Evaluating Models

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Question 01: Code your metric as a function

```
# We picked winter streamflow (11,12,1,2)
source("performance_metric.R")
```

Question 02: Apply to the streamflow data provided in sagerm.txt (multiple model results)

```
# read in sager data
# -----------------------------------------------------------------------------
sager = read.table("sager.txt", header=T) %>%
  mutate(date=make_date(year=year, month=month, day=day))

# now read in the model outputs
# -----------------------------------------------------------------------------
sagerm = read.table("sagerm.txt", header = T) %>%
  mutate(date = sager$date,
         month = sager$month,
         year = sager$year,
         day = sager$day,
         wy = sager$wy,
         obs = sager$obs)

# call in and run function using sager data
# -----------------------------------------------------------------------------

winter_flow(m = sagerm$m,
            o = sagerm$o,
            month = sagerm$month,
            year = sagerm$year,
            wy = sagerm$wy)
```

```
## [1] 0.05905527
```

Question 03: Find the simulation that gives the best performance (record that and add to the quiz on gauchospace)

```
# to turn all the columns of different outputs into a single column identified by "run"
# -----------------------------------------------------------------------------
sagerml = sagerm %>%
  gather(key="run",
         value="streamflow",
         -date, -month, -day, -year, -wy, -obs)
```

```
# compute performance measures for all output
# ------------------------------------------------------------------------------
res = sagerm %>%
  select(-date, -month, -day, -year, -wy,-obs ) %>%
  map_dbl(~nse(m=.x, o=sagerm$obs))

summary(res)
```

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

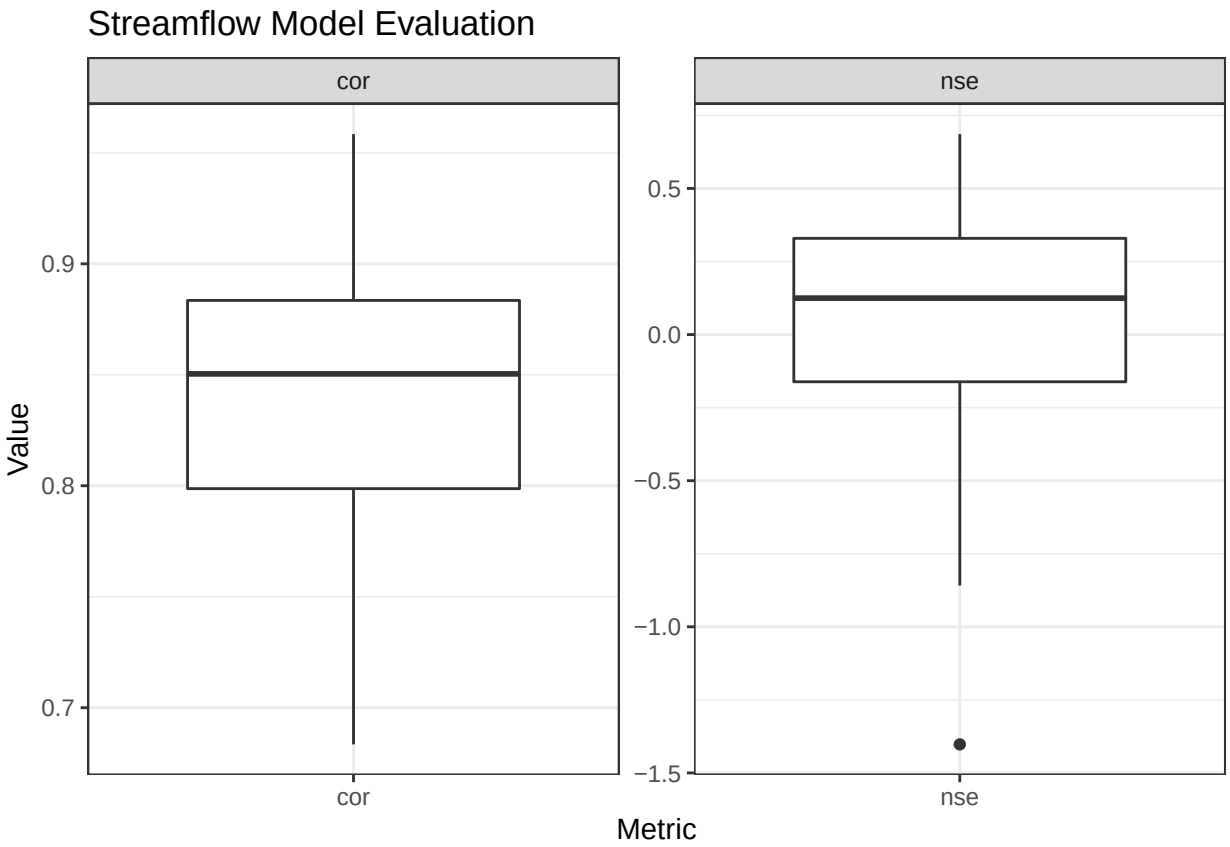
```
sims = names(sagerm %>% select(-date, -month, -day,-year,-wy, -obs))
results = cbind.data.frame(simnames=sims, nse=res)

# another example using our low flow statistics
# use apply to compute for all the data
# ------------------------------------------------------------------------------
res = sagerm %>%
  select(-date, -month, -day, -year, -wy, -obs) %>%
  map_dbl(~winter_flow(o=sagerm$obs, month=sagerm$month,
                       year=sagerm$year, wy=sagerm$wy, m=.x))
# add to our results
# ------------------------------------------------------------------------------
results$cor = res
answer_03 = max(results$cor)

# put this in a format that's easy to compare
# use which.min and convert all to positive values to find the closest match
# ------------------------------------------------------------------------------
resultsl = results %>%
  gather(key="metric",value="value", -simnames)

which.min(abs(0 - resultsl$value))
```

```
## [1] 70
```

```
# For us the closest simulation was V168
```

Question 04: Create a boxplot of your metric applied to sagerm.txt

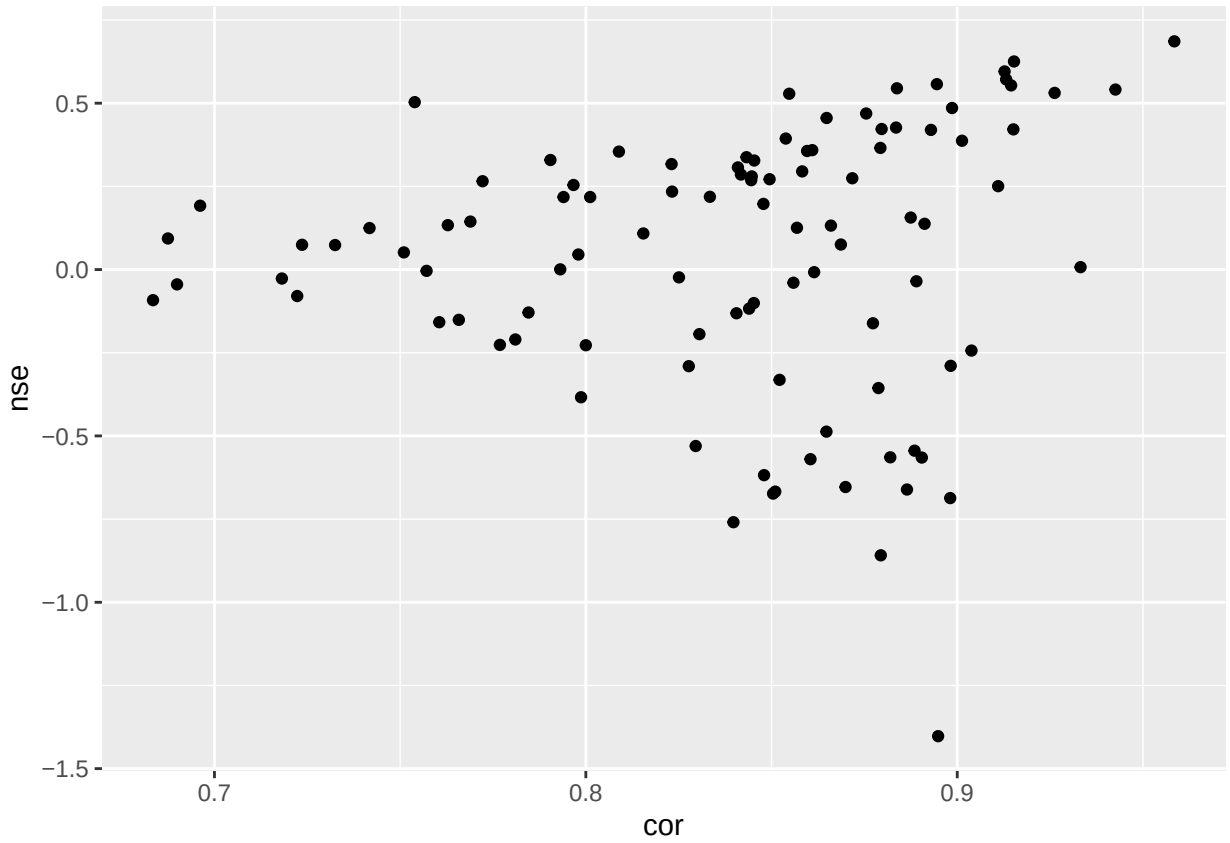
```
# graph range of performance measures

ggplot(resultsl, aes(metric, value))+
  geom_boxplot()+
  facet_wrap(~metric, scales="free") +
  labs(title = "Streamflow Model Evaluation", x = "Metric", y = "Value") +
  theme_bw()
```




```
ggsave("evaluating_models.png")
```

```
## Saving 6.5 x 4.5 in image
```

```
# are metrics related to each other
# useful for assessing whether there are tradeoffs
# ------------------------------------------------------------------------
ggplot(results, aes(cor, nse))+geom_point()
```



Question 05: Submit metric function and boxplot on gauchospace