from New York for the years 1947-1965
! Data from Bangkok for the years 1975-1984
! Data from London is 1944-1966?
!
Constants
  nb = 26                          ! number of bi-weeks
End Constants

Parameters
  N            = 3.2e6             ! population size        (individuals)
  mu           = 7.8e-4            ! scaled birth rate      (births/biweek/total population) * 1e5
  gamma        = 0.07              ! recovery rate          (recoveries/biweek/infectives)
  rep_frac     = 0.45              ! reporting fraction to account for underreporting
  biweek[1:nb] = 0                 ! indicate the particular biweek for each data set
  beta[1:nb]   = 1   , > 0.1 , < 100  ! transmission parameter (potentially infectious contacts/biweek)
  Vr           = 0
End Parameters

Variables
  cases = 180 , >= 0               ! cases reported         (new individuals infected per biweek)
  S = 0.06 * N , >= 0, <= N        ! susceptibles           (individuals in the total population)
  I = 0.001 * N, >= 0, <= N        ! infectives             (individuals infected)
  V = 200000                       ! vaccine                (initial supply = 200,000)
End Variables

Intermediates
  ! infection rate per biweek
  R[0] = 0
  Rs   = S * I / N
  R[1:nb] = biweek[1:nb] * beta[1:nb] * Rs  + R[0:nb-1]
End Intermediates

Equations
  $S = -R[nb] +  mu * N - Vr
  $I =  R[nb] -  gamma * I
  $V = -Vr
  cases = rep_frac * R[nb]
End Equations
```

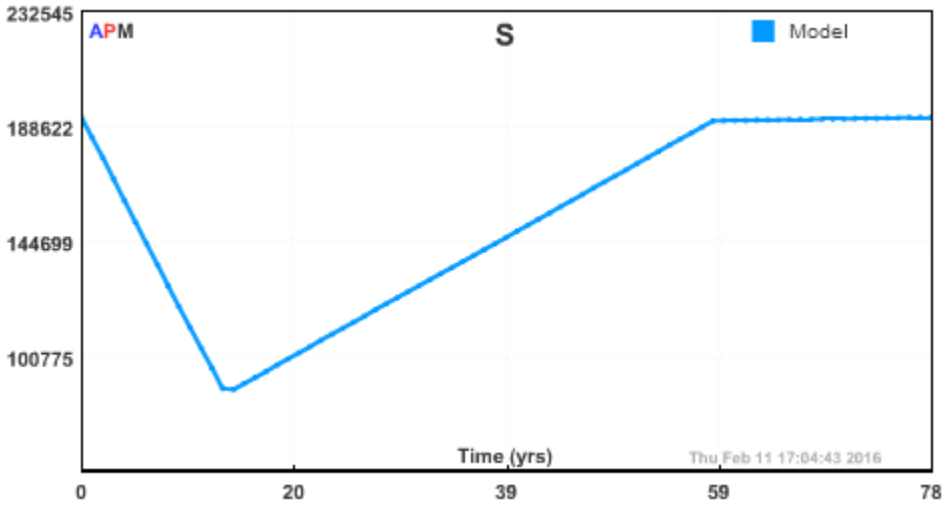
Part D)


APM
VR
Model
Meas
13900
9675
5450
1225
Time (yrs)
Thu Feb 11 17:04:43 2016
0
20
39
59
78


APM
V
Model
Biased Model
Track HI
Track LO
278000
193500
109000
24500
Time (yrs)
Thu Feb 11 17:04:43 2016
0
20
39
59
78


APM
CASES
Model
Biased Model
Track HI
Track LO
320
180
40
Time (yrs)
Thu Feb 11 17:04:43 2016
0
20
39
59
78


4478
APM
I
Model
3123
1768
412
Time (yrs)
Thu Feb 11 17:04:43 2016
0
20
39
59
78


232545
APM
S
Model
188622
144699
100775
Time (yrs)
Thu Feb 11 17:04:43 2016
0
20
39
59
78