# Data Fusion

a) $FC_1(s,t) = (\frac{OBS_m(t)}{\overline{OBS_m}})_{krig} \times \overline{FC(s)}$
$OBS_m$: daily observation at each monitor
$\overline{OBS_m}$: Annual mean level
interpolated using the krig method
$\overline{FC(s)}$: CMAQ annual field adjusted to the annual mean observations

b) $\overline{FC(s)} = \alpha_{year} \times \overline{CMAQ(s)}^{\beta}$

$\alpha_{year}$: regression parameter derived for each year
$\overline{CMAQ(s)}$: CMAQ simulations at monitor locations over a year

c) $FC_2(s,t) = CMAQ(s,t) \times (\frac{\overline{FC(s)}}{\overline{CMAQ(s)}}) \times \beta_{season}(t)$

$\overline{FC(s)}$: CMAQ annual field adjusted to the annual mean observations
$\overline{CMAQ(s)}$: CMAQ simulations at monitor locations over a year
$\beta_{season}$: is the seasonal correction function

d) $rRobs(d) = R_{coll} e^{\frac{-d}{r}}$

$rRobs(d)$: is the temporal Pearson correlation between observations from monitors a distance d apart
$R_{coll}$: is the intercept which results from instrument error
r: is the range at which the correlation between monitors has decreased to an e-folding of $R_{coll}$

e) $R_1(s,t) \approx R_{coll} e^{\frac{-x(s,t)}{r}}$
$R_1$: is the estimated temporal correlation of $FC_1$ and ambient pollution
x: is the distance to the nearest observation

f) $R_{cmaq} = \frac{1}{N} \sum_{m=1}^{N} corr(OBS_m(t), CMAQ_m(t)) \approx R_2$

N: Total number of monitors
$R_{cmaq}$: values are provided in the table
$R_1 and R_2$: are conservative estimates of temporal variance in that FC1 uses information from multiple measurements and FC2 incorporates annual and seasonal adjustments to CMAQ.

g) $W(s,t) = \frac{R_1(s,t) \times (1-R_2)}{R_1(s,t) \times (1-R_2) + R_2 \times (1-R_1(s,t))}$
This formula is to measure the weighting factor. It is a number that varies over time.

h) $FC_{opt}(s,t) = W(s,t) \times FC_1(s,t) + (1 - W(s,t)) \times FC_2(s,t)$
this is also a weighting function and this basically uses the resemblance of FC1 and FC2 to help balance out the weighting measurement.

i) $if R_1 > R_2, R_{opt}(s,t) = W(s,t) \times R_1(s,t) + (1 - W(s,t)) \times R_2$
$Else, R_{opt} = R_2$ this is the cross validation function for the weighting functions.

# Example 2

a) **Example f.** $formula$

b) **Example g.** $another$formula