Assignment LHS

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```
source(here("atm_conduct_function.R"))
```

Question 2:

```
#parameters
factors = c("vm", "h")

#how many parameter sets to run
nsets = 100

#choose distributions for parameters
q = c("qnorm", "qunif")
q.arg = list(list(mean = 250, sd = 30),
             list(min = 950, max = 1050)
             )

#generate samples from LHS
sens_conduct = LHS(NULL, factors, nsets, q, q.arg)
sens_pars = get.data(sens_conduct)
head(sens_pars)
```

```
##         vm      h
## 1 297.9458  994.5
## 2 280.4567 1009.5
## 3 256.4410 1019.5
## 4 264.4518 1022.5
## 5 251.8812  957.5
## 6 248.8718  999.5
```

```
#run model for all of the parameters generated by LHS, using pmap

conductance <- sens_pars %>%
  pmap(atm_conduct)

# turn results in to a dataframe for easy display/analysis
conductance_df = conductance %>% map_dfr(`[`,c("Cat"))

mean(conductance_df$Cat)
```

```
## [1] 15.43956
```

Question 3:

Part a:

```r
kd <- 0.7
k0 <- 0.1
deviation <- 0.01

#parameters
factors = c("kd", "k0", "vm", "h")

#how many parameter sets to run
nsets = 100

#choose distributions for parameters
q = c("qunif", "qunif", "qnorm", "qunif")
q.arg = list(list(min = kd-deviation*kd,
                  max = kd+deviation*kd),
             list(min = k0-deviation*k0,
                  max = k0+deviation*k0),
             list(mean = 250, sd = 30),
             list(min = 950, max = 1050)
             )

#generate samples from LHS
sens_conduct = LHS(NULL, factors, nsets, q, q.arg)
sens_pars = get.data(sens_conduct)
head(sens_pars)
```

```
##        kd      k0       vm      h
## 1 0.69783 0.10095 327.2749 1028.5
## 2 0.70049 0.10019 265.3022  950.5
## 3 0.69825 0.09941 230.2349 1032.5
## 4 0.70287 0.10007 238.8443  990.5
## 5 0.69377 0.09925 206.8141 1017.5
## 6 0.69545 0.10093 172.7251  968.5
```

Part b:

```r
#run model for all of the parameters generated by LHS, using pmap

conductance <- sens_pars %>%
  pmap(atm_conduct)

head(conductance)
```

```
## [[1]]
## [[1]]$Cat
## [1] 20.62925
##
```

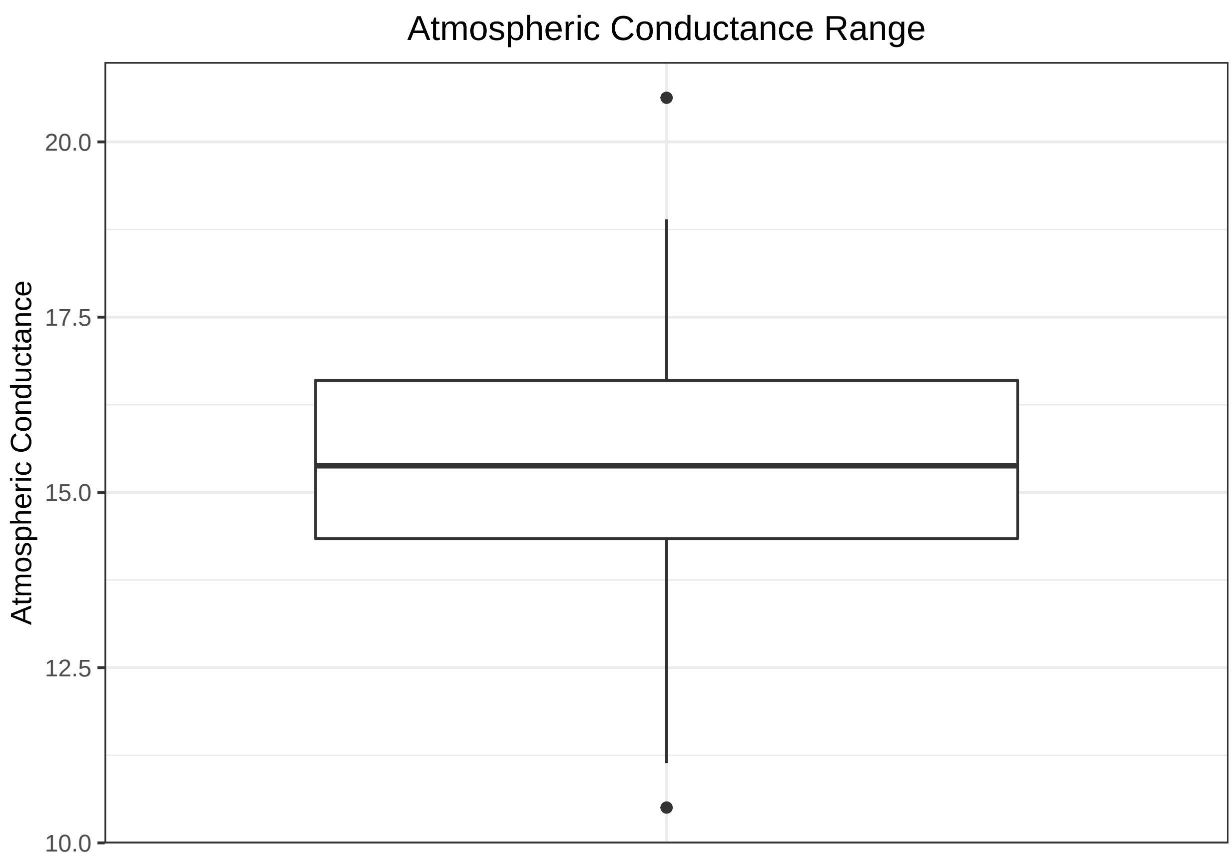
```
##
## [[2]]
## [[2]]$Cat
## [1] 16.03175
##
##
## [[3]]
## [[3]]$Cat
## [1] 14.2784
##
##
## [[4]]
## [[4]]$Cat
## [1] 14.80108
##
##
## [[5]]
## [[5]]$Cat
## [1] 12.56938
##
##
## [[6]]
## [[6]]$Cat
## [1] 10.50382
```

```
# turn results in to a dataframe for easy display/analysis
conductance_df = conductance %>% map_dfr(`[`,c("Cat"))
```

```
sens_conduct = pse::tell(sens_conduct, t(as.matrix(conductance_df)),
                         res.names=c("Cat"))
```

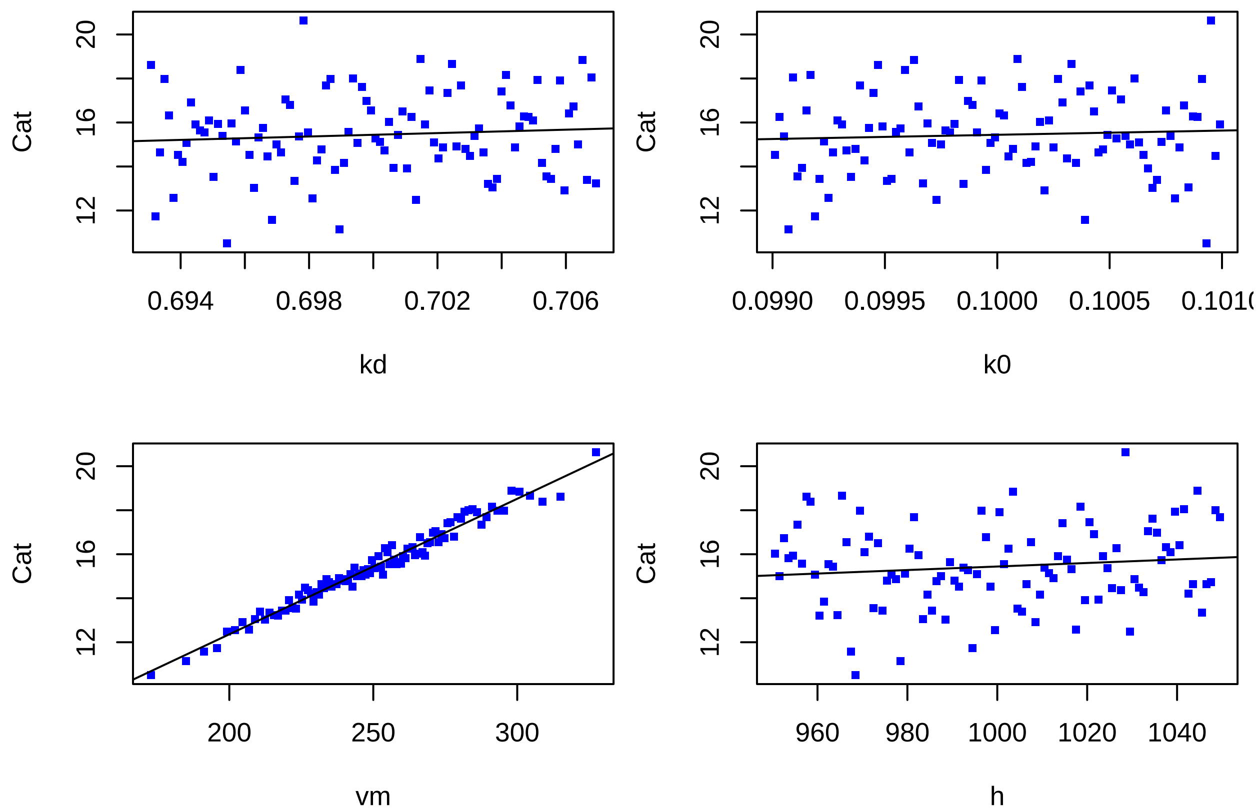
Part c:

```
# Plot conductance estimates accounting for parameter uncertainty

ggplot(conductance_df, aes(x=factor(0), y=Cat))+
  geom_boxplot()+
  labs(y="Atmospheric Conductance",
       x = NULL,
       title = "Atmospheric Conductance Range")+
  theme_bw()+
  theme(axis.text.x = element_blank(),
        axis.ticks.x = element_blank(),
        plot.title = element_text(hjust = 0.5))
```



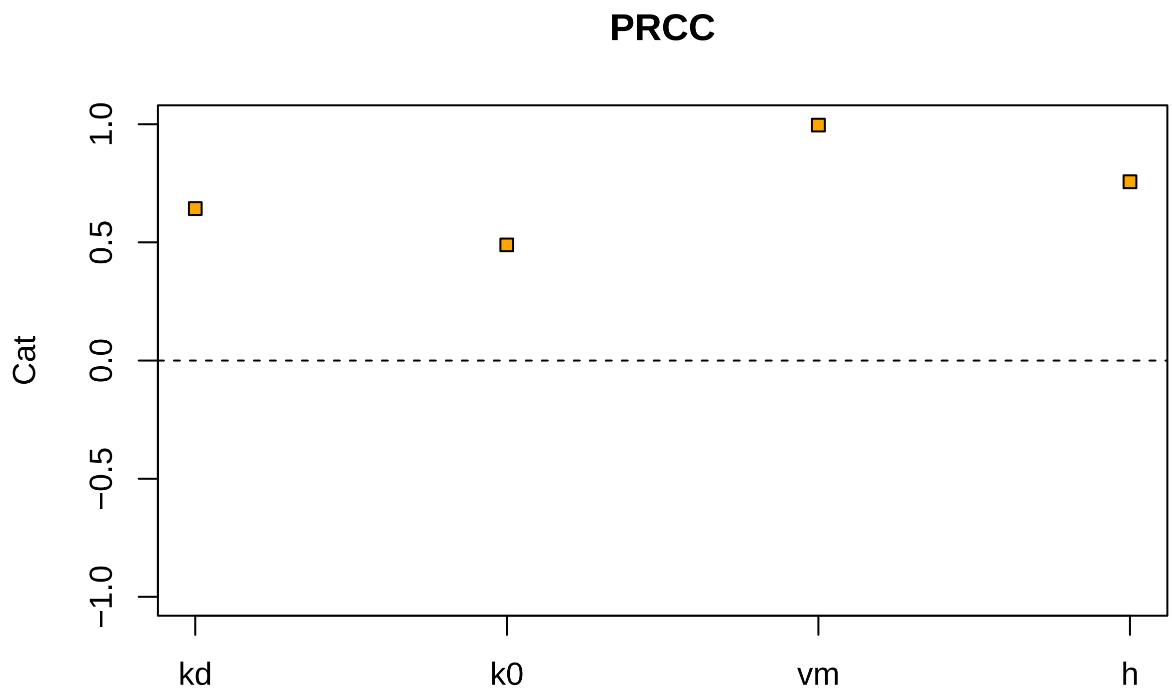
Part d:

```
#Plot conductance estimates against each parameter

# now we use built in LHS functions to analyze parameter sensitivity
pse::plotscatter(sens_conduct, col="blue", cex=5)
```



Part e:

```
# estimate the Partial Rank Correlation Coefficients

#plot
pse::plotprcc(sens_conduct)
```




```r
#PRCC values for parameters
sens_conduct$prcc
```

```
## [[1]]
##
## Call:
## pcc.default(X = L, y = r, rank = T, nboot = nboot)
##
## Partial Rank Correlation Coefficients (PRCC):
##     original
## kd 0.6431584
## k0 0.4891765
## vm 0.9962976
## h  0.7564949
```

Part f:

When analyzing parameter sensitivity, our results indicate that wind speed is the greatest indicator of aerodynamic conductance. Thus, to reduce uncertainty in aerodynamic conductance estimates, one should focus on wind speed. There is evidence that climate change is increasing average wind speeds. Therefore, as our model suggests, atmospheric conductance will also increase with higher wind speeds. Thus, plants will lose more water due to this increased atmospheric conductance, and will be more sensitive to water use.