Strorm Data Affect Analysis: What are the Public Economic and Health Effects?

grldsndrs

```
## [1] "Fri Feb 05 09:02:47 2016"
```

Data Processing: Load Data via *"ProjectTemplate"*

```
> ldData <- process.loadData()
```

```
Loading project configuration

Autoloading helper functions

 Running helper script: controllerGeneratorHelp.R

 Running helper script: helpers.R

 Running helper script: modelGeneratorHelp.R

 Running helper script: viewGeneratorHelp.R

Autoloading packages

 Loading package: reshape

 Loading package: plyr

 Loading package: ggplot2

 Loading package: stringr

 Loading package: lubridate

 Loading package: dplyr

 Loading package: graphics

 Loading package: rmarkdown

 Loading package: knitr

 Loading package: reshape2
```

```
 Loading package: Amelia

 Loading package: xtable

 Loading package: RColorBrewer

 Loading package: scales

 Loading package: outliers

 Loading package: tidyr

Autoloading cache

Autoloading data

Converting data.frames to data.tables

Munging data

 Running preprocessing script: 00-modelQueryHelp.R

 Running preprocessing script: 00-transformationsHelp.R

 Running preprocessing script: 01-A.R

 Running preprocessing script: 10-plotViewHelp.R

$repdata_data_StormData.csv.bz2
$repdata_data_StormData.csv.bz2$tag
[1] "Summary"

$repdata_data_StormData.csv.bz2$out
    STATE__                  BGN_DATE             BGN_TIME
 Min.   : 1.0   5/25/2011 0:00:00:  1202   12:00:00 AM: 10163
 1st Qu.:19.0   4/27/2011 0:00:00:  1193   06:00:00 PM:  7350
 Median :30.0   6/9/2011 0:00:00 :  1030   04:00:00 PM:  7261
 Mean   :31.2   5/30/2004 0:00:00:  1016   05:00:00 PM:  6891
 3rd Qu.:45.0   4/4/2011 0:00:00 :  1009   12:00:00 PM:  6703
 Max.   :95.0   4/2/2006 0:00:00 :   981   03:00:00 PM:  6700
                (Other)          :895866   (Other)    :857229
   TIME_ZONE          COUNTY           COUNTYNAME         STATE
 CST    :547493   Min.   :  0.0   JEFFERSON :  7840   TX     : 83728
 EST    :245558   1st Qu.: 31.0   WASHINGTON:  7603   KS     : 53440
 MST    : 68390   Median : 75.0   JACKSON   :  6660   OK     : 46802
 PST    : 28302   Mean   :100.6   FRANKLIN  :  6256   MO     : 35648
 AST    :  6360   3rd Qu.:131.0   LINCOLN   :  5937   IA     : 31069
 HST    :  2563   Max.   :873.0   MADISON   :  5632   NE     : 30271
 (Other):  3631                   (Other)   :862369   (Other):621339
              EVTYPE         BGN_RANGE           BGN_AZI
```

```
HAIL             :288661   Min.   :   0.000          :547332
TSTM WIND        :219940   1st Qu.:   0.000   N      : 86752
THUNDERSTORM WIND: 82563   Median :   0.000   W      : 38446
TORNADO          : 60652   Mean   :   1.484   S      : 37558
FLASH FLOOD      : 54277   3rd Qu.:   1.000   E      : 33178
FLOOD            : 25326   Max.   :3749.000   NW     : 24041
(Other)          :170878                      (Other):134990
        BGN_LOCATI                  END_DATE             END_TIME
             :287743                     :243411              :238978
COUNTYWIDE   : 19680   4/27/2011 0:00:00:  1214   06:00:00 PM:  9802
Countywide   :   993   5/25/2011 0:00:00:  1196   05:00:00 PM:  8314
SPRINGFIELD  :   843   6/9/2011 0:00:00 :  1021   04:00:00 PM:  8104
SOUTH PORTION:   810   4/4/2011 0:00:00 :  1007   12:00:00 PM:  7483
NORTH PORTION:   784   5/30/2004 0:00:00:   998   11:59:00 PM:  7184
(Other)      :591444   (Other)          :653450   (Other)    :622432
  COUNTY_END COUNTYENDN       END_RANGE           END_AZI
Min.   :0    Mode:logical   Min.   :  0.0000          :724837
1st Qu.:0    NA's:902297    1st Qu.:  0.0000   N      : 28082
Median :0                   Median :  0.0000   S      : 22510
Mean   :0                   Mean   :  0.9862   W      : 20119
3rd Qu.:0                   3rd Qu.:  0.0000   E      : 20047
Max.   :0                   Max.   :925.0000   NE     : 14606
                                               (Other): 72096
          END_LOCATI         LENGTH              WIDTH
               :499225   Min.   :   0.0000   Min.   :   0.000
COUNTYWIDE     : 19731   1st Qu.:   0.0000   1st Qu.:   0.000
SOUTH PORTION  :   833   Median :   0.0000   Median :   0.000
NORTH PORTION  :   780   Mean   :   0.2301   Mean   :   7.503
CENTRAL PORTION:   617   3rd Qu.:   0.0000   3rd Qu.:   0.000
SPRINGFIELD    :   575   Max.   :2315.0000   Max.   :4400.000
(Other)        :380536
      F               MAG            FATALITIES          INJURIES
Min.   :0.0      Min.   :    0.0   Min.   :  0.0000   Min.   :   0.0000
1st Qu.:0.0      1st Qu.:    0.0   1st Qu.:  0.0000   1st Qu.:   0.0000
Median :1.0      Median :   50.0   Median :  0.0000   Median :   0.0000
Mean   :0.9      Mean   :   46.9   Mean   :  0.0168   Mean   :   0.1557
3rd Qu.:1.0      3rd Qu.:   75.0   3rd Qu.:  0.0000   3rd Qu.:   0.0000
Max.   :5.0      Max.   :22000.0   Max.   :583.0000   Max.   :1700.0000
NA's   :843563
   PROPDMG          PROPDMGEXP        CROPDMG          CROPDMGEXP
Min.   :   0.00          :465934   Min.   :  0.000          :618413
1st Qu.:   0.00   K      :424665   1st Qu.:  0.000   K      :281832
Median :   0.00   M      : 11330   Median :  0.000   M      :  1994
Mean   :  12.06   0      :   216   Mean   :  1.527   k      :    21
3rd Qu.:   0.50   B      :    40   3rd Qu.:  0.000   0      :    19
Max.   :5000.00   5      :    28   Max.   :990.000   B      :     9
                  (Other):    84                     (Other):     9
     WFO                                       STATEOFFIC
       :142069                                       :248769
OUN    : 17393   TEXAS, North                        : 12193
JAN    : 13889   ARKANSAS, Central and North Central: 11738
LWX    : 13174   IOWA, Central                       : 11345
PHI    : 12551   KANSAS, Southwest                   : 11212
TSA    : 12483   GEORGIA, North and Central          : 11120
```

```
 (Other):690738   (Other)                              :595920


 GREATER RENO / CARSON CITY / M - GREATER RENO / CARSON CITY / M
 GREATER LAKE TAHOE AREA - GREATER LAKE TAHOE AREA
 JEFFERSON - JEFFERSON
 MADISON - MADISON
 (Other)
    LATITUDE      LONGITUDE        LATITUDE_E     LONGITUDE_
 Min.   :   0   Min.   :-14451   Min.   :   0   Min.   :-14455
 1st Qu.:2802   1st Qu.:  7247   1st Qu.:   0   1st Qu.:     0
 Median :3540   Median :  8707   Median :   0   Median :     0
 Mean   :2875   Mean   :  6940   Mean   :1452   Mean   :  3509
 3rd Qu.:4019   3rd Qu.:  9605   3rd Qu.:3549   3rd Qu.:  8735
 Max.   :9706   Max.   : 17124   Max.   :9706   Max.   :106220
 NA's   :47                      NA's   :40
                                          REMARKS           REFNUM
                                              :287433   Min.   :     1
                                              : 24013   1st Qu.:225575
 Trees down.\n                                :  1110   Median :451149
 Several trees were blown down.\n             :   568   Mean   :451149
 Trees were downed.\n                         :   446   3rd Qu.:676723
 Large trees and power lines were blown down.\n:   432   Max.   :902297
 (Other)                                      :588295


$repdata_data_StormData.csv.bz2
$repdata_data_StormData.csv.bz2$tag
[1] "Structure"

$repdata_data_StormData.csv.bz2$out
 [1] "Classes 'data.table' and 'data.frame':\t902297 obs. of  37 variables:"
 [2] " $ STATE__    : num  1 1 1 1 1 1 1 1 1 1 ..."
 [3] " $ BGN_DATE   : Factor w/ 16335 levels \"1/1/1966 0:00:00\",..: 6523 6523 4242 11116 2224 2224 226
 [4] " $ BGN_TIME   : Factor w/ 3608 levels \"00:00:00 AM\",..: 272 287 2705 1683 2584 3186 242 1683 318
 [5] " $ TIME_ZONE  : Factor w/ 22 levels \"ADT\",\"AKS\",\"AST\",..: 7 7 7 7 7 7 7 7 7 7 ..."
 [6] " $ COUNTY     : num  97 3 57 89 43 77 9 123 125 57 ..."
 [7] " $ COUNTYNAME: Factor w/ 29601 levels \"\",\"5NM E OF MACKINAC BRIDGE TO PRESQUE ISLE LT MI\",..:
 [8] " $ STATE      : Factor w/ 72 levels \"AK\",\"AL\",\"AM\",..: 2 2 2 2 2 2 2 2 2 2 ..."
 [9] " $ EVTYPE     : Factor w/ 985 levels \"   HIGH SURF ADVISORY\",..: 834 834 834 834 834 834 834 834
[10] " $ BGN_RANGE : num  0 0 0 0 0 0 0 0 0 0 ..."
[11] " $ BGN_AZI   : Factor w/ 35 levels \"\",\"  N\",\" NW\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[12] " $ BGN_LOCATI: Factor w/ 54429 levels \"\",\"- 1 N Albion\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[13] " $ END_DATE  : Factor w/ 6663 levels \"\",\"1/1/1993 0:00:00\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[14] " $ END_TIME  : Factor w/ 3647 levels \"\",\" 0900CST\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[15] " $ COUNTY_END: num  0 0 0 0 0 0 0 0 0 0 ..."
[16] " $ COUNTYENDN: logi  NA NA NA NA NA NA ..."
[17] " $ END_RANGE : num  0 0 0 0 0 0 0 0 0 0 ..."
[18] " $ END_AZI   : Factor w/ 24 levels \"\",\"E\",\"ENE\",\"ESE\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[19] " $ END_LOCATI: Factor w/ 34506 levels \"\",\"- .5 NNW\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[20] " $ LENGTH    : num  14 2 0.1 0 0 1.5 1.5 0 3.3 2.3 ..."
[21] " $ WIDTH     : num  100 150 123 100 150 177 33 33 100 100 ..."
[22] " $ F         : int  3 2 2 2 2 2 2 1 3 3 ..."
[23] " $ MAG       : num  0 0 0 0 0 0 0 0 0 0 ..."
```

```
[24] " $ FATALITIES: num  0 0 0 0 0 0 0 0 1 0 ..."
[25] " $ INJURIES  : num  15 0 2 2 2 6 1 0 14 0 ..."
[26] " $ PROPDMG   : num  25 2.5 25 2.5 2.5 2.5 2.5 2.5 25 25 ..."
[27] " $ PROPDMGEXP: Factor w/ 19 levels \"\",\"-\",\"?\",\"+\",..: 17 17 17 17 17 17 17 17 17 17 ..."
[28] " $ CROPDMG   : num  0 0 0 0 0 0 0 0 0 0 ..."
[29] " $ CROPDMGEXP: Factor w/ 9 levels \"\",\"?\",\"0\",\"2\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[30] " $ WFO       : Factor w/ 542 levels \"\",\" CI\",\"$AC\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[31] " $ STATEOFFIC: Factor w/ 250 levels \"\",\"ALABAMA, Central\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[32] " $ ZONENAMES : Factor w/ 25112 levels \"\",\"
[33] " $ LATITUDE  : num  3040 3042 3340 3458 3412 ..."
[34] " $ LONGITUDE : num  8812 8755 8742 8626 8642 ..."
[35] " $ LATITUDE_E: num  3051 0 0 0 0 ..."
[36] " $ LONGITUDE_: num  8806 0 0 0 0 ..."
[37] " $ REMARKS   : Factor w/ 436781 levels \"\",\"-2 at Deer Park\\n\",..: 1 1 1 1 1 1 1 1 1 1 ..."
[38] " $ REFNUM    : num  1 2 3 4 5 6 7 8 9 10 ..."
[39] " - attr(*, \".internal.selfref\")=<externalptr> "
```

Based on the summary above I will use the *make.names* funcion to tidy up the names

```
$repdata_data_StormData.csv.bz2
$repdata_data_StormData.csv.bz2$tag
[1] "Clean Names"

$repdata_data_StormData.csv.bz2$out
 [1] "STATE__"    "BGN_DATE"   "BGN_TIME"   "TIME_ZONE"  "COUNTY"
 [6] "COUNTYNAME" "STATE"      "EVTYPE"     "BGN_RANGE"  "BGN_AZI"
[11] "BGN_LOCATI" "END_DATE"   "END_TIME"   "COUNTY_END" "COUNTYENDN"
[16] "END_RANGE"  "END_AZI"    "END_LOCATI" "LENGTH"     "WIDTH"
[21] "F"          "MAG"        "FATALITIES" "INJURIES"   "PROPDMG"
[26] "PROPDMGEXP" "CROPDMG"    "CROPDMGEXP" "WFO"        "STATEOFFIC"
[31] "ZONENAMES"  "LATITUDE"   "LONGITUDE"  "LATITUDE_E" "LONGITUDE_"
[36] "REMARKS"    "REFNUM"
```

The Damage variables are transformed into a common scale dollar converting the code into and actual exponent that I use to scale the units

```
> rawData<-repdata.data.StormData
> rawData$PROPDMGEXP <- as.character(rawData$PROPDMGEXP)
> rawData$PROPDMGEXP[rawData$PROPDMGEXP %in% c("","?","+","-","1")]<-1
> rawData$PROPDMGEXP[rawData$PROPDMGEXP %in% c("h","H")]<-2
> rawData$PROPDMGEXP[rawData$PROPDMGEXP %in% c("k","K")]<-3
> rawData$PROPDMGEXP[rawData$PROPDMGEXP %in% c("m","M")]<-6
> rawData$PROPDMGEXP[rawData$PROPDMGEXP %in% c("b","B")]<-9
> rawData$PROPDMGEXP[rawData$PROPDMGEXP %in% c("0")]<-0
> rawData$CROPDMGEXP <- as.character(rawData$CROPDMGEXP)
> rawData$CROPDMGEXP[rawData$CROPDMGEXP %in% c("","?","+","-","1")]<-1
> rawData$CROPDMGEXP[rawData$CROPDMGEXP %in% c("h","H")]<-2
> rawData$CROPDMGEXP[rawData$CROPDMGEXP %in% c("k","K")]<-3
> rawData$CROPDMGEXP[rawData$CROPDMGEXP %in% c("m","M")]<-6
> rawData$CROPDMGEXP[rawData$CROPDMGEXP %in% c("b","B")]<-9
> rawData$CROPDMGEXP[rawData$CROPDMGEXP %in% c("0")]<-0
> rawData$PROPDMGEXP <- as.numeric(rawData$PROPDMGEXP)
```

```
> rawData$CROPDMGEXP <- as.numeric(rawData$CROPDMGEXP)
>
> process.makeDataFrameRepository(rawData)
```

```
> # Use the dfContext to get the current data frame.
> # Pass it to mutate to process columns.
> # Pass the result to dfContext to set the current data frame
> process.dfContext(
+   mutate(process.dfContext(),
+          EVTYPE = str_trim(EVTYPE, side = "both")
+          )
+ )
```

```
setting model data
```

```
> # Use the dfContext to get the current data frame.
> # Pass it to mutate to process columns.
> # Pass the result to dfContext to set the current data frame
> process.dfContext(
+     mutate(process.dfContext(),
+            CROPDMG = CROPDMG*10^CROPDMGEXP,
+            PROPDMG = PROPDMG*10^PROPDMGEXP
+       )%>%
+       select(-CROPDMGEXP,-PROPDMGEXP)
+     )
```

```
setting model data
```

Separate the EVTYPE variables to common antecedents

```
> # Use the dfContext to get the current data frame.
> # Pass it to mutate to process columns.
> # Pass the result to dfContext to set the current data frame
> process.dfContext(
+   separate(
+     process.dfContext(),
+     sep = "/",
+     into = c("EVTYPE", "EVTYPEFwSlash"),
+     col = EVTYPE,
+     convert = FALSE,
+     extra = "merge",
+     fill = "right"
+   ) %>%
+     separate(
+       into = c("EVTYPE", "EVTYPE.1", "EVTYPE.2", "EVTYPE.3", "EVTYPE.4"),
+       col = EVTYPE,
+       convert = FALSE,
+       extra = "merge",
+       fill = "right"
+     )
+ )
```

```
setting model data
```

```
> # Use the dfContext to get the current data frame.
> # Pass it to mutate to process columns.
> # Pass the result to dfContext to set the current data frame
> process.dfContext(
+   mutate(process.dfContext(),
+          EVTYPE = str_trim(EVTYPE, side = "both")
+   )
+ )
```

```
setting model data
```

The variables are reordered according to the role in the analysis. Fixed values, such as location related variables, are the first coloums. The measured values follow.

```
setting model data
```

```
$tag
[1] "Selected Names"

$out
   STATE           BGN_DATE END_DATE  EVTYPE EVTYPE.1 EVTYPE.2 EVTYPE.3
1:    AL  4/18/1950 0:00:00          TORNADO       NA       NA       NA
2:    AL  4/18/1950 0:00:00          TORNADO       NA       NA       NA
3:    AL  2/20/1951 0:00:00          TORNADO       NA       NA       NA
4:    AL   6/8/1951 0:00:00          TORNADO       NA       NA       NA
5:    AL 11/15/1951 0:00:00          TORNADO       NA       NA       NA
6:    AL 11/15/1951 0:00:00          TORNADO       NA       NA       NA
   EVTYPE.4 F MAG FATALITIES INJURIES PROPDMG CROPDMG
1:       NA 3   0          0       15   25000       0
2:       NA 2   0          0        0    2500       0
3:       NA 2   0          0        2   25000       0
4:       NA 2   0          0        2    2500       0
5:       NA 2   0          0        2    2500       0
6:       NA 2   0          0        6    2500       0
```

The *F* and *MAG* variables may be suited for use as a scale in a later plot. I have given them a numeric class in anticipation. The other variables are cast as would be expected.

```
$tag
[1] "Selected Variable Classes"

$out

          BGN_DATE CROPDMG END_DATE EVTYPE EVTYPE.1 EVTYPE.2 EVTYPE.3
  Factor         0       0        0      1        1        1        1
  Numeric        0       1        0      0        0        0        0
  POSIXct        1       0        1      0        0        0        0

          EVTYPE.4 F FATALITIES INJURIES MAG PROPDMG STATE
```

```
  Factor         1 0          0        0   0       0     1
  Numeric        0 1          1        1   1       1     0
  POSIXct        0 0          0        0   0       0     0

$tag
[1] "Summary"

$out
     STATE                     BGN_DATE                   END_DATE
 TX     : 83728   5/25/2011 0:00:00:  1202                    :243411
 KS     : 53440   4/27/2011 0:00:00:  1193   4/27/2011 0:00:00:  1214
 OK     : 46802   6/9/2011 0:00:00 :  1030   5/25/2011 0:00:00:  1196
 MO     : 35648   5/30/2004 0:00:00:  1016   6/9/2011 0:00:00 :  1021
 IA     : 31069   4/4/2011 0:00:00 :  1009   4/4/2011 0:00:00 :  1007
 NE     : 30271   4/2/2006 0:00:00 :   981   5/30/2004 0:00:00:   998
 (Other):621339   (Other)          :895866   (Other)          :653450
    EVTYPE            EVTYPE.1           EVTYPE.2
 Length:902297      Length:902297      Length:902297
 Class :character   Class :character   Class :character
 Mode  :character   Mode  :character   Mode  :character




   EVTYPE.3           EVTYPE.4               F               MAG
 Length:902297      Length:902297      Min.   :0.0      Min.   :    0.0
 Class :character   Class :character   1st Qu.:0.0      1st Qu.:    0.0
 Mode  :character   Mode  :character   Median :1.0      Median :   50.0
                                       Mean   :0.9      Mean   :   46.9
                                       3rd Qu.:1.0      3rd Qu.:   75.0
                                       Max.   :5.0      Max.   :22000.0
                                       NA's   :843563
   FATALITIES          INJURIES           PROPDMG
 Min.   :  0.0000   Min.   :   0.0000   Min.   :0.000e+00
 1st Qu.:  0.0000   1st Qu.:   0.0000   1st Qu.:0.000e+00
 Median :  0.0000   Median :   0.0000   Median :0.000e+00
 Mean   :  0.0168   Mean   :   0.1557   Mean   :4.746e+05
 3rd Qu.:  0.0000   3rd Qu.:   0.0000   3rd Qu.:5.000e+02
 Max.   :583.0000   Max.   :1700.0000   Max.   :1.150e+11

    CROPDMG
 Min.   :0.000e+00
 1st Qu.:0.000e+00
 Median :0.000e+00
 Mean   :5.442e+04
 3rd Qu.:0.000e+00
 Max.   :5.000e+09
```

```
> t<-process.dfContext()
> t[grep("^ABNOR",t$EVTYPE),"EVTYPE"]<- "ABNORMAL"
> t[grep("^AVAL",t$EVTYPE),"EVTYPE"]<- "AVALANCHE"
> t[grep("^BLOW",t$EVTYPE),"EVTYPE"]<- "BLOW/ING"
> t[grep("^COASTALFLOOD",t$EVTYPE),"EVTYPE"]<- "COASTAL FLOOD"
```

```
> t[grep("^COASTALSTORM",t$EVTYPE),"EVTYPE"]<- "COASTAL STORM"
> t[grep("^DRY",t$EVTYPE),"EVTYPE"]<- "DRY"
> t[grep("^EXCESS",t$EVTYPE),"EVTYPE"]<- "EXCESSIVE"
> t[grep("^EXTREM",t$EVTYPE),"EVTYPE"]<- "EXTREME"
> t[grep("^FLOOD",t$EVTYPE),"EVTYPE"]<- "FLOOD/ING/S"
> t[grep("^FREEZ",t$EVTYPE),"EVTYPE"]<- "FREEZ/ING"
> t[grep("^FUNNEL",t$EVTYPE),"EVTYPE"]<- "FUNNEL/S"
> t[grep("^HAILSTORM",t$EVTYPE),"EVTYPE"]<- "HAIL"
> t[grep("^HAIL STORM",t$EVTYPE),"EVTYPE"]<- "HAIL"
> t[grep("^HEAT",t$EVTYPE),"EVTYPE"]<- "HEAT"
> t[grep("^HOT",t$EVTYPE),"EVTYPE"]<- "HEAT"
> t[grep("^HYP",t$EVTYPE),"EVTYPE"]<- "HYPOTHERMIA"
> t[grep("^ICESTORM",t$EVTYPE),"EVTYPE"]<- "ICE"
> t[grep("^ICY",t$EVTYPE),"EVTYPE"]<- "ICE"
> t[grep("^LANDSLIDE",t$EVTYPE),"EVTYPE"]<- "LANDSLIDE"
> t[grep("^LIGHTING",t$EVTYPE),"EVTYPE"]<- "LIGHTNING"
> t[grep("^LIGHNTNING",t$EVTYPE),"EVTYPE"]<- "LIGHTNING"
> t[grep("^LIGHTNING",t$EVTYPE),"EVTYPE"]<- "LIGHTNING"
> t[grep("^LOCAL",t$EVTYPE),"EVTYPE"]<- "LOCAL"
> t[grep("^MUDSLIDE",t$EVTYPE),"EVTYPE"]<- "MUDSLIDE"
> t[grep("^PROLONG",t$EVTYPE),"EVTYPE"]<- "PROLONGED"
> t[grep("^RAIN",t$EVTYPE),"EVTYPE"]<- "RAIN"
> t[grep("^SNOWFALL",t$EVTYPE),"EVTYPE"]<- "SNOW FALL"
> t[grep("^SNOWMELT",t$EVTYPE),"EVTYPE"]<- "SNOW MELT"
> t[grep("^SNOWSTORM",t$EVTYPE),"EVTYPE"]<- "SNOW"
> t[grep("^MUDSLIDE",t$EVTYPE),"EVTYPE"]<- "MUDSLIDE"
> t[grep("^THU",t$EVTYPE),"EVTYPE"]<- "THUNDER STORM"
> t[grep("^TORN",t$EVTYPE),"EVTYPE"]<- "TORNADO"
> t[grep("^TSTM",t$EVTYPE),"EVTYPE"]<- "TSUNAMI"
> t[grep("^TUNDER",t$EVTYPE),"EVTYPE"]<- "THUNDER STORM"
> t[grep("^UN",t$EVTYPE),"EVTYPE"]<- "UNUSUAL"
> t[grep("^VOG",t$EVTYPE),"EVTYPE"]<- "FOG"
> t[grep("^WATERSPOUT",t$EVTYPE),"EVTYPE"]<- "WATER SPOUT"
> t[grep("^WAYERSPOUT",t$EVTYPE),"EVTYPE"]<- "WATER SPOUT"
> t[grep("^WHIRLWIND",t$EVTYPE),"EVTYPE"]<- "WHIRL WIND"
> t[grep("^WILDFIRE",t$EVTYPE),"EVTYPE"]<- "WILD FIRE"
> t[grep("^WIND",t$EVTYPE),"EVTYPE"]<- "WIND"
> t[grep("^WINT",t$EVTYPE),"EVTYPE"]<- "WINTER"
> t[grep("^DUSTSTORM",t$EVTYPE),"EVTYPE"]<- "DUST STORM"
> t[grep("^MUDSLIDE",t$EVTYPE),"EVTYPE"]<- "MUD SLIDE"
> t[grep("^MUD SLIDE",t$EVTYPE),"EVTYPE"]<- "MUD SLIDE"
>
> t$EVTYPE.1 <- toupper(t$EVTYPE.1)
> t$EVTYPE.2 <- toupper(t$EVTYPE.2)
>
> t[grep("^SNOWFALL",t$EVTYPE.1),"EVTYPE.1"]<- "SNOW"
> t[grep("^EROS",t$EVTYPE.1),"EVTYPE.1"]<- "EROSION"
> t[grep("^DEVEL",t$EVTYPE.1),"EVTYPE.1"]<- "DEVIL"
> t[grep("^Snow",t$EVTYPE.1),"EVTYPE.1"]<- "SNOW"
> t[grep("^[fF][lL]",t$EVTYPE.1),"EVTYPE.1"]<- "FLOOD"
> t[grep("^CLOUD",t$EVTYPE.1),"EVTYPE.1"]<- "CLOUD"
> t[grep("^RAINFALL",t$EVTYPE.1),"EVTYPE.1"]<- "RAIN"
> t[grep("^RAINS",t$EVTYPE.1),"EVTYPE.1"]<- "RAIN"
```

```
> t[grep("^SHOWERS",t$EVTYPE.1),"EVTYPE.1"]<- "RAIN"
> t[grep("^SHOWER",t$EVTYPE.1),"EVTYPE.1"]<- "RAIN"
> t[grep("^WIND",t$EVTYPE.1),"EVTYPE.1"]<- "WIND"
> t[grep("^PRECIPATATION ",t$EVTYPE.1),"EVTYPE.1"]<- "PRECIPITATION "
> t[grep("^SNOWPACK",t$EVTYPE.1),"EVTYPE.1"]<- "SNOW"
> t[grep("^SWELLS",t$EVTYPE.1),"EVTYPE.1"]<- "SURF"
> t[grep("^SEAS",t$EVTYPE.1),"EVTYPE.1"]<- "TIDES"
> t[grep("^TEMPERATURE",t$EVTYPE.1),"EVTYPE.1"]<- "TEMPERATURE"
> t[grep("^WATER",t$EVTYPE.1),"EVTYPE.1"]<- "TIDES"
> t[grep("^WAVES",t$EVTYPE.1),"EVTYPE.1"]<- "SURF"
> t[grep("^TIDES",t$EVTYPE.1),"EVTYPE.1"]<- "SURF"
> t[grep("^SNOWFALL",t$EVTYPE.1),"EVTYPE.1"]<- "SNOW"
> t[grep("^PRECIP",t$EVTYPE.1),"EVTYPE.1"]<- "RAIN"
> t[grep("^SNOWFALL",t$EVTYPE.1),"EVTYPE.1"]<- "SNOW"
> t[grep("^SNOWFALL",t$EVTYPE.1),"EVTYPE.1"]<- "SNOW"
> t[grep("^SNOWFALL",t$EVTYPE.1),"EVTYPE.1"]<- "SNOW"
> t[grep("^DRYNESS",t$EVTYPE.1),"EVTYPE.1"]<- "DRY"
> t[grep("^Warm",t$EVTYPE.1),"EVTYPE.1"]<- "HEAT"
> t[grep("^CURRENT",t$EVTYPE.1),"EVTYPE.1"]<- "CURRENT"
> t[grep("^THU",t$EVTYPE.1),"EVTYPE.1"]<- "THUNDER STORM"
> t[grep("^WIND",t$EVTYPE.1),"EVTYPE.1"]<- "WIND"
> t[grep("^MICOBURST",t$EVTYPE.1),"EVTYPE.1"]<- "MICROBURST"
> t[grep("^FIRE",t$EVTYPE.1),"EVTYPE.1"]<- "FIRE"
> t[grep("^STORM",t$EVTYPE.1),"EVTYPE.1"]<- "STORM"
> t[grep("^SLIDE",t$EVTYPE.1),"EVTYPE.1"]<- "SLIDE"
>
> t[grep("^STORM",t$EVTYPE.1),"EVTYPE.1"]<- "STORM"
>
>
> sufficentDescription <- list(
+   "AVALANCHE",
+   "BLIZZARD",
+   "DUSTSTORM",
+   "FLOOD/ING/S",
+   "HAIL STORM/S",
+   "ICE STORM",
+   "LANDSLIDE",
+   "LIGHTNING",
+   "RAIN",
+   "SNOW FALL",
+   "SNOW MELT",
+   "SNOW STORM",
+   "TSUNAMI",
+   "THUNDER STORM",
+   "TYPHOON",
+   "WATERSPOUT",
+   "VOLCANIC",
+   "TORNADO",
+   "HEAT",
+   "WIND",
+   "HAIL",
+   "COLD",
+   "ICE",
```

```
+   "HURRICANE",
+   "SNOW",
+   "SUMMARY",
+   "TROPICAL STORM",
+   "HIGH WIND",
+   "HIGH SURF",
+   "HEAVY SNOW",
+   "HEAVY RAIN",
+   "HEAVY SURF",
+   "EXTREME WIND",
+   "DUST DEVIL",
+   "DRY MICROBURST",
+   "FLASH FLOOD",
+   "COASTAL FLOOD",
+   "COASTAL FLOOD")
>
> sufficentDescription.1 <- list(
+   "WIND",
+   "MICROBURST",
+   "STORM,
+   DEVIL")
>
> newEVTYPE <-
+   mapply(function(evt,evt.1,evt.2){
+     ifelse(
+       test = evt %in% sufficentDescription,
+       yes = evt,
+       no = paste(
+         evt,
+         ifelse(
+           test = is.na(evt.1),
+           yes = "",
+           no = evt.1
+         ),
+         ifelse(
+           test = is.na(evt.2) |evt.1 %in% sufficentDescription.1,
+           yes = "",
+           no = evt.2
+         ),
+       sep = " ")
+     )
+   },t$EVTYPE,t$EVTYPE.1,t$EVTYPE.2,SIMPLIFY = TRUE)
> t$EVTYPE <- newEVTYPE
> process.dfContext(t%>%select(-c(EVTYPE.1,EVTYPE.2,EVTYPE.3,EVTYPE.4)))
```

```
setting model data
```

Generaly there are very few missing values in the data set. The F variable by far contains the most and is to be expected as these events are rare.

```
> analyze.missing.Plot(process.dfContext())
```

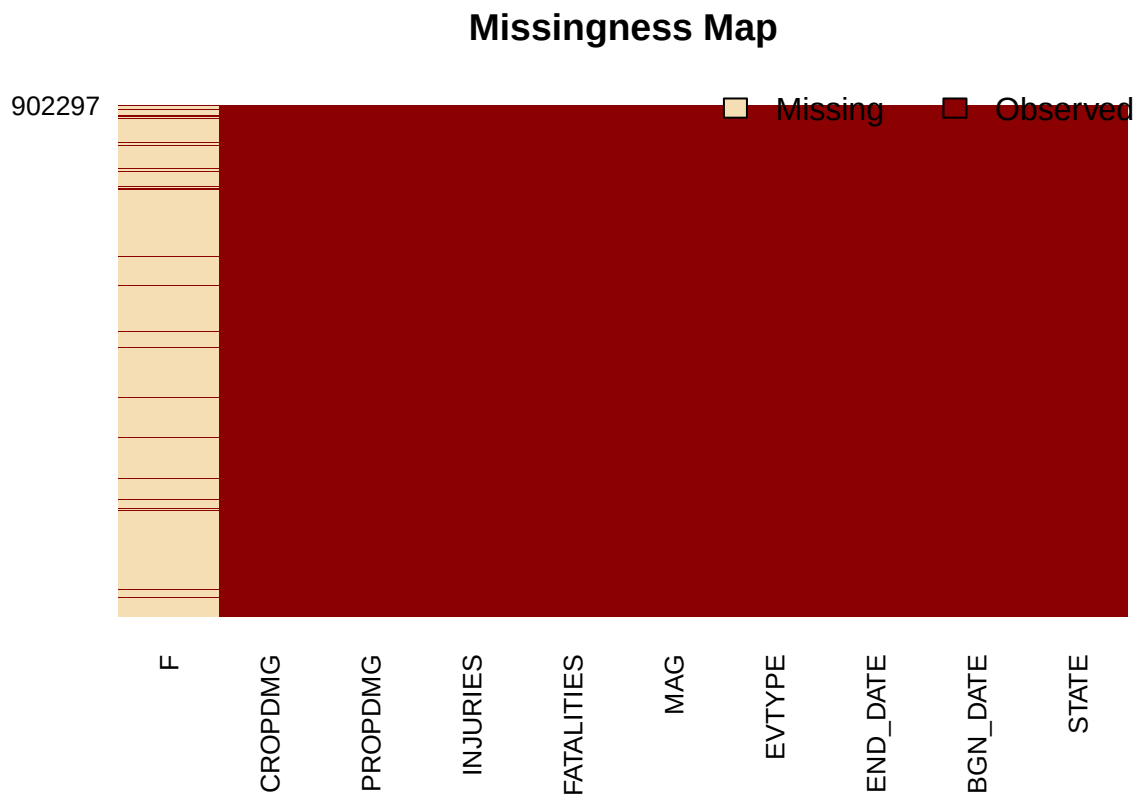


Table: Table showing the Cost in dollars vs Event Type for all data

EVTYPE	Fatlaities	Injuries	PropDmg	CropDmg
	0	0	5.000000e+03	0
ABNORMAL DRY	0	0	0.000000e+00	0
ABNORMAL WARMTH	0	0	0.000000e+00	0
ABNORMAL WET	0	0	0.000000e+00	0
ACCUMULATED SNOW	0	0	0.000000e+00	0
AGRICULTURAL FREEZE	0	0	0.000000e+00	28820000
APACHE COUNTY	0	0	5.000000e+03	0
ASTRONOMICAL HIGH TIDE	0	0	9.425000e+06	0
ASTRONOMICAL LOW TIDE	0	0	3.200000e+05	0
AVALANCHE	225	170	3.721800e+06	0
BEACH EROSION	0	0	1.000000e+05	0
BEACH FLOOD	0	0	0.000000e+00	0
BELOW NORMAL PRECIPITATION	0	0	0.000000e+00	0
BITTER WIND	0	0	0.000000e+00	0
BLACK ICE	1	24	0.000000e+00	0
BLIZZARD	101	805	6.597140e+08	112060000
BLOW/ING DUST	0	0	2.000000e+04	0
BLOW/ING OUT TIDE	0	0	0.000000e+00	0
BLOW/ING OUT TIDES	0	0	0.000000e+00	0
BLOW/ING SNOW	2	14	1.500000e+04	0

BLOW/ING SNOW EXTREME	0	0	0.000000e+00	0
BREAKUP FLOOD	0	0	2.000000e+02	0
BRUSH FIRE	0	2	5.500000e+04	0
COASTAL	0	0	0.000000e+00	0
COASTAL EROSION	0	0	7.660000e+05	0
COASTAL FLOOD	0	0	0.000000e+00	0
COASTAL FLOOD	6	7	4.275661e+08	56000
COASTAL STORM	3	2	5.000000e+04	0
COASTAL STORM	1	0	0.000000e+00	0
COASTAL SURGE	0	0	5.000000e+05	0
COLD	158	60	2.544050e+06	66600050
COOL AND WET	0	0	0.000000e+00	5000000
COOL SPELL	0	0	0.000000e+00	0
CSTL FLOOD	0	0	0.000000e+00	0
DAM BREAK	0	0	1.002000e+06	0
DAM FAILURE	0	0	0.000000e+00	0
DAMAGING FREEZE	0	0	8.000000e+06	296230000
DEEP HAIL	0	0	0.000000e+00	0
DENSE FOG	18	342	9.674000e+06	0
DENSE SMOKE	0	0	1.000000e+05	0
DOWNBURST	0	0	2.000000e+03	0
DOWNBURST WIND	0	0	0.000000e+00	0
DRIEST MONTH	0	0	0.000000e+00	0
DRIFTING SNOW	0	0	0.000000e+00	0
DROUGHT	2	4	1.046106e+09	13972571780
DROWNING	1	0	0.000000e+00	0
DRY	0	0	0.000000e+00	0
DRY CONDITIONS	0	0	0.000000e+00	0
DRY HOT WEATHER	0	0	0.000000e+00	0
DRY MICROBURST	3	28	6.732600e+06	15000
DRY MIRCOBURST WINDS	0	1	0.000000e+00	0
DRY PATTERN	0	0	0.000000e+00	0
DRY SPELL	0	0	0.000000e+00	0
DRY WEATHER	0	0	0.000000e+00	0
DUST DEVIL	2	43	7.186300e+05	0
DUST DEVIL WATERSPOUT	0	0	5.000000e+02	0
DUST STORM	22	440	5.599000e+06	3600000
DUST STORM	0	0	0.000000e+00	0
EARLY FREEZE	0	0	0.000000e+00	0
EARLY FROST	0	0	0.000000e+00	42000000
EARLY RAIN	0	0	0.000000e+00	0
EARLY SNOW	0	0	0.000000e+00	0
EROSION	0	0	1.620000e+07	0
EXCESSIVE	0	0	0.000000e+00	0
EXCESSIVE COLD	0	0	0.000000e+00	0
EXCESSIVE DRY	0	0	0.000000e+00	0
EXCESSIVE HEAT	1903	6525	7.753700e+06	492402000
EXCESSIVE RAIN	2	21	0.000000e+00	0
EXCESSIVE SNOW	0	2	1.935000e+06	0
EXCESSIVE WETNESS	0	0	0.000000e+00	142000000
EXTENDED COLD	1	0	1.000000e+05	0
EXTREME	0	0	0.000000e+00	0
EXTREME COLD	287	255	7.638540e+07	1313023000
EXTREME HEAT	96	155	1.150000e+05	5000000

EXTREME WET	0	0	0.000000e+00	0
EXTREME WIND	17	5	8.050000e+05	17000000
FALLING SNOW	1	1	0.000000e+00	0
FIRST FROST	0	0	0.000000e+00	0
FIRST SNOW	0	0	0.000000e+00	0
FLASH FLOOD	1018	1785	1.741442e+10	1437163150
FLASH FLOOD FROM	0	0	2.500000e+05	0
FLASH FLOOD HEAVY	0	0	1.200000e+04	0
FLASH FLOOD LANDSLIDES	0	0	5.000000e+04	0
FLASH FLOOD WINDS	0	0	4.100000e+00	0
FLOOD/ING/S	495	6806	1.449581e+11	5878707950
FOG	62	734	1.315550e+07	0
FOG AND COLD	1	1	0.000000e+00	0
FOREST FIRE	0	0	5.000000e+06	500000
FREEZ/ING	1	0	2.050000e+05	456725000
FREEZ/ING DRIZZLE	2	15	1.450000e+05	0
FREEZ/ING DRIZZLE AND	0	0	0.000000e+00	0
FREEZ/ING FOG	0	0	2.182000e+06	0
FREEZ/ING RAIN	8	23	8.271500e+06	0
FREEZ/ING RAIN AND	0	0	0.000000e+00	0
FREEZ/ING RAIN SLEET	0	0	0.000000e+00	0
FREEZ/ING SPRAY	1	0	0.000000e+00	0
FROST	1	3	1.049500e+07	1160186000
FROST FREEZE	0	0	5.000000e+05	0
FUNNEL/S	0	0	0.000000e+00	0
FUNNEL/S CLOUD	0	3	1.946000e+05	0
GLAZE	7	231	1.000000e+06	0
GLAZE ICE	0	0	3.045000e+05	800
GRADIENT WIND	0	0	3.700000e+04	0
GRASS FIRE	0	0	1.000000e+04	0
GROUND BLIZZARD	0	0	1.000000e+05	0
GUSTNADO	0	0	1.020500e+05	1550
GUSTNADO AND	0	0	0.000000e+00	0
GUSTY LAKE WIND	0	0	0.000000e+00	0
GUSTY THUNDER STORM WIND	0	0	0.000000e+00	0
GUSTY THUNDER STORM WINDS	0	0	0.000000e+00	0
GUSTY WIND	5	12	1.665000e+06	210000
HAIL	15	1361	1.597747e+10	3026094650
HARD FREEZE	0	0	0.000000e+00	13100000
HAZARDOUS SURF	0	1	0.000000e+00	0
HEAT	1118	2494	1.245705e+07	407061500
HEAVY LAKE SNOW	0	0	5.000000e+05	0
HEAVY MIX	0	0	1.305000e+06	0
HEAVY RAIN	98	255	3.230899e+09	795752800
HEAVY RAIN AND	0	0	6.000000e+05	0
HEAVY RAIN EFFECTS	0	0	0.000000e+00	0
HEAVY RAIN URBAN	0	0	0.000000e+00	0
HEAVY SNOW	127	1032	9.506141e+08	134673100
HEAVY SNOW AND	2	0	1.700000e+06	0
HEAVY SNOW ANDBLOWING	0	0	0.000000e+00	0
HEAVY SNOW FREEZING	0	0	0.000000e+00	0
HEAVY SNOW ICE	0	0	0.000000e+00	0
HEAVY SNOW SHOWER	0	2	1.000000e+04	0
HEAVY SNOW SQUALLS	0	0	7.731000e+05	0

HEAVY SURF	53	88	1.132500e+07	0
HEAVY SURF AND	3	0	0.000000e+00	0
HEAVY SURF COASTAL	0	0	5.000000e+04	0
HEAVY WET SNOW	0	0	0.000000e+00	0
HIGH	0	1	0.000000e+00	0
HIGH SURF	114	164	9.048065e+07	0
HIGH SURF ADVISORIES	0	0	0.000000e+00	0
HIGH SURF ADVISORY	0	0	2.000000e+05	0
HIGH TEMPERATURE RECORD	0	0	0.000000e+00	0
HIGH WIND	293	1471	6.003357e+09	686301900
HIGHWAY FLOOD	0	0	0.000000e+00	0
HURRICANE	135	1328	8.475618e+10	5515292800
HVY RAIN	0	0	0.000000e+00	3000
HYPOTHERMIA	9	0	0.000000e+00	0
ICE	101	2146	3.972058e+09	5027113500
LACK OF SNOW	0	0	0.000000e+00	0
LAKE EFFECT SNOW	0	0	4.018200e+07	0
LAKE FLOOD	0	0	3.000000e+04	0
LAKESHORE FLOOD	0	0	7.540000e+06	0
LANDSLIDE	39	53	3.247010e+08	20017000
LANDSLUMP	0	0	5.700000e+05	0
LANDSPOUT	0	0	7.000000e+03	0
LARGE WALL CLOUD	0	0	0.000000e+00	0
LATE FREEZE	0	0	0.000000e+00	0
LATE SNOW	0	0	0.000000e+00	0
LATE SURF HAIL	0	0	0.000000e+00	0
LATE SURF SNOW	0	0	1.800000e+05	0
LATE SURF SNOWFALL	0	0	0.000000e+00	0
LIGHT FREEZING RAIN	0	0	4.510000e+05	0
LIGHT SNOW	1	2	2.598000e+06	0
LIGHT SNOW AND	0	0	0.000000e+00	0
LIGHTNING	817	5232	9.354575e+08	12092090
LIGNTNING	0	0	5.000000e+03	0
LOCAL FLOOD	0	0	0.000000e+00	0
LOCAL FLOOD FLOOD	0	0	0.000000e+00	0
LOCAL HEAVY RAIN	0	0	0.000000e+00	0
LOW TEMPERATURE	7	0	0.000000e+00	0
LOW TEMPERATURE RECORD	0	0	0.000000e+00	0
LOW WIND	0	0	0.000000e+00	0
MAJOR FLOOD	0	0	1.050000e+08	0
MARINE ACCIDENT	1	2	5.000000e+04	0
MARINE HAIL	0	0	4.000000e+03	0
MARINE HIGH WIND	1	1	1.297010e+06	0
MARINE MISHAP	7	5	0.000000e+00	0
MARINE STRONG WIND	14	22	4.183300e+05	0
MARINE THUNDER STORM WIND	10	26	4.364000e+05	50000
MARINE TSTM WIND	9	8	5.421000e+06	0
METRO STORM MAY	0	0	0.000000e+00	0
MICROBURST	0	0	8.000000e+04	0
MICROBURST WIND	0	0	4.500000e+05	0
MILD	0	0	0.000000e+00	0
MILD AND DRY	0	0	0.000000e+00	0
MILD PATTERN	0	0	0.000000e+00	0
MINOR FLOOD	1	0	5.000000e+03	0

MIXED RAIN	2	26	7.900000e+05	0
MODERATE SNOW	0	0	0.000000e+00	0
MONTHLY RAIN	0	0	0.000000e+00	0
MONTHLY SNOW	0	0	0.000000e+00	0
MONTHLY TEMPERATURE	0	0	0.000000e+00	0
MOUNTAIN SNOWS	0	0	0.000000e+00	0
MUD	0	0	0.000000e+00	0
MUD SLIDE	0	0	6.501000e+05	0
MUD SLIDE	5	2	1.325000e+06	0
MUD SLIDE URBAN	0	0	5.000000e+03	0
NEAR RECORD SNOW	0	0	0.000000e+00	0
NO SEVERE WEATHER	0	0	0.000000e+00	0
NON SEVERE HAIL	0	0	0.000000e+00	0
NON SEVERE WIND	0	7	5.000000e+03	0
NON TSTM WIND	0	1	4.000000e+04	0
NONE	0	0	0.000000e+00	0
NORMAL RAIN	0	0	0.000000e+00	0
NORTHERN LIGHTS	0	0	0.000000e+00	0
OTHER	0	4	5.550000e+04	1034400
PATCHY DENSE FOG	0	0	0.000000e+00	0
PATCHY ICE	0	0	0.000000e+00	0
PROLONGED COLD	0	0	0.000000e+00	0
PROLONGED RAIN	0	0	0.000000e+00	0
PROLONGED WARMTH	0	0	0.000000e+00	0
RAIN	5	2	5.350050e+06	750000
RAPIDLY RISING WATER	1	0	0.000000e+00	0
RECORD	17	0	0.000000e+00	0
RECORD COLD	1	0	5.600000e+07	0
RECORD COLD AND	0	0	0.000000e+00	0
RECORD COOL	0	0	0.000000e+00	0
RECORD DRY	0	0	0.000000e+00	0
RECORD DRY MONTH	0	0	0.000000e+00	0
RECORD HEAT	2	50	0.000000e+00	0
RECORD HEAT WAVE	0	0	0.000000e+00	0
RECORD HIGH	0	0	0.000000e+00	0
RECORD HIGH TEMPERATURE	0	0	0.000000e+00	0
RECORD HIGH TEMPERATURES	0	0	0.000000e+00	0
RECORD LOW	0	0	0.000000e+00	0
RECORD LOW RAINFALL	0	0	0.000000e+00	0
RECORD MAY SNOW	0	0	0.000000e+00	0
RECORD RAIN	0	0	5.000000e+02	0
RECORD SNOW	0	0	1.000000e+06	0
RECORD TEMPERATURE	0	0	0.000000e+00	0
RECORD WARM	0	0	0.000000e+00	0
RECORD WARM TEMPS	0	0	0.000000e+00	0
RECORD WARMTH	0	0	0.000000e+00	0
RECORD WINTER SNOW	0	0	0.000000e+00	0
RED FLOOD CRITERIA	0	0	0.000000e+00	0
RED FLOOD FIRE	0	0	0.000000e+00	0
REMNANTS OF FLOYD	0	0	0.000000e+00	0
RIP CURRENT	577	529	1.630000e+05	0
RIP CURRENT HEAVY	0	0	0.000000e+00	0
RIVER AND STREAM	0	0	1.200000e+06	0
RIVER FLOOD	4	3	5.235239e+09	5057484000

ROCK SLIDE	0	0	1.500000e+05	0
ROGUE WAVE	0	2	0.000000e+00	0
ROTATING WALL CLOUD	0	0	0.000000e+00	0
ROUGH SURF	12	6	1.000000e+04	0
RURAL FLOOD	0	0	1.200000e+03	0
SAHARAN DUST	0	0	0.000000e+00	0
SEASONAL SNOW	0	0	0.000000e+00	0
SEICHE	0	0	9.800000e+05	0
SEVERE COLD	0	0	0.000000e+00	0
SEVERE THUNDER STORM	0	0	1.207360e+09	17200000
SEVERE THUNDER STORM WINDS	0	0	1.750000e+05	29000000
SEVERE TURBULENCE	0	0	5.000000e+04	0
SLEET	2	0	5.000000e+05	0
SLEET FREEZING RAIN	0	0	0.000000e+00	0
SLEET STORM	0	0	0.000000e+00	0
SMALL HAIL	0	10	7.000000e+04	20793000
SMALL STREAM	0	0	0.000000e+00	0
SMALL STREAM AND	0	0	0.000000e+00	0
SMALL STREAM FLOOD	0	0	0.000000e+00	5000
SMALL STREAM FLOODING	0	0	0.000000e+00	0
SMALL STREAM URBAN	0	0	0.000000e+00	0
SML STREAM FLD	0	0	0.000000e+00	0
SMOKE	0	0	0.000000e+00	0
SNOW	13	103	2.263760e+07	10000
SNOW FALL	0	0	0.000000e+00	0
SNOW MELT	0	0	5.050000e+06	0
SOUTHEAST	0	0	0.000000e+00	0
STORM FORCE WINDS	0	0	2.000000e+05	0
STORM SURGE	24	43	4.796472e+10	855000
STREAM FLOOD	0	0	0.000000e+00	0
STREET FLOOD	0	0	0.000000e+00	0
STRONG WIND	111	301	1.776742e+08	69953500
SUMMARY	0	0	0.000000e+00	0
TEMPERATURE RECORD	0	0	0.000000e+00	0
THUNDER STORM	202	2453	5.433539e+09	606760460
TIDAL FLOOD	0	1	1.300000e+04	0
TORNADO	5658	91364	5.855215e+10	417461470
TORRENTIAL RAIN	0	4	0.000000e+00	0
TROPICAL DEPRESSION	0	0	1.737000e+06	0
TROPICAL STORM	58	340	7.703891e+09	678346000
TROPICAL STORM ALBERTO	0	0	5.000000e+06	0
TROPICAL STORM DEAN	0	0	4.000000e+05	50000
TROPICAL STORM GORDON	8	43	5.000000e+05	500000
TROPICAL STORM JERRY	0	0	4.600000e+06	16000000
TSUNAMI	543	7185	4.682129e+09	618723600
TYPHOON	0	5	6.002300e+08	825000
UNUSUAL	0	0	0.000000e+00	0
UNUSUAL COLD	2	0	0.000000e+00	30142500
UNUSUAL COOL	0	0	0.000000e+00	0
UNUSUAL COOL WET	0	0	0.000000e+00	0
UNUSUAL DRY	0	0	0.000000e+00	0
UNUSUAL HOT	0	0	0.000000e+00	0
UNUSUAL LATE SNOW	0	0	0.000000e+00	0
UNUSUAL LOW TEMP	0	0	0.000000e+00	0

UNUSUAL RAIN	0	0	0.000000e+00	10000000
UNUSUAL WARM	11	17	0.000000e+00	10000
UNUSUAL WARM AND	29	0	0.000000e+00	0
UNUSUAL WARM WET	0	0	0.000000e+00	0
UNUSUAL WARM YEAR	0	0	0.000000e+00	0
UNUSUAL WARMTH	0	0	0.000000e+00	0
UNUSUAL WET	0	0	0.000000e+00	0
URBAN	28	79	5.836570e+07	8488100
URBAN AND SMALL	1	0	5.000000e+03	0
URBAN FLOOD	0	0	2.389510e+07	1290000
URBAN FLOOD LANDSLIDE	0	0	0.000000e+00	0
URBAN SMALL	0	0	5.000000e+01	0
URBAN SMALL STREAM	0	0	0.000000e+00	0
VERY DRY	0	0	0.000000e+00	0
VERY WARM	0	0	0.000000e+00	0
VOLCANIC	0	0	5.000000e+05	0
WAKE LOW WIND	0	0	0.000000e+00	0
WALL CLOUD	0	0	0.000000e+00	0
WARM DRY CONDITIONS	0	0	0.000000e+00	0
WARM WEATHER	0	2	0.000000e+00	0
WATER SPOUT	0	0	0.000000e+00	0
WATER SPOUT	6	71	6.067520e+07	0
WATER SPOUT FUNNEL CLOUD	0	0	0.000000e+00	0
WATER SPOUT TORNADO	0	1	5.500000e+04	0
WAYTERSPOUT	0	0	0.000000e+00	0
WET MICROBURST	0	0	3.500000e+04	0
WET MONTH	0	0	0.000000e+00	0
WET SNOW	0	0	0.000000e+00	0
WET WEATHER	0	0	0.000000e+00	0
WET YEAR	0	0	0.000000e+00	0
WHIRL WIND	1	0	1.200000e+04	0
WILD	12	545	3.001850e+09	106808830
WILD FIRE	3	150	6.241000e+08	0
WILD FIRE	75	911	4.865614e+09	295972800
WIND	25	87	1.072800e+07	860000
WINTER MIX	1	77	1.250000e+04	0
WINTER STORM	216	1338	6.688997e+09	27444000
WINTER STORM HIGH	1	15	6.000000e+07	5000000
WINTER WEATHER	61	470	2.723800e+07	15000000
WINTER WEATHER MIX	0	68	6.000000e+04	0
WND	0	0	0.000000e+00	0

Note

The table above indicates that the data could be tidyer. The Event Type variable has multiple varibles embeded and they could be separated. However, any scheme that I come is aribitary due to my lack of domain knowlege. Therefore, I will use the judgement of those that put together the list. In short, I will not tidy the EVTYPE further

Results

Which types of events have the greatest economic consequences?

and

Which types of events are most harmful to Human Health?

The data are grouped by EVTYPE and ordered by BGN_DATE.

The color and opacity of each name is scaled according to the cost function listed at the end of this doccument in a variable called scaled.Cost.

The MAG variable has been scaled to the symbol fill color.

The F variable scales to the line color of the symbol.

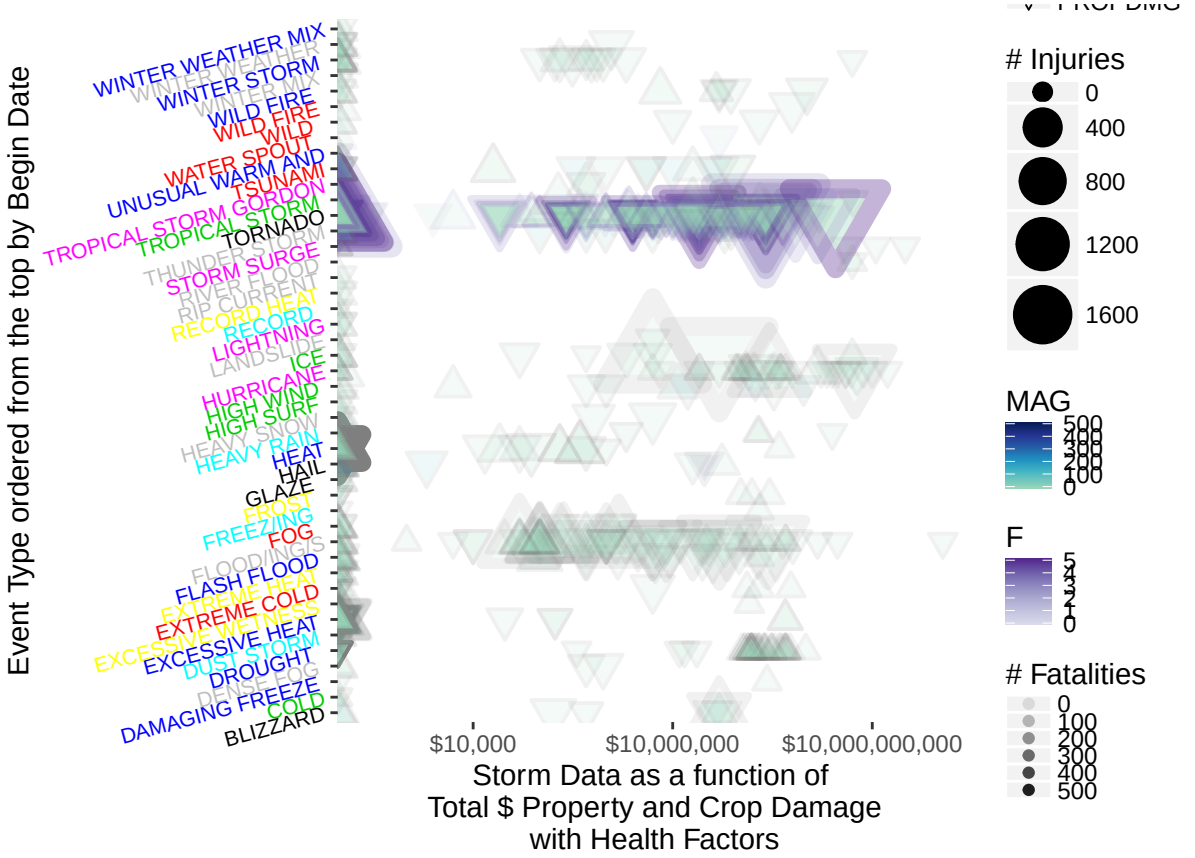
Fatalities scale to the opacity of the symbol.

Injuries scale to the size of the symbol.

Finally the stroke of the line has been scaled to the *scaled* sum of Damages and Human suffuring.

Refer to the end of the documentto see how this calculated

```
> analyze.summarize.Plot(percentData = 1, percentile = .1, dayta = process.dfContext())
```



Synopsis

This plot summarizes the data so that the storm data, can be viewed as a function of the Cost of storm, in terms of human health consequense and finacial damages. The fundamental statistic calculated here is the sum of the Crop and Property damages. This sum is used as input to the model while other variable of interest, such as Injuries and Fatalities have been scaled in an aesthetics to decorate that fundamental statistic.

The result is a plot in which the highest cost data points stand out in either size or color and tend to the right side of the graph. The left side provides the answer to the questions posed.

Each Event Type name, has be scaled in color and opacity according to the calculted metric scaled.Cost, which is based on the fundamental stat refered to above.

The more visiable the name the larger the apparent cost.

The fadded names on the y axis can be regarded as having a relatively small measure of consequence (monetary or health).

So the names which can be resolved most clearly can be regarded as having the Greatest Consequence, in either respect. Additionally, *the the text color has been scaled by the cost statistic with the colors of a heat map.* The red-er colors indicate a higher cost. Also since the data are ordered by year one can see when the events, that had the greatest impact, took place .

-

Some unintended consequences of my plot design.

- The grouping of the event types on the y axis has caused a super positon of the colors.
- The text is scaled to heat map colors (yellows oranges and reds), but since each observation in the data have an event type, with its own scaled color, the device draws the label for that row with the individual's color. Because they are grouped, matching label are drawn at the same positions.
- The color of the Event Types vary depending on how many observations it claims and the scale at which they register.
- The hot colors(reds ,oranges) are those which can address the issue of consquences.
- The supprising thing is that the Events which do not have a high relative cost , but have high
- repeatablity manifest themselves in black text.
- The black text color is not on the heat map color scale.
- So why is there black text? In a word, Superpostion.
- The opacity on the events that have low cost is high, making their text barely visible with a bright yellow color.
- However, since some of these events have thousands of observations, that barely visible color adds up an eventually makes the text visible.
-

This unintended effect has made this design difficult to use, as the low cost Events were intended to have barely visible y labels.

- On the other hand, it does show that there is a sort of additive high cost associated with events that have high repeatablity.

EventType Economic Consequences Appendix ——————————————————

```
> daytaPlotSet<-
+   daytaPlotSet%>%
+   mutate(
+     scale.PDmg= rescale(PROPDMG,c(0,1),range(PROPDMG,na.rm=TRUE)),
+     scale.CDmg= rescale(CROPDMG,c(0,1),range(CROPDMG,na.rm=TRUE)),
+     scale.Injr= rescale(INJURIES,c(0,1),range(INJURIES,na.rm=TRUE)),
+     scale.Fatl= rescale(FATALITIES,c(0,1),range(FATALITIES,na.rm=TRUE)),
+
+     scale.Cost = rescale(scale.PDmg + scale.CDmg + scale.Injr + scale.Fatl,c(0,1)),
+
+     scale.Cost.HumanFactors = rescale(scale.Injr + scale.Fatl,c(.1,1)),
+
+     scale.Cost.Stroke= floor(rescale(scale.Cost.HumanFactors,c(1,6))),
+
+     scale.Cost.EventType.TextColor = floor(rescale(scale.Cost,c(1,numberOfColsForEventType))),
+
+     EVTYPE.Color.Alpha = alpha(palEVTYPECols[scale.Cost.EventType.TextColor],scale.Cost)
+     )
```