Volcanoes and Weather Stations

Volcanic eruptions can inject sulphate aerosols and dust into the atmosphere [1]. This can lead to cooling of the climate. In the case of a large eruption, such as Mt Pinatubo in the Philippines in 1991, this can be a change of -0.5C for several years. Large eruptions can send material into the stratosphere where it can last for several years [1]. Smaller eruptions do not get that high and are rained out in only a few weeks. Interestingly these climate effects are only temporary and have no long term effect on the temperature trend. I was interested in whether these cooling effects could be detected at the level of weather stations

Method

Four groups of weather stations were downloaded [2] using the Forcing "Volcanos". Data was first normalised (1900-1950) and combined. The correlation between the temperature and volcanic radiative forcing was calculated for each set of weather stations. With three of the groups there was a small positive correlation but the weather stations selected from the Philippines showed a small negative correlation.

As this was not very convincing the same data was used but removing the temperature trend. The idea being that the variations in temperature would be more closely correlated to volcanic activity. Though this changed the Philippines negative correlation to positive the results were still not very sharp.

Results

File ID	File Description	Correlation	Correlation no trend
#HgWzXjPuBgCedClHjBjmBgf	Random	0.13	0.11
#XiDBziCnNlBsgCtxHgJdJmIeZxEpEsCzC	Latitudes	0.02	0.14
#KpsBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBCBBBBBBBBBBBBBBBBB	UK	0.24	0.24
#IyiBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB	Philippines	-0.04	0.06

Conclusion

Though there was a slight correlation of temperature with volcanic activity it was not as large an effect as expected. Perhaps the weather station samples were not large enough. It would be interesting to investigate further.

References

[1] Global Warming – Understanding the Forecast, David Archer, ISBN-13: **978-0470943410**

[2] http://climatemodels.uchicago.edu/timeseries

Appendix - R Code used

```
# First File - Random -       #HgWzXjPuBgCedClHjBjmBgf
# Second File Latitudes -     #XiDBziCnNlBsgCtxHgJdJmIeZxEpEsCzC
# Third File - UK -           #KpsBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBCBBBBBBBBBBBBBBBBBB
# Fourth file - Philippines - #IyiBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB
#http://climatemodels.uchicago.edu/timeseries/#XiDBziCnNlBsgCtxHgJdJmIeZxEpEsCzC

# URL of data source
# Uncomment lines to open browser
#ccurl<-"http://climatemodels.uchicago.edu/timeseries"
#http://climatemodels.uchicago.edu/timeseries/#HgWzXjPuBgCedClHjBjmBgf
#browseURL(ccurl, browser="C:/Program Files (x86)/Internet Explorer/iexplore.exe")

getfiledata<-function(filename) {
  dirname<-"F:/MyStuff/Coursera/ClimateModels/TermProject/"
  filtest<-paste(dirname, filename, ".txt", sep="")
  testfile<-read.csv(filtest)
  colnames(testfile)<-c("Year", "Temp", "Volcanos")  #add column names
  x<-removeNA(testfile)
  return(x)
}

removepre<-function(testfile) {
  colnames(b)<-c("Year", "Temp", "Volcanos")  #add column names
  return(b)
}


removeNA<-function(filedata) {
  indNA<-!is.na(filedata)
  indNA2<-indNA[, "Temp"] == TRUE & indNA[, "Volcanos"]
  filenoNA<-filedata[indNA2,]
  if (notrend == TRUE) {
    a<-removetrend(filenoNA)
  } else {
    a<-filenoNA
  }
  return(a)
}

removetrend<-function(filenoNA) {
  temps<-filenoNA[,"Temp"]
  year<-as.numeric(filenoNA[,"Year"])
  regress<-lm(temps~year)
  x<-cbind(Year=year, Temp=residuals(regress), Volcanos=filenoNA[,"Volcanos"])
  #plot(residuals(regress)~year)
  #abline(regress)
  return(x)
}

dofiles<-function(filenames) {
  for (filename in filenames) {
    filedata<-getfiledata(filename)

    cat(cor(filedata[, "Volcanos"], filedata[, "Temp"],
          use="pairwise.complete.obs"), "\n")
    #return(cor(filedata[, "Volcanos"], filedata[, "Temp"]))
  }
}

################################################################################
# Start here
filenames<-c("#HgWzXjPuBgCedClHjBjmBgf",
```

```
        "#XiDBziCnNlBsgCtxHgJdJmIeZxEpEsCzC",
        "#KpsBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBCBBBBBBBBBBBBBBBBB",
        "#IyiBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBBB")


notrend<-FALSE
dofiles(filenames)
notrend<-TRUE
dofiles(filenames)

################################################################################

End of code
```