

EvalMH - Assignment 8: Evaluating Models

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```
library(tidyverse)
library(purrr)
library(lubridate)
library(tinytex)
```

```
#read in sager data and add date YYYYMMDD column
sager <- read_csv(here::here("data", "sager.csv")) %>%
  mutate(date=make_date(year=year, month=month, day=day))

#seems pointless to recreate all of the plots from class
#go right into applying given functions to measure performance

source("functions/nse.R")
source("functions/relerr.R")
source("functions/cper.R")
nse(m=sager$model, o=sager$obs)
```

```
## [1] 0.6253416
```

```
relerr(m=sager$model, o=sager$obs)*100
```

```
## [1] -18.9577
```

```
cper(m=sager$model, o=sager$obs, weight.nse=0.8)
```

```
## [1] 0.5002733
```

```
#try using total annual flow by water year
sager_wy = sager %>% group_by(wy) %>% summarize(model=sum(model), obs=sum(obs))

nse(sager_wy$model, sager_wy$obs)
```

```
## [1] 0.7702007
```

```
cper(m=sager_wy$model, o=sager_wy$obs, weight.nse=0.8)
```

```
## [1] 0.6161606
```

```

# We are concerned about flooding during high flows, in this case November is the most important month
tmp = sager %>%
  group_by(month, year) %>%
  summarize(model=sum(model), obs=sum(obs))

# now extract august
sager_nov = subset(tmp, month==11)
cor(sager_nov$model, sager_nov$obs)

```

```
## [1] 0.8854429
```

```

# turn our evaluation metric into a function for correlating annual maximum flow
source("functions/check_maxannual.R")

check_maxannual(m=sager$model, o=sager$obs, month=sager$month, day=sager$day, year=sager$year, wy=sager$wy)

```

```
## [1] 0.8897863
```

```

# multiple results - lets say we've run the model for multiple years, each column is streamflow for a d
msage <- read_csv(here::here("data", "sagerm.csv"))

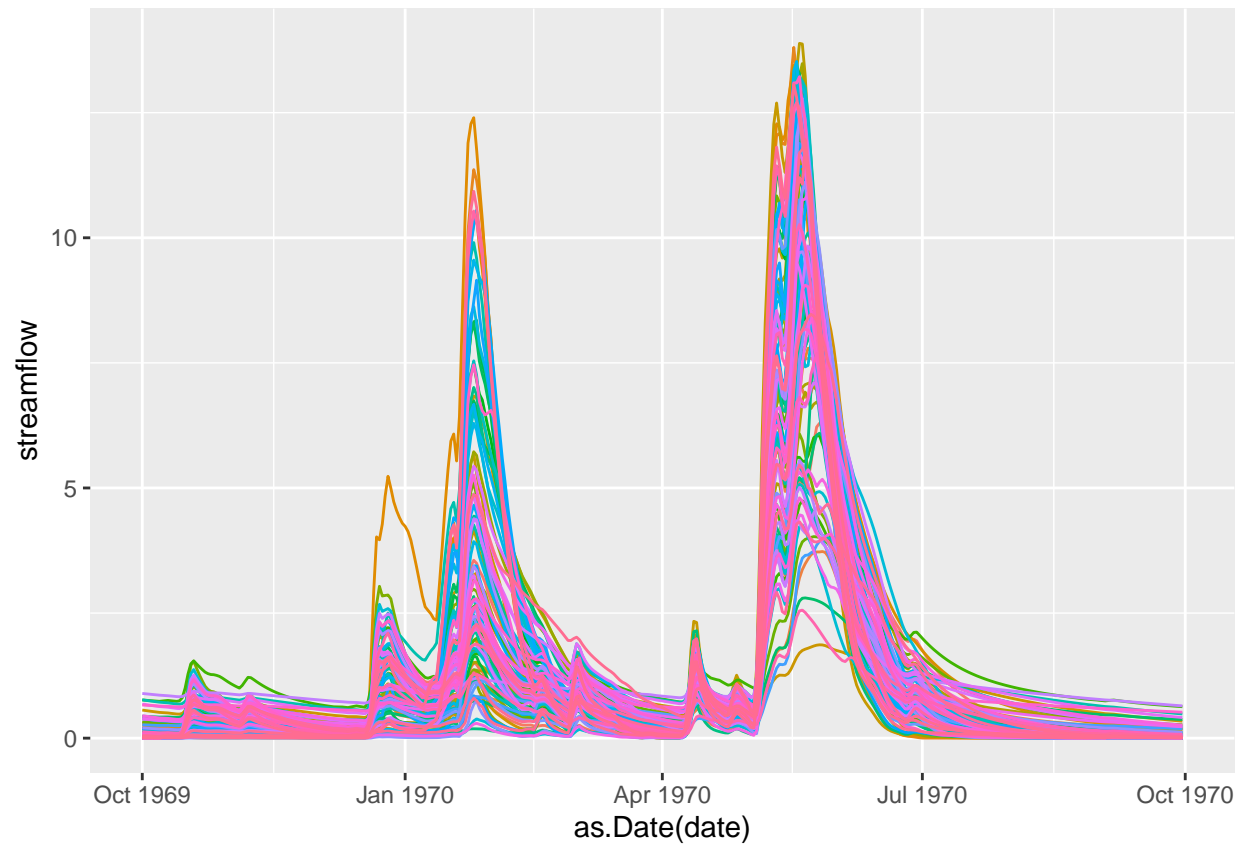
# we know the start date from our earlier output
msage$date = sager$date
# head(msage)
msage$month = sager$month
msage$year = sager$year
msage$day = sager$day
msage$wy = sager$wy

# combine by date to make sure that streamflow and observe match
msage$obs = sager$obs

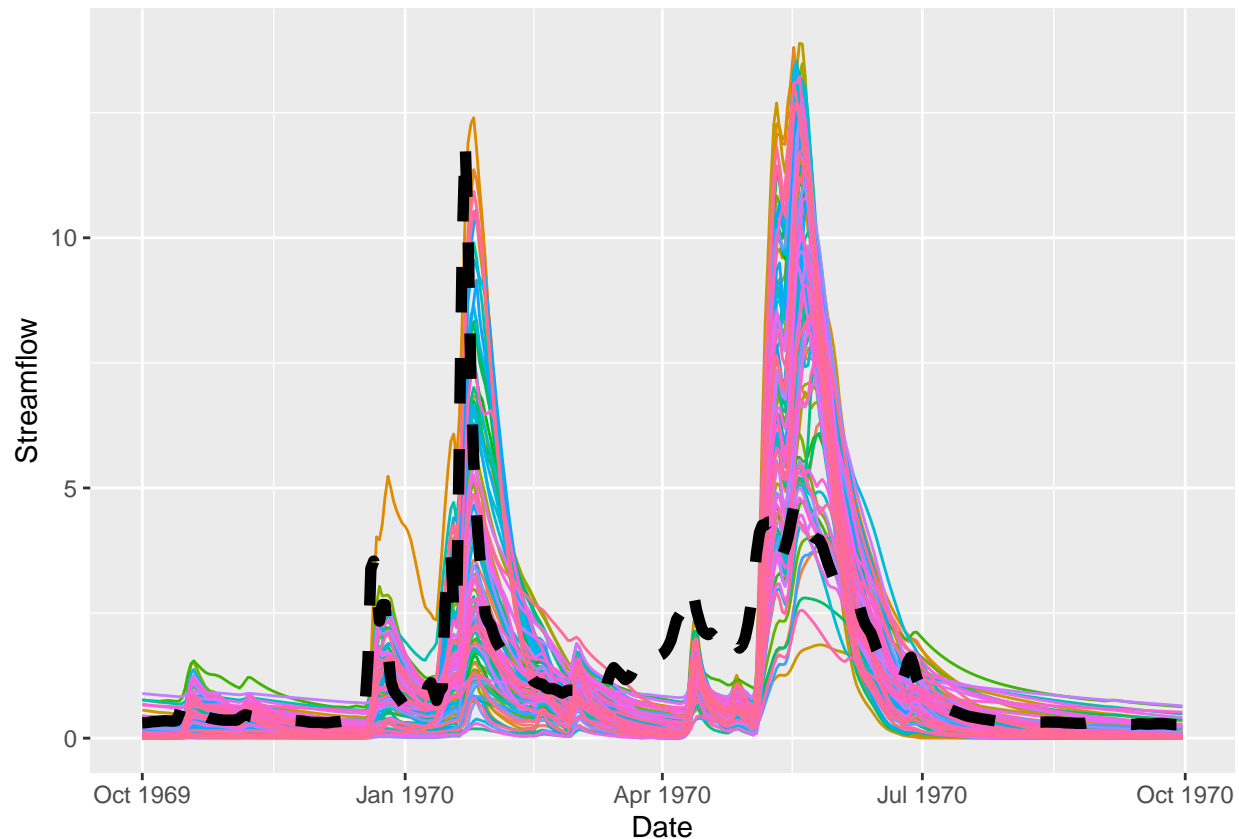
# plot all results
msage1 = msage %>%
  gather(key="run", value="streamflow", -date, -month, -day, -year, -wy, -obs)

# lets plot water year 1970 otherwise its hard to see
p1 = ggplot(subset(msage1, wy == 1970), aes(as.Date(date), streamflow, col=run)) +
  geom_line()+theme(legend.position = "none")
p1

```



```
# lets add observed streamflow
p1 + geom_line(aes(as.Date(date), obs), size=2, col="black", linetype=2) +
  labs(y="Streamflow", x="Date")
```



```
# compute performance measures for all output
```

```
res = msage %>% select(-date, -month, -day, -year, -wy ) %>% map_dbl(~nse(m=.x, o=msage$obs))
summary(res)
```

```
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -1.40236 -0.16063  0.12515  0.04981  0.33553  1.00000
```

```
# max has a "perfect score", remove observations to confirm this is why
```

```
res = msage %>% select(-date, -month, -day, -year, -wy, -obs) %>% map_dbl(~nse(m=.x, o=msage$obs))
summary(res)
```

```
##      Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
## -1.4024 -0.1614  0.1247  0.0404  0.3293  0.6859
```

```
# create unique identifiers, ID's that track each model output
```

```
simnames = names(msage %>% select(-date, -month, -day, -year, -wy, -obs))
results = cbind.data.frame(simnames=simnames, nse=res)
```

```
# example using our high flow statistics
```

```
res = msage %>%
  select(-date, -month, -day, -year, -wy, -obs ) %>%
  map_dbl(~check_maxannual( o=msage$obs, month=msage$month, day=msage$day, year=msage$year, wy=msage$wy
```

```
# add to our results
```

```
results$maxannual_cor = res
```

```
# look at range of metrics
summary(results)
```

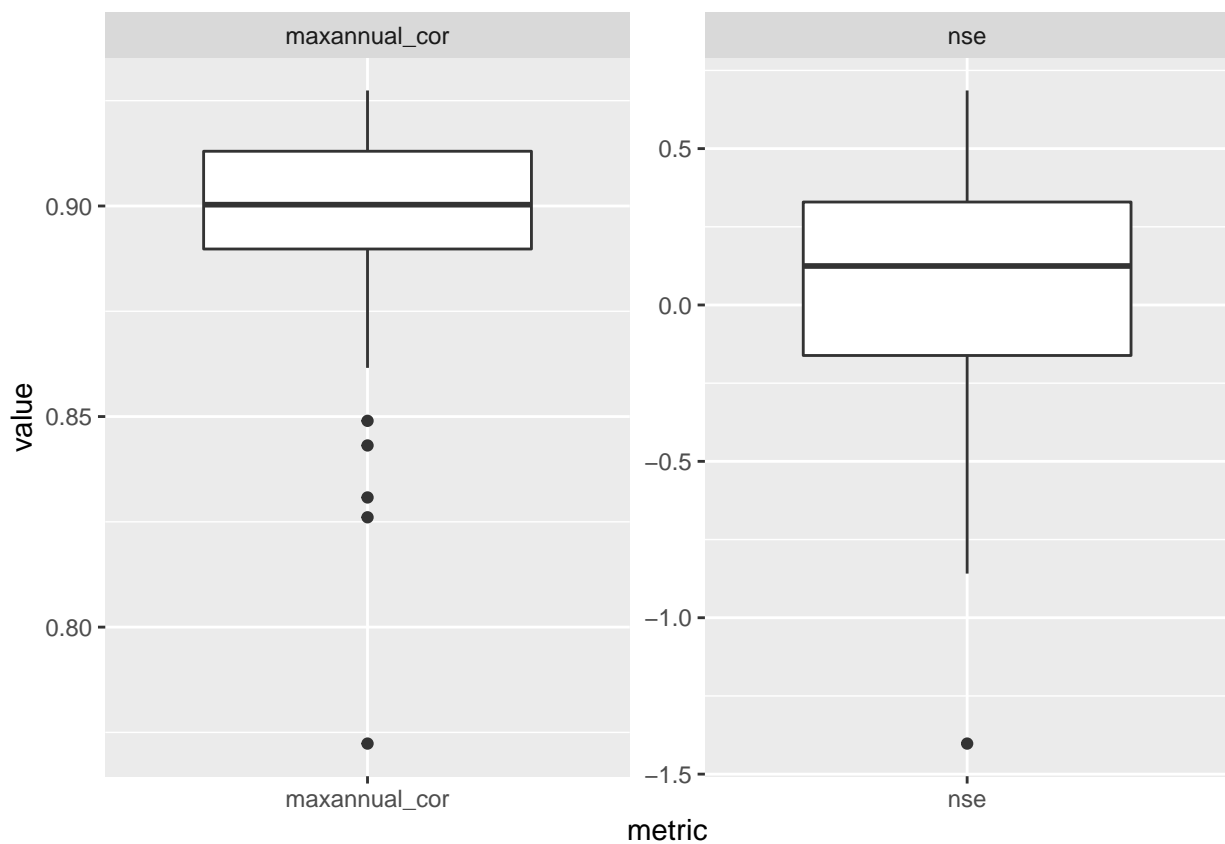
```
##      simnames          nse      maxannual_cor
## Length:101      Min.   :-1.4024   Min.   :0.7723
## Class :character 1st Qu.: -0.1614   1st Qu.:0.8898
## Mode  :character Median   : 0.1247   Median :0.9003
##                Mean    : 0.0404   Mean   :0.8964
##                3rd Qu.: 0.3293   3rd Qu.:0.9130
##                Max.    : 0.6859   Max.   :0.9274
```

```
# V130 gave the best match to our function of max annual streamflow
```

```
# graph range of performance measures
```

```
results1 = results %>%
  gather(key="metric",value="value", -simnames)

ggplot(results1, aes(metric, value)) +
  geom_boxplot()+facet_wrap(~metric, scales="free")
```



```
# are metrics related to each other
```

```
# useful for assessing whether there are tradeoffs
```

```
ggplot(results, aes(maxannual_cor, nse))+geom_point()
```

