**Week 4 final assignment**

**##Plot 1.** Have total emissions from PM2.5 decreased in the United States from 1999 to 2008?

NEI <- readRDS("summarySCC\_PM25.rds")

SCC <- readRDS("Source\_Classification\_Code.rds")

##Calculate yearly totals for US

nei\_usy<-summarize(group\_by(NEI,year),sum(Emissions))

names(nei\_usy)<-c("year","tot\_em")

##Plot and embellish a little, at least for my taste…

with(nei\_usy,plot(year,tot\_em,typ="l",lwd=3,ylim= range(nei\_usy$tot\_em), xaxt="n",yaxt="n",bty="n",ylab="MT PM2.5",main="US total emissions of PM2.5 (tons)"))

axis(2, at= c(min(nei\_usy$tot\_em),max( nei\_usy$tot\_em)),labels=formatC**(**c(min(nei\_usy$tot\_em),max( nei\_usy$tot\_em)),format="f",digits=0,big.mark=","**),**lwd=2)

axis(1, at= year(as.Date(as.character(nei\_usy$year),"%Y")),labels= year(as.Date(as.character(nei\_usy$year),"%Y")),lwd=2)

abline(h=nei\_usy$tot\_em,lwd=1,lty="dashed")

abline(v=nei\_usy$year,lwd=1,lty="dashed")

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dev.copy(png, file = "plot1.png", bg = "white",height=480,width=480)

dev.off()

**##Plot 2.** Have total emissions from PM2.5 decreased in the **Baltimore City**, Maryland (fips=="24510") from 1999 to 2008?

NEI <- readRDS("summarySCC\_PM25.rds")

SCC <- readRDS("Source\_Classification\_Code.rds")

##Calculate yearly totals for Baltimore City, Maryland

nei\_bay<-summarize(group\_by(subset(NEI,fips=="24510"),year),sum(Emissions))

names(nei\_bay)<-c("year","tot\_em")

##Plot and embellish a little, at least for my taste…

with(nei\_bay,plot(year,tot\_em,typ="l",lwd=3,ylim= range(nei\_bay$tot\_em), xaxt="n",yaxt="n",bty="n",ylab="MT PM2.5",main="Baltimore City, Maryland, total emissions of PM2.5 (tons)"))

axis(2, at= c(min(nei\_bay$tot\_em),max( nei\_bay$tot\_em)),labels=formatC**(**c(min(nei\_bay$tot\_em),max( nei\_bay$tot\_em)),format="f",digits=0,big.mark=","**),**lwd=2)

axis(1, at= year(as.Date(as.character(nei\_bay$year),"%Y")),labels= year(as.Date(as.character(nei\_bay$year),"%Y")),lwd=2)

abline(h=nei\_bay$tot\_em,lwd=1,lty="dashed")

abline(v=nei\_bay$year,lwd=1,lty="dashed")

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**##Plot 3.** Of the four types of sources indicated by the type (point, nonpoint, onroad, nonroad) variable, which of these four sources have seen decreases in emissions from 1999–2008 for **Baltimore City**?

NEI <- readRDS("summarySCC\_PM25.rds")

SCC <- readRDS("Source\_Classification\_Code.rds")

##Calculate yearly totals for Baltimore City, Maryland, this time including the category "type"

nei\_bay<-summarize(group\_by(subset(NEI,fips=="24510"),year,type),sum(Emissions))

names(nei\_bay)<-c("year","type","tot\_em")

##Plot with ggplot2

h<- ggplot(data=nei\_bay, aes(x=year, y=tot\_em,color=type))

h+geom\_point()+geom\_path()+facet\_grid(.~type)+theme\_bw()+ scale\_x\_continuous(breaks=nei\_bay$year)+scale\_y\_continuous(labels = scales::comma,breaks=c(filter(nei\_bay,year=="1999")$tot\_em, filter(nei\_bay,year=="2008")$tot\_em))+labs(x="Year",y="MT PM2.5",title="Baltimore City, Maryland, total PM2.5 emissions by type")+ theme(plot.title = element\_text(hjust = 0.5))+ theme(axis.text.x = element\_text(angle = 45, hjust = 1))+ theme(legend.position="none")

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**##Plot 4.** Across the United States, how have emissions from coal combustion-related sources changed from 1999–2008?

##After inspecting the SCC data.frame it seems that the most appropriate variable to answer this question is Short.Name, as seen with the command View(unique(SCC$Short.Name))

NEI <- readRDS("summarySCC\_PM25.rds")

SCC <- readRDS("Source\_Classification\_Code.rds")

##Select SCC codes that relate to coal

select<-unique(SCC[grep("Coal", SCC$Short.Name,ignore.case=TRUE),]$SCC)

##select NEI rows that refer to coal

nei\_coal<-subset(NEI,NEI$SCC%in%select)

##calculate total emissions from coal for the US

nei\_coal\_s<-summarize(group\_by(nei\_coal,year),tot\_em=sum(Emissions))

##Plot and embellish a little, at least for my taste…

with(nei\_coal\_s,plot(year,tot\_em,typ="l",lwd=3,ylim= range(nei\_coal\_s$tot\_em), xaxt="n",yaxt="n",bty="n",ylab="MT PM2.5",main="US total emissions of PM2.5 (tons) from Coal sources"))

axis(2, at= c(min(nei\_coal\_s$tot\_em),max( nei\_coal\_s$tot\_em)),labels=formatC**(**c(min(nei\_coal\_s$tot\_em),max( nei\_coal\_s$tot\_em)),format="f",digits=0,big.mark=","**),**lwd=2)

axis(1, at= year(as.Date(as.character(nei\_coal\_s$year),"%Y")),labels= year(as.Date(as.character(nei\_coal\_s$year),"%Y")),lwd=2)

abline(h=nei\_coal\_s$tot\_em,lwd=1,lty="dashed")

abline(v=nei\_coal\_s$year,lwd=1,lty="dashed")

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**##Plot 5.** How have emissions from motor vehicle sources changed from 1999–2008 in **Baltimore City**?

##The best variable to work with in this case seems to be SCC.Level.Two, as seen with the command View(unique(SCC$SCC.Level.Two))

NEI <- readRDS("summarySCC\_PM25.rds")

SCC <- readRDS("Source\_Classification\_Code.rds")

##Filter the data.frame for Baltimore city observations

nei\_bay<-subset(NEI,fips=="24510")

##Select SCC codes that relate to vehicles

select<-unique(SCC[grep("ehicl", SCC$SCC.Level.Two,ignore.case=TRUE),]$SCC)

##select nei\_bay rows that refer to vehicles

nei\_veh<-subset(nei\_bay,nei\_bay$SCC%in%select)

##calculate total emissions from vehivles in Baltimore City

nei\_veh\_s<-summarize(group\_by(nei\_veh,year),tot\_em=sum(Emissions))

##Plot and embellish a little, at least for my taste…

with(nei\_veh\_s,plot(year,tot\_em,typ="l",lwd=3,ylim= range(nei\_veh\_s$tot\_em), xaxt="n",yaxt="n",bty="n",ylab="MT PM2.5",main="Baltimore City PM2.5 Emissions (tons) from Motor Vehicles"))

axis(2, at= c(min(nei\_veh\_s$tot\_em),max( nei\_veh\_s$tot\_em)),labels=formatC**(**c(min(nei\_veh\_s$tot\_em),max( nei\_veh\_s$tot\_em)),format="f",digits=0,big.mark=","**),**lwd=2)

axis(1, at= year(as.Date(as.character(nei\_veh\_s$year),"%Y")),labels= year(as.Date(as.character(nei\_veh\_s$year),"%Y")),lwd=2)

abline(h=nei\_veh\_s$tot\_em,lwd=1,lty="dashed")

abline(v=nei\_veh\_s$year,lwd=1,lty="dashed")

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dev.off()

**##Plot 6.** Compare emissions from motor vehicle sources in Baltimore City with emissions from motor vehicle sources in **Los Angeles County**, California (fips=="06037"). Which city has seen greater changes over time in motor vehicle emissions?

##The best variable to work with in this case seems to be SCC.Level.Two, as seen with the command View(unique(SCC$SCC.Level.Two))

NEI <- readRDS("summarySCC\_PM25.rds")

SCC <- readRDS("Source\_Classification\_Code.rds")

##Filter the data.frame for Baltimore city and Los Angeles observations

nei\_bcla<-subset(NEI,fips=="24510"|fips=="06037")

##Select SCC codes that relate to vehicles

select<-unique(SCC[grep("ehicl", SCC$SCC.Level.Two,ignore.case=TRUE),]$SCC)

##select nei\_bcla rows that refer to vehicles

nei\_veh<-subset(nei\_bcla,nei\_bcla$SCC%in%select)

##calculate total emissions from vehicles in Baltimore City and Los Angeles

nei\_veh\_s<-summarize(group\_by(nei\_veh,year,fips),tot\_em=sum(Emissions))

##Plot with ggplot2

h<- ggplot(data=nei\_veh\_s, aes(x=year, y=tot\_em,color=fips))

h+geom\_point()+geom\_path()+theme\_bw()+ scale\_x\_continuous(breaks=nei\_veh\_s$year)+scale\_y\_continuous(labels = scales::comma,breaks=c(filter(nei\_veh\_s,year=="1999")$tot\_em, filter(nei\_veh\_s,year=="2008")$tot\_em))+labs(x="Year",y="MT PM2.5",title="Los Angeles vs Baltimore City PM2.5 emissions from motor vehicles")+ theme(plot.title = element\_text(hjust = 0.5))+ theme(axis.text.x = element\_text(angle = 45, hjust = 1)) +scale\_color\_manual(labels = c("Los Angeles", "Baltimore City"),values=c("pink","blue"))+ guides(color=guide\_legend("Cities"))

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dev.off()