Model 1

```
# Enhanced Line Plot with Tweaks
ggplot(year_month_data, aes(x = YearMonth, y = Total_Storms, group = 1)) +
  # Line plot with adjusted color for better contrast
  geom_line(color = "navy", linewidth = 1.2) +

  # Highlight hurricane seasons with slightly darker orange
  annotate("rect", xmin = "2003-Jul", xmax = "2003-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.3, fill = "darkorange") +
  annotate("rect", xmin = "2004-Jul", xmax = "2004-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.3, fill = "darkorange") +
  annotate("rect", xmin = "2005-Jul", xmax = "2005-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.3, fill = "darkorange") +
  annotate("rect", xmin = "2006-Jul", xmax = "2006-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.3, fill = "darkorange") +
  annotate("rect", xmin = "2007-Jul", xmax = "2007-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.3, fill = "darkorange") +
  annotate("rect", xmin = "2008-Jul", xmax = "2008-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.3, fill = "darkorange") +

  # Annotation for peak with repositioning
  annotate("text", x = "2005-Sep", y = max(year_month_data$Total_Storms) +
30,
           label = "Record Peak (2005)", color = "red", size = 4, fontface
= "bold") +

  # Add horizontal gridlines for better magnitude readability
  geom_hline(yintercept = seq(100, 400, by = 100), color = "gray80",
linetype = "dashed") +

  # Improved x-axis breaks and labels
  scale_x_discrete(
    breaks = x_breaks,
    labels = x_labels
  ) +

  # Titles and labels
  labs(
    title = "Monthly Tropical Storm Frequency (2003-2008)",
    subtitle = "Hurricane seasons (July-October) highlighted in orange",
    x = "Time (4-Month Intervals)",
    y = "Number of Tropical Storms"
  ) +

  # Improved theme
  theme_minimal() +
  theme(
    axis.text.x = element_text(angle = 45, hjust = 1),
    plot.title = element_text(face = "bold", size = 16),
    plot.subtitle = element_text(size = 12),
    axis.title = element_text(size = 12),
    axis.text = element_text(size = 10),
```

```
    panel.grid.major.x = element_blank()  # Remove vertical gridlines
  )
```

Model 2

```
# Filter data for the years 2003 to 2008 (5 years)
filtered_data <- tropical_storm_data %>%
  filter(YEAR >= 2003 & YEAR <= 2008)

# Group data by year and month to analyze trends
year_month_data <- filtered_data %>%
  group_by(YEAR, MONTH) %>%
  summarise(Total_Storms = n(), .groups = "drop")

# Create a new column for Year-Month labels
year_month_data <- year_month_data %>%
  mutate(YearMonth = paste(YEAR, month.abb[MONTH], sep = "-"))

# Ensure YearMonth is treated as a factor with correct ordering
year_month_data$YearMonth <- factor(year_month_data$YearMonth, levels =
unique(year_month_data$YearMonth))

# Line plot with seasonality and smoothing
ggplot(year_month_data, aes(x = YearMonth, y = Total_Storms, group = 1)) +
  # Line plot for tropical storm trends
  geom_line(color = "blue", linewidth = 1.2) +

  # Highlight hurricane seasons (July to October)
  annotate("rect", xmin = "2003-Jul", xmax = "2003-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.2, fill = "orange") +
  annotate("rect", xmin = "2004-Jul", xmax = "2004-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.2, fill = "orange") +
  annotate("rect", xmin = "2005-Jul", xmax = "2005-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.2, fill = "orange") +
  annotate("rect", xmin = "2006-Jul", xmax = "2006-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.2, fill = "orange") +
  annotate("rect", xmin = "2007-Jul", xmax = "2007-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.2, fill = "orange") +
  annotate("rect", xmin = "2008-Jul", xmax = "2008-Oct", ymin = -Inf, ymax
= Inf, alpha = 0.2, fill = "orange") +

  # Add a smoothing line to show the overall trend
  geom_smooth(method = "loess", color = "darkred", linetype = "dashed",
linewidth = 1) +

  # Annotation for peak activity
  annotate("text", x = "2005-Sep", y = max(year_month_data$Total_Storms) +
10,
           label = "Record Peak (2005)", color = "red", size = 4, fontface
= "bold") +

  # Titles and labels
  labs(
```

```
  title = "Monthly Tropical Storm Frequency (2003-2008)",
  subtitle = "Hurricane seasons (July-October) highlighted in orange.",
  x = "Time (4-Month Intervals)",
  y = "Number of Tropical Storms"
) +

# Improved theme for clarity
theme_minimal() +
theme(
  plot.title = element_text(face = "bold", size = 16, hjust = 0.5),
  plot.subtitle = element_text(size = 12, hjust = 0.5),
  axis.text.x = element_text(angle = 45, hjust = 1),
  axis.title = element_text(size = 12),
  axis.text = element_text(size = 10)
)
```