MA615 Worldwide Ocean Project

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Region Name: 4

List of Sources with URLs

Station 46002 (LLNR 765.1) - WEST OREGON - 275NM West of Coos Bay, OR

http://www.ndbc.noaa.gov/station_history.php?station=46002

Station 46028 (LLNR 275) - CAPE SAN MARTIN - 55NM West NW of Morro Bay, CA

http://www.ndbc.noaa.gov/station_history.php?station=46028

Station 46089 (LLNR 689) - TILLAMOOK, OR - 85 NM WNW of Tillamook, OR

http://www.ndbc.noaa.gov/station_history.php?station=46089

Overview and Summary:

Report on the condition of the data and any interesting detail

Discuss the data acquisition, selection of buoys or ships

Density of data

We carried our data collection of the National Data Buoy Center's Worldwide Ocean Temperature via three locations in North America: #406002, #46028 and #46089, respectively, from 2005 to 2016, within twelve-year span. The baseline and collected factors are: date and time (YYYY-MM-HH-DD), air temperature (ATMP) and water temperature (WTMP) to meet the research goal. In regards to the data per se: the obtained total valid observations are 10839. In addition, the twelve years' water temperature range is 9.6 °C, with the mean of 13.6 °C; the air temperature range is 15.2°C with the mean value of 12.50°C. For the density of fluctuations, our EDA analysis presents the "noises" regionally and seasonally. The detailed discussions are listed in the body paragraph as follows.

```
library(foreign)
library(ggplot2)
library(car)
library(MASS)
library(arm)
```

```
## Loading required package: Matrix
```

```
## Loading required package: lme4
```

```
##
## arm (Version 1.9-3, built: 2016-11-21)
```

```
## Working directory is /Users/shuyijiang/Documents/MA615/Worldwide Ocean Project/Buoy

##
## Attaching package: 'arm'

## The following object is masked from 'package:car':
##
##     logit
```

```r
library(dplyr)
```

```
##
## Attaching package: 'dplyr'

## The following object is masked from 'package:MASS':
##
##     select

## The following object is masked from 'package:car':
##
##     recode

## The following objects are masked from 'package:stats':
##
##     filter, lag

## The following objects are masked from 'package:base':
##
##     intersect, setdiff, setequal, union
```

```r
library(tidyverse)
```

```
## Loading tidyverse: tibble
## Loading tidyverse: tidyr
## Loading tidyverse: readr
## Loading tidyverse: purrr

## Conflicts with tidy packages ----------------------------------------------

## expand(): tidyr, Matrix
## filter(): dplyr, stats
## lag():    dplyr, stats
## recode(): dplyr, car
## select(): dplyr, MASS
## some():   purrr, car
```

```r
library(ggmap)
library(readr)
```

Point 46028 Data Cleaning

```r
data <- readLines("46028h2005.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
```

```r
  df <- rbind(df, subtmp)
}

data.clean2005028 <- read.fwf(textConnection(df), widths=c(14,5,5))
names(data.clean2005028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2006.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2006028 <- read.fwf(textConnection(df), widths=c(14,5,5))
names(data.clean2006028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2007.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2007028 <- read.fwf(textConnection(df), widths=c(14,5,5))
names(data.clean2007028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2008.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2008028 <- read.fwf(textConnection(df), widths=c(14,5,5))
names(data.clean2008028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2009.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 66, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2009028 <- read.fwf(textConnection(df), widths=c(14,6,5))
names(data.clean2009028) <- c("YYMMDDHH", "WTMP","ATMP")
```

```r
data <- readLines("46028h2010.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 66, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2010028 <- read.fwf(textConnection(df), widths=c(14,5,5))
names(data.clean2010028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2011.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 66, 70), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2011028 <- read.fwf(textConnection(df), widths=c(14,5,5))
names(data.clean2011028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2012.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2012028 <- read.fwf(textConnection(df), widths=c(14,4,5))
names(data.clean2012028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2013.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2013028 <- read.fwf(textConnection(df), widths=c(14,4,5))
names(data.clean2013028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2014.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
```

```r
}

data.clean2014028 <- read.fwf(textConnection(df), widths=c(14,4,5))
names(data.clean2014028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2015.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 14), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2015028 <- read.fwf(textConnection(df), widths=c(14,5,5))
names(data.clean2015028) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46028h2016.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2016028 <- read.fwf(textConnection(df), widths=c(14,4,5))
names(data.clean2016028) <- c("YYMMDDHH", "WTMP","ATMP")

data.clean46028 <- rbind(data.clean2005028, data.clean2006028, data.clean2007028,
                         data.clean2008028, data.clean2009028, data.clean2010028,
                         data.clean2011028, data.clean2012028, data.clean2013028,
                         data.clean2014028, data.clean2015028, data.clean2016028)

data46028 <- filter(data.clean46028, substr(data.clean46028$YYMMDDHH,12,13)=="12" )

data46028$region <- 4
data46028$typereading <- "buoy"
data46028$lat <- "35.712 N"
data46028$lon <- "121.858 W"
data46028$timediff <- "+/- 0"

data <- data46028[c("region", "typereading", "timediff", "YYMMDDHH",
                    "lat","lon", "WTMP", "ATMP")]

data2005028 <- filter(data, substr(YYMMDDHH,1,4)==2005)
data2006028 <- filter(data, substr(YYMMDDHH,1,4)==2006)
data2007028 <- filter(data, substr(YYMMDDHH,1,4)==2007)
data2008028 <- filter(data, substr(YYMMDDHH,1,4)==2008)
data2009028 <- filter(data, substr(YYMMDDHH,1,4)==2009)
data2010028 <- filter(data, substr(YYMMDDHH,1,4)==2010)
data2011028 <- filter(data, substr(YYMMDDHH,1,4)==2011)
data2012028 <- filter(data, substr(YYMMDDHH,1,4)==2012)
data2013028 <- filter(data, substr(YYMMDDHH,1,4)==2013)
data2014028 <- filter(data, substr(YYMMDDHH,1,4)==2014)
```

```r
data2015028 <- filter(data, substr(YYMMDDHH,1,4)==2015)
data2016028 <- filter(data, substr(YYMMDDHH,1,4)==2016)
```

```r
data2005028$year <- 2005
data2006028$year <- 2006
data2007028$year <- 2007
data2008028$year <- 2008
data2009028$year <- 2009
data2010028$year <- 2010
data2011028$year <- 2011
data2012028$year <- 2012
data2013028$year <- 2013
data2014028$year <- 2014
data2015028$year <- 2015
data2016028$year <- 2016
```

```r
data28 <- rbind(data2005028,data2006028,data2007028,
                data2008028,data2009028,data2010028,
                data2011028,data2012028,data2013028,
                data2014028,data2015028,data2016028)
```

```r
data028 <- filter(data28, WTMP != 99.0 & ATMP !=99.0)
data028 <- filter(data028, WTMP != 999.0 & ATMP != 999.0)
data028 <- filter(data028, WTMP != 0 & ATMP != 0)
```

Point 46028 Data Cleaning Finished, chart finished

Point 46089 Data Cleaning

```r
data <- readLines("46089h2005.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2005089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2005089) <- c("YYMMDDHH", "WTMP","ATMP")
```

```r
data <- readLines("46089h2006.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2006089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2006089) <- c("YYMMDDHH", "WTMP","ATMP")
```

```r
data <- readLines("46089h2007.txt")
df <- NULL
```

```r
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2007089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2007089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2008.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2008089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2008089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2009.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2009089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2009089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2010.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2010089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2010089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2011.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2011089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2011089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2012.txt")
df <- NULL
```

```r
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2012089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2012089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2013.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2013089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2013089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2014.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2014089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2014089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2015.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2015089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2015089) <- c("YYMMDDHH", "WTMP","ATMP")

data <- readLines("46089h2016.txt")
df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61, 65))
  df <- rbind(df, subtmp)
}

data.clean2016089 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2016089) <- c("YYMMDDHH", "WTMP","ATMP")
```

Txt files reading finished

Join two data frames (datasets) vertically, use the rbind function for data frame combination.

```
data46089 <- rbind(data.clean2005089,data.clean2006089,data.clean2007089,
                 data.clean2008089,data.clean2009089,data.clean2010089,
                 data.clean2011089, data.clean2012089, data.clean2013089,
                 data.clean2014089, data.clean2015089,data.clean2016089)
```

Filter data point at 12 o'clock

```
data46089 <- filter(data46089, substr(data46089$YYMMDDHH,12,13)=="12" )
```

Add columns

```
data46089$region <- 4
data46089$typereading <- "buoy"
data46089$lat <- "35.712 N"
data46089$lon <- "121.858 W"
data46089$timediff <- "+/- 0"
```

```
data <- data46089[c("region", "typereading", "timediff", "YYMMDDHH",
                   "lat","lon", "WTMP", "ATMP")]
```

Split By Year

```
data2005089 <- filter(data, substr(YYMMDDHH,1,4)==2005)
data2006089 <- filter(data, substr(YYMMDDHH,1,4)==2006)
data2007089 <- filter(data, substr(YYMMDDHH,1,4)==2007)
data2008089 <- filter(data, substr(YYMMDDHH,1,4)==2008)
data2009089 <- filter(data, substr(YYMMDDHH,1,4)==2009)
data2010089 <- filter(data, substr(YYMMDDHH,1,4)==2010)
data2011089 <- filter(data, substr(YYMMDDHH,1,4)==2011)
data2012089 <- filter(data, substr(YYMMDDHH,1,4)==2012)
data2013089 <- filter(data, substr(YYMMDDHH,1,4)==2013)
data2014089 <- filter(data, substr(YYMMDDHH,1,4)==2014)
data2015089 <- filter(data, substr(YYMMDDHH,1,4)==2015)
data2016089 <- filter(data, substr(YYMMDDHH,1,4)==2016)
```

Add "year" Column

```
data2005089$year <- 2005
data2006089$year <- 2006
data2007089$year <- 2007
data2008089$year <- 2008
data2009089$year <- 2009
data2010089$year <- 2010
data2011089$year <- 2011
data2012089$year <- 2012
data2013089$year <- 2013
data2014089$year <- 2014
data2015089$year <- 2015
data2016089$year <- 2016
```

```
data46089 <- rbind(data2005089,data2006089,data2007089,
                   data2008089,data2009089,data2010089,
                   data2011089,data2012089,data2013089,
                   data2014089,data2015089,data2016089)
```

```
data089 <- filter(data46089, WTMP != 99.0 & ATMP !=99.0)
data089 <- filter(data089, WTMP != 999.0 & ATMP != 999.0)
data089 <- filter(data089, WTMP != 0 & ATMP != 0)
```

Point 46089 Data Cleaning and Chart Finished

Point 46002 Data Cleaning

```
#read data files from 2005-2016 at point 46002
data<-readLines("46002h2005.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2005002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2005002) <- c("YYMMDDHH","WTMP","ATMP")
```

```
data<-readLines("46002h2006.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2006002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2006002) <- c("YYMMDDHH","WTMP","ATMP")
```

```r
data<-readLines("46002h2007.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2007002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2007002) <- c("YYMMDDHH","WTMP","ATMP")

data<-readLines("46002h2008.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2008002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2008002) <- c("YYMMDDHH","WTMP","ATMP")

data<-readLines("46002h2009.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2009002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2009002) <- c("YYMMDDHH","WTMP","ATMP")

data<-readLines("46002h2011.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2011002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2011002) <- c("YYMMDDHH","WTMP","ATMP")

data<-readLines("46002h2012.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
```

```
}

data.clean2012002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2012002) <- c("YYMMDDHH","WTMP","ATMP")

data<-readLines("46002h2013.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2013002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2013002) <- c("YYMMDDHH","WTMP","ATMP")

data<-readLines("46002h2014.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2014002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2014002) <- c("YYMMDDHH","WTMP","ATMP")

data<-readLines("46002h2015.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2015002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2015002) <- c("YYMMDDHH","WTMP","ATMP")

data<-readLines("46002h2016.txt")

df <- NULL
for (i in 2:length(data)) {
  tmp <- data[i]
  subtmp <- paste0(substr(tmp, 1, 13), substr(tmp, 67, 71), substr(tmp, 61,65))
  df <- rbind(df, subtmp)
}

data.clean2016002 <- read.fwf(textConnection(df), widths=c(13,5,5))
names(data.clean2016002) <- c("YYMMDDHH","WTMP","ATMP")

#bind data files together and add required columns;also we select data only at 12pm
data46002=rbind(data.clean2005002,data.clean2006002,data.clean2007002,
```

```r
               data.clean2008002,data.clean2009002,data.clean2011002,
               data.clean2012002,data.clean2013002,data.clean2014002,
               data.clean2015002,data.clean2016002,by=c("YYDDMMHH","WTMP","ATMP"))
data46002=data46002%>%
  filter(substr(data46002$YYMMDDHH,12,13)=="12")

data46002$region<-4
data46002$typereading<-"buoy"
data46002$lat<-"42.612N"
data46002$lon<-"130.537W"
data46002$timediff<-"+/- 0"
data<-data46002[c("region","typereading","timediff","YYMMDDHH",
                  "lat","lon","WTMP","ATMP")]
#clean data by removing missing values
data <- filter(data, WTMP != 99.0 & ATMP !=99.0)
data <- filter(data, WTMP != 999.0 & ATMP != 999)
data <- filter(data, WTMP != 0 & ATMP != 0)

#select data for each year
data2005002 <- filter(data, substr(YYMMDDHH,1,4)==2005)
data2006002 <- filter(data, substr(YYMMDDHH,1,4)==2006)
data2007002 <- filter(data, substr(YYMMDDHH,1,4)==2007)
data2008002 <- filter(data, substr(YYMMDDHH,1,4)==2008)
data2009002 <- filter(data, substr(YYMMDDHH,1,4)==2009)
data2011002 <- filter(data, substr(YYMMDDHH,1,4)==2011)
data2012002 <- filter(data, substr(YYMMDDHH,1,4)==2012)
data2013002 <- filter(data, substr(YYMMDDHH,1,4)==2013)
data2014002 <- filter(data, substr(YYMMDDHH,1,4)==2014)
data2015002 <- filter(data, substr(YYMMDDHH,1,4)==2015)
data2016002 <- filter(data, substr(YYMMDDHH,1,4)==2016)

#add an extra year column
data2005002$year <- 2005
data2006002$year <- 2006
data2007002$year <- 2007
data2008002$year <- 2008
data2009002$year <- 2009
data2011002$year <- 2011
data2012002$year <- 2012
data2013002$year <- 2013
data2014002$year <- 2014
data2015002$year <- 2015
data2016002$year <- 2016

#rebind data together
data002 <- rbind(data2005002,data2006002,data2007002,
                 data2008002,data2009002,data2011002,
                 data2012002,data2013002,data2014002,
                 data2015002,data2016002)
```
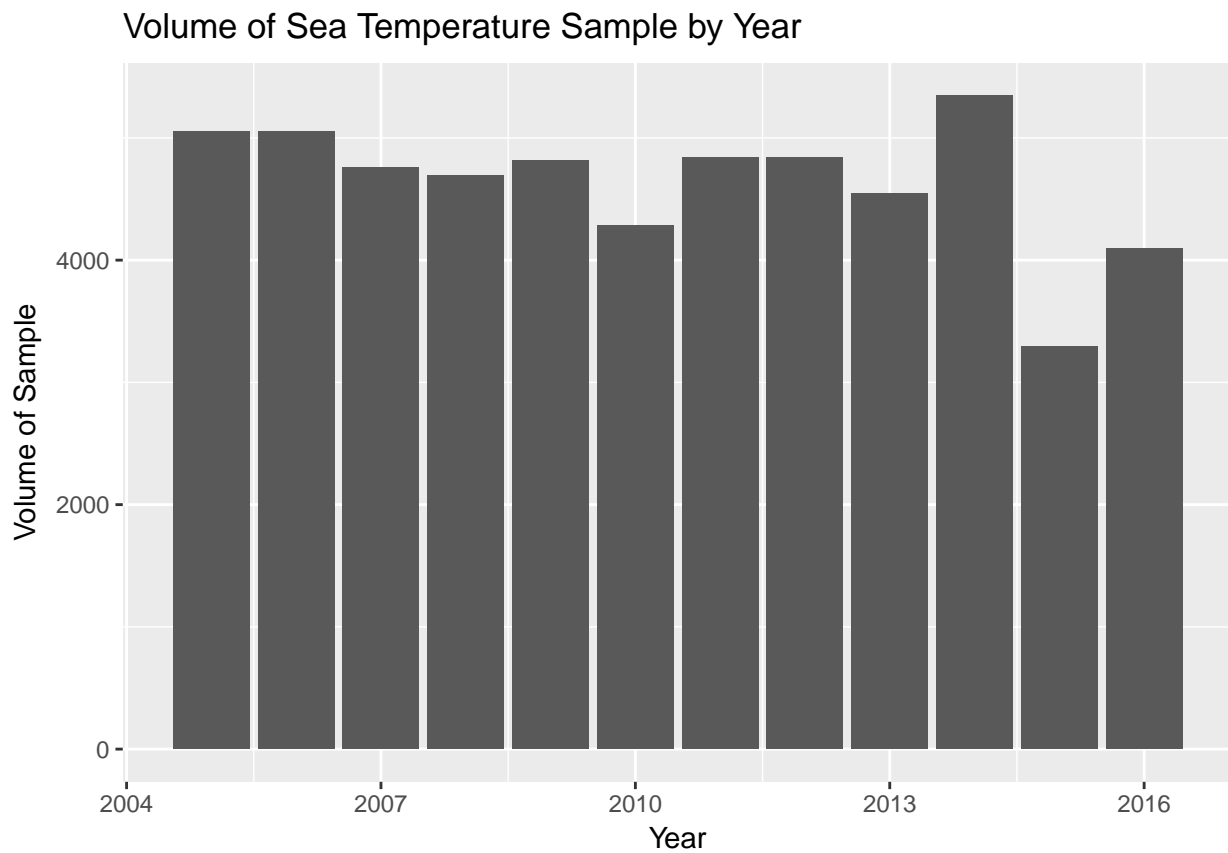
46028 EDA

Data Density

```r
ggplot(data = data028, aes(x=year, y=WTMP)) + geom_bar(stat = "identity") +
  labs(title="Volume of Sea Temperature Sample by Year",
       y="Volume of Sample", x="Year")
```


Volume of Sea Temperature Sample by Year

```r
ggplot(data = data028, aes(x=year, y=ATMP)) + geom_bar(stat = "identity") +
  labs(title="Volume of Air Temperature Sample by Year",
       y="Volume of Sample", x="Year")
```

Volume of Air Temperature Sample by Year
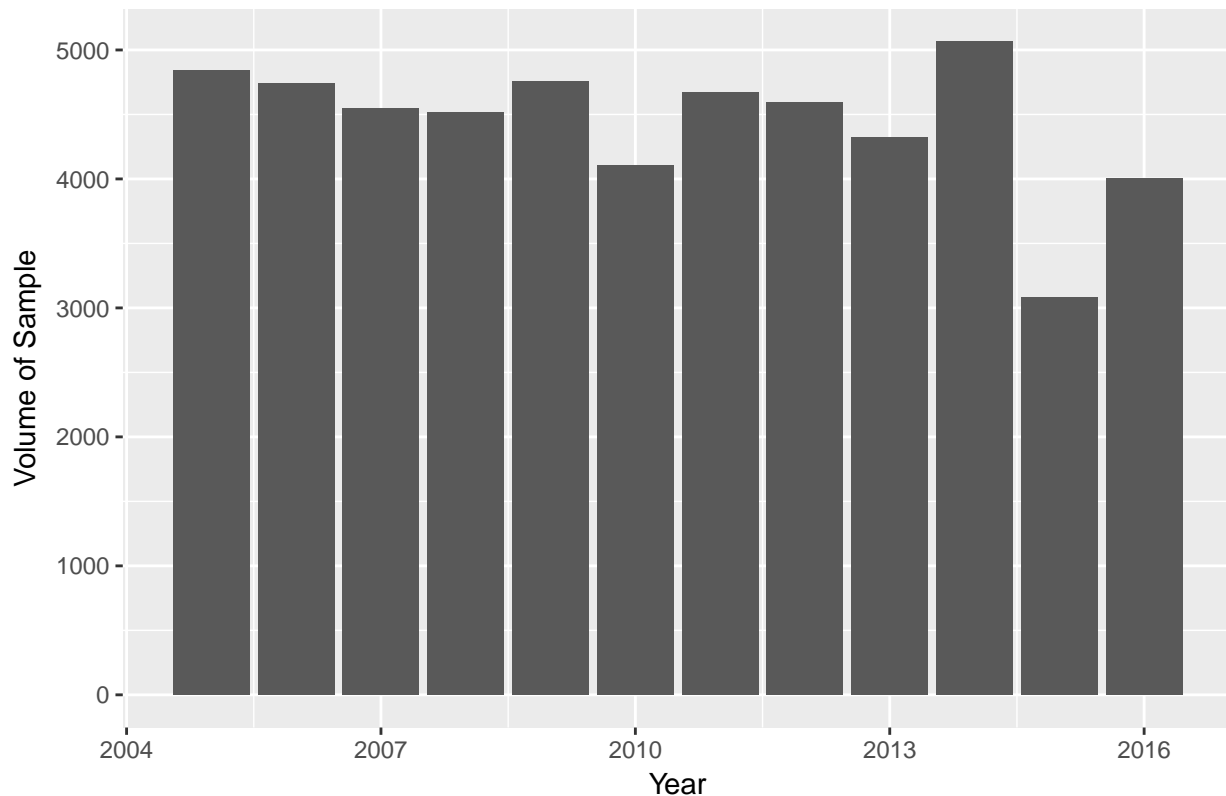

```r
#Five Points Summary of Sea Temperature From 2005 To 2016 at Point 46028
summary(data028$WTMP)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    9.90   12.40   13.60   13.72   14.80   19.50
```

```r
#Table that shows the summary of Sea Temperature for each year
wtmp<- data.frame(matrix(ncol =6, nrow =12))
colnames(wtmp) <- paste0(c("Min","1st Qu","Median","Mean","3rd Qu","Max"), c(1:6))
wtmp[1,]=summary(as.numeric(data2005028$WTMP))
wtmp[2,]=summary(as.numeric(data2006028$WTMP))
wtmp[3,]=summary(as.numeric(data2007028$WTMP))
wtmp[4,]=summary(as.numeric(data2008028$WTMP))
wtmp[5,]=summary(as.numeric(data2009028$WTMP))
wtmp[6,]=summary(as.numeric(data2010028$WTMP))
wtmp[7,]=summary(as.numeric(data2011028$WTMP))
wtmp[8,]=summary(as.numeric(data2012028$WTMP))
wtmp[9,]=summary(as.numeric(data2013028$WTMP))
wtmp[10,]=summary(as.numeric(data2014028$WTMP))
wtmp[11,]=summary(as.numeric(data2015028$WTMP))
wtmp[12,]=summary(as.numeric(data2016028$WTMP))
wtmp$year<-c(2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015,2016)
wtmp<-wtmp[c(7,1,2,3,4,5,6)]
wtmp
```

```
##    year Min1 1st Qu2 Median3    Mean4 3rd Qu5   Max6
## 1  2005 10.0  13.600   14.00 13.99889  14.600  16.60
## 2  2006 10.7  12.700   13.60 13.96519  15.200  17.60
```

```
## 3   2007   9.9   12.200    12.70 13.12039   14.050   16.90
## 4   2008   0.0   11.700    12.70 13.71882   14.300   99.09
## 5   2009 10.4   12.400    13.20 21.44682   14.400 999.00
## 6   2010 10.6   13.000    13.50 19.76006   14.400 999.00
## 7   2011 11.0   12.000    13.00 16.01096   15.000 999.00
## 8   2012 10.3   11.800    12.80 13.21913   14.875   16.80
## 9   2013 10.0   11.900    13.00 15.00899   14.300   99.00
## 10 2014 11.4   13.400    14.50 15.67694   16.500   99.00
## 11 2015 10.8   14.575    14.95 29.68443   17.825 999.00
## 12 2016 11.1   13.400    14.15 14.12862   15.175   16.40
```

```r
#Boxplot of Sea Temperature from 2005 to 2016 at Point 46028
ggplot(data028,aes(x=year, y=WTMP,group=year, fill=year))+geom_boxplot() +
  labs(title="Sea Temperature from 2005 to 2016 at Point 46028",
       y="Sea Temperature", x="Year")
```


Sea Temperature from 2005 to 2016 at Point 46028
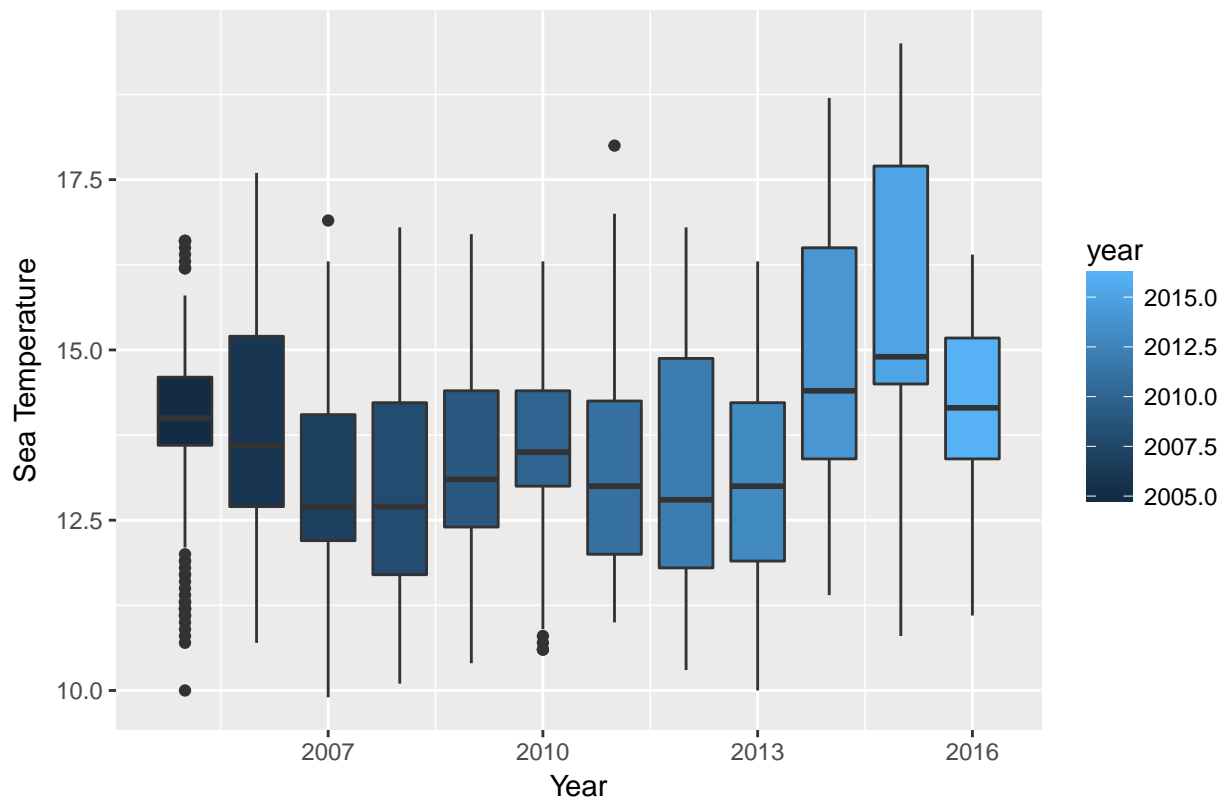
Year 2015 has seen the highest sea temperature compare to other years.

```r
#Five Points Summary of Air Temperature From 2005 To 2016 at Point 46028
summary(data028$ATMP)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    5.20   12.00   13.10   13.13   14.20   18.70
```

```r
#Table that shows the summary of Air Temperature for each year
atmp<- data.frame(matrix(ncol =6, nrow =12))
colnames(atmp) <- paste0(c("Min","1st Qu","Median","Mean","3rd Qu","Max"), c(1:6))
atmp[1,]=summary(as.numeric(data2005028$ATMP))
atmp[2,]=summary(as.numeric(data2006028$ATMP))
atmp[3,]=summary(as.numeric(data2007028$ATMP))
```

```
atmp[4,]=summary(as.numeric(data2008028$ATMP))
atmp[5,]=summary(as.numeric(data2009028$ATMP))
atmp[6,]=summary(as.numeric(data2010028$ATMP))
atmp[7,]=summary(as.numeric(data2011028$ATMP))
atmp[8,]=summary(as.numeric(data2012028$ATMP))
atmp[9,]=summary(as.numeric(data2013028$ATMP))
atmp[10,]=summary(as.numeric(data2014028$ATMP))
atmp[11,]=summary(as.numeric(data2015028$ATMP))
atmp[12,]=summary(as.numeric(data2016028$ATMP))
atmp$year<-c(2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015,2016)
atmp<-atmp[c(7,1,2,3,4,5,6)]
atmp
```

```
##    year Min1 1st Qu2 Median3    Mean4 3rd Qu5   Max6
## 1  2005  9.8  12.700   13.60 13.42216  14.200   15.5
## 2  2006  7.3  12.100   13.00 13.10166  14.200   17.2
## 3  2007  6.5  11.400   12.30 12.53388  13.850   16.3
## 4  2008  8.8  11.000   12.40 13.24356  14.000   99.0
## 5  2009  8.6  12.000   13.20 13.42548  14.400   99.0
## 6  2010  9.8  12.300   13.00 19.20472  13.700  999.0
## 7  2011  5.2  11.800   12.70 12.84247  13.700   17.1
## 8  2012  6.8  11.300   12.40 12.55519  13.800   17.0
## 9  2013  8.6  11.000   12.50 17.94860  13.500  999.0
## 10 2014  8.9  12.600   13.85 19.67556  15.900  999.0
## 11 2015 10.5  13.000   14.50 24.03821  16.700  999.0
## 12 2016 10.8  12.925   13.80 13.81793  14.675   17.3
```

```r
#Boxplot of Air Temperature from 2005 to 2016 at Point 46028
ggplot(data028,aes(x=year, y=ATMP,group=year, fill=year))+geom_boxplot() +
  labs(title="Air Temperature from 2005 to 2016 at Point 46028",
       y="Aea Temperature", x="Year")
```
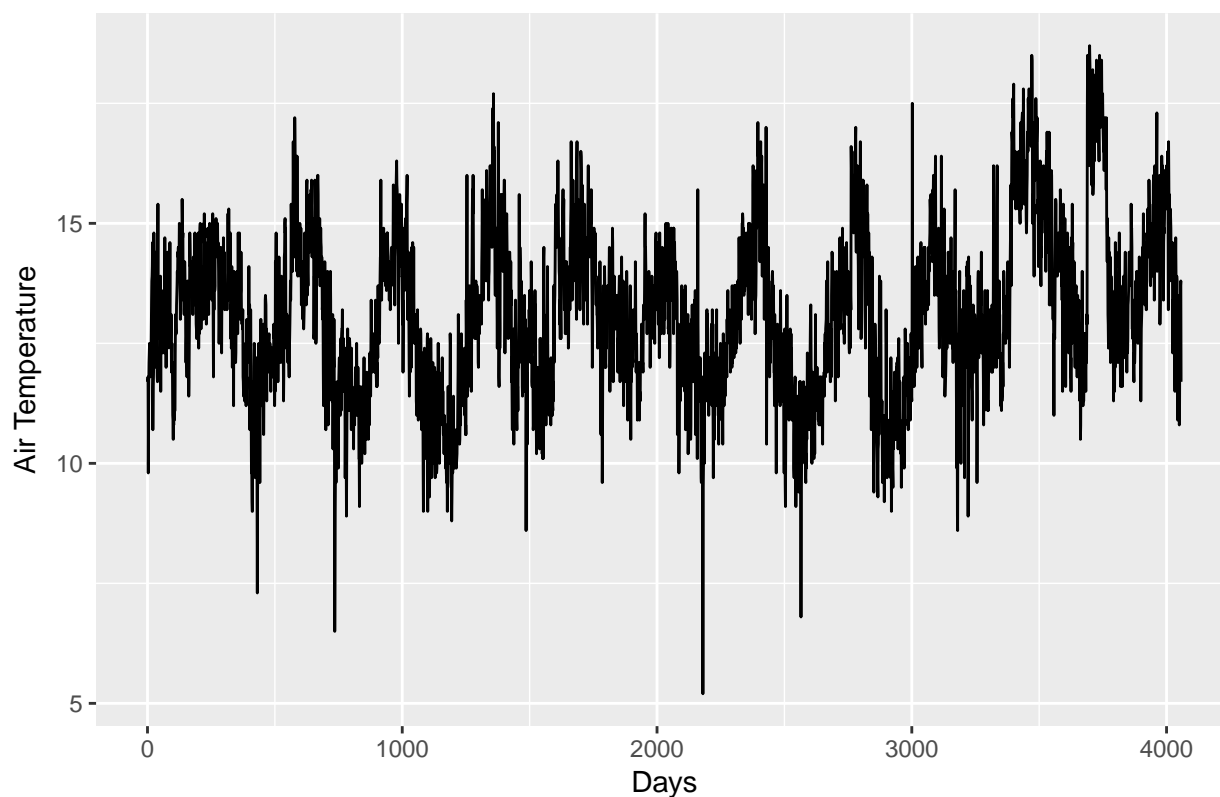
Air Temperature from 2005 to 2016 at Point 46028
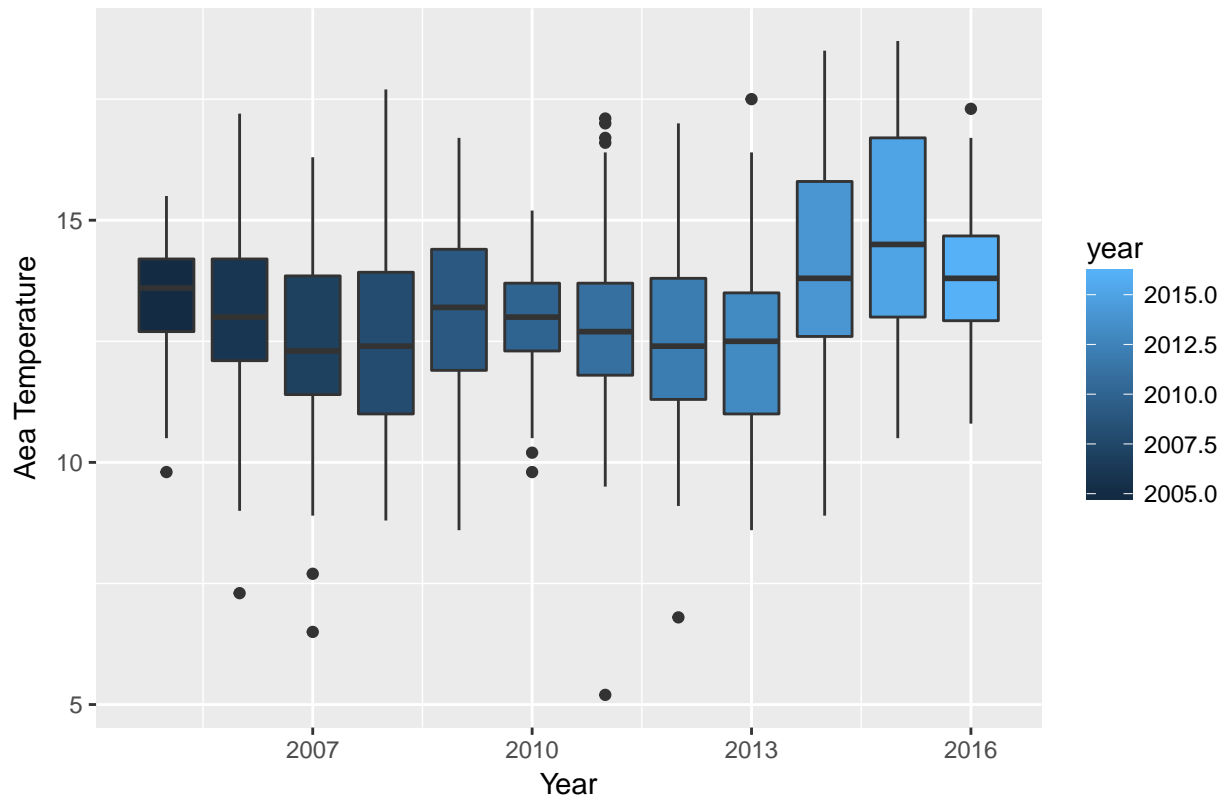
Year 2015 has seen the highest air temperature, and the tendency is similar to the sea temperature graph.

```
#Lineplot of Air temperatue from 2005 to 2016 at Point 46028
ggplot(data028,aes(x=as.numeric(row.names(data028)),y=as.numeric(ATMP)))+
  geom_line()+labs(title="Air Temperature from 2005 to 2016 at Point 46028",
                   y="Air Temperature", x="Days")
```
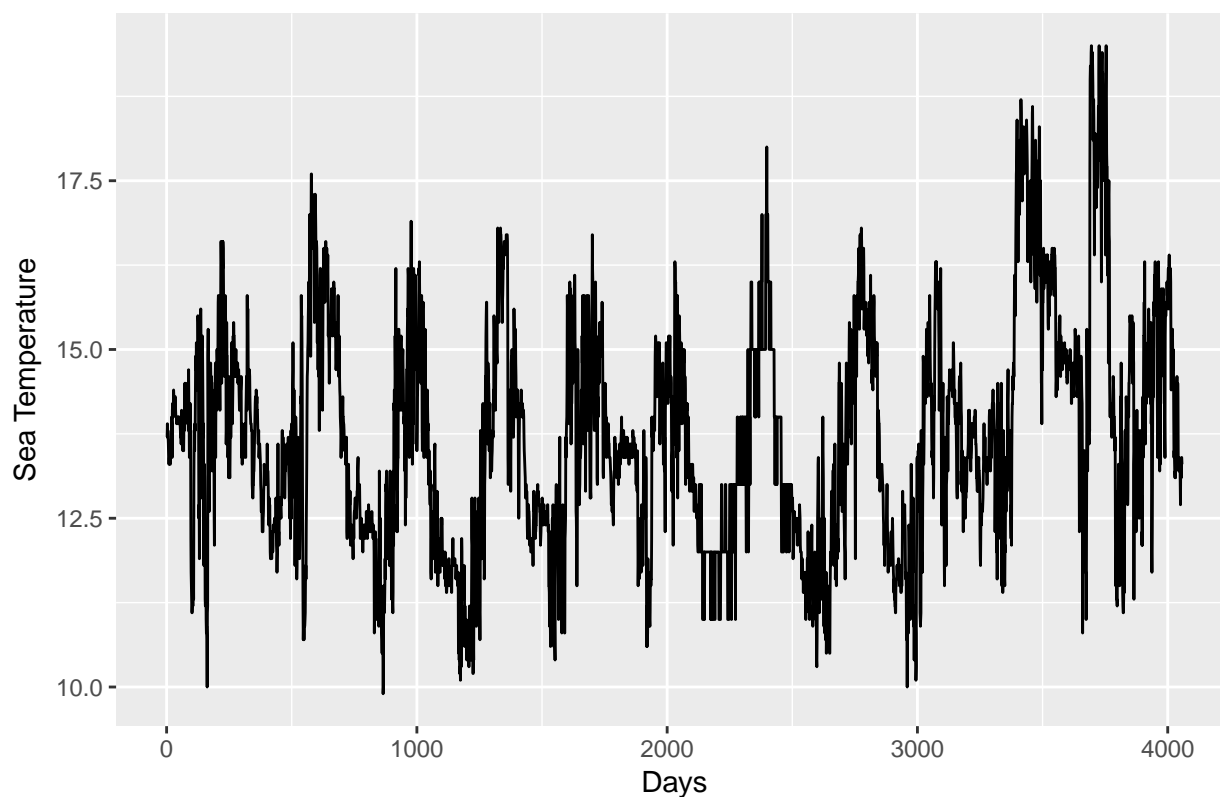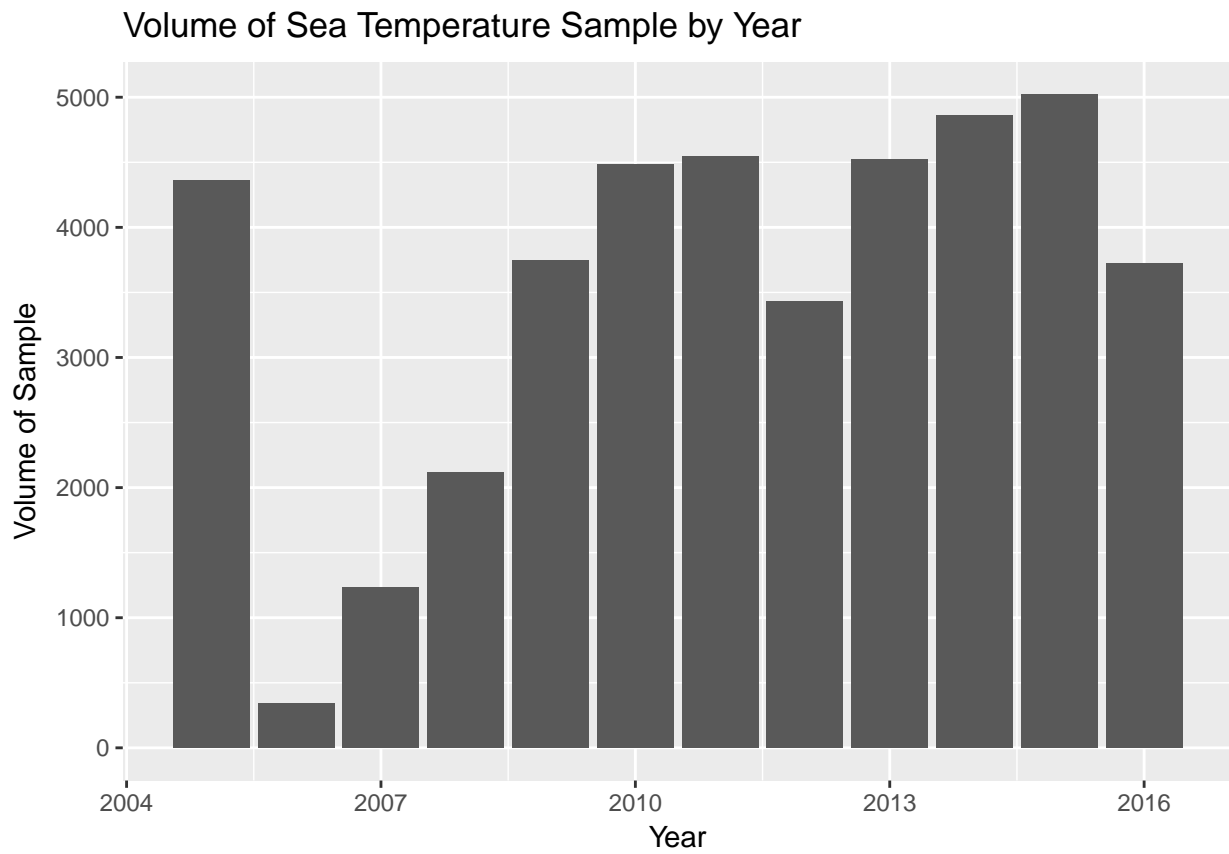
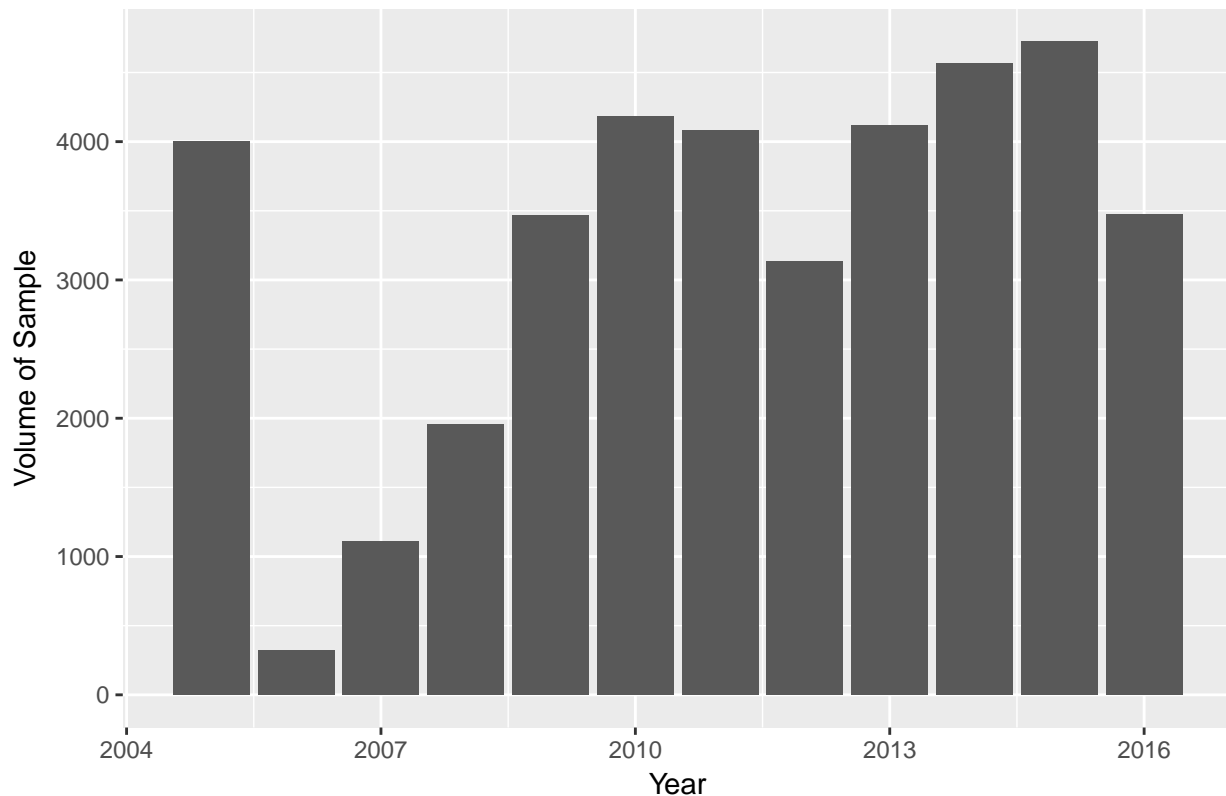## Air Temperature from 2005 to 2016 at Point 46028

Air temperature from 2005 to 2016 at point 46028 slightly rised.

```
#Lineplot of Sea Temperatue from 2005 to 2016 at Point 46028
ggplot(data028,aes(x=as.numeric(row.names(data028)),y=as.numeric(WTMP)))+
  geom_line()+labs(title="Sea Temperature from 2005 to 2016 at Point 46028",
                    y="Sea Temperature", x="Days")
```

Sea Temperature from 2005 to 2016 at Point 46028

Sea temperature from 2005 to 2016 slightly rised in the last couple of years. #EDA of Point 46089 Data Density

```
ggplot(data = data089, aes(x=year, y=WTMP)) + geom_bar(stat = "identity") +
  labs(title="Volume of Sea Temperature Sample by Year",
       y="Volume of Sample", x="Year")
```

Volume of Sea Temperature Sample by Year


```
ggplot(data = data089, aes(x=year, y=ATMP)) + geom_bar(stat = "identity") +
  labs(title="Volume of Air Temperature Sample by Year",
       y="Volume of Sample", x="Year")
```

Volume of Air Temperature Sample by Year

Year 2006, 2007, and 2008 have much less data than other years.

```r
#Five Points Summary of Sea Temperature From 2005 To 2016 at Point 46089
summary(data089$WTMP)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    3.60   10.10   12.50   12.92   15.80   18.80
```

```r
#Table that shows the summary of Sea Temperature for each year
wtmp<- data.frame(matrix(ncol =6, nrow =12))
colnames(wtmp) <- paste0(c("Min","1st Qu","Median","Mean","3rd Qu","Max"), c(1:6))
wtmp[1,]=summary(as.numeric(data2005089$WTMP))
wtmp[2,]=summary(as.numeric(data2006089$WTMP))
wtmp[3,]=summary(as.numeric(data2007089$WTMP))
wtmp[4,]=summary(as.numeric(data2008089$WTMP))
wtmp[5,]=summary(as.numeric(data2009089$WTMP))
wtmp[6,]=summary(as.numeric(data2010089$WTMP))
wtmp[7,]=summary(as.numeric(data2011089$WTMP))
wtmp[8,]=summary(as.numeric(data2012089$WTMP))
wtmp[9,]=summary(as.numeric(data2013089$WTMP))
wtmp[10,]=summary(as.numeric(data2014089$WTMP))
wtmp[11,]=summary(as.numeric(data2015089$WTMP))
wtmp[12,]=summary(as.numeric(data2016089$WTMP))
wtmp$year<-c(2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015,2016)
wtmp<-wtmp[c(7,1,2,3,4,5,6)]
wtmp
```

```
##    year Min1 1st Qu2 Median3    Mean4 3rd Qu5  Max6
## 1  2005  9.4  10.400   12.70  13.17976  16.000  18.4
```

```
## 2   2006  3.6   9.325    10.05  11.30000  10.275  17.7
## 3   2007 10.6  12.775    15.65 269.00690 999.000 999.0
## 4   2008  9.1  12.600    15.90 310.74064 999.000 999.0
## 5   2009  7.9   9.300    13.60  16.52021  16.550 999.0
## 6   2010  9.2  10.400    11.70  15.23750  15.000 999.0
## 7   2011  8.9   9.600    11.85  18.07845  15.900 999.0
## 8   2012  7.8   8.500    10.00  11.14026  13.700  17.3
## 9   2013  8.6   9.400    11.80  12.39479  15.400  18.2
## 10  2014  8.2   9.600    13.30  13.30932  17.000  18.8
## 11  2015 10.3  11.300    12.90  13.80685  16.400  18.6
## 12  2016 10.0  10.400    13.40  13.54145  16.900  17.8
```

```r
#Boxplot of Sea Temperature from 2005 to 2016 at Point 46089
ggplot(data089,aes(x=year, y=WTMP,group=year, fill=year))+geom_boxplot() +
  labs(title="Sea Temperature from 2005 to 2016 at Point 46089",
       y="Sea Temperature", x="Year")
```
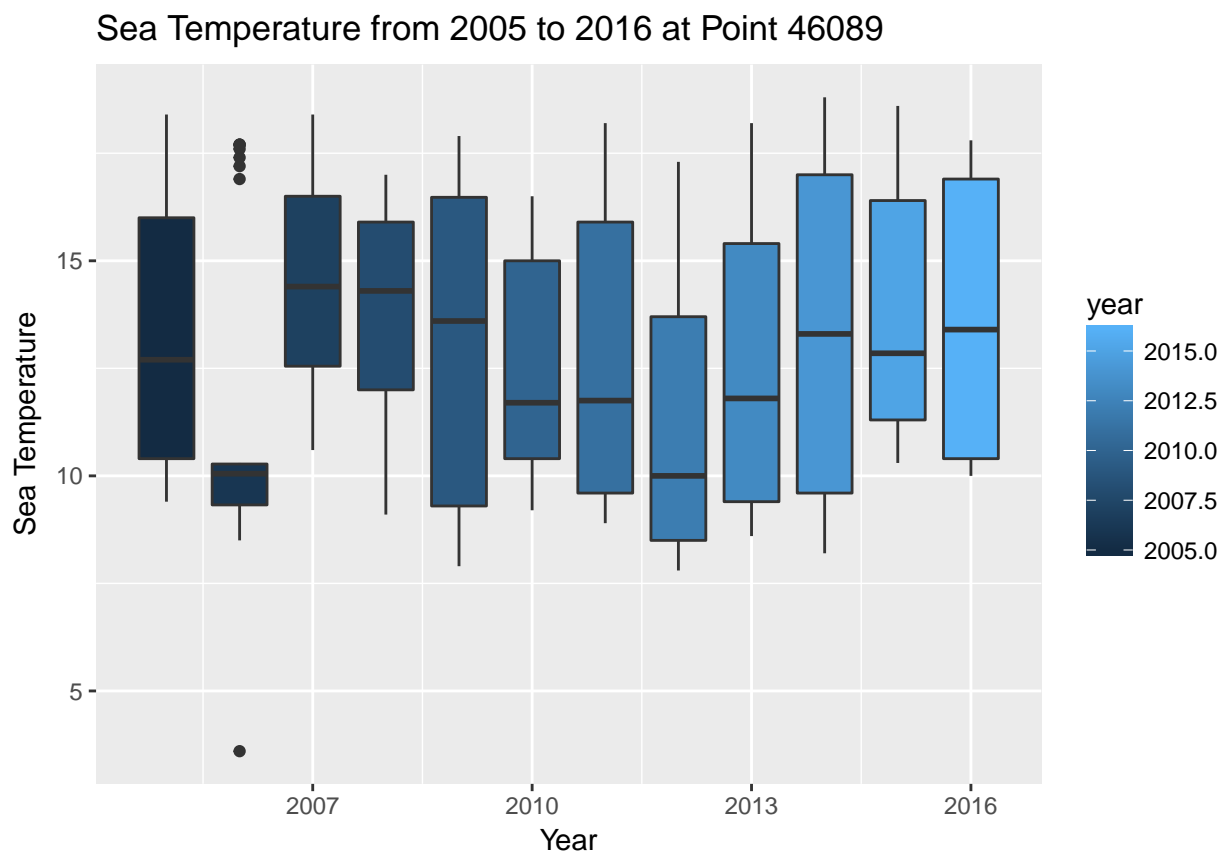

Sea temperature at 46089 at year 2006 is less various than other years.

```r
#Five Points Summary of Air Temperature From 2005 To 2016 at Point 46089
summary(data089$ATMP)
```

```
##    Min. 1st Qu.  Median    Mean 3rd Qu.    Max.
##    1.10    9.40   11.60   11.92   14.80   18.70
```

```r
#Table that shows the summary of Air Temperature for each year
atmp<- data.frame(matrix(ncol =6, nrow =12))
colnames(atmp) <- paste0(c("Min","1st Qu","Median","Mean","3rd Qu","Max"), c(1:6))
atmp[1,]=summary(as.numeric(data2005089$ATMP))
atmp[2,]=summary(as.numeric(data2006089$ATMP))
```

```
atmp[3,]=summary(as.numeric(data2007089$ATMP))
atmp[4,]=summary(as.numeric(data2008089$ATMP))
atmp[5,]=summary(as.numeric(data2009089$ATMP))
atmp[6,]=summary(as.numeric(data2010089$ATMP))
atmp[7,]=summary(as.numeric(data2011089$ATMP))
atmp[8,]=summary(as.numeric(data2012089$ATMP))
atmp[9,]=summary(as.numeric(data2013089$ATMP))
atmp[10,]=summary(as.numeric(data2014089$ATMP))
atmp[11,]=summary(as.numeric(data2015089$ATMP))
atmp[12,]=summary(as.numeric(data2016089$ATMP))
atmp$year<-c(2005,2006,2007,2008,2009,2010,2011,2012,2013,2014,2015,2016)
atmp<-atmp[c(7,1,2,3,4,5,6)]
atmp
```

```
##    year Min1 1st Qu2 Median3    Mean4 3rd Qu5   Max6
## 1  2005  5.4   9.600   11.70 12.09154  14.850   17.8
## 2  2006  5.2   8.675    9.65 10.60000  11.300   16.5
## 3  2007  4.7   9.400   11.80 11.72586  14.125   18.7
## 4  2008  2.1   7.650   11.80 20.12420  14.250  999.0
## 5  2009  2.2   8.900   12.80 12.09965  15.300   18.4
## 6  2010  3.0   9.600   11.20 14.39639  14.000  999.0
## 7  2011  2.1   8.625   10.40 11.32376  14.400   18.0
## 8  2012  3.5   8.100    9.55 10.17208  12.400   16.7
## 9  2013  1.1   8.300   10.90 11.28521  14.400   18.6
## 10 2014  1.9   9.400   12.80 12.50822  15.900   18.3
## 11 2015  6.2  10.700   11.90 15.68521  15.800  999.0
## 12 2016  5.8  10.200   12.10 12.63564  15.550   17.5
```

```
#Boxplot of Air Temperature from 2005 to 2016 at Point 46089
ggplot(data089,aes(x=year, y=ATMP,group=year, fill=year))+geom_boxplot() +
  labs(title="Air Temperature from 2005 to 2016 at Point 46089",
       y="Aea Temperature", x="Year")
```
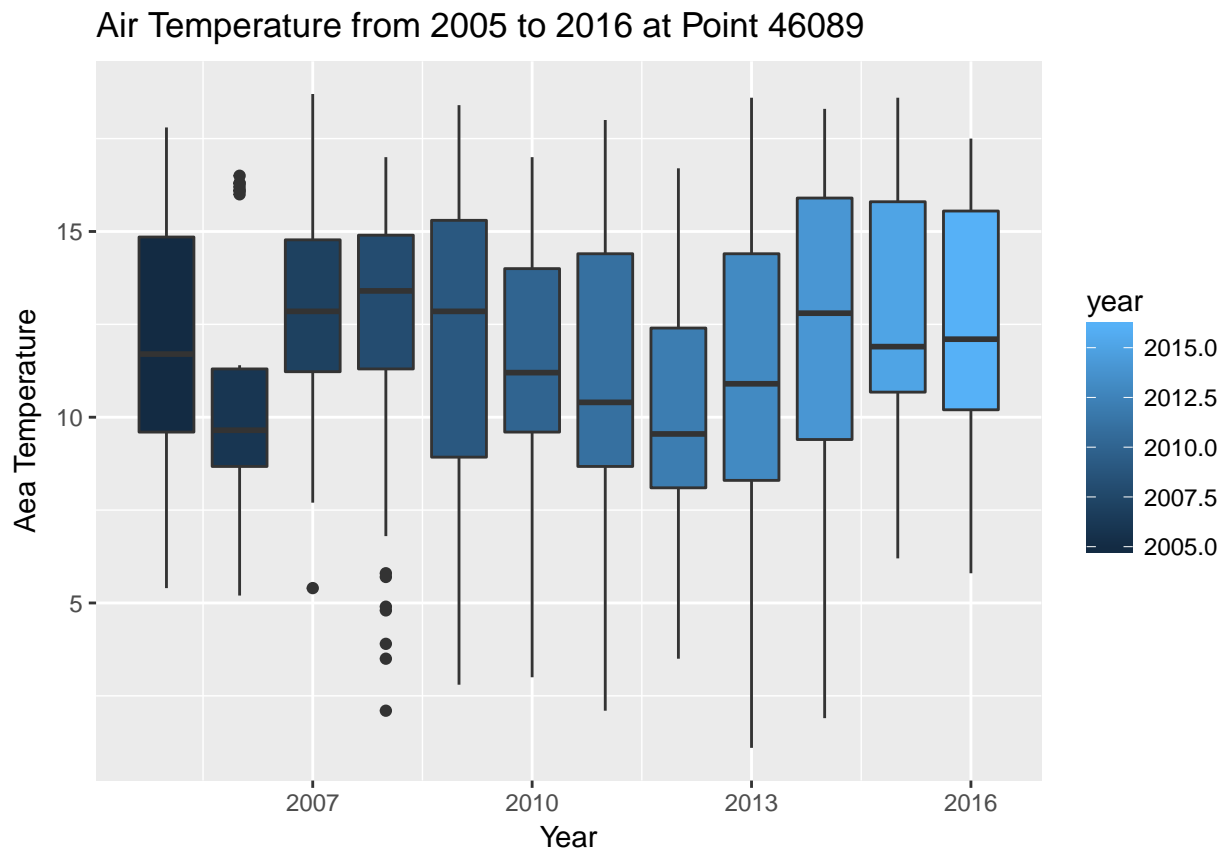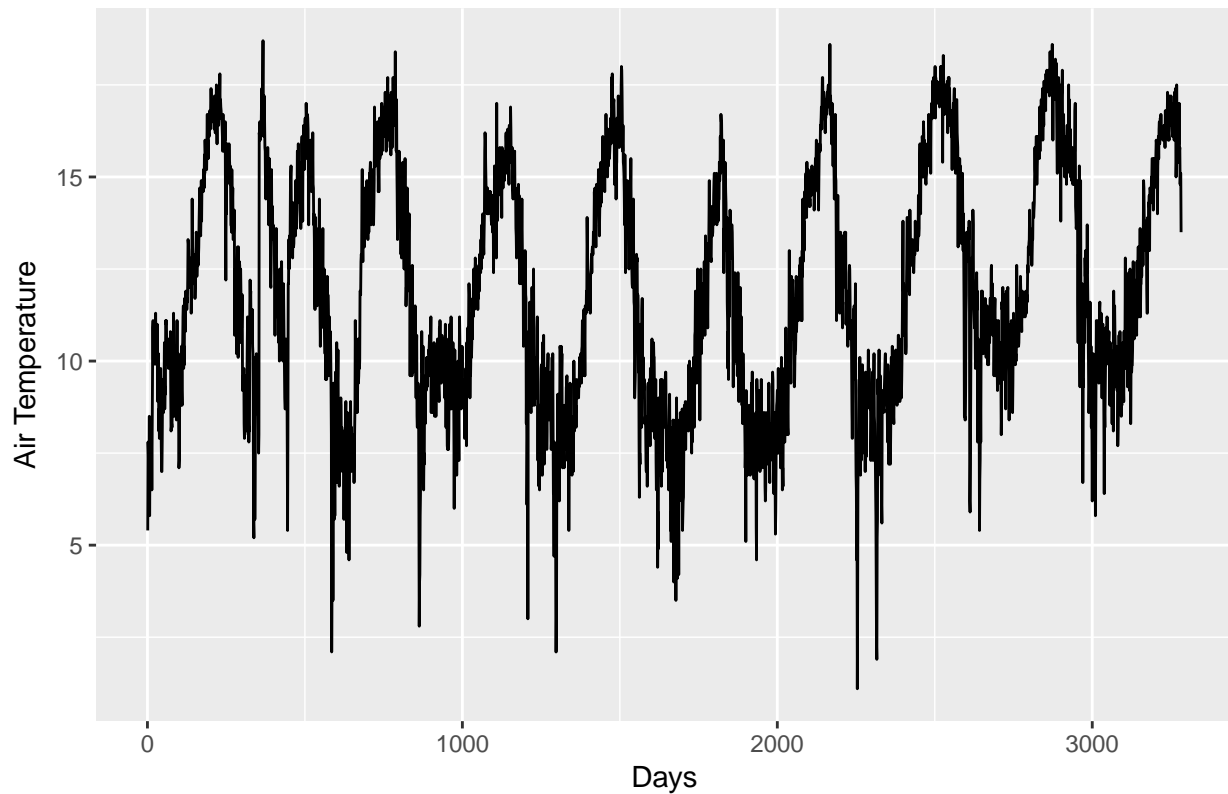
Air Temperature from 2005 to 2016 at Point 46089

Year 2008 has seen the highest average temperature from 2005 to 2016

```r
#Lineplot of Air temperatue from 2005 to 2016 at Point 46089
ggplot(data089,aes(x=as.numeric(row.names(data089)),y=as.numeric(ATMP)))+
  geom_line()+labs(title="Air Temperature from 2007 to 2016 at Point 46089",
                   y="Air Temperature", x="Days")
```
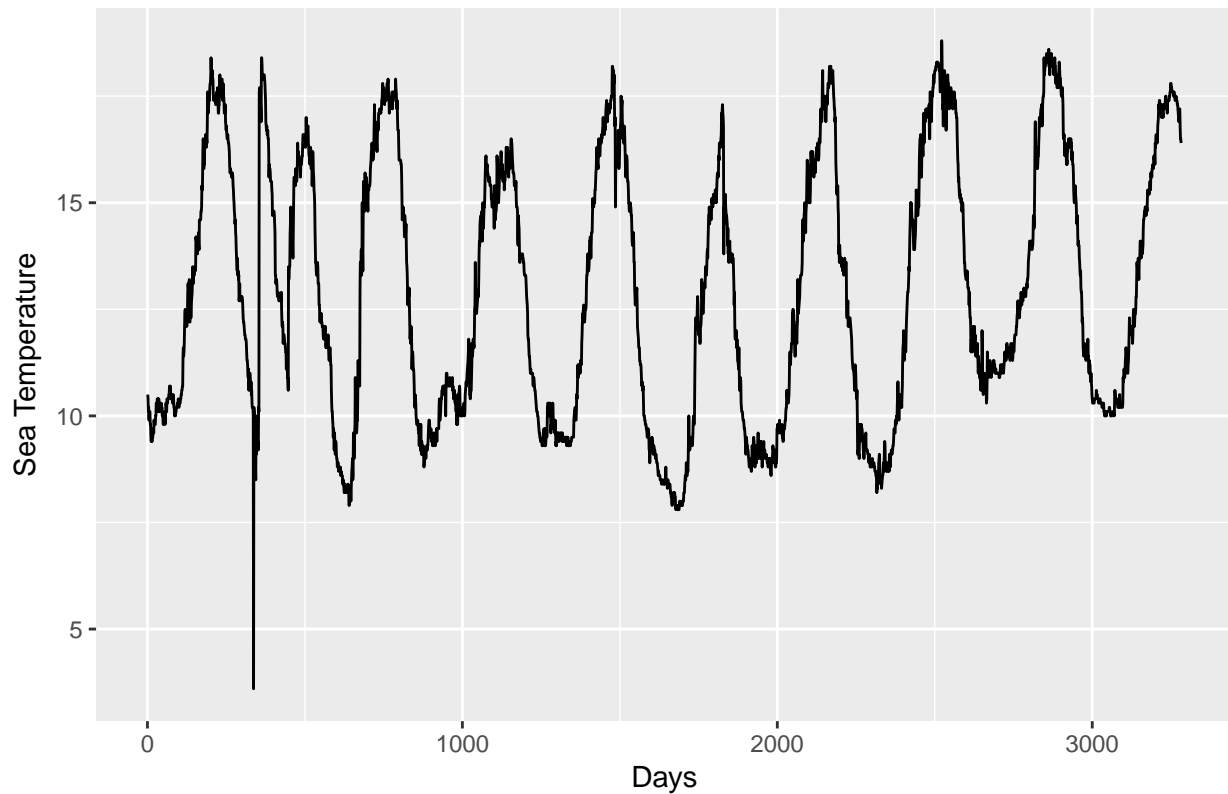
Air Temperature from 2007 to 2016 at Point 46089

Air temperature fluctuated during the ten year period, whereas sea temperature in the next graph is more stable.

```
#Lineplot of Sea Temperatue from 2005 to 2016 at Point 46089
ggplot(data089,aes(x=as.numeric(row.names(data089)),y=as.numeric(WTMP)))+
  geom_line()+labs(title="Sea Temperature from 2007 to 2016 at Point 46089",
                   y="Sea Temperature", x="Days")
```

Sea Temperature from 2007 to 2016 at Point 46089

Sea Temperature at point 46089 was stable from 2005 to 2016. #EDA of Point 46002 Data Density

```
ggplot(data = data002, aes(x=year, y=as.numeric(WTMP))) + geom_bar(stat = "identity") +
  labs(title="Volume of Sea Temperature Sample by Year",
       y="Volume of Sample", x="Year")
```

Volume of Sea Temperature Sample by Year
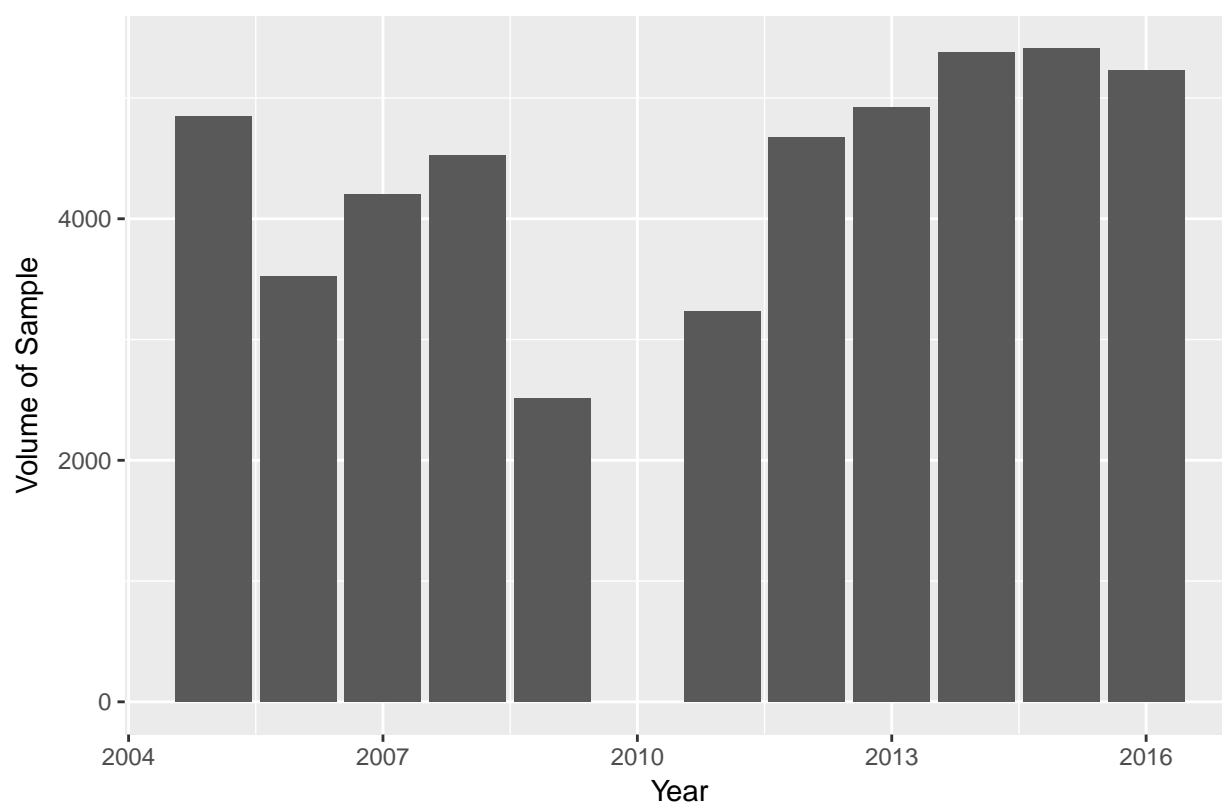

```r
ggplot(data = data002, aes(x=year, y=as.numeric(ATMP))) + geom_bar(stat = "identity") +
  labs(title="Volume of Air Temperature Sample by Year",
       y="Volume of Sample", x="Year")
```

Volume of Air Temperature Sample by Year
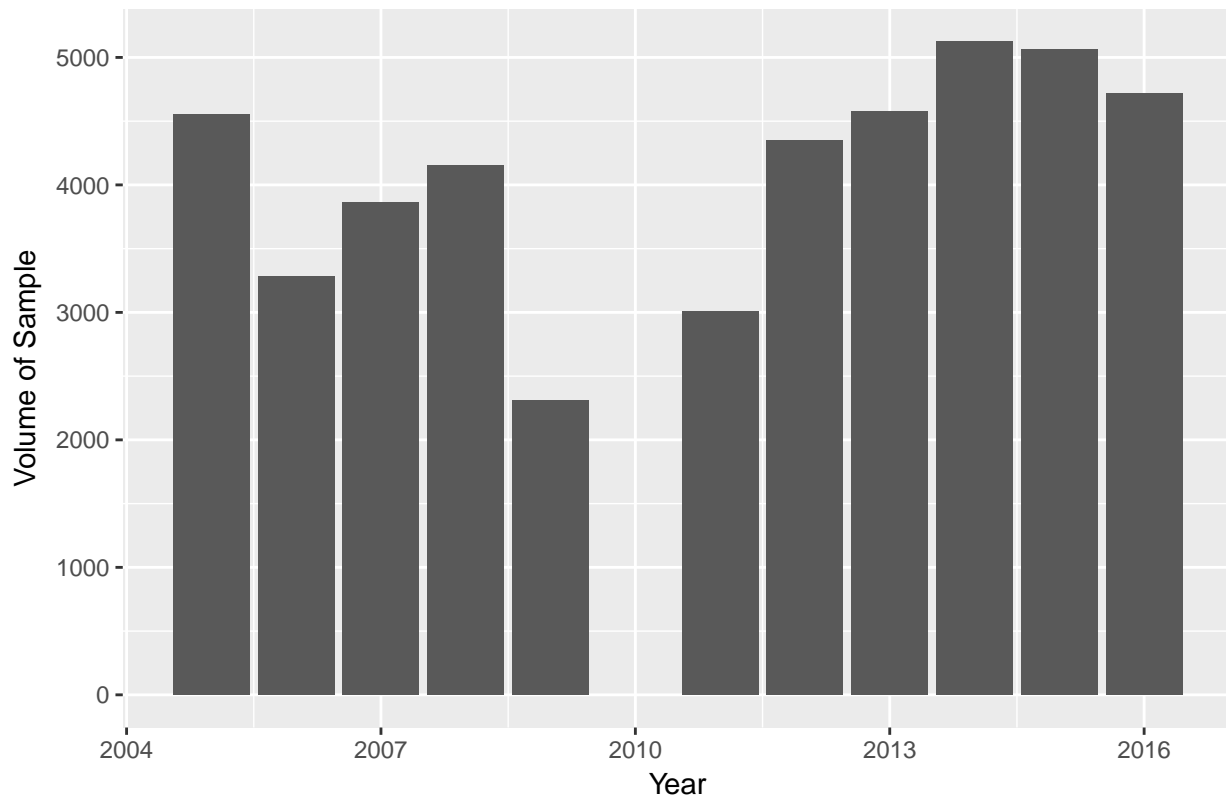
Data in 2010 is missing.

```
#Table that shows the summary of Air Temperature for each year
atmp<- data.frame(matrix(ncol =6, nrow =11))
colnames(atmp) <- paste0(c("Min","1st Qu","Median","Mean","3rd Qu","Max"), c(1:6))
atmp[1,]=summary(as.numeric(data2005002$ATMP))
atmp[2,]=summary(as.numeric(data2006002$ATMP))
atmp[3,]=summary(as.numeric(data2007002$ATMP))
atmp[4,]=summary(as.numeric(data2008002$ATMP))
atmp[5,]=summary(as.numeric(data2009002$ATMP))
atmp[6,]=summary(as.numeric(data2011002$ATMP))
atmp[7,]=summary(as.numeric(data2012002$ATMP))
atmp[8,]=summary(as.numeric(data2013002$ATMP))
atmp[9,]=summary(as.numeric(data2014002$ATMP))
atmp[10,]=summary(as.numeric(data2015002$ATMP))
atmp[11,]=summary(as.numeric(data2016002$ATMP))
atmp$year<-c(2005,2006,2007,2008,2009,2011,2012,2013,2014,2015,2016)
atmp<-atmp[c(7,1,2,3,4,5,6)]
atmp
```

```
##    year Min1 1st Qu2 Median3    Mean4 3rd Qu5 Max6
## 1  2005  5.1  10.975    12.6 12.94574  15.200 18.0
## 2  2006  5.3   9.700    14.4 13.17108  16.300 18.4
## 3  2007  5.8  10.200    11.8 12.10470  14.000 17.4
## 4  2008  6.3   9.200    11.8 12.22588  15.500 18.5
## 5  2009  6.4   9.200    10.5 11.09808  12.775 17.0
## 6  2011  8.7  11.500    13.8 13.74703  15.600 19.7
## 7  2012  5.4   9.700    11.7 11.97851  14.600 17.6
```

```
## 8   2013  5.9   9.700    12.2 12.53288  15.100 19.5
## 9   2014  8.4  11.500    13.7 14.08544  16.700 20.0
## 10  2015  8.5  12.000    13.5 14.14581  16.775 19.4
## 11  2016  6.5  10.900    12.2 12.99917  15.550 18.6
```

```r
#Table that shows the summary of Sea Temperature for each year
wtmp<- data.frame(matrix(ncol =6, nrow =11))
colnames(wtmp) <- paste0(c("Min","1st Qu","Median","Mean","3rd Qu","Max"), c(1:6))
wtmp[1,]=summary(as.numeric(data2005002$WTMP))
wtmp[2,]=summary(as.numeric(data2006002$WTMP))
wtmp[3,]=summary(as.numeric(data2007002$WTMP))
wtmp[4,]=summary(as.numeric(data2008002$WTMP))
wtmp[5,]=summary(as.numeric(data2009002$WTMP))
wtmp[6,]=summary(as.numeric(data2011002$WTMP))
wtmp[7,]=summary(as.numeric(data2012002$WTMP))
wtmp[8,]=summary(as.numeric(data2013002$WTMP))
wtmp[9,]=summary(as.numeric(data2014002$WTMP))
wtmp[10,]=summary(as.numeric(data2015002$WTMP))
wtmp[11,]=summary(as.numeric(data2016002$WTMP))
wtmp$year<-c(2005,2006,2007,2008,2009,2011,2012,2013,2014,2015,2016)
wtmp<-wtmp[c(7,1,2,3,4,5,6)]
wtmp
```

```
##     year Min1 1st Qu2 Median3    Mean4 3rd Qu5 Max6
## 1   2005 10.2   11.40   13.60 13.78040  16.400 18.2
## 2   2006  9.0   10.50   15.40 14.16707  17.500 18.4
## 3   2007 10.6   11.35   12.50 13.17900  14.500 18.0
## 4   2008  9.3    9.90   13.80 13.31676  16.325 18.6
## 5   2009  9.6   10.30   11.40 12.06587  13.400 17.3
## 6   2011  9.3   12.55   14.80 14.76256  16.450 18.9
## 7   2012  8.9   10.40   12.40 12.86887  15.450 17.4
## 8   2013  8.9   10.10   13.20 13.49425  16.100 19.6
## 9   2014 10.4   11.90   14.10 14.78654  17.425 20.4
## 10  2015 12.1   12.70   14.15 15.11704  17.900 19.5
## 11  2016 11.1   12.00   13.30 14.40138  17.200 18.9
```

```r
#Boxplot of Air Temperatue from 2005 to 2016 at Point 46002
ggplot(data002,aes(x=year, y=as.numeric(ATMP),group=year, fill=year))+geom_boxplot() +
  labs(title="Air Temperature from 2007 to 2016 at Point 46002",
       y="Air Temperature", x="Year")
```
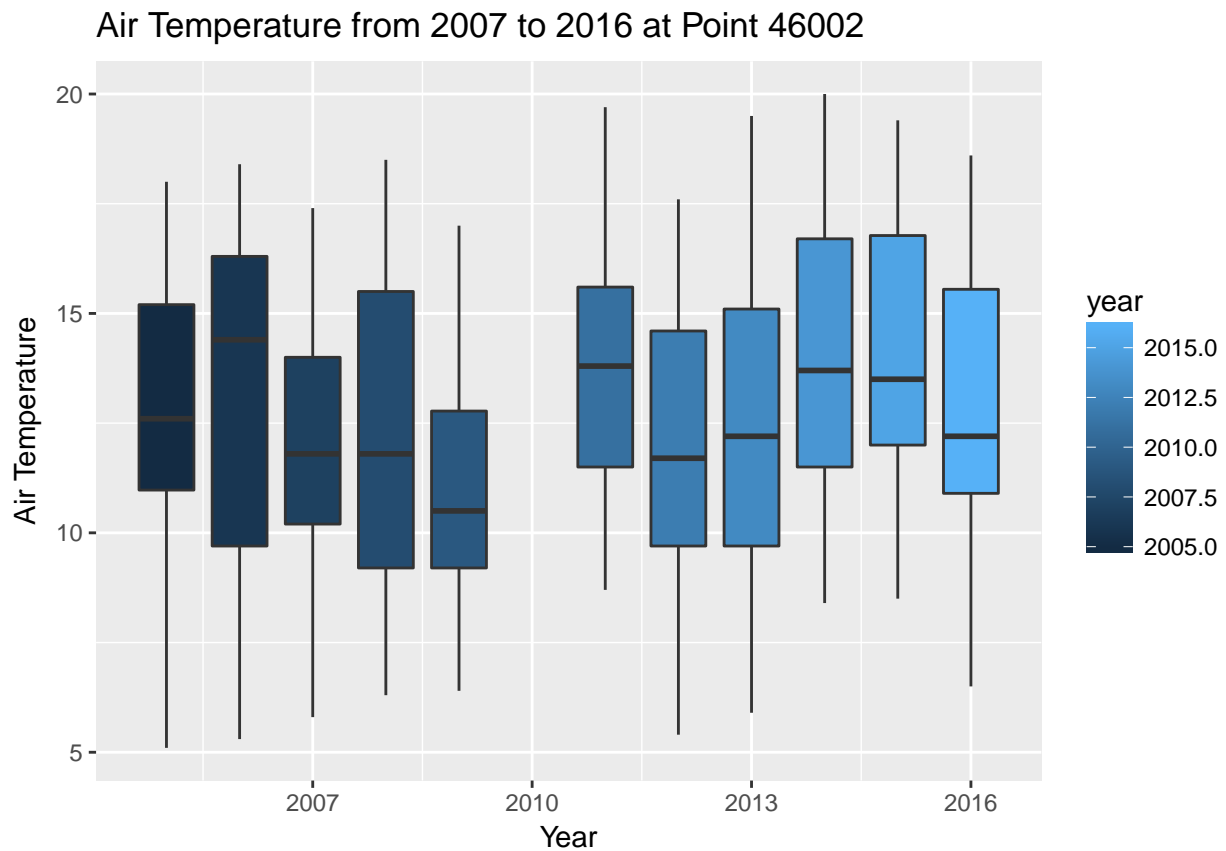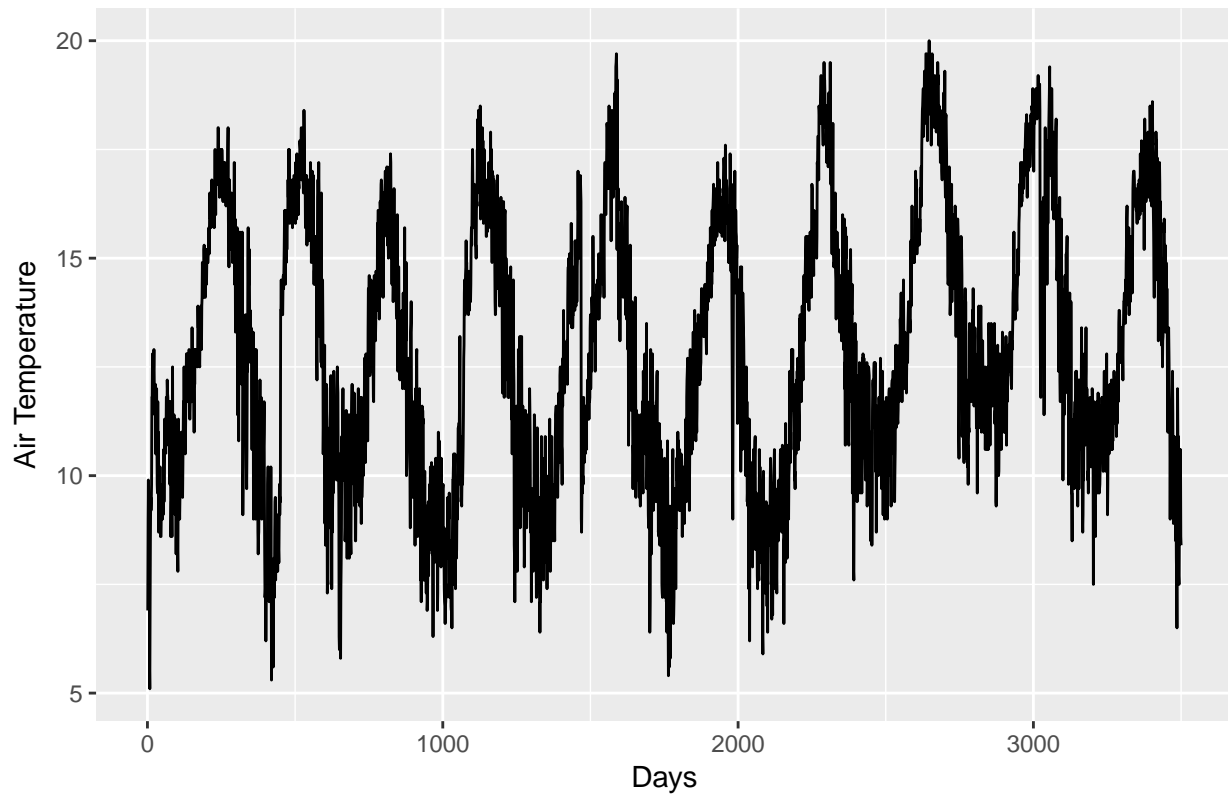
Air Temperature from 2007 to 2016 at Point 46002


```
#Boxplot of Sea Temperatue from 2005 to 2016 at Point 46002
ggplot(data002,aes(x=year, y=as.numeric(WTMP),group=year, fill=year))+geom_boxplot() +
  labs(title="Sea Temperature from 2007 to 2016 of Point 46002",
       y="Sea Temperature", x="Year")
```

Sea Temperature from 2007 to 2016 of Point 46002
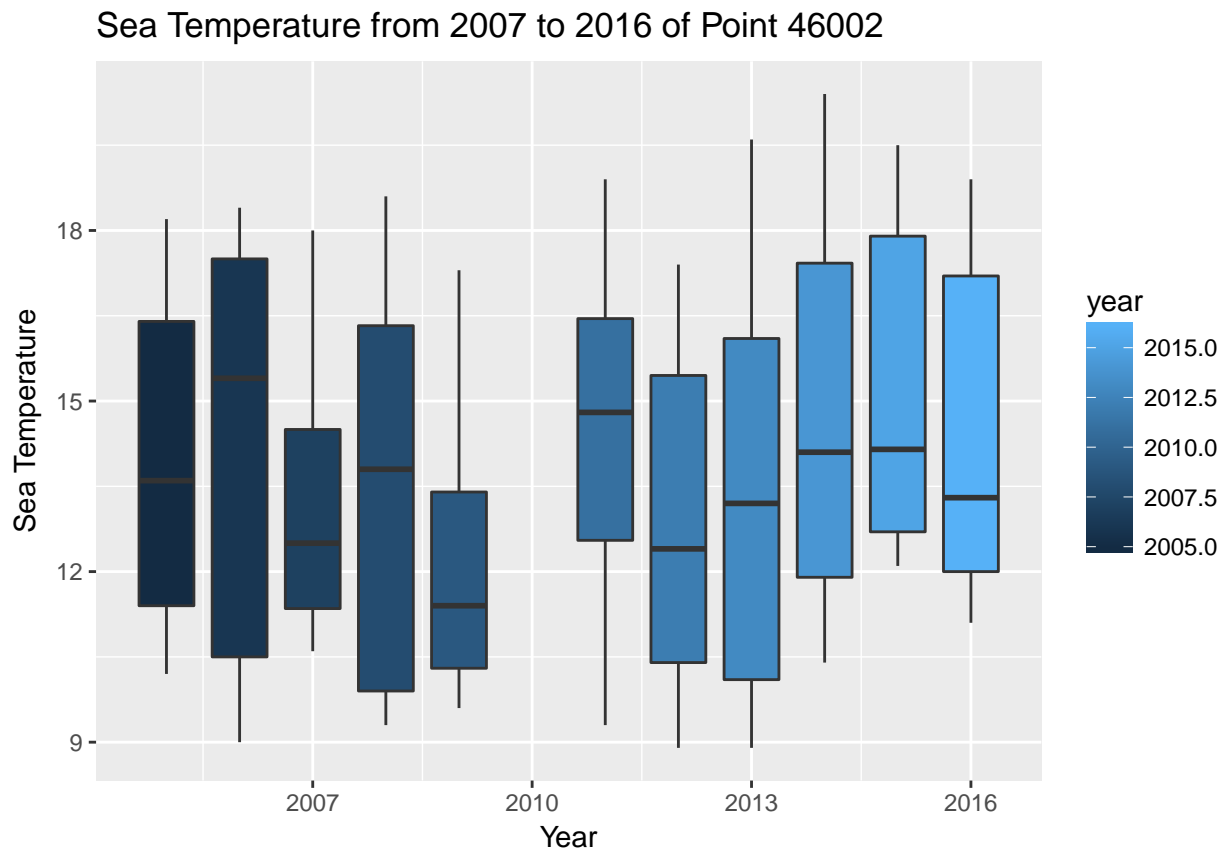
The tendency of air and sea temperature at point 46002 are similar throughout 10 years period.

```
#Lineplot of Air temperatue from 2005 to 2016 at Point 46002
ggplot(data002,aes(x=as.numeric(row.names(data002)),y=as.numeric(ATMP)))+
  geom_line()+labs(title="Air Temperature from 2007 to 2016 at Point 46002",
                   y="Air Temperature", x="Days")
```
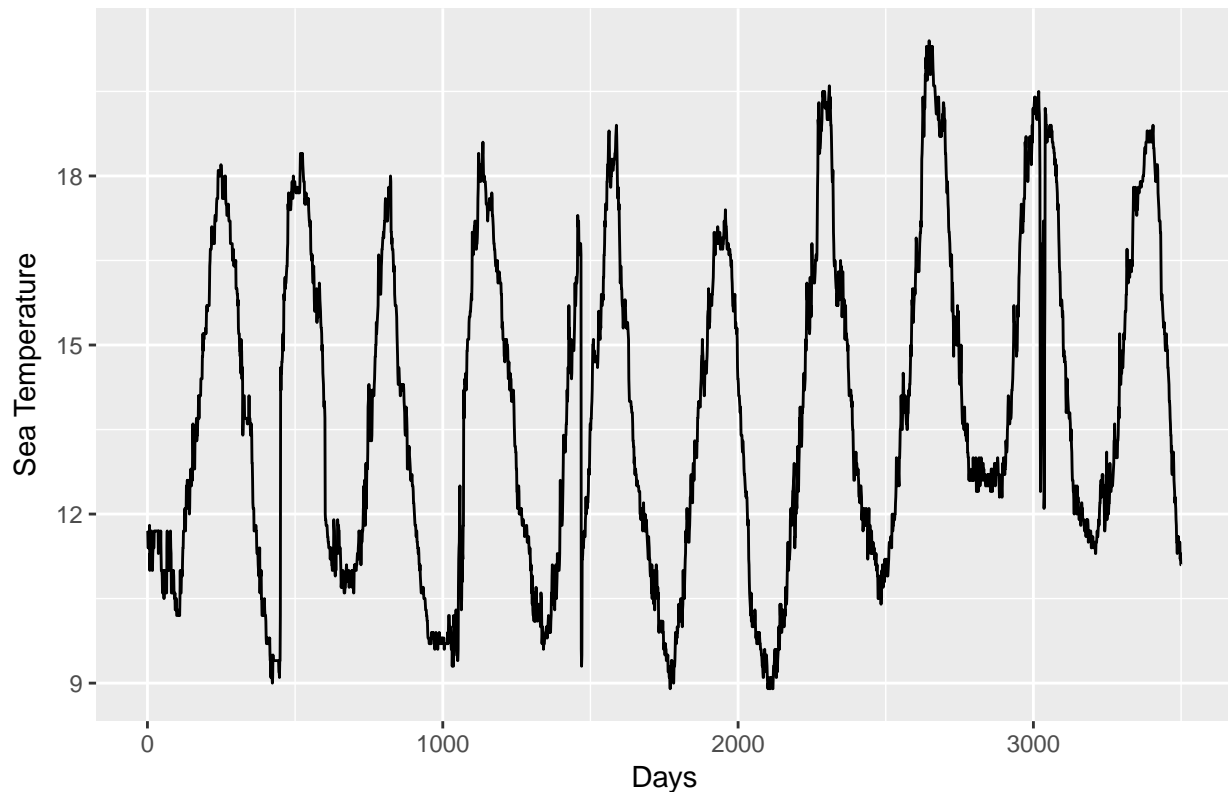
Air Temperature from 2007 to 2016 at Point 46002

Air temperature at point 46002 fluctuate every year and slightly rises from year 2005 to 2016.

```r
#Lineplot of Sea Temperatue from 2005 to 2016 at Point 46002
ggplot(data002,aes(x=as.numeric(row.names(data002)),y=as.numeric(WTMP)))+
  geom_line()+labs(title="Sea Temperature from 2007 to 2016 at Point 46002",
                   y="Sea Temperature", x="Days")
```

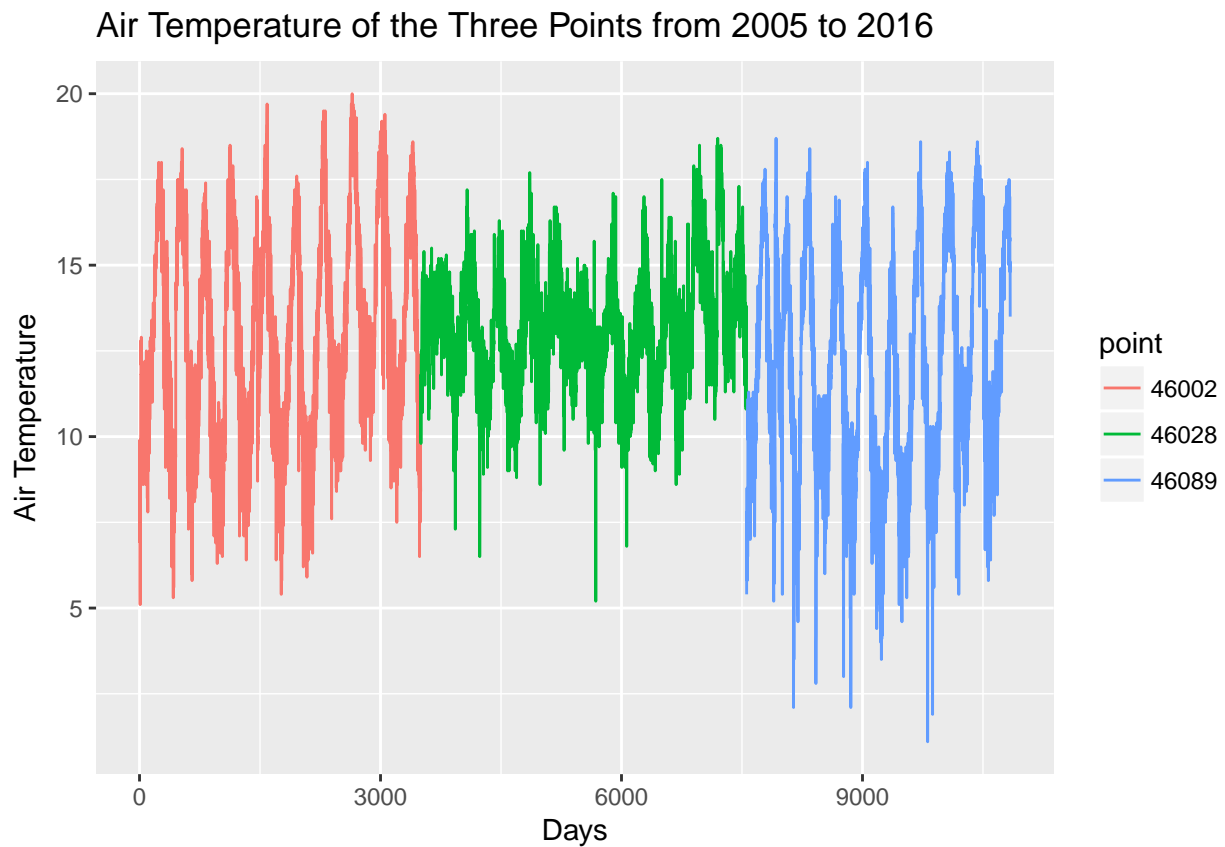## Sea Temperature from 2007 to 2016 at Point 46002

Sea temperature at point 46002 fluctuate every year and slightly rises from year 2005 to 2016.

Three Buoy Points Summary

```
#Bind Three Points Together

data028$point <- "46028"
data002$point <- "46002"
data089$point <- "46089"
data_all <- rbind(data002,data028,data089)
```

```
#Comparision of Air Temperature of the Three Points from 2005 to 2016
ggplot(data_all,aes(x=as.numeric(row.names(data_all)),y=as.numeric(ATMP),
                    group=point,color=point))+geom_line()+
  labs(title="Air Temperature of the Three Points from 2005 to 2016",
       y="Air Temperature", x="Days")
```

Air Temperature of the Three Points from 2005 to 2016

Point 46002 and 46089, which are closer to the continent, where the air temperature varies more throughout years than point 46028, which is farther away from the continent.

```
#Comparision of Sea Temperature of the Three Points from 2005 to 2016
ggplot(data_all,aes(x=as.numeric(row.names(data_all)),y=as.numeric(WTMP),
                    group=point,color=point))+geom_line()+
  labs(title="Sea Temperature of the Three Points from 2005 to 2016",
       y="Air Temperature", x="Days")
```

Sea Temperature of the Three Points from 2005 to 2016
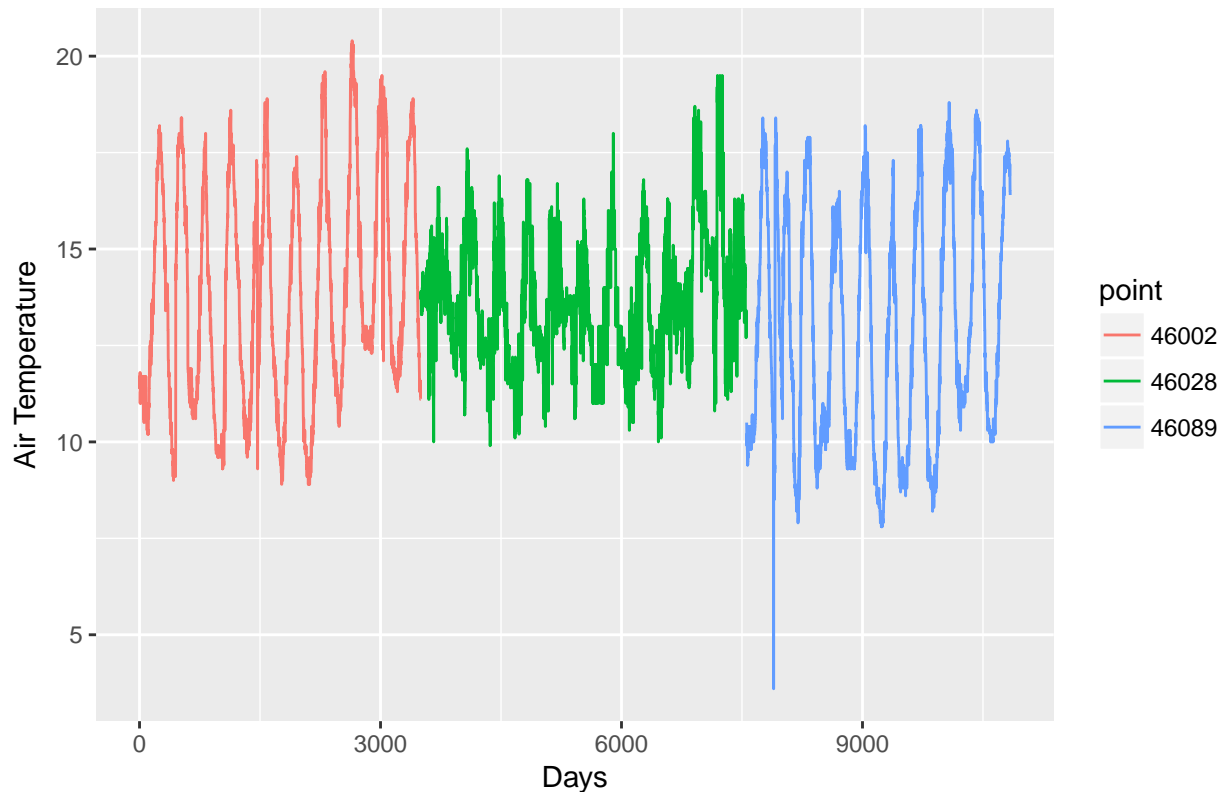
Similarly, point 46002 and 46089, which are closer to the continent, where the sea temperature varies more throughout years than point 46028, which is farther away from the continent.

```
#Map
data_map<-read.csv("Data_map.csv",header=TRUE)
map <- ggmap(get_map(location =c(-130,45),scale =1, zoom = 3,
                    source = "google", maptype = "roadmap")) +
  geom_point(aes(x=Longitude,y=Latitude),
```

```
## Map from URL : http://maps.googleapis.com/maps/api/staticmap?center=45,-130&zoom=3&size=640x640&scale
```

```
  scale_size(range=c(3,20))
```

```
## <ScaleContinuous>
##  Range:
##  Limits:    0 --    1
map
```