Exploring the U.S. National Oceanic and Atmospheric Administration's (NOAA) Storm database

Analysis of U.S. NOAA Storm database

Synopsis

Storms and other severe weather events can cause both public health and economic problems for communities and municipalities. Many severe events can result in fatalities, injuries, crop and property damage, and preventing such outcomes to the extent possible is a key concern.

This project tracks the type of events that are most harmful with respect to population health in terms of FATALITIES(Death of human beings) and Injuires. It also tracks the type of events that have the greatest economic consequences in dollar terms of crop and property damage.

Loading and Processing the raw data

Down the Storm Data file at https://d396qusza40orc.cloudfront.net/repdata%2Fdata%2FStormData.csv.bz2 and copy it in the R Studio working directory Download the Storm Data file and Read in the data

```
# download.file(url="http://d396qusza40orc.cloudfront.net/repdata%2Fdata%2FStormData.csv.bz2",
# destfile="repdata-data-StormData.csv.bz2")

# Reading in the data using read.csv
Storm <- read.csv("repdata-data-StormData.csv.bz2",stringsAsFactors=FALSE)
```

This data analysis addresses two questions about the dataset. 1. Across the United States, which types of events (as indicated in the EVTYPE variable) are most harmful with respect to population health? 2. Across the United States, which types of events have the greatest economic consequences? Subset the original dataset to satisfy population health(FATALITIES and INJURIES) and economic consequences(CROPDMG,CROPDMGEXP, PROPDMG, PROPDMGEXP) along with a few more self explanatory variables.

Variables subset: BGN DATE, BGN TIME, TIME_ZONE, COUNTYNAME, STATE, EVTYPE, LENGTH , WIDTH, FATALITIES, INJURIES, PROPDMG, PROPDMGEXP, CROPDMG, CROPDMGEXP

```
StormSubset<- Storm[ ,c("BGN_DATE","BGN_TIME","TIME_ZONE","COUNTYNAME","STATE","EVTYPE",
"LENGTH", "WIDTH", "FATALITIES","INJURIES", "PROPDMGEXP", "PROPDMG",
"CROPDMGEXP", "CROPDMG", "REFNUM")]
# Fix the outlier. Million(M) instead of Billion(B)
StormSubset[StormSubset$REFNUM == 605943, "PROPDMGEXP" ] <- "M"
```

Get the year component of the beginning date of the event(BGN_DATE) to enable us to display the popluation health and economic consequences on a yearly basis

```
# Get the Year of the Event in variable BGN_YEAR
StormSubset$BGN_DATE1<-as.Date(as.character(StormSubset$BGN_DATE), format="%m/%d/%Y",tz="")
StormSubset$BGN_YEAR <- as.integer(substr(as.character(StormSubset$BGN_DATE1), 1,4))
```

Determine the event types(variable EVTYPE) in the original dataset

```
length(unique(StormSubset$EVTYPE))
```

[1] 985

From 1996 to present, 48 event types are recorded as defined in NWS Directive 10-1605. We must Consolidate the **985** unique events in the original dataset to one of the 48 possible values. However consolidating **985** event types to 48 is a very tedious task. Therefore we filter the data on the basis of non zero values in FATALITIES, INJURIES, CROPDMG or PROPDMG. This significantly reduces the unique EVENT types.

Create a new variable, EVTYPE1 to hold the consolidated EVENT type after converting to upper case

```
StormSubset$EVTYPE <- toupper(StormSubset$EVTYPE)
StormSubset$EVTYPE1 <- StormSubset$EVTYPE
```

Process to answer question 1: Across the United States, which types of events (as indicated in the EVTYPE variable) are most harmful with respect to population health?

Eliminate the observations in the dataset with zero(0) FATALITIES and INJURIES

```
StormSubsetHealth <- StormSubset[StormSubset$FATALITIES != 0 & StormSubset$INJURIES != 0,]
```

Determine the unique EVENT types(variable EVTYPE) in the health subset dataset, StormSubsetHealth.

```
length(unique(StormSubsetHealth$EVTYPE))
```

[1] 84

We must approximately consolidate the **84** unique events in the data subset to one of the 48 possible values.

Consolidation of EVENT types for the population health dataset Write the unique types of EVENTS to a csv file,events_health.csv for easy readability

```
EVENT_HEALTH <- data.frame(table(StormSubsetHealth$EVTYPE1))
write.csv(EVENT_HEALTH, file="events_health.csv", row.names=FALSE)
```

Consolidation Methodology The data in terms of types of EVENT(EVTYPE) is not normalized in the TRUEST sense of the word. There are also multiple types of EVENTS that do not seem to have a match. However these EVENTS are very small in number and therefore can be ignored. No single routine can fix The consolidation of the types of EVENT. It is a manual process using the following methodology: 1. Search for a particular pattern(eg EXTREME) in EVTYPE1 for the EVENT "EXTREME COLD/WIND CHILL" using:

```
# pattern=".*EXTREME*." to match the EVENT "EXTREME COLD/WIND CHILL"
# Use the command below without the #.
# unique(grep( pattern, StormSubsetProp$EVTYPE1, ignore.case = FALSE, value=TRUE))
```

This gives you the result of unique types of EVENT for that pattern. 2. If all the EVENTs in the result look like they match the event, "EXTREME COLD/WIND CHILL" then replace the EVTYPE1 values in the health dataset, StormSubsetHealth using:

```
# pattern=".*EXTREME*." to match the EVENT "EXTREME COLD/WIND CHILL"
# Use the command below without the #.
# StormSubsetHealth[grep(pattern, StormSubsetHealth$EVTYPE1, ignore.case = FALSE), "EVTYPE1"]
#<- "EXTREME COLD/WIND CHILL"
```

Else note the EVENTS that are not a match and repeat step 1 again for each one of these unmatched EVENTS. Resolve the all unmatched EVENTS before coming back to the original EVENT(eg EXTREME COLD/WIND CHILL) in this example for replacement.

```
StormSubsetHealth[grep(".*EXTREME*.", StormSubsetHealth$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "EXTREME COLD/WIND CHILL"
StormSubsetHealth[grep(".*WIND CHILL*.", StormSubsetHealth$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "EXTREME COLD/WIND CHILL"

StormSubsetHealth[grep("MARINE THUNDERSTORM.*WIND*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "MTW"
StormSubsetHealth[grep("THUNDER", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "THUNDERSTORM WIND"

StormSubsetHealth[grep(".*MARINE TSTM WIND*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "MTW"
StormSubsetHealth[grep(".*TSTM*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "THUNDERSTORM WIND"
StormSubsetHealth[grep("MTW", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "MARINE THUNDERSTORM WIND"

StormSubsetHealth[grep(".*SURF*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "HIGH SURF"
StormSubsetHealth[grep(".*HIGH SEAS*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "HIGH SURF"

StormSubsetHealth[grep(".*FLASH FLOOD*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "FF"
StormSubsetHealth[grep(".*FLOOD*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "FLOOD"
StormSubsetHealth[grep(".*FF*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "FLASH FLOOD"

StormSubsetHealth[grep(".*MARINE STRONG WIND*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "MSW"
StormSubsetHealth[grep(".*STRONG*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "STRONG WIND"
StormSubsetHealth[grep(".*GUSTY*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "STRONG WIND"
StormSubsetHealth[grep("MSW", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "MARINE STRONG WIND"

StormSubsetHealth[grep(".*WINTER STORM*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "WINTER STORM"

StormSubsetHealth[grep(".*MARINE HIGH WIND*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "MHW"
StormSubsetHealth[grep(".*HIGH WIND*.", StormSubsetHealth$EVTYPE1,
```

```
ignore.case = FALSE), "EVTYPE1"] <- "HIGH WIND"
StormSubsetHealth[grep("MHW", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "MARINE HIGH WIND"

StormSubsetHealth[grep(".*WINTER WEATHER*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "WINTER WEATHER"

StormSubsetHealth[grep(".*HURRICANE*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "HURRICANE/TYPHOON"

StormSubsetHealth[grep(".*TORNADO*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "TORNADO"

StormSubsetHealth[grep(".*TROPICAL*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "TROPICAL STORM"

StormSubsetHealth[grep(".*RIP CURRENT*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "RIP CURRENT"

StormSubsetHealth[grep(".*SNOW*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "HEAVY SNOW"

StormSubsetHealth[grep(".*HEAT WAVE*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "HEAT"

StormSubsetHealth[grep(".*ICY ROADS*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "ICE STORM"
StormSubsetHealth[grep(".*BLACK ICE*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "ICE STORM"
StormSubsetHealth[grep("ICE", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "ICE STORM"

StormSubsetHealth[grep(".*LANDSLIDE*.", StormSubsetHealth$EVTYPE1,
ignore.case = FALSE), "EVTYPE1"] <- "DEBRIS FLOW"
```

Install and load the dplyr, knitr package to utilize grouping of data

```
#if (!require("dplyr")) {
#suppressWarnings(suppressMessages(install.packages("dplyr")))
#}
if (!require("knitr")) {
suppressWarnings(suppressMessages(install.packages("knitr")))
}
```

```
## Loading required package: knitr
```

```
## Warning: package 'knitr' was built under R version 3.1.3
```

Grouping and Summarizing the population health data Group the Storm data set by EVENT type(EVTYPE1), summarize the values for totals of FATALITIES and INJURIES and then sort by highest FATALITIES first followed by highest INJURIES.

```
StormSubsetHealthFbyE_1 <- with(StormSubsetHealth, aggregate(FATALITIES,by=list(EVENT=EVTYPE1), sum))
colnames(StormSubsetHealthFbyE_1) <- c("EVENT", "FATALITIES")

StormSubsetHealthIbyE_1 <- with(StormSubsetHealth, aggregate(INJURIES,by=list(EVENT=EVTYPE1), sum))
colnames(StormSubsetHealthIbyE_1) <- c("EVENT", "INJURIES")

StormSubsetHealth3 <- merge(StormSubsetHealthFbyE_1, StormSubsetHealthIbyE_1, by.x = "EVENT", by.y = "E
StormSubsetHealth4 <- StormSubsetHealth3[order(-StormSubsetHealth3$FATALITIES),]
StormSubsetHealth5 <- StormSubsetHealth3[order(-StormSubsetHealth3$INJURIES),]

colnames(StormSubsetHealth4) <- c("EVENT", "FATALITIES", "INJURIES")
colnames(StormSubsetHealth5) <- c("EVENT", "FATALITIES", "INJURIES")
```

The top 10 Storm Data Events that are most harmful with respect to population health in terms of FATALITIES is are as shown below.

```
kable(head(StormSubsetHealth4,10), row.names=FALSE, align="c")
```

EVENT	FATALITIES	INJURIES
TORNADO	5230	60226
FLASH FLOOD	414	4293
EXCESSIVE HEAT	402	4791
LIGHTNING	283	649
THUNDERSTORM WIND	282	833
HIGH WIND	120	375
HEAT	99	1704
WINTER STORM	96	631
RIP CURRENT	82	154
HEAVY SNOW	60	250

The top 10 Storm Data Events that are most harmful with respect to population health in terms of INJURIES is are as shown below.

```
kable(head(StormSubsetHealth5,10), row.names=FALSE, align="c")
```

EVENT	FATALITIES	INJURIES
TORNADO	5230	60226
EXCESSIVE HEAT	402	4791
FLASH FLOOD	414	4293
ICE STORM	44	1755
HEAT	99	1704
HURRICANE/TYPHOON	46	1237
THUNDERSTORM WIND	282	833
BLIZZARD	48	718
LIGHTNING	283	649
WINTER STORM	96	631

Process to answer question 2: Across the United States, which types of events have the greatest economic consequences? This will be broken down into two parts. The first is Crop damage and second is Property damage.

Eliminate the observations in the dataset with zero(0) CROP DAMAGE(CROPDMG) or PROPERTY DAMAGE (PROPDMG) to create a broad economic subset(StormSubsetEconomic) of data with non zero values. This subset, StormSubsetEconomic will be processed separately for Crop damage and Property damage.

```
StormSubsetEconomic <- StormSubset[(StormSubset$CROPDMG != 0 | StormSubset$PROPDMG != 0),]
```

The Crop damage cost is estimated by multiplying the variable ending "exp"(CROPDMGEXP and PROPDMGEXP) by their respective damage count variables(CROPDMG and PROPDMG). The valid values for the exp variables K(thousand = 1000), M(million = 1000000) and B(billion = 1000000000).

Crop Damage data consolidation Create a new dataset for Crop damage clean up from the economic dataset

```
StormSubsetCrop <- StormSubsetEconomic
StormSubsetCrop <- StormSubsetCrop[(StormSubsetCrop$CROPDMG != 0),]
```

Get the distinct values for CROPDMGEXP in the dataset

```
cexp <- data.frame(table(StormSubsetCrop$CROPDMGEXP))
colnames(cexp) <- c("CROPDMGEXP", "Freq")
kable(cexp, row.names=FALSE, align="c")
```

CROPDMGEXP	Freq
	3
0	12
B	7
k	21
K	20137
m	1
M	1918

There are CROPDMGEXP values of k and m. Convert these to K and M respectively. Eliminate observations with values 0, ? and ""(blank)

```
StormSubsetCrop[StormSubsetCrop$CROPDMGEXP=="k", "CROPDMGEXP"] <- "K"
StormSubsetCrop[StormSubsetCrop$CROPDMGEXP=="m", "CROPDMGEXP"] <- "M"
```

Subset only observations with CROPDMGEXP values of K, M and B

```
StormSubsetCrop <- StormSubsetCrop[(StormSubsetCrop$CROPDMGEXP == "K") |
(StormSubsetCrop$CROPDMGEXP == "M") | (StormSubsetCrop$CROPDMGEXP == "B"),]
```

Calculate actual Crop damage cost by multiplying CROPDMG by CROPDMGEXP. Valid values for CROPDMGEXP are K(thousand = 1000), M(million = 1000000) and B(billion = 1000000000). Store the Crop damage cost in variable, CROPDMGCOST

```
StormSubsetCrop <- cbind(StormSubsetCrop,CROPDMGCOST =
ifelse((StormSubsetCrop$CROPDMGEXP=="B"),1000000000 * StormSubsetCrop$CROPDMG,0))

StormSubsetCrop$CROPDMGCOST <- ifelse((StormSubsetCrop$CROPDMGEXP == "M"),
1000000 * StormSubsetCrop$CROPDMG,  StormSubsetCrop$CROPDMGCOST)

StormSubsetCrop$CROPDMGCOST <- ifelse((StormSubsetCrop$CROPDMGEXP == "K"),
1000 * StormSubsetCrop$CROPDMG, StormSubsetCrop$CROPDMGCOST)
```

Write the unique types of EVENTS to a csv file,events_crop.csv for easy readability

```
EVENT_CROP <- data.frame(table(StormSubsetCrop$EVTYPE1))
write.csv(EVENT_CROP, file="events_crop.csv", row.names=FALSE)
```

Consolidate the **131** EVENT type to 48 possible values in variable EVTYPE1. Look above for Consolidation Methodology in this document.

```
StormSubsetCrop[grep(".*EXTREME*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "EXTREME COLD/WIND CHILL"

StormSubsetCrop[grep(".*THUNDER*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "THUNDERSTORM WIND"
StormSubsetCrop[grep("THUDERSTORM WINDS", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "THUNDERSTORM WIND"

StormSubsetCrop[grep(".*TORNADO*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "TORNADO"

StormSubsetCrop[grep(".*TSTM*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "THUNDERSTORM WIND"

StormSubsetCrop[grep(".*STORM SURGE*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "STORM SURGE/TIDE"

StormSubsetCrop[grep(".*HEAVY RAIN/HIGH SURF*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HIGH SURF"

StormSubsetCrop[grep(".*HEAVY SNOW*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HEAVY SNOW"

StormSubsetCrop[grep(".*HURRICANE*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HURRICANE/TYPHOON"
StormSubsetCrop[grep(".*TYPHOON*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HURRICANE/TYPHOON"

StormSubsetCrop[grep(".*WINTER*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WINTER STORM"

StormSubsetCrop[grep(".*DUST*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "DUST STORM"

StormSubsetCrop[grep(".*HIGH WIND*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HIGH WIND"
```

```
StormSubsetCrop[grep(".*HEAVY RAIN*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HEAVY RAIN"

StormSubsetCrop[grep(".*RIVER FLOOD*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"
StormSubsetCrop[grep(".*COASTAL FLOODING*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"
StormSubsetCrop[grep(".*COASTAL FLOOD*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "CF"

StormSubsetCrop[grep(".*FLASH FLOOD*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FF"
StormSubsetCrop[grep(".*FLOOD*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FLOOD"

StormSubsetCrop[grep("CF", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"
StormSubsetCrop[grep("FF", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FLASH FLOOD"

StormSubsetCrop[grep(".*HAIL*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HAIL"

StormSubsetCrop[grep(".*TROPICAL STORM*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "TROPICAL STORM"

StormSubsetCrop[grep(".*MARINE STRONG WIND*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MSW"
StormSubsetCrop[grep(".*STRONG WIND*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "STRONG WIND"
StormSubsetCrop[grep(".*MSW*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MARINE STRONG WIND"

StormSubsetCrop[grep(".*GUST*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "STRONG WIND"

StormSubsetCrop[grep(".*HEAT WAVE*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HEAT"

StormSubsetCrop[grep(".*WILD*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WF"
StormSubsetCrop[grep(".*FOREST*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WILDFIRE"
StormSubsetCrop[grep("WF", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WILDFIRE"

StormSubsetCrop[grep(".*FREEZE*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FROST/FREEZE"

StormSubsetCrop[grep(".*LANDSLIDE*.", StormSubsetCrop$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "DEBRIS FLOW"
```

Group the Crop damage data set by EVENT type(EVTYPE1), summarize the values for the totals of the

Crop Damage cost(CROPDMGCOST) and then sort by the highest Crop Damage cost(CROPDMGCOST) first.

```
StormSubsetCrop1 <- with(StormSubsetCrop, aggregate(CROPDMGCOST,by=list(EVENT=EVTYPE1), sum))
colnames(StormSubsetCrop1) <- c("EVENT", "CROPDMGCOST")

StormSubsetCrop2 <- StormSubsetCrop1[order(-StormSubsetCrop1$CROPDMGCOST),]

StormSubsetCrop2$CROP_DAMAGE_COST <- ifelse(StormSubsetCrop2$CROPDMGCOST > 1000000000,
paste(signif(StormSubsetCrop2$CROPDMGCOST/1000000000, digits=5),"B", sep=" "),
StormSubsetCrop2$CROPDMGCOST)
colnames(StormSubsetCrop2) <- c("EVENT","CROPDMGCOST", "CROP DAMAGE COST")
StormSubsetCrop2$EVENT <- factor(StormSubsetCrop2$EVENT)
```

The Top 10 Storm Data Events with greatest economic consequences being Crop damage are as shown below in tabular form.

```
kable(head(StormSubsetCrop2[, c("EVENT","CROP DAMAGE COST")],10), row.names=FALSE, align="c")
```

EVENT	CROP DAMAGE COST
DROUGHT	13.973 B
FLOOD	5.79 B
HURRICANE/TYPHOON	5.5161 B
COASTAL FLOOD	5.0575 B
ICE STORM	5.0221 B
HAIL	3.0469 B
FROST/FREEZE	1.8891 B
FLASH FLOOD	1.5322 B
EXTREME COLD/WIND CHILL	1.335 B
THUNDERSTORM WIND	1.2717 B

Property Damage data consolidation Create a new dataset for Property damage clean up from the economic dataset

```
StormSubsetProp <- StormSubsetEconomic
StormSubsetProp <- StormSubsetProp[(StormSubsetProp$PROPDMG != 0),]
```

Get the distinct values for CROPDMGEXP in the dataset

```
pexp <- data.frame(table(StormSubsetProp$PROPDMGEXP))
colnames(pexp) <- c("PROPDMGEXP", "Freq")
kable(pexp, row.names=FALSE, align="c")
```

PROPDMGEXP	Freq
	76
-	1
+	5
0	209
2	1

PROPDMGEXP	Freq
3	1
4	4
5	18
6	3
7	2
B	39
h	1
H	6
K	227481
m	7
M	11320

There are PROPDMGEXP values of m. Convert m to M respectively. Eliminate observations with values 0, ? and “”(blank)

```
StormSubsetProp[StormSubsetProp$PROPDMGEXP=="m", "PROPDMGEXP"] <- "M"
```

Subset only observations with PROPDMGEXP values of K, M and B

```
StormSubsetProp <- StormSubsetProp[(StormSubsetProp$PROPDMGEXP == "K") |
(StormSubsetProp$PROPDMGEXP == "M") | (StormSubsetProp$PROPDMGEXP == "B"),]
```

Calculate actual Property damage cost by multiplying PROPDMG by PROPDMGEXP. Values for PROPDMGEXP are K(thousand = 1000), M(million = 1000000) and B(billion = 1000000000). Store the Property damage cost in variable, PROPDMGCOST

```
StormSubsetProp <- cbind(StormSubsetProp,PROPDMGCOST =
ifelse((StormSubsetProp$PROPDMGEXP == "B"), 1000000000 * StormSubsetProp$PROPDMG, 0))

StormSubsetProp$PROPDMGCOST <- ifelse((StormSubsetProp$PROPDMGEXP == "M"),
1000000 * StormSubsetProp$PROPDMG,  StormSubsetProp$PROPDMGCOST)

StormSubsetProp$PROPDMGCOST <- ifelse((StormSubsetProp$PROPDMGEXP == "K"),
1000 * StormSubsetProp$PROPDMG, StormSubsetProp$PROPDMGCOST)
```

Write the unique types of EVENTS to a csv file,events_prop.csv for easy readability

```
EVENT_PROP <- data.frame(table(StormSubsetProp$EVTYPE1))
write.csv(EVENT_PROP, file="events_prop.csv", row.names=FALSE)
```

Consolidate the **370** EVENT types to 48 possible values as defined in NWS Directive 10-1605 in variable EVTYPE1

```
StormSubsetProp[grep("MARINE THUNDERSTORM WIND", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MTW"
StormSubsetProp[grep(".*THUN*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "THUNDERSTORM WIND"
StormSubsetProp[grep("THUDERSTORM WINDS", StormSubsetProp$EVTYPE1, ignore.case = FALSE), "EVTYPE1"] <-
StormSubsetProp[grep("TUNDERSTORM WIND", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
```

```
"EVTYPE1"] <- "THUNDERSTORM WIND"

StormSubsetProp[grep("MARINE TSTM WIND", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MTW"

StormSubsetProp[grep(".*DUST DEVIL*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "DUST DEVIL"
StormSubsetProp[grep(".*WATERSPOUT*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WATERSPOUT"

StormSubsetProp[grep(".*TORNADO*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "TORNADO"
StormSubsetProp[grep("TORNDAO", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "TORNADO"

StormSubsetProp[grep("NON-TSTM WIND", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HIGH WIND"

StormSubsetProp[grep(".*TSTM*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "THUNDERSTORM WIND"

StormSubsetProp[grep("MTW", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MARINE THUNDERSTORM WIND"

StormSubsetProp[grep(".*HURRICANE*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HURRICANE/TYPHOON"
StormSubsetProp[grep(".*TYPHOON*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HURRICANE/TYPHOON"

StormSubsetProp[grep(".*HEAVY SNOW*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HEAVY SNOW"

StormSubsetProp[grep(".*TROPICAL STORM*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "TROPICAL STORM"

StormSubsetProp[grep("BLIZZARD/WINTER STORM", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "BLIZZARD"

StormSubsetProp[grep(".*WINTER STORM*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WINTER STORM"

StormSubsetProp[grep(".*WINTER WEATHER*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WINTER WEATHER"

StormSubsetProp[grep(".*WILD*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WILDFIRE"
StormSubsetProp[grep(".*FOREST*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "WILDFIRE"

StormSubsetProp[grep("HEAVY SURF", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HIGH SURF"

StormSubsetProp[grep(".*DUST STORM*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
```

```
"EVTYPE1"] <- "DUST STORM"

StormSubsetProp[grep("SNOW/HIGH WINDS", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HIGH WIND"

StormSubsetProp[grep("MARINE HIGH WIND", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MHW"

StormSubsetProp[grep(".*HIGH WIND*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HIGH WIND"

StormSubsetProp[grep("MHW", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MARINE HIGH WIND"

StormSubsetProp[grep(".*EFFECT*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LAKE-EFFECT SNOW"

StormSubsetProp[grep("FLASH FLOOD - HEAVY RAIN", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FLASH FLOOD"

StormSubsetProp[grep("FLOOD & HEAVY RAIN", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FLOOD"

StormSubsetProp[grep(".*LIGHTNING*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LIGHTNING"
StormSubsetProp[grep("LIGNTNING", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LIGHTNING"
StormSubsetProp[grep("LIGHTING", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LIGHTNING"

StormSubsetProp[grep(".*HEAVY RAIN*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HEAVY RAIN"

StormSubsetProp[grep("LAKE-EFFECT SNOW", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LES"

StormSubsetProp[grep("SNOW", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "HEAVY SNOW"

StormSubsetProp[grep("LES", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LAKE-EFFECT SNOW"

StormSubsetProp[grep("MARINE HAIL", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MH"
StormSubsetProp[grep("MARINE STRONG WIND", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MSW"
StormSubsetProp[grep("MARINE THUNDERSTORM WIND", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MTW"

StormSubsetProp[grep(".*GUSTY*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "STRONG WIND"

StormSubsetProp[grep(".*HAIL*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
```

```
"EVTYPE1"] <- "HAIL"

StormSubsetProp[grep(".*STRONG WIND*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "STRONG WIND"

StormSubsetProp[grep("MH", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MARINE HAIL"
StormSubsetProp[grep("MSW", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MARINE STRONG WIND"
StormSubsetProp[grep("MTW", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "MARINE THUNDERSTORM WIND"

StormSubsetProp[grep(".*COASTAL*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"

StormSubsetProp[grep(".*COASTAL*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"

StormSubsetProp[grep(".*EXTREME HEAT*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "EXCESSIVE HEAT"

StormSubsetProp[grep(".*EXTREME*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "EXTREME COLD/WIND CHILL"

StormSubsetProp[grep("EXTENDED COLD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "EXTREME COLD/WIND CHILL"
StormSubsetProp[grep("RECORD COLD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "EXTREME COLD/WIND CHILL"

StormSubsetProp[grep("FLASH FLOOD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FF"
StormSubsetProp[grep("FLOOD FLASH", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FF"

StormSubsetProp[grep("FLOOD/RIVER FLOOD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FLOOD"

StormSubsetProp[grep(".*RIVER FLOOD*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"
StormSubsetProp[grep("EROSION/CSTL FLOOD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"
StormSubsetProp[grep("TIDAL FLOODING", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"
StormSubsetProp[grep("RIVER AND STREAM FLOOD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"

StormSubsetProp[grep("COASTAL FLOOD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "CF"
StormSubsetProp[grep("EROSION/CSTL FLOOD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"

StormSubsetProp[grep("LAKE FLOOD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LAKESHORE FLOOD"
```

```
StormSubsetProp[grep("LAKESHORE FLOOD", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LF"

StormSubsetProp[grep(".*FLOOD*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FLOOD"

StormSubsetProp[grep("CF", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COASTAL FLOOD"
StormSubsetProp[grep("LF", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "LAKESHORE FLOOD"
StormSubsetProp[grep("FF", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "FLASH FLOOD"

StormSubsetProp[grep("EXTREME COLD/WIND CHILL", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "ECWC"

StormSubsetProp[grep(".*COLD*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "COLD/WIND CHILL"
StormSubsetProp[grep("ECWC", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "EXTREME COLD/WIND CHILL"

StormSubsetProp[grep(".*STORM SURGE*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "STORM SURGE/TIDE"

StormSubsetProp[grep(".*LANDSLIDE*.", StormSubsetProp$EVTYPE1, ignore.case = FALSE),
"EVTYPE1"] <- "DEBRIS FLOW"
```

Group the Property damage data set by EVENT type(EVTYPE1), summarize the values for Property Damage cost(PROPDMGCOST) and then sort by highest PROPDMGCOST first.

```
StormSubsetProp1 <- with(StormSubsetProp, aggregate(PROPDMGCOST,by=list(EVENT=EVTYPE1), sum))
colnames(StormSubsetProp1) <- c("EVENT", "PROPDMGCOST")

StormSubsetProp2 <- StormSubsetProp1[order(-StormSubsetProp1$PROPDMGCOST),]

StormSubsetProp2$PROPERTY_DAMAGE_COST <- ifelse(StormSubsetProp2$PROPDMGCOST > 1000000000,
paste(signif(StormSubsetProp2$PROPDMGCOST/1000000000, digits=5),"B", sep=" "), StormSubsetProp2$PROPDMG
colnames(StormSubsetProp2) <- c("EVENT","PROPDMGCOST","PROPERTY DAMAGE COST")
```

The top 10 Storm Data Events with greatest economic consequences being Property damage are as shown below.

```
kable(head(StormSubsetProp2[, c("EVENT","PROPERTY DAMAGE COST")],10), row.names=FALSE, align="c")
```

EVENT	PROPERTY DAMAGE COST
HURRICANE/TYPHOON	85.356 B
TORNADO	58.542 B
STORM SURGE/TIDE	47.965 B
FLOOD	30.033 B
FLASH FLOOD	16.947 B
HAIL	15.975 B
THUNDERSTORM WIND	10.971 B

EVENT	PROPERTY DAMAGE COST
WILDFIRE	8.4966 B
TROPICAL STORM	7.7144 B
WINTER STORM	6.749 B

Group the Property damage data set by EVENT type(EVTYPE1) and STATE(STATE), summarize the values for Property Damage cost(PROPDMGCOST) and then sort by highest PROPDMGCOST first.

```
StormSubsetPropState1 <- with(StormSubsetProp, aggregate(PROPDMGCOST,by=list(YEAR=BGN_YEAR,EVENT=EVTYPE
colnames(StormSubsetPropState1) <- c("YEAR","EVENT","STATE", "PROPDMGCOST")

StormSubsetPropState2 <- StormSubsetPropState1[order(-StormSubsetPropState1$YEAR,-StormSubsetPropState1$
source('C:/russel/CurrencyFormat.R')
StormSubsetPropState2 <- StormSubsetPropState2[(StormSubsetPropState2$PROPDMG != 0),]

StormSubsetPropState2$PROPERTY_DAMAGE_COST <- ifelse((StormSubsetPropState2$PROPDMGCOST > 1000000 & Sto
paste(signif(StormSubsetPropState2$PROPDMGCOST/1000000, digits=5),"M", sep=" "), StormSubsetPropState2$

StormSubsetPropState2$PROPERTY_DAMAGE_COST <- ifelse(StormSubsetPropState2$PROPDMGCOST > 1000000000,
paste(signif(StormSubsetPropState2$PROPDMGCOST/1000000000, digits=5),"B", sep=" "), StormSubsetPropStat

StormSubsetPropState2$PROPERTY_DAMAGE_COST <- ifelse(StormSubsetPropState2$PROPDMGCOST < 1000000,
paste(signif(StormSubsetPropState2$PROPDMGCOST/1000, digits=5),"K", sep=" "), StormSubsetPropState2$PROP

# StormSubsetPropState2$PROPERTY_DAMAGE_COST <- CurrencyFormat(StormSubsetPropState2$PROPDMGCOST,F)

colnames(StormSubsetPropState2) <- c("YEAR","EVENT", "STATE", "PROPDMGCOST", "PROPERTY DAMAGE COST")
```

The top 10 Storm Data Events with greatest economic consequences being Property damage are as shown below.

```
# kable(head(StormSubsetPropState2[, c("STATE", "EVENT", "PROPERTY DAMAGE COST")],10))
```

```
year <- unique(StormSubsetPropState2$YEAR)
par(mfrow=c(1,3))
for (i in 1:length(year)) {
print(kable(head(StormSubsetPropState2[ StormSubsetPropState2$YEAR == year[i], c(1:3,5)],10), row.names=
}
```

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2011	TORNADO	AL	4.3621 B
2011	TORNADO	MO	2.8393 B
2011	FLOOD	TN	2.0117 B
2011	FLOOD	NJ	1.5416 B
2011	FLOOD	VT	1.0597 B
2011	FLOOD	MS	1.0116 B
2011	FLOOD	NY	815.02 M
2011	TORNADO	MS	572.94 M
2011	WILDFIRE	TX	495.77 M
2011	FLOOD	PA	478.06 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2010	HAIL	AZ	2.8101 B
2010	FLOOD	TN	2.163 B
2010	TORNADO	MS	365.71 M
2010	FLASH FLOOD	IL	299 M
2010	WILDFIRE	CO	218.6 M
2010	HAIL	MI	175.12 M
2010	FLASH FLOOD	TN	169.78 M
2010	FLOOD	MA	152.04 M
2010	HAIL	KS	151.46 M
2010	FLOOD	CA	148.96 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2009	THUNDERSTORM WIND	LA	715.84 M
2009	HAIL	TX	614.05 M
2009	HAIL	CO	602.35 M
2009	THUNDERSTORM WIND	IL	297.83 M
2009	FLOOD	GA	263.2 M
2009	TORNADO	AR	144.84 M
2009	THUNDERSTORM WIND	MO	144.36 M
2009	ICE STORM	AR	142.02 M
2009	TORNADO	TN	107.81 M
2009	HIGH WIND	NY	102.03 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2008	STORM SURGE/TIDE	TX	4.5004 B
2008	HURRICANE/TYPHOON	TX	1.8452 B
2008	FLOOD	IA	1.0354 B
2008	WINTER STORM	OH	769.71 M
2008	THUNDERSTORM WIND	OK	757.92 M
2008	HIGH WIND	OH	587.02 M
2008	HURRICANE/TYPHOON	LA	563.44 M
2008	FLOOD	IN	550.04 M
2008	FLASH FLOOD	WI	359.49 M
2008	TORNADO	AR	357.7 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2007	WILDFIRE	CA	971.32 M
2007	FLASH FLOOD	TX	323.84 M
2007	ICE STORM	OK	310 M
2007	TORNADO	FL	282.77 M
2007	TORNADO	AL	269.71 M
2007	TORNADO	KS	259.43 M
2007	FLASH FLOOD	OH	247.58 M
2007	FLASH FLOOD	KS	205.33 M
2007	FLASH FLOOD	MN	171.99 M
2007	TORNADO	GA	154.58 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2006	FLASH FLOOD	NY	852.27 M
2006	HAIL	WI	671.77 M
2006	FLOOD	LA	619.37 M
2006	FLASH FLOOD	OH	494.16 M
2006	FLOOD	CA	417.52 M
2006	FLASH FLOOD	PA	392.5 M
2006	FLASH FLOOD	TX	211.44 M
2006	HAIL	OH	201.42 M
2006	FLOOD	NY	159.22 M
2006	TORNADO	TN	154.4 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2005	STORM SURGE/TIDE	LA	31.734 B
2005	HURRICANE/TYPHOON	LA	20.984 B
2005	HURRICANE/TYPHOON	MS	13.483 B
2005	HURRICANE/TYPHOON	FL	11.878 B
2005	STORM SURGE/TIDE	MS	11.261 B
2005	HURRICANE/TYPHOON	TX	2.2495 B
2005	HURRICANE/TYPHOON	AL	1.1215 B
2005	FLOOD	CA	488.21 M
2005	FLOOD	UT	300.1 M
2005	HEAVY RAIN	CA	253.49 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2004	HURRICANE/TYPHOON	FL	15.719 B
2004	HIGH WIND	FL	3.0823 B
2004	HURRICANE/TYPHOON	AL	2.5 B
2004	TROPICAL STORM	FL	397.47 M
2004	FLASH FLOOD	PA	279.83 M
2004	HAIL	TX	190.64 M
2004	TORNADO	NE	173.26 M
2004	FLOOD	NC	167.56 M
2004	FLOOD	PA	167.02 M
2004	HAIL	CO	148.6 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2003	WILDFIRE	CA	2.1891 B
2003	FLASH FLOOD	AL	1.0114 B
2003	DROUGHT	IA	645.15 M
2003	TROPICAL STORM	MD	532.93 M
2003	HURRICANE/TYPHOON	VA	512 M
2003	HURRICANE/TYPHOON	NC	463.69 M
2003	TORNADO	OK	394.61 M
2003	TORNADO	MO	284.45 M
2003	FLASH FLOOD	MS	271.4 M
2003	FLASH FLOOD	OH	254.47 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2002	HURRICANE/TYPHOON	LA	518.58 M
2002	ICE STORM	OK	301.5 M
2002	HURRICANE/TYPHOON	GU	225 M
2002	FLOOD	MN	203.8 M
2002	ICE STORM	NC	199 M
2002	TORNADO	OH	142.37 M
2002	WILDFIRE	CA	129.4 M
2002	TORNADO	MD	125.82 M
2002	TROPICAL STORM	LA	108.75 M
2002	TORNADO	IN	108.56 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2001	TROPICAL STORM	TX	5.15 B
2001	HAIL	MO	1.0517 B
2001	HAIL	NE	553.38 M
2001	HAIL	TX	249.56 M
2001	FLOOD	MN	243.21 M
2001	HAIL	ND	236.21 M
2001	FLASH FLOOD	WV	210.81 M
2001	FLASH FLOOD	PR	130.64 M
2001	FLASH FLOOD	AR	120.78 M
2001	TORNADO	OK	105.77 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
2000	WILDFIRE	NM	1.5032 B
2000	WILDFIRE	CA	574.5 M
2000	ICE STORM	AR	525.02 M
2000	FLOOD	FL	454.91 M
2000	FLOOD	NJ	178.5 M
2000	ICE STORM	TX	155.68 M
2000	ICE STORM	LA	133.37 M
2000	FLASH FLOOD	ND	123.7 M
2000	TORNADO	KY	122.71 M
2000	HAIL	WI	119.07 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1999	HURRICANE/TYPHOON	NC	3.5318 B
1999	TORNADO	OK	1.1095 B
1999	FLASH FLOOD	NJ	503 M
1999	HURRICANE/TYPHOON	FL	395.45 M
1999	FLASH FLOOD	FL	212.36 M
1999	TORNADO	UT	170.7 M
1999	HAIL	TX	170.46 M
1999	TORNADO	TX	160.3 M
1999	TORNADO	KS	147.18 M
1999	WILDFIRE	CA	117.78 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1998	HURRICANE/TYPHOON	PR	1.7 B
1998	HURRICANE/TYPHOON	MS	674 M
1998	HAIL	MN	636.13 M
1998	FLOOD	TX	591.88 M
1998	HAIL	KY	510.19 M
1998	THUNDERSTORM WIND	MN	464.96 M
1998	HURRICANE/TYPHOON	FL	459.51 M
1998	FLOOD	FL	399.72 M
1998	TORNADO	MN	391.56 M
1998	TORNADO	FL	384.59 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1997	FLOOD	ND	3.404 B
1997	FLOOD	MN	713.69 M
1997	FLOOD	NV	640 M
1997	HURRICANE/TYPHOON	GU	600.23 M
1997	FLOOD	CA	589.38 M
1997	FLOOD	KY	361.9 M
1997	FLASH FLOOD	CO	320.94 M
1997	TORNADO	AR	267.12 M
1997	BLIZZARD	ND	220.92 M
1997	TORNADO	TX	144.8 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1996	HURRICANE/TYPHOON	NC	1.3456 B
1996	FLOOD	OR	453.4 M
1996	FLASH FLOOD	PA	419.49 M
1996	HAIL	TX	323.49 M
1996	TORNADO	AR	317.55 M
1996	FLASH FLOOD	NY	169.6 M
1996	DROUGHT	TX	135.4 M
1996	HAIL	CO	130.98 M
1996	TORNADO	KY	118.24 M
1996	FLOOD	NY	105.62 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1995	HURRICANE/TYPHOON	FL	3.3376 B
1995	HEAVY RAIN	LA	2.5 B
1995	THUNDERSTORM WIND	TX	1.2854 B
1995	HAIL	TX	430.22 M
1995	HURRICANE/TYPHOON	AL	193 M
1995	THUNDERSTORM WIND	NY	191.23 M
1995	FLASH FLOOD	CA	134.19 M
1995	THUNDERSTORM WIND	KY	128.64 M
1995	HAIL	LA	100.04 M
1995	TORNADO	TX	88.595 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1994	FLASH FLOOD	TX	317.51 M
1994	HAIL	TX	197.15 M
1994	FLASH FLOOD	TN	158.48 M
1994	THUNDERSTORM WIND	TX	152.84 M
1994	TORNADO	TX	120.68 M
1994	WILDFIRE	NM	100 M
1994	THUNDERSTORM WIND	KS	92.449 M
1994	FLASH FLOOD	NY	76.785 M
1994	TORNADO	TN	72.284 M
1994	FLOOD	GA	72.122 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1993	WINTER STORM	AL	5 B
1993	COASTAL FLOOD	IL	5 B
1993	TORNADO	FL	1.7435 B
1993	WILDFIRE	CA	619 M
1993	HIGH WIND	CA	343.42 M
1993	HAIL	TX	208.27 M
1993	FLASH FLOOD	MO	162.37 M
1993	FLOOD	IA	149.39 M
1993	TORNADO	GA	132.11 M
1993	STORM SURGE/TIDE	FL	130 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1992	TORNADO	TX	446.59 M
1992	TORNADO	MS	176.23 M
1992	TORNADO	MN	100.28 M
1992	TORNADO	OH	87.83 M
1992	TORNADO	IN	78.158 M
1992	TORNADO	LA	76.922 M
1992	TORNADO	GA	65.582 M
1992	TORNADO	KS	62.736 M
1992	TORNADO	WI	55.176 M
1992	TORNADO	SD	43.385 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1991	TORNADO	KS	574.97 M
1991	TORNADO	IL	110.61 M
1991	TORNADO	TN	55.28 M
1991	TORNADO	GA	52.355 M
1991	TORNADO	OK	52.26 M
1991	TORNADO	MO	51.352 M
1991	TORNADO	MI	41.82 M
1991	TORNADO	TX	39.11 M
1991	TORNADO	IN	26.055 M
1991	TORNADO	OH	25.6 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1990	TORNADO	IL	286.2 M
1990	TORNADO	NE	267.85 M
1990	TORNADO	KS	225.57 M
1990	TORNADO	IA	134.63 M
1990	TORNADO	TX	123.41 M
1990	TORNADO	OH	115.95 M
1990	TORNADO	IN	95.808 M
1990	TORNADO	MO	84.38 M
1990	TORNADO	KY	34.428 M
1990	TORNADO	MD	28.352 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1989	TORNADO	AL	521.1 M
1989	TORNADO	CT	325 M
1989	TORNADO	IA	234.47 M
1989	TORNADO	NY	175.6 M
1989	TORNADO	NC	167.1 M
1989	TORNADO	GA	61.78 M
1989	TORNADO	TX	52.305 M
1989	TORNADO	IL	37.878 M
1989	TORNADO	FL	35.131 M
1989	TORNADO	IN	29.43 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1988	TORNADO	NC	290.06 M
1988	TORNADO	IA	282.81 M
1988	TORNADO	AR	148.78 M
1988	TORNADO	TX	65.76 M
1988	TORNADO	MO	60.375 M
1988	TORNADO	FL	32.681 M
1988	TORNADO	AL	31.1 M
1988	TORNADO	LA	29.26 M
1988	TORNADO	TN	29.082 M
1988	TORNADO	CO	28.883 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1987	TORNADO	TX	111.1 M
1987	TORNADO	MS	90.63 M
1987	TORNADO	LA	55.135 M
1987	TORNADO	MN	33.032 M
1987	TORNADO	CA	25.5 M
1987	TORNADO	AR	25.25 M
1987	TORNADO	IA	13.253 M
1987	TORNADO	KS	7.3078 M
1987	TORNADO	WI	6.5275 M
1987	TORNADO	VA	5.005 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1986	TORNADO	IA	517.46 M
1986	TORNADO	TX	63.212 M
1986	TORNADO	MO	60.353 M
1986	TORNADO	NE	60.017 M
1986	TORNADO	IN	51.332 M
1986	TORNADO	OK	36.705 M
1986	TORNADO	GA	31.075 M
1986	TORNADO	MS	28.825 M
1986	TORNADO	OH	28.1 M
1986	TORNADO	KY	25.65 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1985	TORNADO	OH	842.62 M
1985	TORNADO	PA	379.38 M
1985	TORNADO	WI	89.528 M
1985	TORNADO	AR	53.35 M
1985	TORNADO	OK	35.9 M
1985	TORNADO	FL	34.748 M
1985	TORNADO	IA	28.428 M
1985	TORNADO	NE	26.568 M
1985	TORNADO	AL	23.213 M
1985	TORNADO	GA	13.328 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1984	TORNADO	NC	351.6 M
1984	TORNADO	IA	270.94 M
1984	TORNADO	AR	238.2 M
1984	TORNADO	SC	230.61 M
1984	TORNADO	OK	142.43 M
1984	TORNADO	MS	130.3 M
1984	TORNADO	TX	109.84 M
1984	TORNADO	LA	106.24 M
1984	TORNADO	MN	93.552 M
1984	TORNADO	WI	89.158 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1983	TORNADO	LA	149.38 M
1983	TORNADO	FL	99.904 M
1983	TORNADO	PA	64.4 M
1983	TORNADO	TX	63.151 M
1983	TORNADO	OH	53.778 M
1983	TORNADO	MI	50.979 M
1983	TORNADO	NY	42.775 M
1983	TORNADO	IL	38.553 M
1983	TORNADO	MO	35.836 M
1983	TORNADO	KS	31.136 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1982	TORNADO	IL	318.28 M
1982	TORNADO	OK	317.23 M
1982	TORNADO	MO	188.41 M
1982	TORNADO	AR	176.95 M
1982	TORNADO	MS	107.63 M
1982	TORNADO	TX	106.05 M
1982	TORNADO	KS	50.908 M
1982	TORNADO	KY	36.55 M
1982	TORNADO	NM	25.25 M
1982	TORNADO	FL	12.763 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1981	TORNADO	OK	305.49 M
1981	TORNADO	TX	66.247 M
1981	TORNADO	MN	62.958 M
1981	TORNADO	MO	59.086 M
1981	TORNADO	IL	45.535 M
1981	TORNADO	OH	33.66 M
1981	TORNADO	CO	32.53 M
1981	TORNADO	KS	31.563 M
1981	TORNADO	AL	30.356 M
1981	TORNADO	WI	27.03 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1980	TORNADO	PA	1.0086 B
1980	TORNADO	TX	346.35 M
1980	TORNADO	NE	303.08 M
1980	TORNADO	MS	65.255 M
1980	TORNADO	OH	57.13 M
1980	TORNADO	MI	52.91 M
1980	TORNADO	MO	36.375 M
1980	TORNADO	MN	36.278 M
1980	TORNADO	FL	36.203 M
1980	TORNADO	IA	35.805 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1979	TORNADO	TX	327.3 M
1979	TORNADO	CT	250 M
1979	TORNADO	IA	67.766 M
1979	TORNADO	AR	48.91 M
1979	TORNADO	FL	42.673 M
1979	TORNADO	OK	34.598 M
1979	TORNADO	SD	33.325 M
1979	TORNADO	WY	27.553 M
1979	TORNADO	MN	13.1 M
1979	TORNADO	NE	11.01 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1978	TORNADO	LA	261.13 M
1978	TORNADO	MS	104.15 M
1978	TORNADO	NE	71.618 M
1978	TORNADO	MN	28.734 M
1978	TORNADO	FL	19.428 M
1978	TORNADO	OH	17.2 M
1978	TORNADO	AR	14.458 M
1978	TORNADO	IA	13.825 M
1978	TORNADO	GA	13.525 M
1978	TORNADO	KY	7.775 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1977	TORNADO	MO	63.435 M
1977	TORNADO	WI	48.33 M
1977	TORNADO	OH	35.228 M
1977	TORNADO	TX	29.889 M
1977	TORNADO	AL	28.135 M
1977	TORNADO	KS	18.383 M
1977	TORNADO	IL	11.402 M
1977	TORNADO	NE	11.094 M
1977	TORNADO	MN	10.6 M
1977	TORNADO	LA	10.474 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1976	TORNADO	MS	52.412 M
1976	TORNADO	TX	36.103 M
1976	TORNADO	MI	32.05 M
1976	TORNADO	AR	29.716 M
1976	TORNADO	IA	28.331 M
1976	TORNADO	IL	26.053 M
1976	TORNADO	IN	11.165 M
1976	TORNADO	OK	11.011 M
1976	TORNADO	AL	10.333 M
1976	TORNADO	LA	9.9 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1975	TORNADO	GA	280.73 M
1975	TORNADO	NE	257.29 M
1975	TORNADO	MO	39.13 M
1975	TORNADO	OK	35.96 M
1975	TORNADO	AL	34.905 M
1975	TORNADO	IL	33.724 M
1975	TORNADO	MS	30.943 M
1975	TORNADO	AR	28.63 M
1975	TORNADO	NJ	25.275 M
1975	TORNADO	FL	12.406 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1974	TORNADO	IN	956.18 M
1974	TORNADO	OH	257.18 M
1974	TORNADO	AL	139.52 M
1974	TORNADO	OK	128.02 M
1974	TORNADO	KY	70.478 M
1974	TORNADO	KS	62.49 M
1974	TORNADO	LA	55.438 M
1974	TORNADO	IA	36.928 M
1974	TORNADO	GA	35.805 M
1974	TORNADO	NC	29.282 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1973	TORNADO	GA	1.3104 B
1973	TORNADO	KS	258.74 M
1973	TORNADO	AL	227.06 M
1973	TORNADO	OK	33.421 M
1973	TORNADO	SC	31.21 M
1973	TORNADO	VA	25.028 M
1973	TORNADO	MA	25.025 M
1973	TORNADO	FL	20.499 M
1973	TORNADO	MO	19.009 M
1973	TORNADO	LA	16.136 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1972	TORNADO	AZ	30.625 M
1972	TORNADO	WA	25.3 M
1972	TORNADO	IL	17.133 M
1972	TORNADO	TX	12.539 M
1972	TORNADO	FL	8.784 M
1972	TORNADO	GA	8.0727 M
1972	TORNADO	IA	5.93 M
1972	TORNADO	AR	5.8825 M
1972	TORNADO	MI	5.608 M
1972	TORNADO	MS	4.6377 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1971	TORNADO	MS	34.045 M
1971	TORNADO	TX	32.532 M
1971	TORNADO	MO	26.738 M
1971	TORNADO	IA	15.801 M
1971	TORNADO	LA	15.64 M
1971	TORNADO	KY	13.18 M
1971	TORNADO	TN	7.125 M
1971	TORNADO	OH	5.9775 M
1971	TORNADO	GA	5.1875 M
1971	TORNADO	IL	4.1755 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1970	TORNADO	TX	382.04 M
1970	TORNADO	OK	139.44 M
1970	TORNADO	SD	25.375 M
1970	TORNADO	TN	15.453 M
1970	TORNADO	KS	10.458 M
1970	TORNADO	AR	6.735 M
1970	TORNADO	PA	5.9025 M
1970	TORNADO	WI	5.7575 M
1970	TORNADO	MO	5.1607 M
1970	TORNADO	MN	3.905 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1969	TORNADO	KS	26.78 M
1969	TORNADO	MN	16.668 M
1969	TORNADO	WI	13.26 M
1969	TORNADO	MO	11.953 M
1969	TORNADO	OH	9.1155 M
1969	TORNADO	MI	5.6025 M
1969	TORNADO	TX	5.4733 M
1969	TORNADO	NY	3.0775 M
1969	TORNADO	GA	2.985 M
1969	TORNADO	IA	2.4275 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1968	TORNADO	IA	55.44 M
1968	TORNADO	KY	30.55 M
1968	TORNADO	OR	25 M
1968	TORNADO	OH	13.88 M
1968	TORNADO	IL	10.775 M
1968	TORNADO	FL	10.481 M
1968	TORNADO	MN	9.0228 M
1968	TORNADO	AR	8.4202 M
1968	TORNADO	TX	8.1136 M
1968	TORNADO	AL	7.2778 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1967	TORNADO	MN	280.45 M
1967	TORNADO	MO	65.239 M
1967	TORNADO	IL	60.698 M
1967	TORNADO	KS	33.855 M
1967	TORNADO	MI	28.908 M
1967	TORNADO	MS	25.758 M
1967	TORNADO	IA	17.978 M
1967	TORNADO	AL	12.753 M
1967	TORNADO	OK	8.8835 M
1967	TORNADO	FL	8.0603 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1966	TORNADO	KS	255.71 M
1966	TORNADO	MS	77.538 M
1966	TORNADO	FL	75.808 M
1966	TORNADO	IA	29.89 M
1966	TORNADO	WI	7.7775 M
1966	TORNADO	MO	5.9986 M
1966	TORNADO	GA	3.965 M
1966	TORNADO	IL	3.3028 M
1966	TORNADO	OH	2.775 M
1966	TORNADO	MN	2.665 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1965	TORNADO	IN	781.07 M
1965	TORNADO	MI	310.18 M
1965	TORNADO	MN	258.18 M
1965	TORNADO	NE	100.65 M
1965	TORNADO	OH	96.33 M
1965	TORNADO	IL	81.008 M
1965	TORNADO	TX	28.04 M
1965	TORNADO	AR	26.945 M
1965	TORNADO	IA	13.947 M
1965	TORNADO	WI	11.03 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1964	TORNADO	IA	43.202 M
1964	TORNADO	TX	27.08 M
1964	TORNADO	MO	12.955 M
1964	TORNADO	LA	12.635 M
1964	TORNADO	WI	10.992 M
1964	TORNADO	GA	9.925 M
1964	TORNADO	TN	7.825 M
1964	TORNADO	KS	6.3912 M
1964	TORNADO	NE	6.2552 M
1964	TORNADO	FL	4.1628 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1963	TORNADO	PA	27.525 M
1963	TORNADO	IN	9.6928 M
1963	TORNADO	AL	9.228 M
1963	TORNADO	OH	8.26 M
1963	TORNADO	GA	7.2775 M
1963	TORNADO	TN	4.575 M
1963	TORNADO	IL	4.3775 M
1963	TORNADO	SC	2.608 M
1963	TORNADO	FL	1.5838 M
1963	TORNADO	WI	1.3025 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1962	TORNADO	TX	14.428 M
1962	TORNADO	NE	11.23 M
1962	TORNADO	KS	7.87 M
1962	TORNADO	SD	5.7352 M
1962	TORNADO	FL	5.385 M
1962	TORNADO	CT	5.025 M
1962	TORNADO	OH	2.7775 M
1962	TORNADO	IA	1.85 M
1962	TORNADO	OK	1.763 M
1962	TORNADO	IN	1.6302 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1961	TORNADO	IL	41.618 M
1961	TORNADO	KY	20.05 M
1961	TORNADO	IN	17.123 M
1961	TORNADO	OK	16.466 M
1961	TORNADO	IA	15.475 M
1961	TORNADO	KS	10.71 M
1961	TORNADO	AR	9.38 M
1961	TORNADO	TX	6.1926 M
1961	TORNADO	PA	5.3275 M
1961	TORNADO	LA	5.0102 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1960	TORNADO	KS	28.836 M
1960	TORNADO	OK	26.909 M
1960	TORNADO	NY	25.275 M
1960	TORNADO	AR	8.8852 M
1960	TORNADO	IL	5.4105 M
1960	TORNADO	TX	5.1828 M
1960	TORNADO	SC	2.575 M
1960	TORNADO	KY	2.5002 M
1960	TORNADO	IA	2.315 M
1960	TORNADO	NE	2.035 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1959	TORNADO	MO	50.868 M
1959	TORNADO	TX	4.6124 M
1959	TORNADO	IA	4.25 M
1959	TORNADO	WI	3.9653 M
1959	TORNADO	FL	3.3062 M
1959	TORNADO	IL	3.2555 M
1959	TORNADO	KY	2.775 M
1959	TORNADO	OK	2.613 M
1959	TORNADO	AR	1.6 M
1959	TORNADO	NE	1.4635 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1958	TORNADO	WI	84.105 M
1958	TORNADO	MS	9.7325 M
1958	TORNADO	IL	9.3206 M
1958	TORNADO	MO	4.2681 M
1958	TORNADO	KS	3.0578 M
1958	TORNADO	TX	2.901 M
1958	TORNADO	MT	2.5028 M
1958	TORNADO	AL	2.06 M
1958	TORNADO	NE	1.7092 M
1958	TORNADO	IN	1.39 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1957	TORNADO	MO	82.226 M
1957	TORNADO	TX	39.953 M
1957	TORNADO	ND	25.11 M
1957	TORNADO	IL	16.556 M
1957	TORNADO	KS	10.851 M
1957	TORNADO	NE	8.7792 M
1957	TORNADO	OK	7.2543 M
1957	TORNADO	AL	7.2233 M
1957	TORNADO	LA	4.9155 M
1957	TORNADO	MS	3.9851 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1956	TORNADO	KS	23.035 M
1956	TORNADO	MI	20.935 M
1956	TORNADO	OK	15.666 M
1956	TORNADO	IL	11.528 M
1956	TORNADO	IN	9.6177 M
1956	TORNADO	WI	5.7525 M
1956	TORNADO	GA	3.0632 M
1956	TORNADO	FL	3.0528 M
1956	TORNADO	KY	2.8575 M
1956	TORNADO	MA	2.8555 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1955	TORNADO	OK	27.008 M
1955	TORNADO	TX	8.6831 M
1955	TORNADO	AL	7.58 M
1955	TORNADO	IL	7.1553 M
1955	TORNADO	GA	5.6132 M
1955	TORNADO	IN	3.935 M
1955	TORNADO	MN	3.5258 M
1955	TORNADO	OH	3.5 M
1955	TORNADO	AR	3.0105 M
1955	TORNADO	MO	2.0634 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1954	TORNADO	GA	35.418 M
1954	TORNADO	OK	14.539 M
1954	TORNADO	NE	8.3677 M
1954	TORNADO	TX	5.8753 M
1954	TORNADO	MS	3.6828 M
1954	TORNADO	IN	2.941 M
1954	TORNADO	NY	2.525 M
1954	TORNADO	AR	2.1778 M
1954	TORNADO	IL	1.575 M
1954	TORNADO	MO	1.3706 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1953	TORNADO	MA	257.5 M
1953	TORNADO	MI	84.056 M
1953	TORNADO	GA	51.15 M
1953	TORNADO	IL	50.275 M
1953	TORNADO	TX	33.514 M
1953	TORNADO	LA	32.705 M
1953	TORNADO	MS	28.338 M
1953	TORNADO	WI	20.025 M
1953	TORNADO	IN	10.051 M
1953	TORNADO	NE	9.2685 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1952	TORNADO	MO	27.878 M
1952	TORNADO	MN	17.6 M
1952	TORNADO	TN	13.202 M
1952	TORNADO	AR	7.2353 M
1952	TORNADO	AL	5.4525 M
1952	TORNADO	GA	3.9025 M
1952	TORNADO	LA	3.8525 M
1952	TORNADO	PA	3.0325 M
1952	TORNADO	IA	2.5 M
1952	TORNADO	WI	2.5 M

YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1951	TORNADO	MN	30.25 M
1951	TORNADO	OH	7.5 M
1951	TORNADO	IN	5.75 M
1951	TORNADO	IL	5.525 M
1951	TORNADO	KS	3.7028 M
1951	TORNADO	TX	3.6328 M
1951	TORNADO	CA	2.5 M
1951	TORNADO	OK	1.301 M
1951	TORNADO	WI	1.3 M
1951	TORNADO	MI	827.5 K

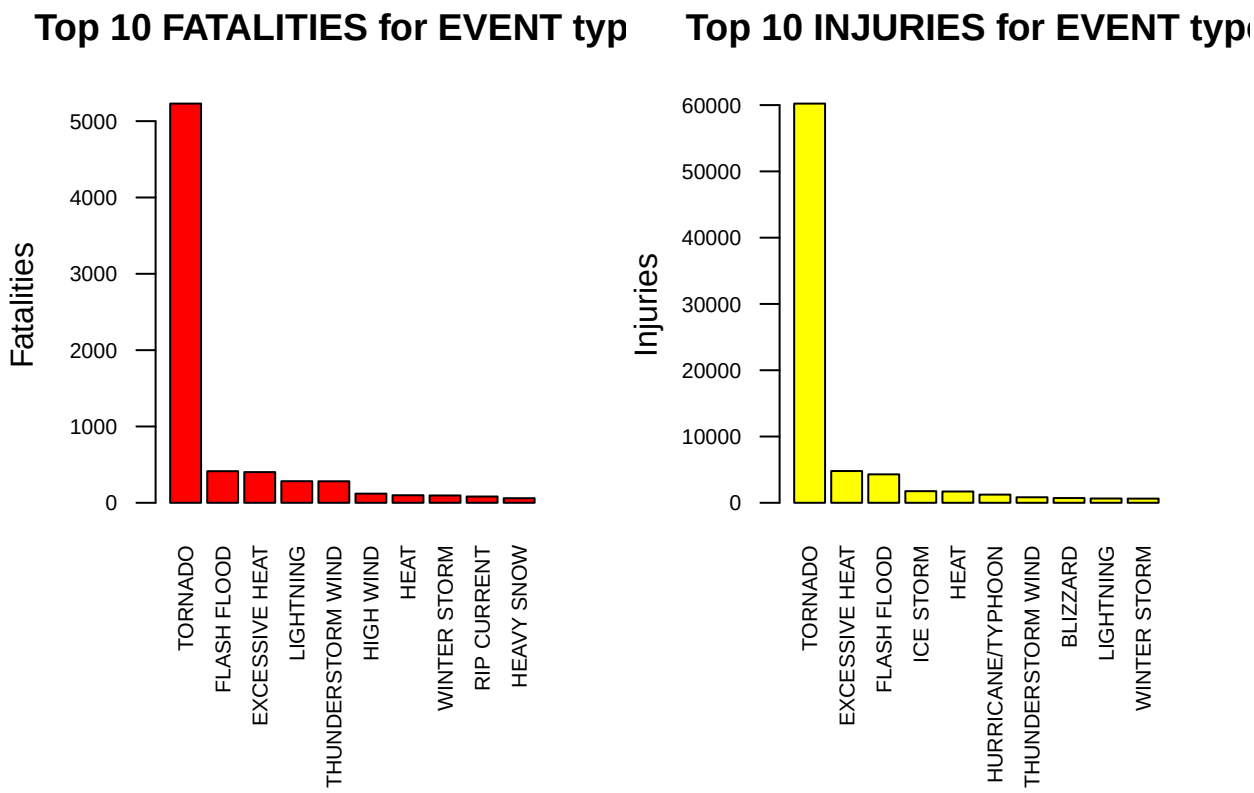
YEAR	EVENT	STATE	PROPERTY DAMAGE COST
1950	TORNADO	IL	5.8775 M
1950	TORNADO	KS	5.0925 M
1950	TORNADO	TX	4.43 M
1950	TORNADO	LA	4.3 M
1950	TORNADO	MO	2.7555 M
1950	TORNADO	NE	2.5775 M
1950	TORNADO	OH	2.525 M
1950	TORNADO	OK	1.7158 M
1950	TORNADO	MS	1.375 M
1950	TORNADO	AR	860.03 K

RESULTS

Barplot for top 10 Storm Data Events that are most harmful with respect to population health in terms of FATALITIES and INJURIES

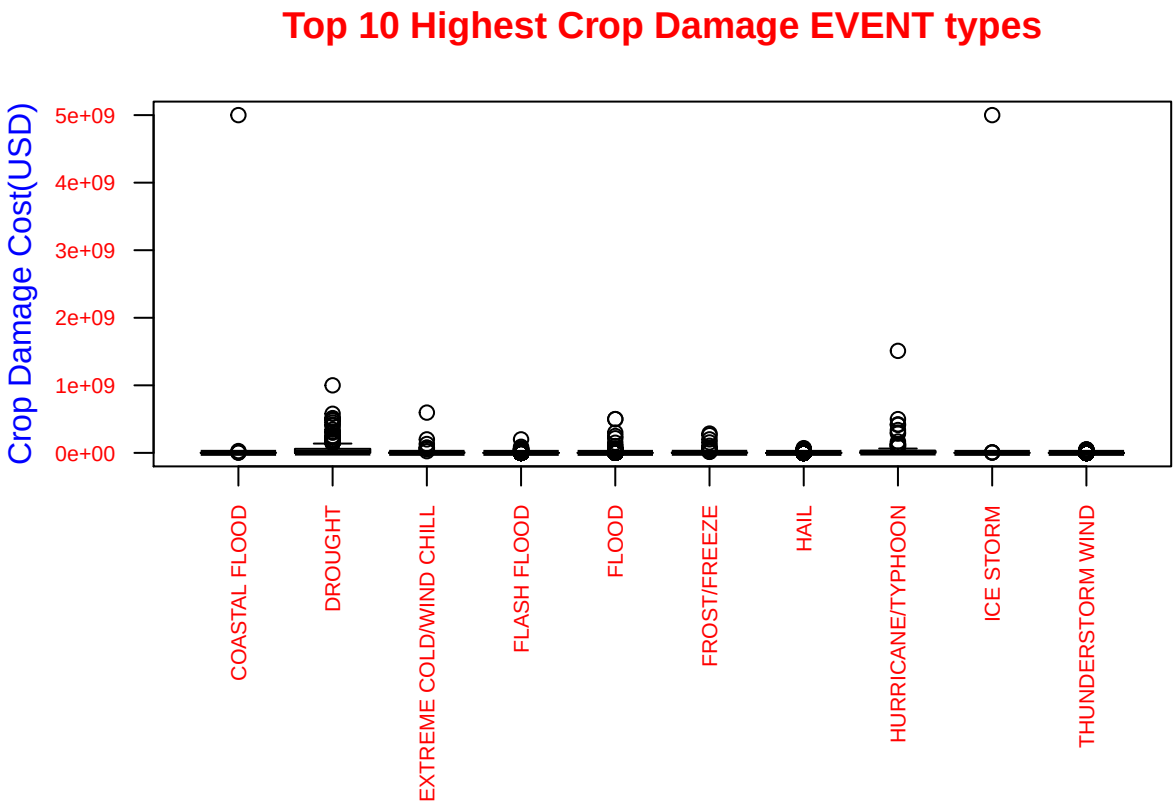
```
par(mfrow = c(1, 2), mar=c(8, 4, 4, 2), las = 2, cex.axis=0.65)
with(StormSubsetHealth4,
{
    fat <- as.table(head(StormSubsetHealth4[,c("FATALITIES")],10))
    dimnames(fat) <- list(head(StormSubsetHealth4[,c("EVENT")],10))
    barplot(fat, main="Top 10 FATALITIES for EVENT types", col="red", ylab="Fatalities")

    inj <- as.table(head(StormSubsetHealth5[,c("INJURIES")],10))
    dimnames(inj) <- list(head(StormSubsetHealth5[,c("EVENT")],10))
    barplot(inj, main="Top 10 INJURIES for EVENT type", col="yellow", , ylab="Injuries")
})
```



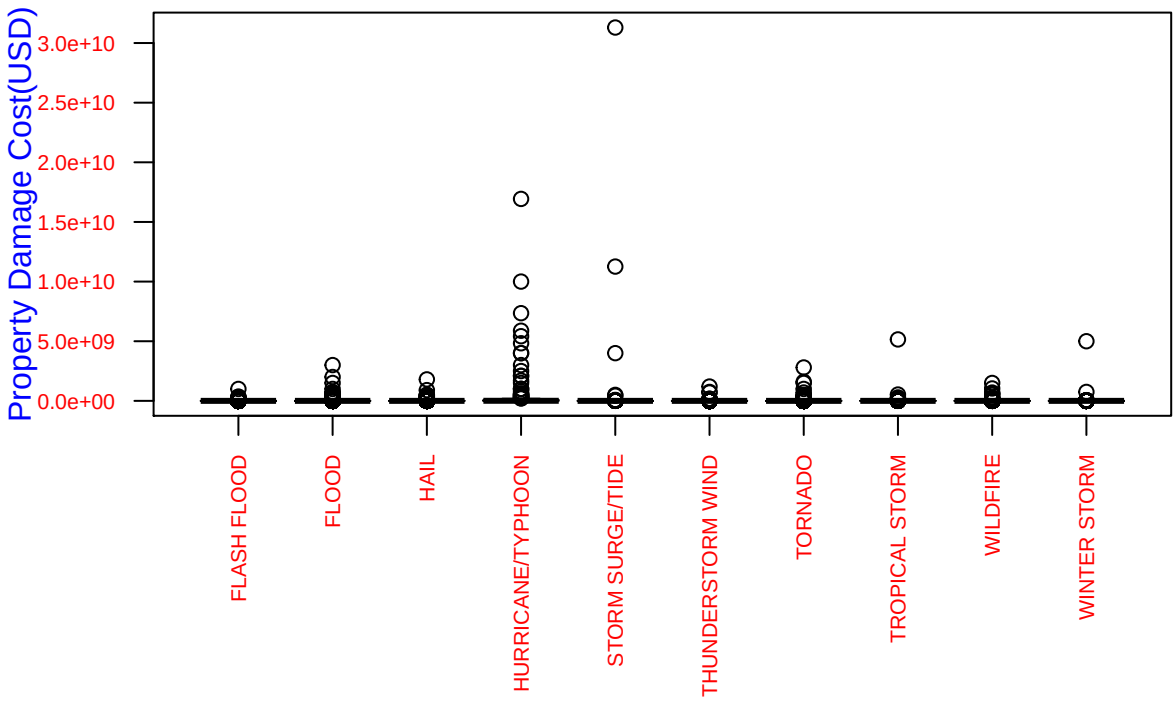
Boxplot for Top 10 Storm Data Events with greatest economic consequences being Crop damage.

```
crop10 <- data.frame(head(StormSubsetCrop2[, "EVENT"],10))
colnames(crop10)<- "EVENT"
par(mfrow=c(1,1), mar=c(9, 4, 4, 2),las = 2, cex.axis=0.65)
boxplot(CROPDMGCOST ~ EVTYPE1, data=subset(StormSubsetCrop,
subset=StormSubsetCrop$EVTYPE1 %in% crop10$EVENT), plot=TRUE,
main="Top 10 Highest Crop Damage EVENT types", ylab="Crop Damage Cost(USD)",
col.axis = "red", col.main="red", col.lab = "blue")
```



Boxplot for Top 10 Storm Data Events with greatest economic consequences being Property damage.

```
prop10 <- data.frame(head(StormSubsetProp2[, "EVENT"],10))
colnames(prop10)<- "EVENT"
par(mfrow=c(1,1), mar=c(8, 4, 4, 2), las = 2, cex.axis=0.65)
boxplot(PROPDMGCOST ~ EVTYPE1, data=subset(StormSubsetProp,
subset=StormSubsetProp$EVTYPE1 %in% prop10$EVENT), plot=TRUE,
main="Top 10 Highest Property Damage EVENT types", ylab="Property Damage Cost(USD)",
col.axis = "red", col.main="red", col.lab = "blue")
```


Top 10 Highest Property Damage EVENT types
Property Damage Cost(USD)
3.0e+10
2.5e+10
2.0e+10
1.5e+10
1.0e+10
5.0e+09
0.0e+00
FLASH FLOOD
FLOOD
HAIL
HURRICANE/TYPHOON
STORM SURGE/TIDE
THUNDERSTORM WIND
TORNADO
TROPICAL STORM
WILDFIRE
WINTER STORM