Public Health and Economic Consequences of Severe Weather Events in the U.S.

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This analysis will analyze data from the U.S. National Oceanic and Atmospheric Administration's (NOAA) storm data base to assess which severe weather evenets cause the most public health consequences (fatalities and injuries) and economic consequences (property and crop damage) in the U.S..

Part I: Public Health Consequences

Data Processing

```
library(tidyr)
library(dplyr)
library(ggplot2)
library(ggpubr)
```

```
storm <- read.csv("repdata_data_StormData.csv")
```

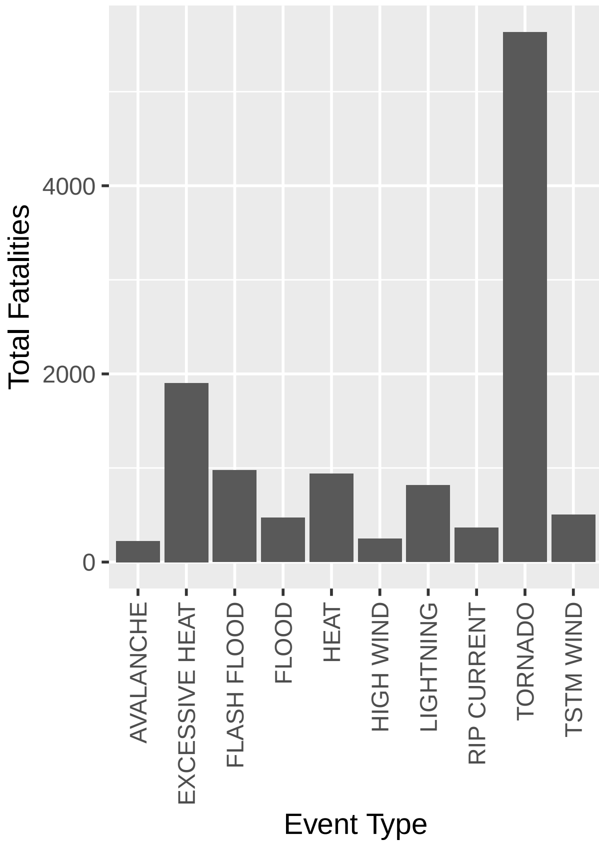
```
#Total fatalities by event type
sum_f_by_event <- storm %>%
  group_by(EVTYPE) %>%
  summarise(
    sum_fatalities = sum(FATALITIES, na.rm = TRUE)) %>%
  arrange(desc(sum_fatalities))
#Mean fatalities by event type
mean_f_by_event <- storm %>%
  group_by(EVTYPE) %>%
  summarise(
    mean_fatalities = mean(FATALITIES, na.rm = TRUE)) %>%
  arrange(desc(mean_fatalities))
```

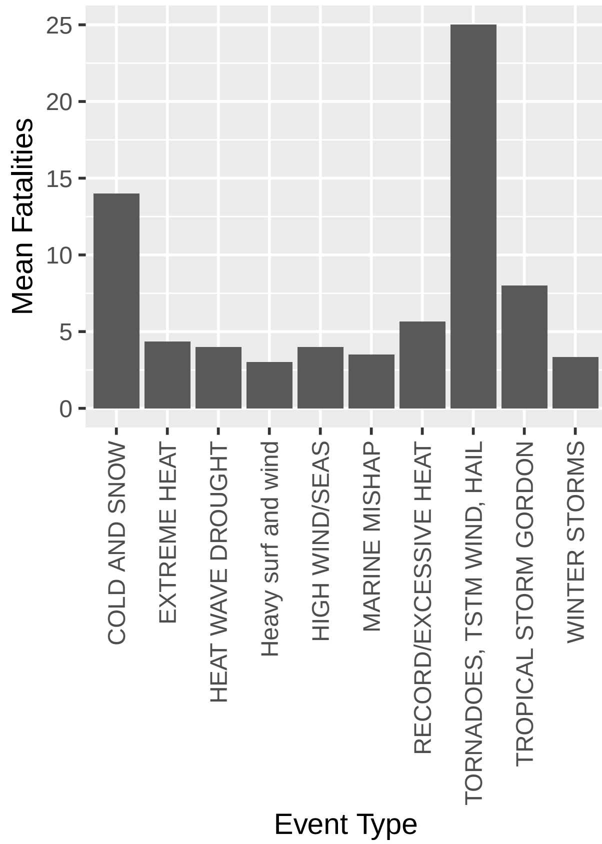
```
sum_i_by_event <- storm %>%
  group_by(EVTYPE) %>%
  summarise(
  sum_injuries = sum(INJURIES, na.rm = TRUE)) %>%
  arrange(desc(sum_injuries))
mean_i_by_event <- storm %>%
  group_by(EVTYPE) %>%
  summarise(
```

```
    mean_injuries = mean(INJURIES, na.rm = TRUE)) %>%
  arrange(desc(mean_injuries))
```

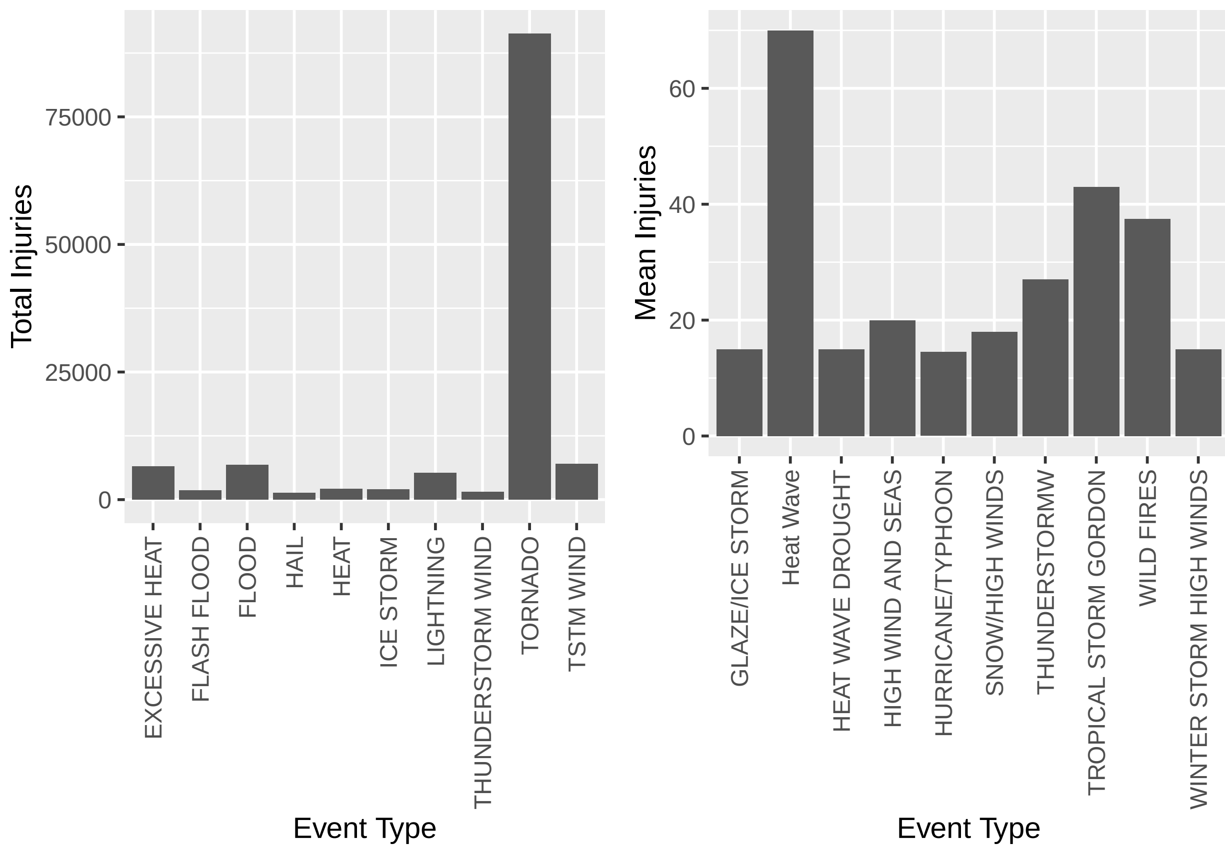
Results

```
aa <- sum_f_by_event[1:10,] %>%
  ggplot(aes(x = EVTYPE, y = sum_fatalities)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Total Fatalities",
    x = "Event Type"
  )
bb <- mean_f_by_event[1:10,] %>%
  ggplot(aes(x = EVTYPE, y = mean_fatalities)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Mean Fatalities",
    x = "Event Type"
  )
cc <- sum_i_by_event[1:10,] %>%
  ggplot(aes(x = EVTYPE, y = sum_injuries)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Total Injuries",
    x = "Event Type"
  )
dd <- mean_i_by_event[1:10,] %>%
  ggplot(aes(x = EVTYPE, y = mean_injuries)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Mean Injuries",
    x = "Event Type"
  )
ggarrange(aa, bb)
```






```
ggarrange(cc, dd)
```



As you can see from the graphs above, torandos caused the greatest number of total fatalities, average fatalities, and total injuries. Meanwhile, heat waves caused the greatest number of average injuries.

Part II: Economic Consequences

Data Processing

In order to appropriately analyze the data. Multipliers coded as letters and characters had to be re-coded (i.e., "B" -> 1e9).

```r
#Converting multiplier to numeric value
storm$CROPDMGEXP[storm$CROPDMGEXP == "B"] <- 1e9
storm$CROPDMGEXP[storm$CROPDMGEXP == "M"] <- 1e6
storm$CROPDMGEXP[storm$CROPDMGEXP == "m"] <- 1e6
storm$CROPDMGEXP[storm$CROPDMGEXP == "K"] <- 1000
storm$CROPDMGEXP[storm$CROPDMGEXP == "k"] <- 1000
storm$CROPDMGEXP[storm$CROPDMGEXP == ""] <- 1
storm$CROPDMGEXP[storm$CROPDMGEXP == 2] <- 1e2
storm$CROPDMGEXP[storm$CROPDMGEXP == 0] <- 1
storm$CROPDMGEXP[storm$CROPDMGEXP == "?"] <- 1

#Multiplier * CROPDMG
storm <- storm %>%
  mutate(
```

```
    total_crop_dmg = as.numeric(CROPDMG) * as.numeric(CROPDMGEXP)
  )
```

```
#Converting multiplier to numeric value
storm$PROPDMGEXP[storm$PROPDMGEXP == "B"] <- 1e9
storm$PROPDMGEXP[storm$PROPDMGEXP == "M"] <- 1e6
storm$PROPDMGEXP[storm$PROPDMGEXP == "m"] <- 1e6
storm$PROPDMGEXP[storm$PROPDMGEXP == "K"] <- 1000
storm$PROPDMGEXP[storm$PROPDMGEXP == "k"] <- 1000
storm$PROPDMGEXP[storm$PROPDMGEXP == ""] <- 1
storm$PROPDMGEXP[storm$PROPDMGEXP == 2] <- 1e2
storm$PROPDMGEXP[storm$PROPDMGEXP == 3] <- 1e3
storm$PROPDMGEXP[storm$PROPDMGEXP == 4] <- 1e4
storm$PROPDMGEXP[storm$PROPDMGEXP == 5] <- 1e5
storm$PROPDMGEXP[storm$PROPDMGEXP == 6] <- 1e6
storm$PROPDMGEXP[storm$PROPDMGEXP == 7] <- 1e7
storm$PROPDMGEXP[storm$PROPDMGEXP == 8] <- 1e8
storm$PROPDMGEXP[storm$PROPDMGEXP == "?"] <- 1
storm$PROPDMGEXP[storm$PROPDMGEXP == ""] <- 1
storm$PROPDMGEXP[storm$PROPDMGEXP == "-"] <- 1
storm$PROPDMGEXP[storm$PROPDMGEXP == "+"] <- 1
storm$PROPDMGEXP[storm$PROPDMGEXP == "0"] <- 1
storm$PROPDMGEXP[storm$PROPDMGEXP == "H"] <- 100
storm$PROPDMGEXP[storm$PROPDMGEXP == "h"] <- 100

#Multiplier * PROPDMG
storm <- storm %>%
  mutate(
    total_prop_dmg = as.numeric(PROPDMG) * as.numeric(PROPDMGEXP)
  )

#Creating variable for total dmg (property + crop dmg)
storm <- storm %>%
  mutate(
    total_dmg = total_prop_dmg + total_crop_dmg
  )
```

```
#creating tibble with total and mean crop, property, and total dmg
storm_summ <- storm %>%
  group_by(EVTYPE) %>%
  summarise(
    sum_prop_dmg = sum(total_prop_dmg, na.rm = TRUE),
    mean_prop_dmg = mean(total_prop_dmg, na.rm = TRUE),
    sum_crop_dmg = sum(total_crop_dmg, na.rm = TRUE),
    mean_crop_dmg = mean(total_crop_dmg, na.rm = TRUE),
    sum_total_dmg = sum(total_dmg, na.rm = TRUE),
    mean_total_dmg = mean(total_dmg, na.rm = TRUE)
  )
head(storm_summ)
```

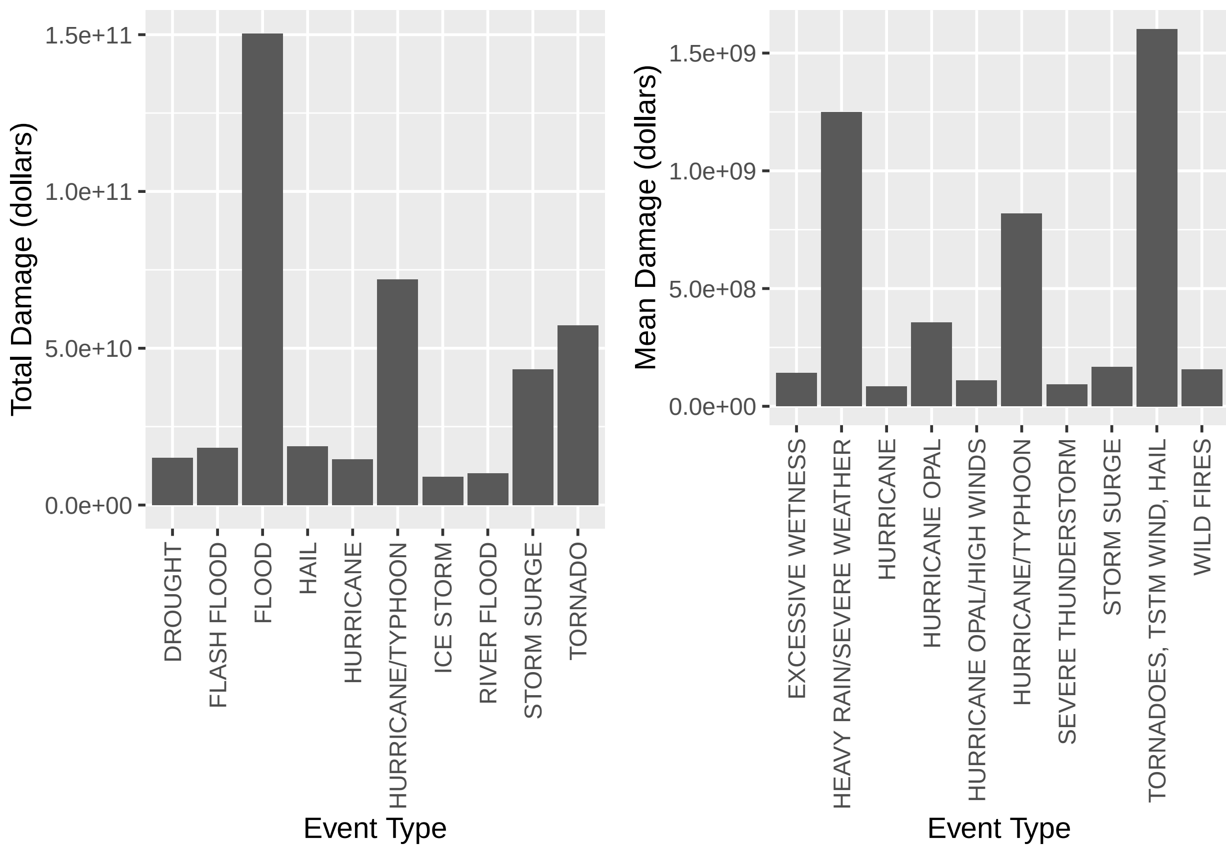
```
## # A tibble: 6 x 7
##   EVTYPE                  sum_prop_dmg mean_pr~1 sum_c~2 mean_~3 sum_t~4 mean_~5
##   <chr>                          <dbl>     <dbl>   <dbl>   <dbl>   <dbl>   <dbl>
```

```
## 1 "   HIGH SURF ADVISORY"       200000    200000       0       0  200000  200000
## 2 " COASTAL FLOOD"                    0         0       0       0       0       0
## 3 " FLASH FLOOD"                  50000     50000       0       0   50000   50000
## 4 " LIGHTNING"                        0         0       0       0       0       0
## 5 " TSTM WIND"                  8100000   2025000       0       0 8100000 2025000
## 6 " TSTM WIND (G45)"               8000      8000       0       0    8000    8000
## # ... with abbreviated variable names 1: mean_prop_dmg, 2: sum_crop_dmg,
## #   3: mean_crop_dmg, 4: sum_total_dmg, 5: mean_total_dmg
```

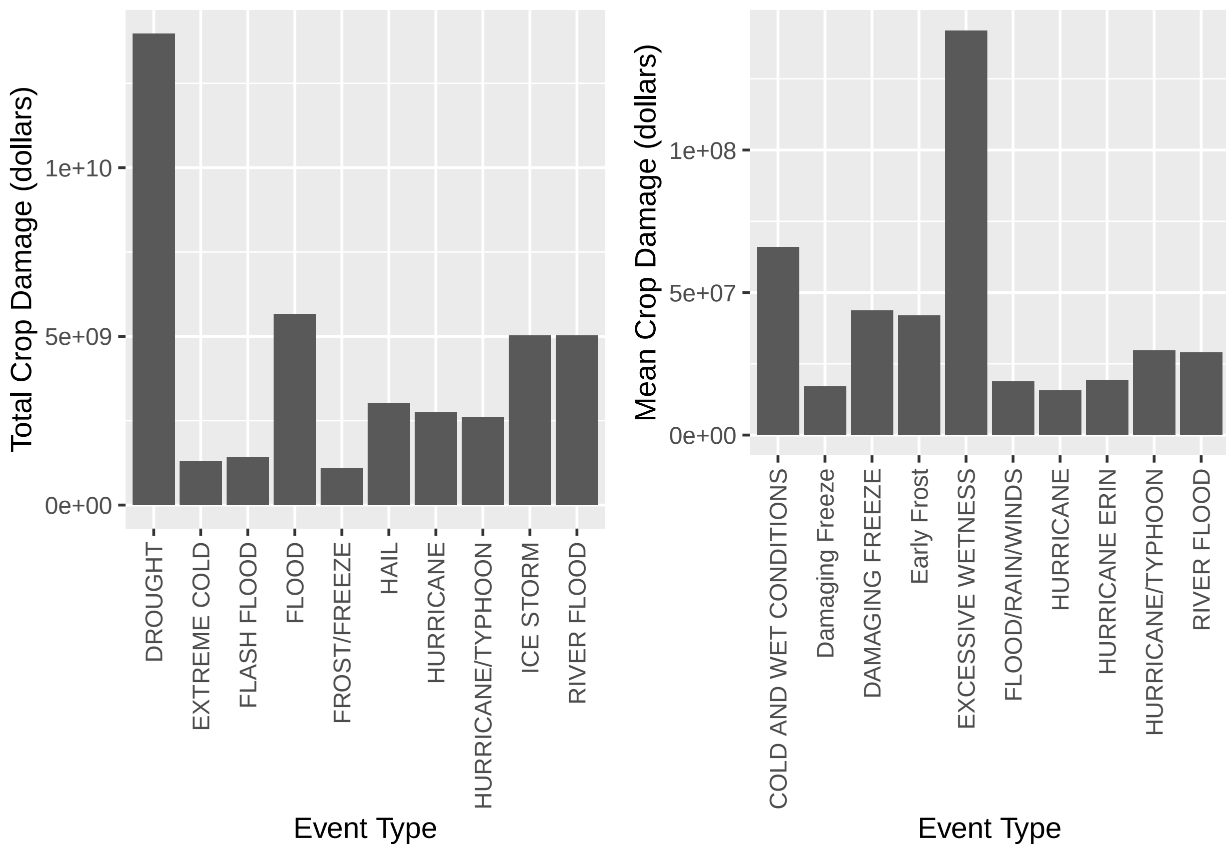
Results

```
#Top 10 Events: Total Damage by event
a <- storm_summ %>%
  arrange(desc(sum_total_dmg)) %>%
  head(10) %>%
  ggplot(aes(x = EVTYPE, y = sum_total_dmg)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Total Damage (dollars)",
    x = "Event Type"
  )
#Top 10 Events: Total Damage per event
b <- storm_summ %>%
  arrange(desc(mean_total_dmg)) %>%
  head(10) %>%
  ggplot(aes(x = EVTYPE, y = mean_total_dmg)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Mean Damage (dollars)",
    x = "Event Type"
  )
#Top 10 Events: Total Crop Damage by event
c <- storm_summ %>%
  arrange(desc(sum_crop_dmg)) %>%
  head(10) %>%
  ggplot(aes(x = EVTYPE, y = sum_crop_dmg)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Total Crop Damage (dollars)",
    x = "Event Type"
  )
#Top 10 Events: Mean Crop Damage per event
d <- storm_summ %>%
  arrange(desc(mean_crop_dmg)) %>%
  head(10) %>%
  ggplot(aes(x = EVTYPE, y = mean_crop_dmg)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
```

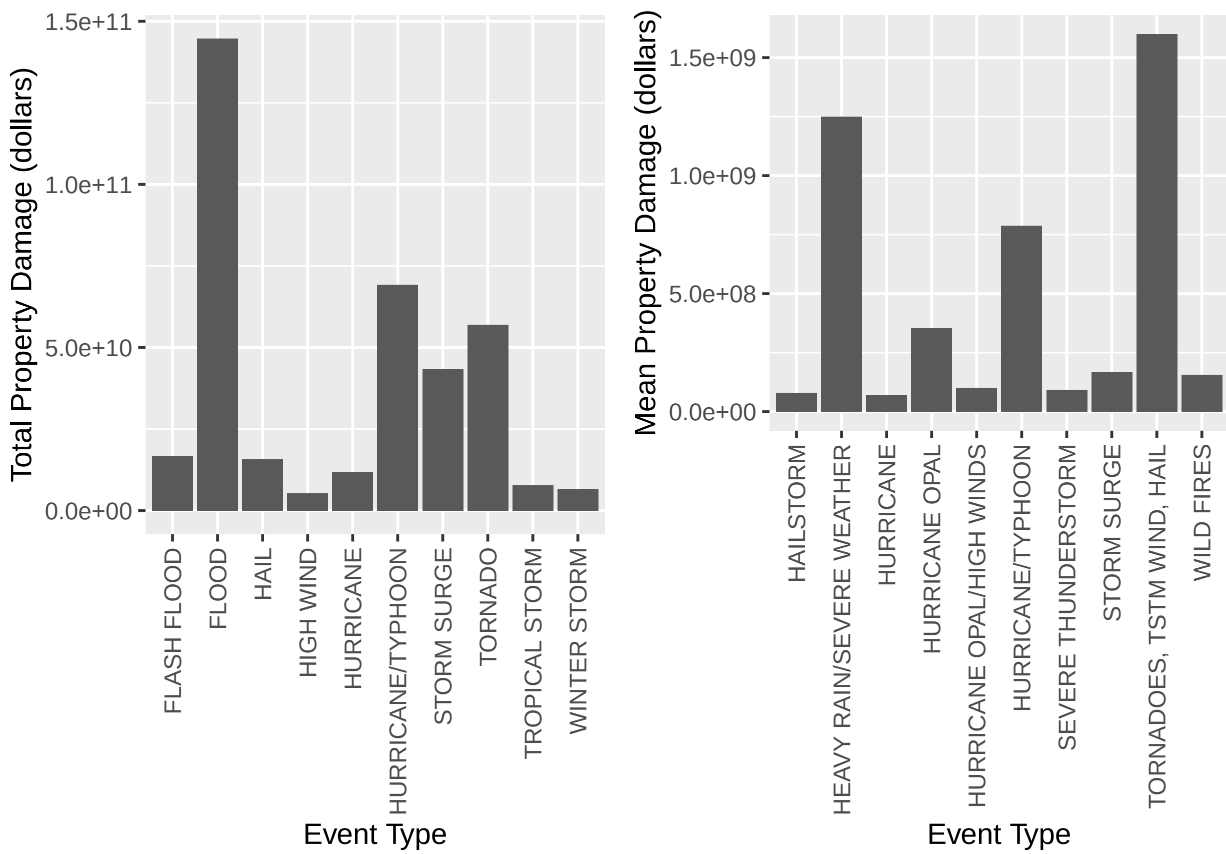
```
    y = "Mean Crop Damage (dollars)",
    x = "Event Type"
  )
#Top 10 Events:Total Property damage by event
e <- storm_summ %>%
  arrange(desc(sum_prop_dmg)) %>%
  head(10) %>%
  ggplot(aes(x = EVTYPE, y = sum_prop_dmg)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Total Property Damage (dollars)",
    x = "Event Type"
  )
#Top 10 Events: Mean Property damage by event
f <- storm_summ %>%
  arrange(desc(mean_prop_dmg)) %>%
  head(10) %>%
  ggplot(aes(x = EVTYPE, y =  mean_prop_dmg)) +
  geom_bar(stat = "identity") +
  theme(axis.text.x = element_text(angle = 90, vjust = 0.5, hjust=1)) +
  labs(
    y = "Mean Property Damage (dollars)",
    x = "Event Type"
  )
ggarrange(a, b)
```




```
ggarrange(c, d)
```




```
ggarrange(e, f)
```



As you can see from the figure above, floods and tornadoes/TSTM Wind/hail caused the greatest total and average economic damage (property + crop damage), respectively. Breaking up economic damage into its components, drought and excessive wetness caused the greatest total and average crop damage, respectively, while floods and tornadoes/TSTM Wind/hail caused the greatest total and average property damage, respectively.