Initial HHH4 Models: Meeting Notes

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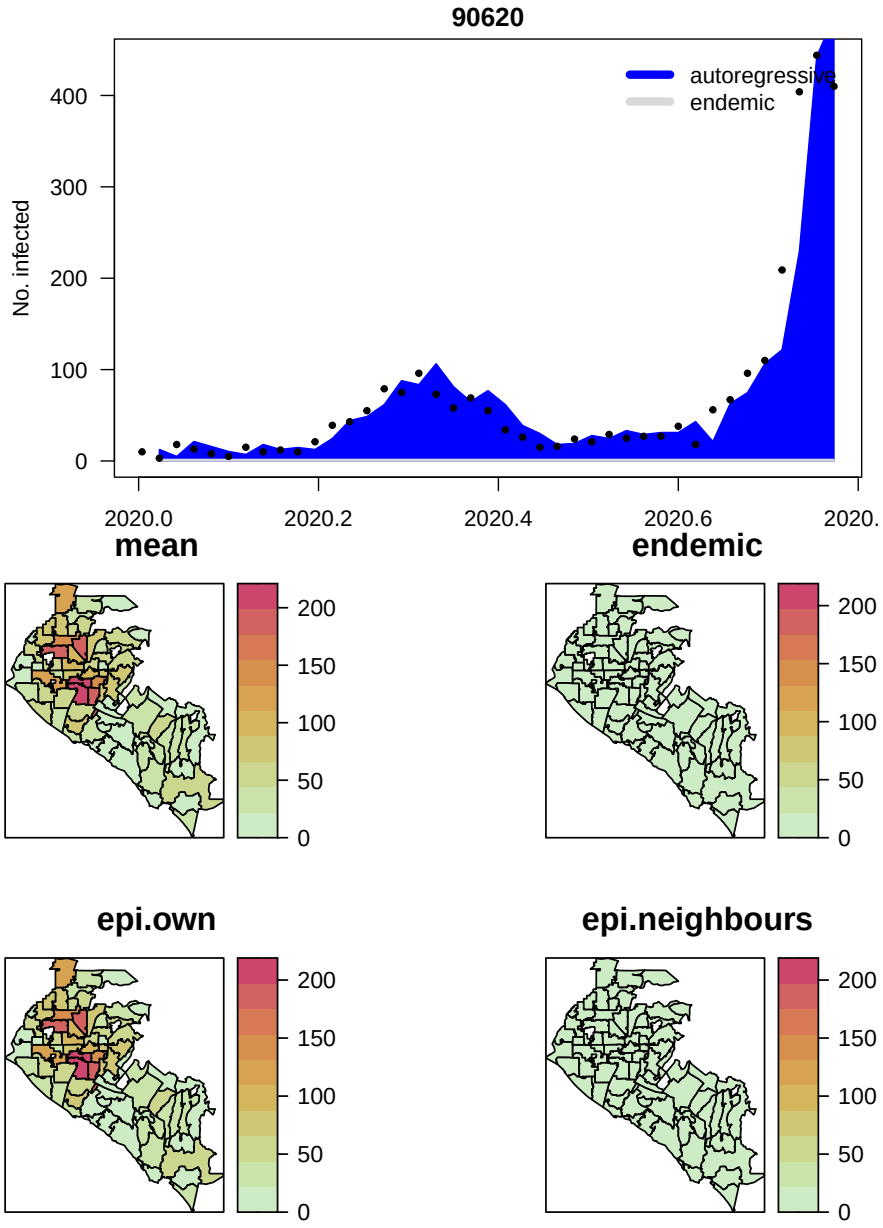
Summary and a few plots from the fitted models.

Model 1: no weights

```
fit_noweights <-
  surveillance::hhh4(oc_zip_covid)
```

```
##
## Call:
## surveillance::hhh4(stsObj = oc_zip_covid, control = list(ar = list(f = ~1)))
##
## Coefficients:
##        Estimate  Std. Error
## ar.1   0.087395  0.002721
## end.1  0.539704  0.034483
##
## Log-likelihood:   -19330.16
## AIC:              38664.32
## BIC:              38676.31
##
## Number of units:        74
## Number of time points:  40
```

Plots for the model:



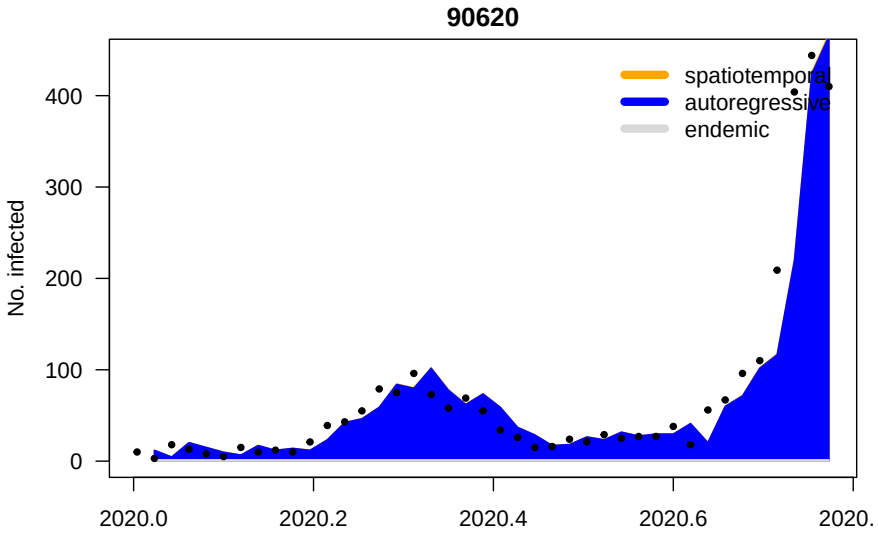
Model 2: Sum Weights of Out Visits from Safegraph

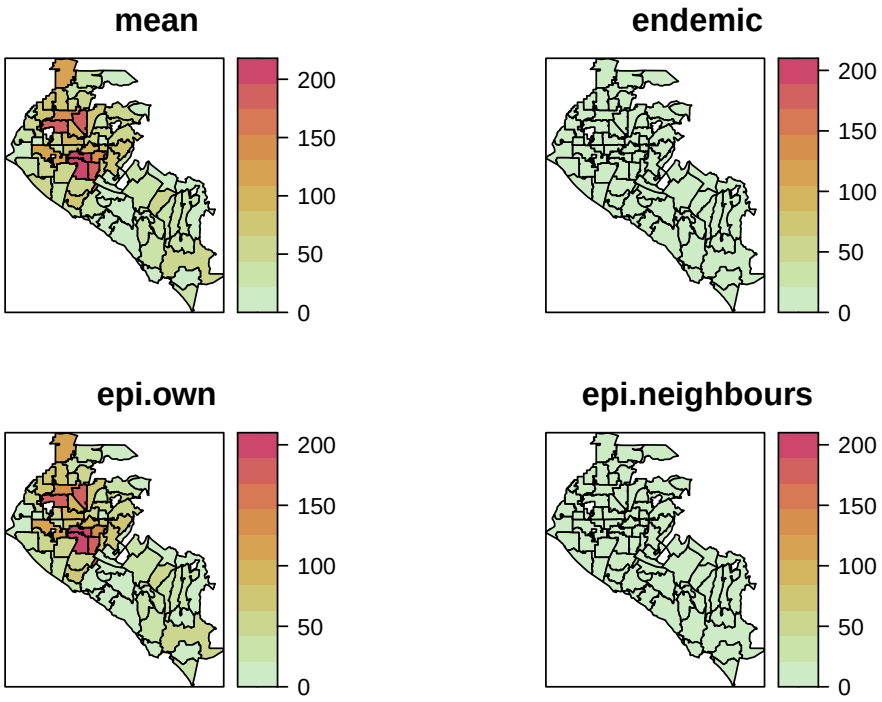
```
# oc zip covid in this case is an sts object with a weighted out visit matrix
sumweights_nb <- surveillance::hhh4(
  oc_zip_covid,
  control = list(
    ne = list(
      f = ~1,
      weights = neighbourhood(oc_zip_covid),
      family = "NegBin1",
      normalize = TRUE
    )
```

```
  )
)
```

```
##
## Call:
## surveillance::hhh4(stsObj = oc_zip_covid, control = list(ar = list(f = ~1),
##     ne = list(f = ~1, weights = neighbourhood(oc_zip_covid),
##         family = "NegBin1", normalize = TRUE)))
##
## Coefficients:
##        Estimate   Std. Error
## ar.1    0.043648   0.004555
## ne.1   -2.969973   0.081085
## end.1   0.400258   0.040238
##
## Log-likelihood:   -19250.21
## AIC:              38506.42
## BIC:              38524.4
##
## Number of units:        74
## Number of time points:  40
```

Plots for the model: *Maps of the fitted component proportions averaged over all weeks*





Notes from documentation:

- " Note that we usually normalize the transmission weights such that $\sum_i w_{ji} = 1$, i.e., the $Yj, t-1$ cases are distributed among the regions proportionally to the jth row vector of the weight matrix wji ."

Model 3: Binary Neighbours Weights Matrix

From Zip codes adjacency: 0 (not neighbours). 1 (neighbours).

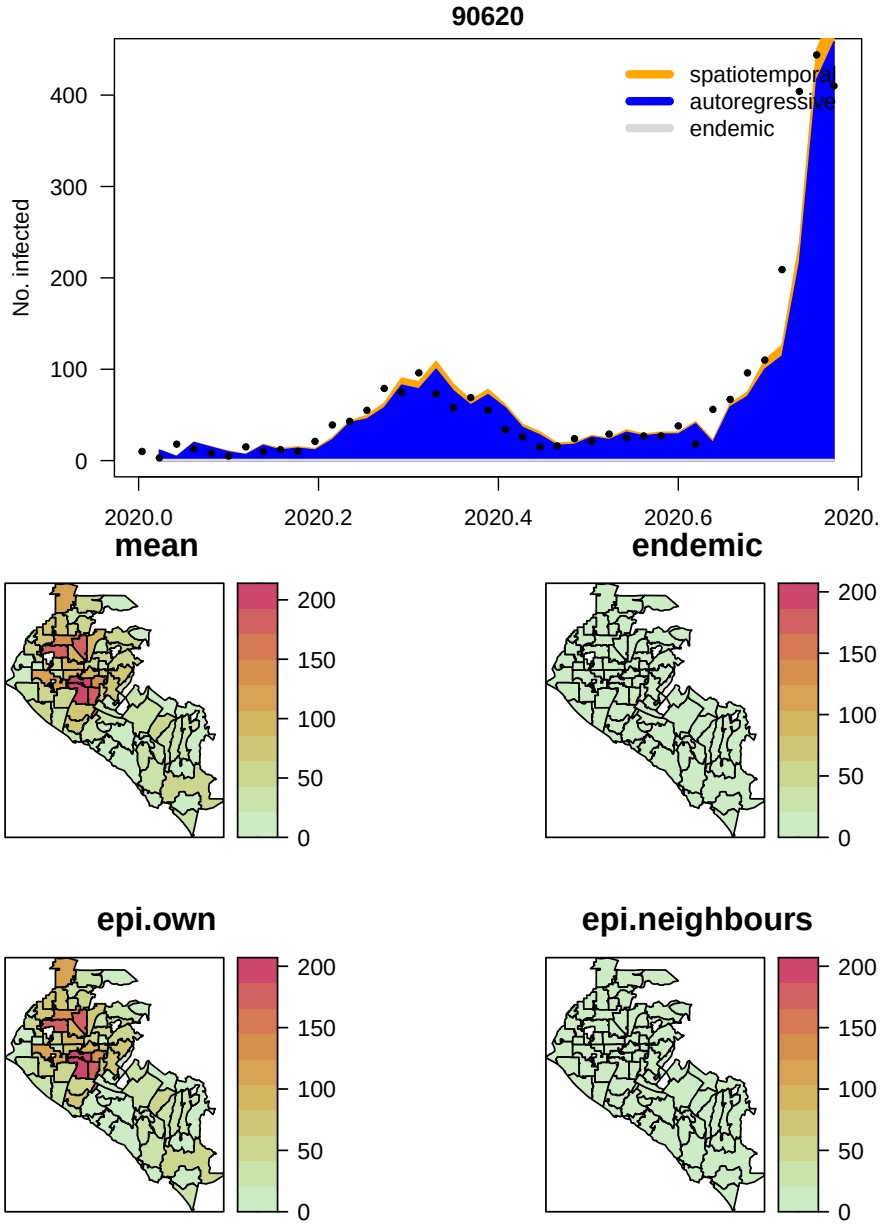
```
# oc zip covid in this case is an sts object with a neighbourhood binary matrix

binweights_nb <- surveillance::hhh4(
  oc_zip_covid,
  control = list(
    ne = list(
      f = ~ 1,
      weights = neighbourhood(oc_zip_covid),
      family = "NegBin1",
      normalize = TRUE
    )
  )
)
```

```
##
## Call:
## surveillance::hhh4(stsObj = oc_zip_covid, control = list(ar = list(f = ~1),
##     ne = list(f = ~1, weights = neighbourhood(oc_zip_covid),
##         family = "NegBin1", normalize = TRUE)))
```

```
##
## Coefficients:
##        Estimate   Std. Error
## ar.1    0.029056   0.004589
## ne.1   -2.649672   0.060562
## end.1   0.251688   0.048139
##
## Log-likelihood:   -19188.04
## AIC:              38382.08
## BIC:              38400.06
##
## Number of units:        74
## Number of time points:  40
```

Plots for the model:



Model 4: Time-Varying Neighbours Weights Matrix (from Safegraph out visits)

```
##
## Call:
## surveillance::hhh4(stsObj = oc_zip_covid, control = list(ar = list(f = ~1),
##     f = ~1, ne = list(f = ~1, weights = weights_array), family = "NegBin1"))
##
## Coefficients:
##           Estimate    Std. Error
## ar.1        0.065987    0.012129
## ne.1      -13.493695    0.658570
## end.1       0.576016    0.054878
## overdisp    0.203532    0.007503
##
## Log-likelihood:   -11227.3
## AIC:              22462.61
## BIC:              22486.58
##
## Number of units:        74
## Number of time points:  40
```

Notes:

- Having issues with interpretation of the models.
- Not all 85 ZIP Codes due to incongruence between the data files. To be resolved. Currently, these models are based on 74 zip codes.