

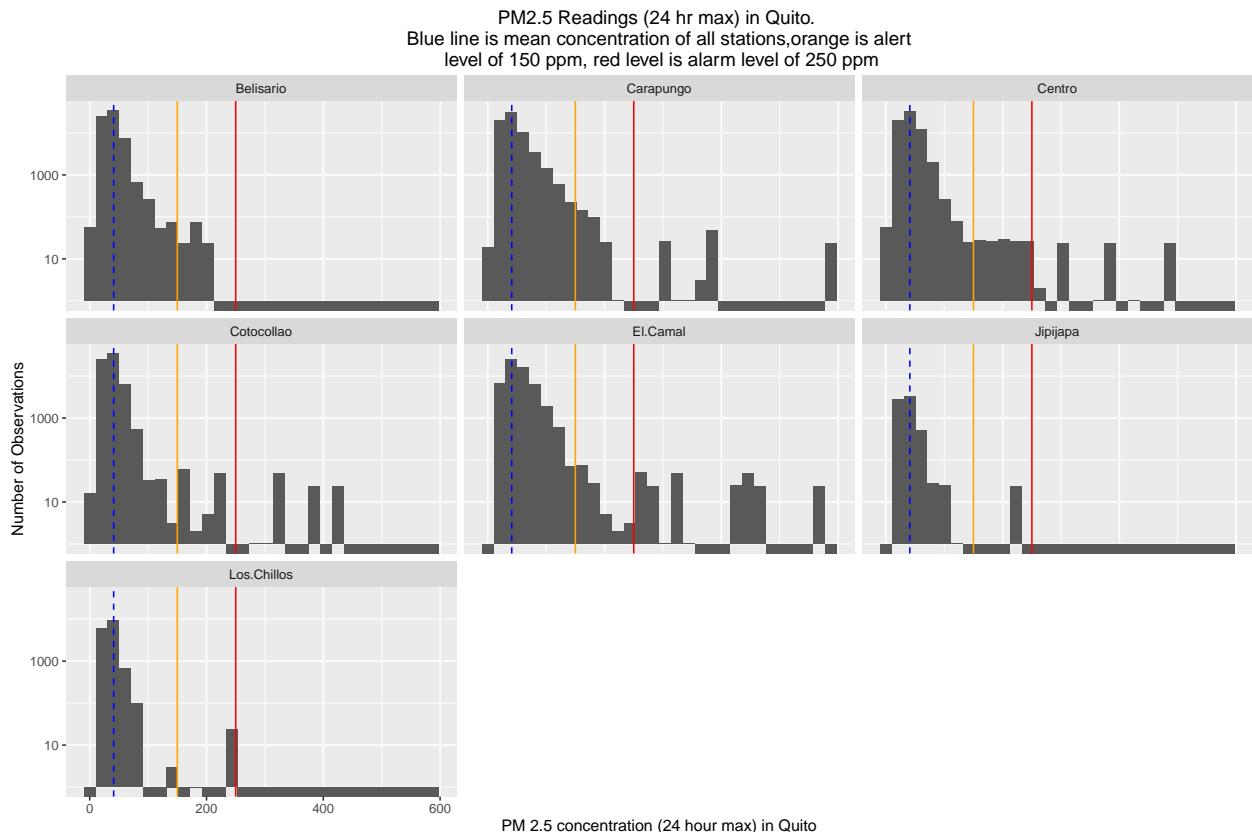
Quito air quality - modeled on Beijing Air Quality

Moroney & Thomas

Sep 21, 2016

```
# make pm 25 24 hour max data
PM25 <- a %>%
  na.omit() %>%
  filter(chem == "PM25") %>%
  mutate(PM25.24 = rollmax(x = conc, 24, align = "right", fill = NA),
         mean24 = rollmean(x = conc, 24, align = "right", fill = NA)) %>%
  na.omit()

# plot 1
# ggplot histograms by station pm25
ggplot(PM25, aes(x = PM25.24)) +
  geom_histogram() +
  geom_vline(xintercept = mean(PM25$PM25.24), col = "blue", lty = 2) +
  geom_vline(xintercept = 150, col = "orange") +
  geom_vline(xintercept = 250, col = "red") +
  xlab("PM 2.5 concentration (24 hour max) in Quito") +
  ylab("Number of Observations") +
  facet_wrap(~station) +
  ggtitle("PM2.5 Readings (24 hr max) in Quito. \n Blue line is mean concentration of all stations,orange is alert level of 150 ppm, red level is alarm level of 250 ppm") +
  scale_y_log10()
```

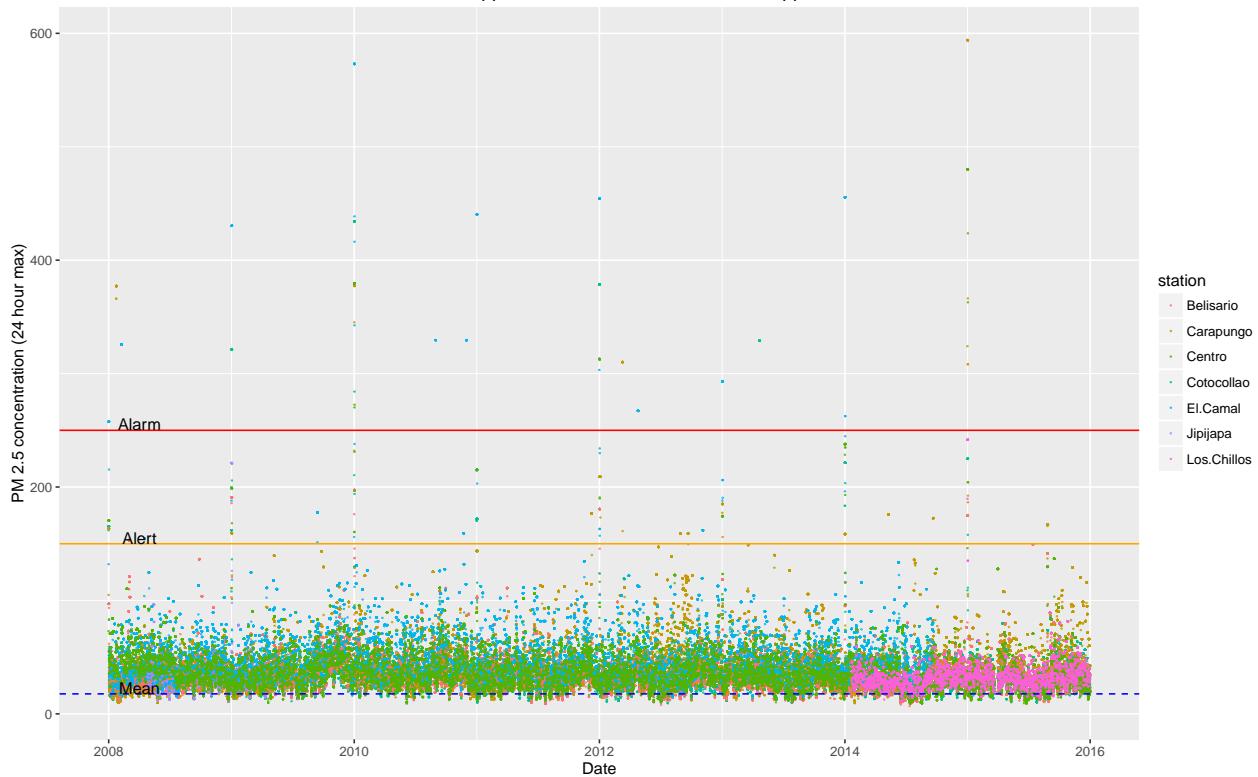


```

# plot 2
# scatterplot of pm25
ggplot(PM25, aes(x = date, y = PM25.24, col = station)) +
  geom_point(alpha = 0.8, size = 0.1) +
  geom_hline(yintercept = mean(PM25$conc), col = "blue", lty = 2) +
  geom_hline(yintercept = 150, col = "orange") +
  geom_hline(yintercept = 250, col = "red") +
  annotate("text", x = first(PM25$date), y = mean(PM25$conc)+5, label = "Mean") +
  annotate("text", x = first(PM25$date), y = 155, label = "Alert") +
  annotate("text", x = first(PM25$date), y = 255, label = "Alarm") +
  ggtitle("PM2.5 Readings (24 hr max) in Quito. Blue \n line is mean concentration of all stations,orange is alert level of 150 ppm, red level is alarm level of 250 ppm")
  xlab("Date") +
  ylab("PM 2.5 concentration (24 hour max)")

```

PM2.5 Readings (24 hr max) in Quito. Blue line is mean concentration of all stations,orange is alert level of 150 ppm, red level is alarm level of 250 ppm.

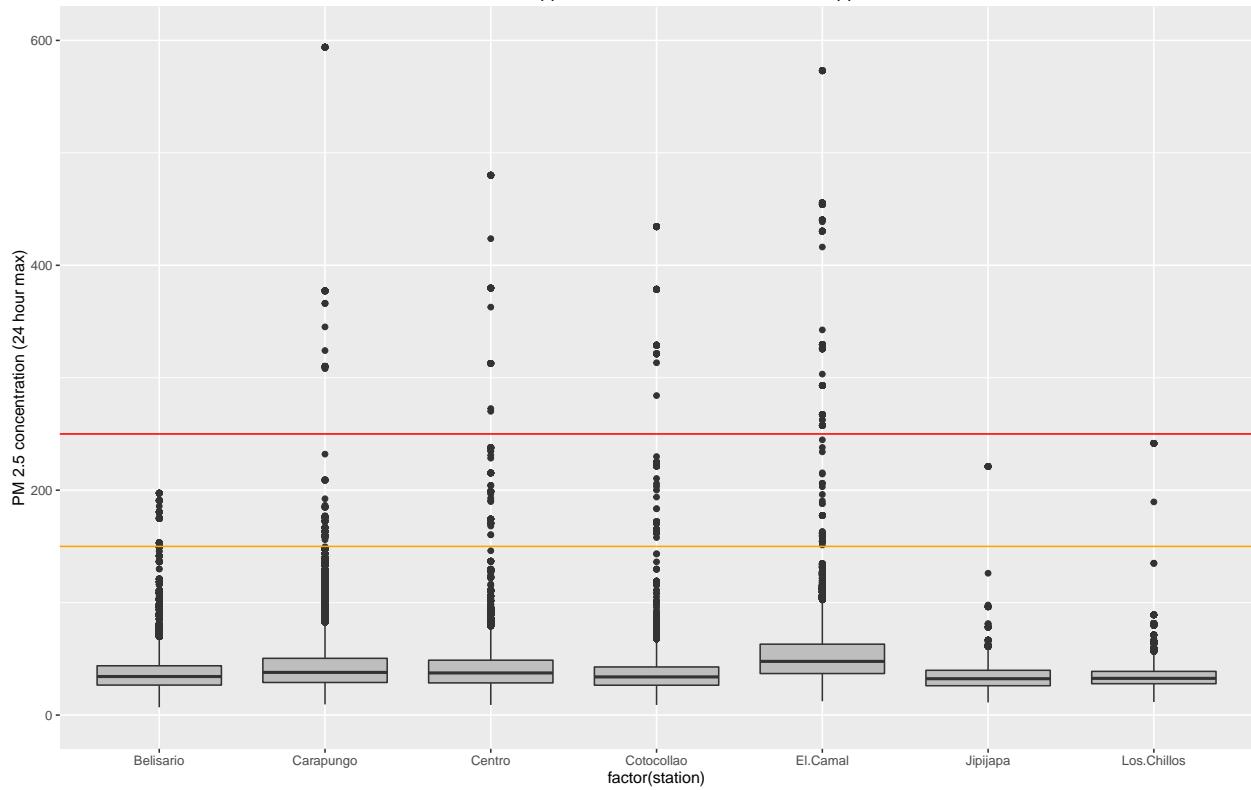


```

#boxplot PM25 24 hour max
ggplot(PM25, aes(factor(station), PM25.24)) +
  geom_boxplot(fill = "gray") +
  geom_hline(yintercept = 150, col = "orange") +
  geom_hline(yintercept = 250, col = "red") +
  ylab("PM 2.5 concentration (24 hour max)") +
  ggtitle("PM2.5 Readings (24 hour max) in Quito. Orange is alert \n level of 150 ppm, red level is a")
  ylim(c(0,600))

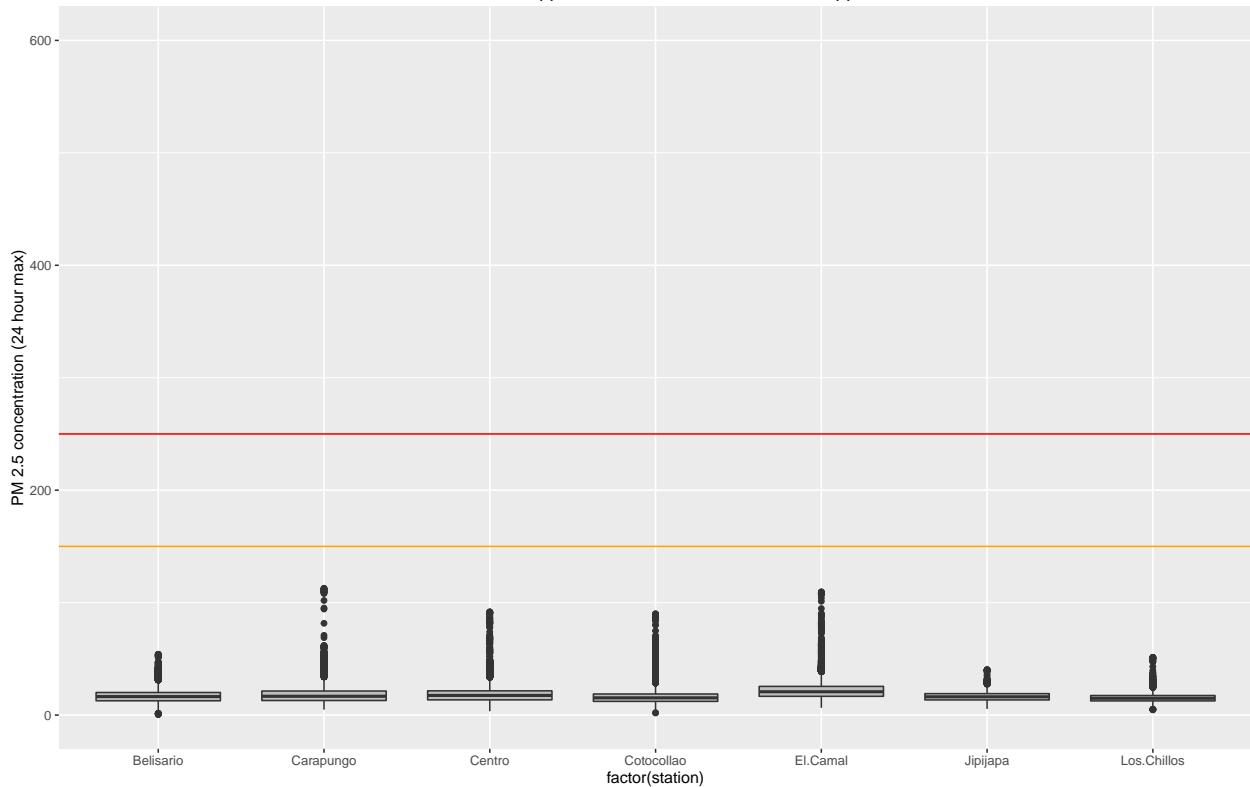
```

PM2.5 Readings (24 hour max) in Quito. Orange is alert level of 150 ppm, red level is alarm level of 250 ppm.



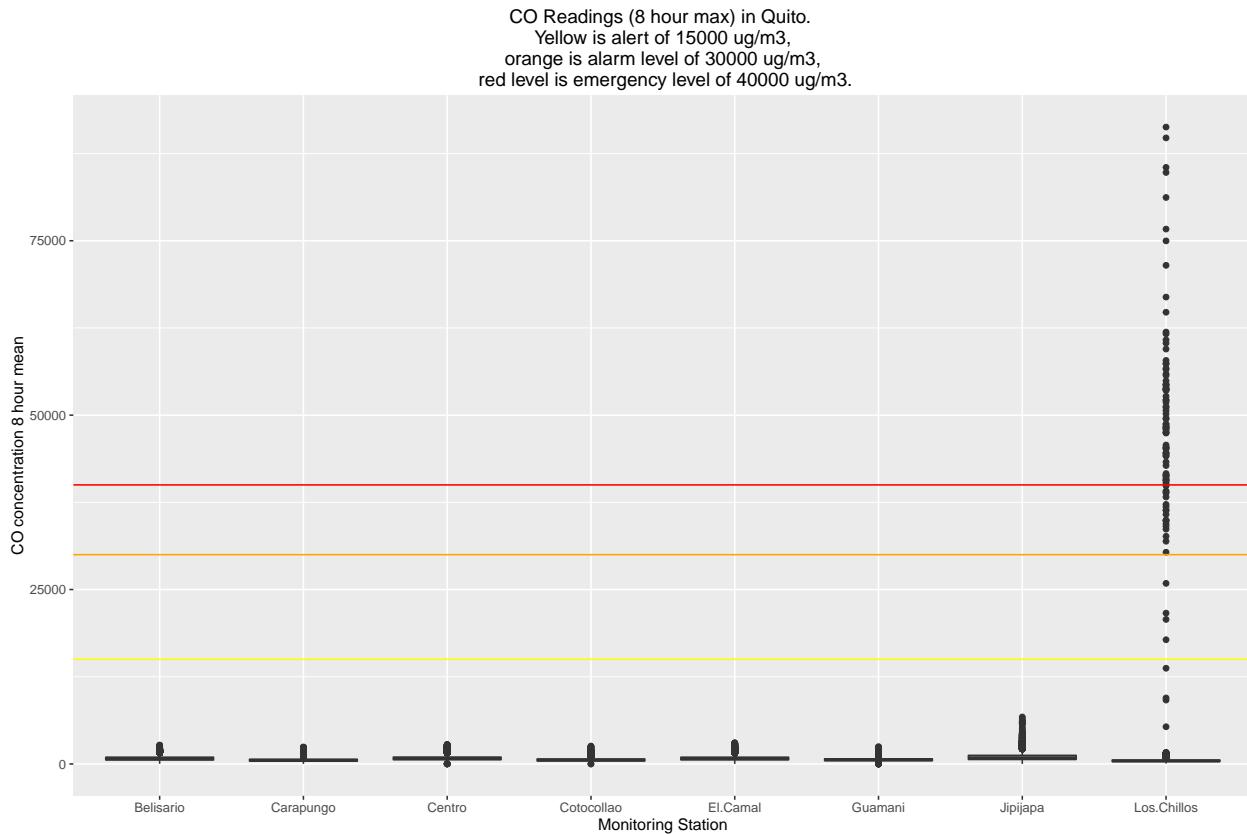
```
#boxplot PM25 24 hour mean
ggplot(PM25, aes(factor(station), mean24)) +
  geom_boxplot(fill = "gray") +
  geom_hline(yintercept = 150, col = "orange") +
  geom_hline(yintercept = 250, col = "red") +
  ylab("PM 2.5 concentration (24 hour max)") +
  ggtitle("PM2.5 Readings (24 hour mean) in Quito. Orange is alert \n level of 150 ppm, red level is a
  ylim(c(0,600))
```

PM2.5 Readings (24 hour mean) in Quito. Orange is alert level of 150 ppm, red level is alarm level of 250 ppm.



```
# boxplot CO 8 hour mean
CO <- a %>%
  na.omit() %>%
  group_by(station) %>%
  filter(chem == "CO") %>%
  mutate(CO.8 = rollmean(x = conc, 8, align = "right", fill = NA)) %>%
  na.omit()

ggplot(CO, aes(factor(station), CO.8)) +
  geom_boxplot(fill = "gray") +
  geom_hline(yintercept = 15000, col = "yellow") +
  geom_hline(yintercept = 30000, col = "orange") +
  geom_hline(yintercept = 40000, col = "red") +
  ylab("CO concentration 8 hour mean") +
  xlab("Monitoring Station") +
  ggtitle("CO Readings (8 hour max) in Quito. \n Yellow is alert of 15000 ug/m3, \n orange is alarm level of 30000 ug/m3, \n red is alarm level of 40000 ug/m3")
```



```
# When does CO.8 get higher than 40000
group_by(CO, station) %>%
filter(CO.8 > 40000) %>%
ungroup() %>%
select(date) %>% as.vector() %>%
table()

## .
## 2014-03-17 10:00:00 2014-03-17 11:00:00 2014-03-17 12:00:00
##           1           1           1
## 2014-03-17 13:00:00 2014-03-17 14:00:00 2014-03-17 15:00:00
##           1           1           1
## 2014-03-17 16:00:00 2014-03-17 17:00:00 2014-03-17 18:00:00
##           1           1           1
## 2014-03-17 19:00:00 2014-03-17 20:00:00 2014-03-17 21:00:00
##           1           1           1
## 2014-03-17 22:00:00 2014-03-17 23:00:00 2014-03-18 08:00:00
##           1           1           1
## 2014-03-18 09:00:00 2014-03-18 10:00:00 2014-03-18 11:00:00
##           1           1           1
## 2014-03-18 12:00:00 2014-03-18 13:00:00 2014-03-18 14:00:00
##           1           1           1
## 2014-03-18 15:00:00 2014-03-18 16:00:00 2014-03-18 17:00:00
##           1           1           1
## 2014-03-18 18:00:00 2014-03-18 19:00:00 2014-03-18 20:00:00
##           1           1           1
## 2014-03-18 21:00:00 2014-03-18 22:00:00 2014-03-18 23:00:00
##           1           1           1
```

```

## 2014-03-19 01:00:00 2014-03-19 02:00:00 2014-03-19 03:00:00
##           1                  1                  1
## 2014-03-19 04:00:00 2014-03-19 05:00:00 2014-03-19 06:00:00
##           1                  1                  1
## 2014-03-19 07:00:00 2014-03-19 08:00:00 2014-03-19 09:00:00
##           1                  1                  1
## 2014-03-19 10:00:00 2014-03-19 11:00:00 2014-03-19 12:00:00
##           1                  1                  1
## 2014-03-19 13:00:00 2014-03-19 14:00:00 2014-03-19 15:00:00
##           1                  1                  1
## 2014-03-19 16:00:00 2014-03-19 17:00:00 2014-03-19 18:00:00
##           1                  1                  1
## 2014-03-19 19:00:00 2014-03-19 20:00:00 2014-03-19 21:00:00
##           1                  1                  1
## 2014-03-19 22:00:00 2014-03-19 23:00:00 2014-03-20 00:00:00
##           1                  1                  1
## 2014-03-20 01:00:00 2014-03-20 02:00:00 2014-03-20 03:00:00
##           1                  1                  1
## 2014-03-20 07:00:00 2014-03-20 08:00:00 2014-03-20 09:00:00
##           1                  1                  1
## 2014-03-20 10:00:00 2014-03-20 11:00:00 2014-03-20 12:00:00
##           1                  1                  1
## 2014-03-20 13:00:00 2014-03-20 14:00:00 2014-03-20 15:00:00
##           1                  1                  1
## 2014-03-20 20:00:00 2014-03-20 21:00:00 2014-03-20 22:00:00
##           1                  1                  1
## 2014-03-20 23:00:00 2014-03-21 01:00:00 2014-03-21 02:00:00
##           1                  1                  1
## 2014-03-21 03:00:00 2014-03-21 04:00:00
##           1                  1

```

This is when CO was exceeded at Los Chillos. Looks like 3/17/14 to 3/21/14. Instrument error or event?