Homework 2 Solution

Disclaimer

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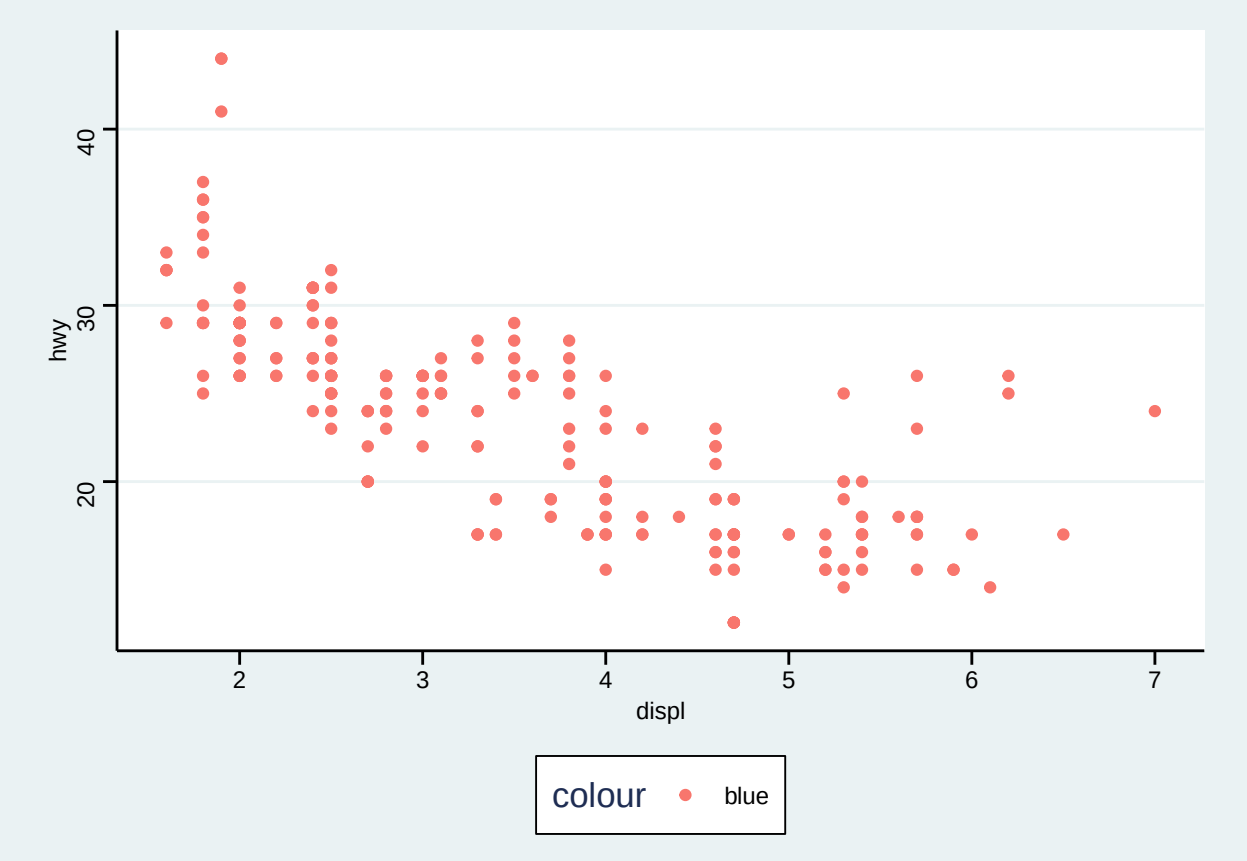
Problem 1: Spot the error

Explain why the following command does not color the data points blue, then write down the command that will turn the points blue.

```
> library(ggplot2)
> ggplot(data = mpg) +
+   geom_point(mapping = aes(x = displ, y = hwy, color = "blue"))
```



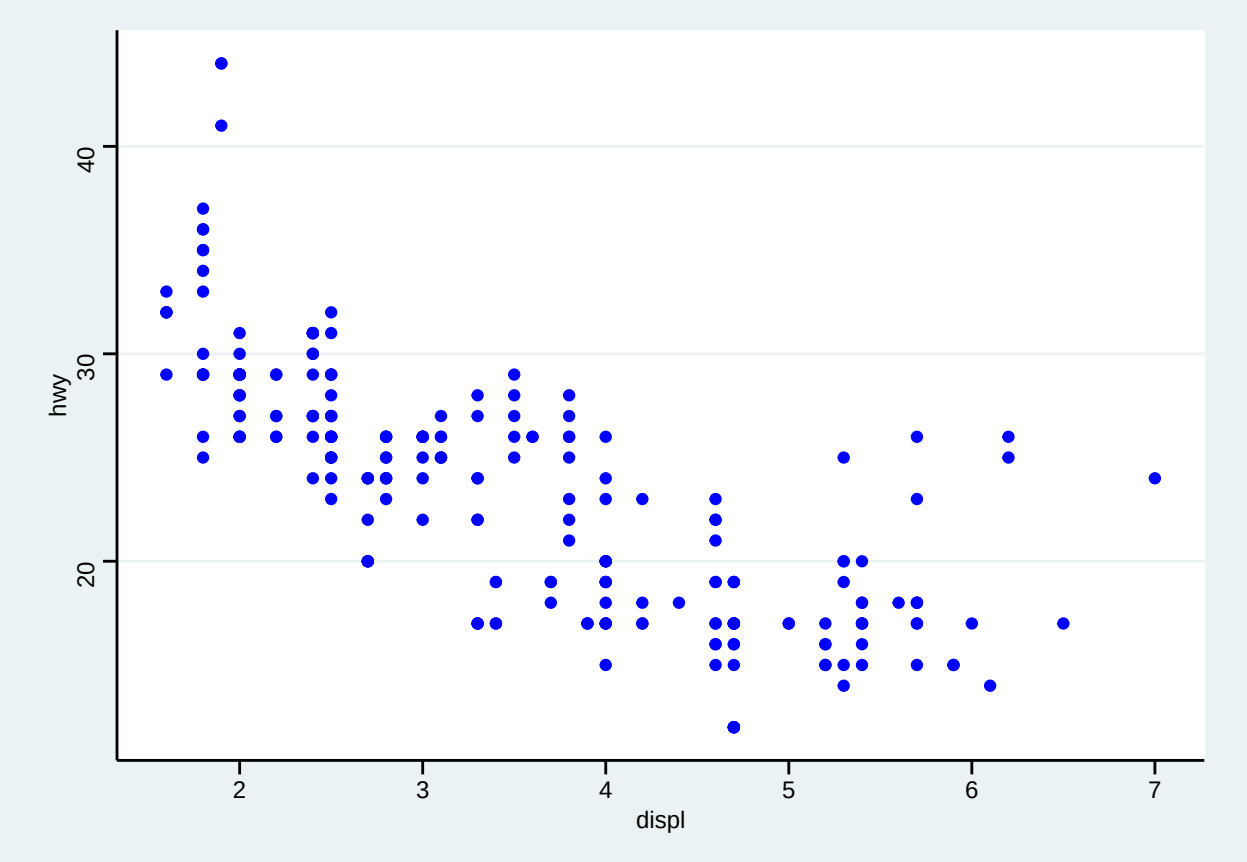
answer:

The `aes` aesthetic command defines how variables in the data set map to positions in the graph. Using `color` in the `aes` results in ggplot thinking that the character vector `"blue"` is a discrete variable value. It is

assigned to all data points and used as a "discrete" variable value when coloring the graph. The first color choice for the default `scale_color_discrete` palette is the red you see in the graph.

To correct the graph, move the color choice outside the `aes`:

```
> ggplot(data = mpg) +
+   geom_point(mapping = aes(x = displ, y = hwy), color = "blue")
```



Problem 2: Penguins

Load the data `penguins` using the command

```
> # install.packages("palmerpenguins")  # run once then DELETE FROM RMD
> data(penguins, package = 'palmerpenguins')
```

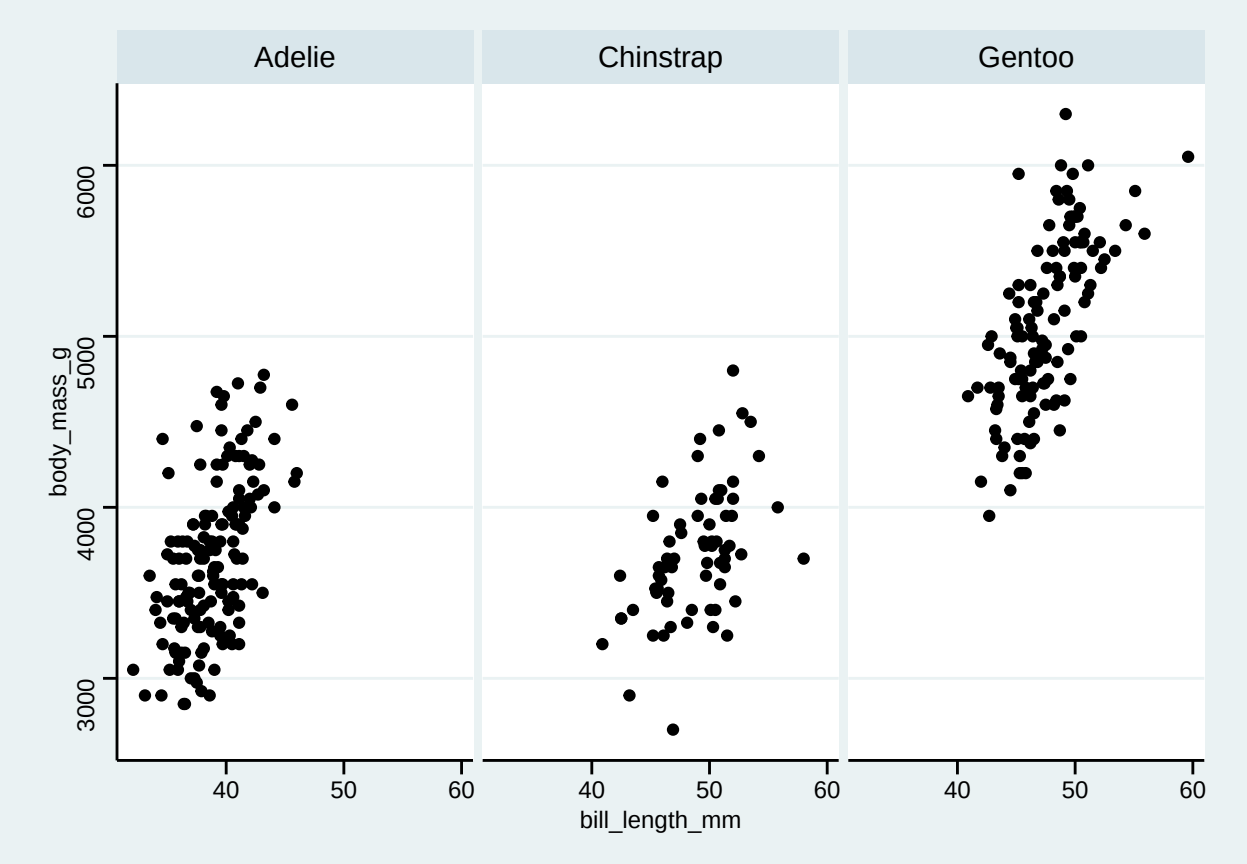
Look at help file for for variable info: `?palmerpenguins::penguins`.

a.

Create a scatterplot of `body_mass_g` (y) against `bill_length_mm` (x) and separate the plot into facets by `species`.

answer:

```
> g <- ggplot(penguins, aes(x = bill_length_mm, y = body_mass_g))
> g + geom_point() +
+   facet_wrap(~species)
Warning: Removed 2 rows containing missing values or values outside the scale range
(`geom_point()`).
```

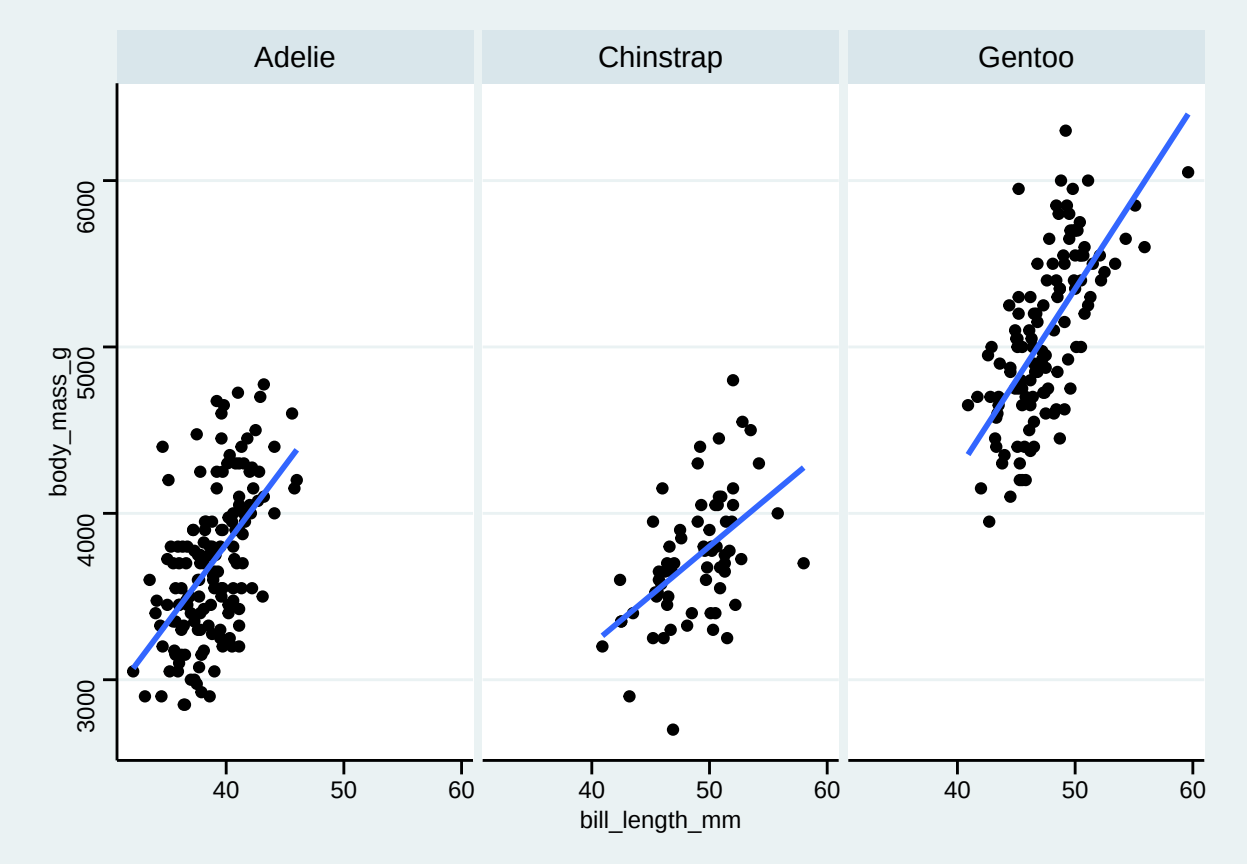


b.

Add regression lines to the plot in (a) for each species with no standard error shading. See `?geom_smooth` to see how to add a regression (`lm`) line instead of a wigglely smoother.

answer:

```
> g + geom_point() +
+   facet_wrap(~species) +
+   geom_smooth(method = lm, se = FALSE)
Warning: Removed 2 rows containing non-finite outside the scale range
(`stat_smooth()`).
Warning: Removed 2 rows containing missing values or values outside the scale range
(`geom_point()`).
```

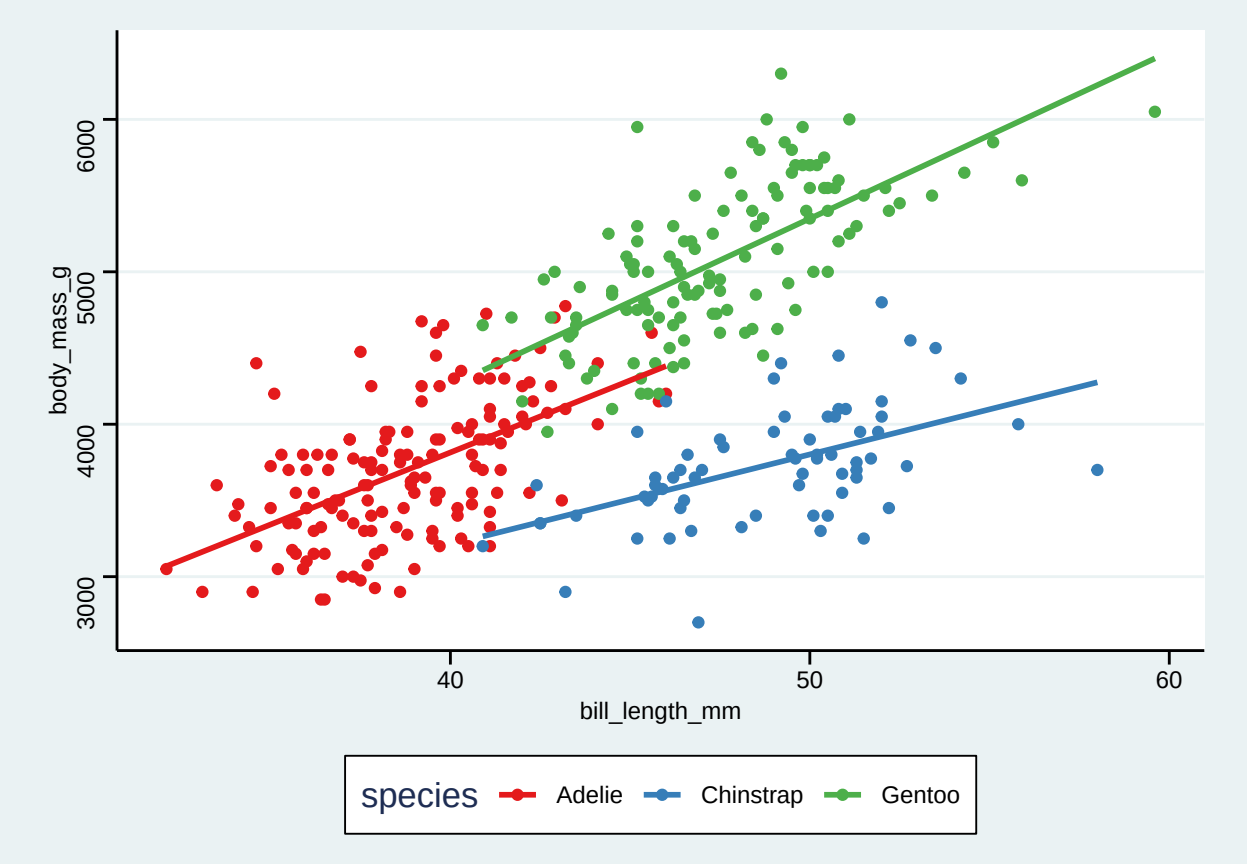


c.

Instead of faceting by `species`, use `species` to color the points and regression lines. Use a color scheme for the points that is not the default coloring.

answer:

```
> g + geom_point(aes(color = species)) +
+   geom_smooth(aes(color = species), method = lm, se = FALSE) +
+   scale_color_brewer(palette = "Set1")
Warning: Removed 2 rows containing non-finite outside the scale range
(`stat_smooth()`).
Warning: Removed 2 rows containing missing values or values outside the scale range
(`geom_point()`).
```



d.

Which visual, (b) or (c), makes it easiest to compare the **slopes** of the lines for each species? Explain.

answer:

The plot in (c) is easier to directly compare slopes on the same x/y scales.

Problem 3: Storm paths by year

Install the package `nasaweather`, if needed, and load the `storms` data.

```
> # install.packages("nasaweather")
> data(storms, package = "nasaweather")
```

a.

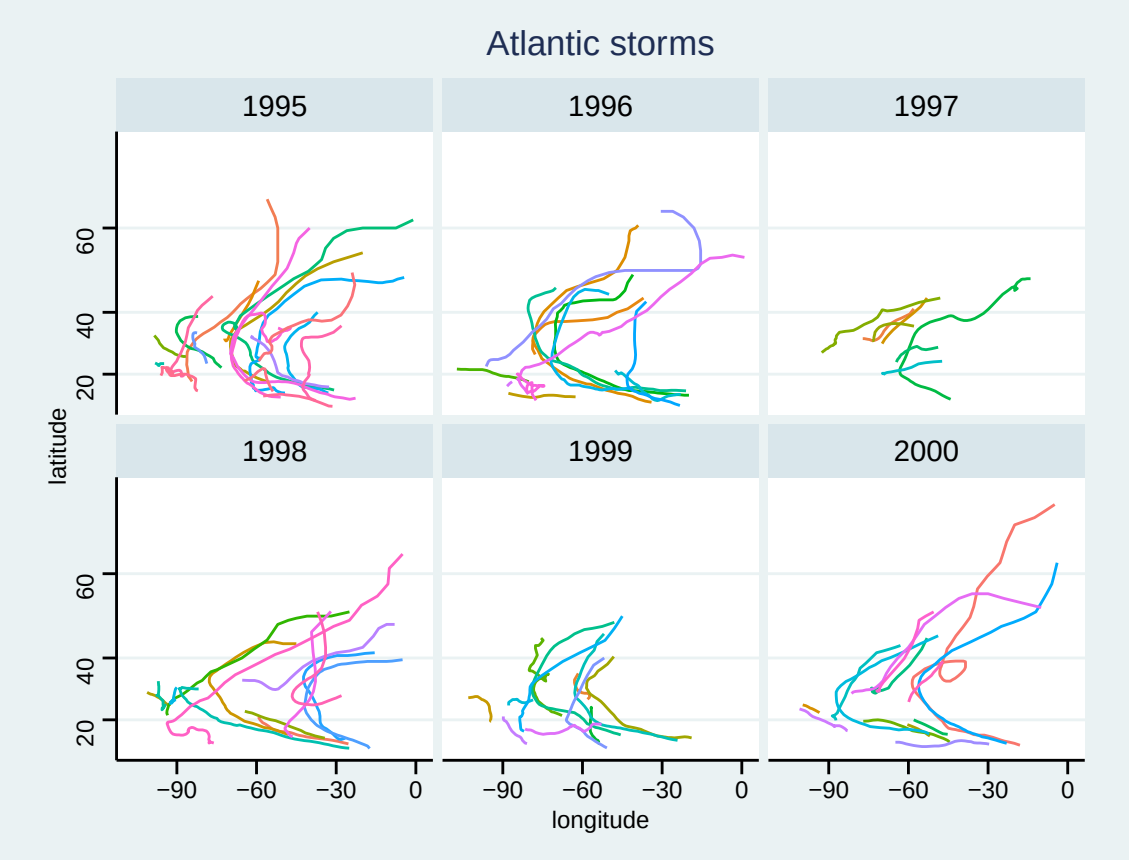
Use `geom_path()` to plot the path of each tropical storm in this data set where you

- use color to distinguish the storms from one another
- use faceting to plot each `year` on its own panel
- change your coordinate system to a map

answer: The `group` argument is needed so that one path is drawn for each named storm.

```
> dplyr::glimpse(storms)
Rows: 2,747
Columns: 11
```

```
$ name     <chr> "Allison", "Allison", "Allison", "Allison", "Allison", "Allis~
$ year     <int> 1995, 1995, 1995, 1995, 1995, 1995, 1995, 1995, 1995, 1995, 1~
$ month    <int> 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6, 6~
$ day      <int> 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6, 7, 7, 7, 7, 8~
$ hour     <int> 0, 6, 12, 18, 0, 6, 12, 18, 0, 6, 12, 18, 0, 6, 12, 18, 0, 6,~
$ lat      <dbl> 17.4, 18.3, 19.3, 20.6, 22.0, 23.3, 24.7, 26.2, 27.6, 28.5, 2~
$ long     <dbl> -84.3, -84.9, -85.7, -85.8, -86.0, -86.3, -86.2, -86.2, -86.1~
$ pressure <int> 1005, 1004, 1003, 1001, 997, 995, 987, 988, 988, 990, 990, 99~
$ wind     <int> 30, 30, 35, 40, 50, 60, 65, 65, 65, 60, 60, 45, 30, 35, 35, 4~
$ type     <chr> "Tropical Depression", "Tropical Depression", "Tropical Storm~
$ seasday  <int> 3, 3, 3, 3, 4, 4, 4, 4, 5, 5, 5, 5, 6, 6, 6, 6, 7, 7, 7, 7, 8~
> storm_plot <-  ggplot(storms, aes(x = long, y = lat)) +
+   geom_path(aes(group = name, color = name)) +
+   facet_wrap(~year) +
+   scale_color_discrete(guide = "none") +
+   labs(
+     x = "longitude",
+     y = "latitude",
+     title = "Atlantic storms"
+     )
> storm_plot + coord_map()
```



b.

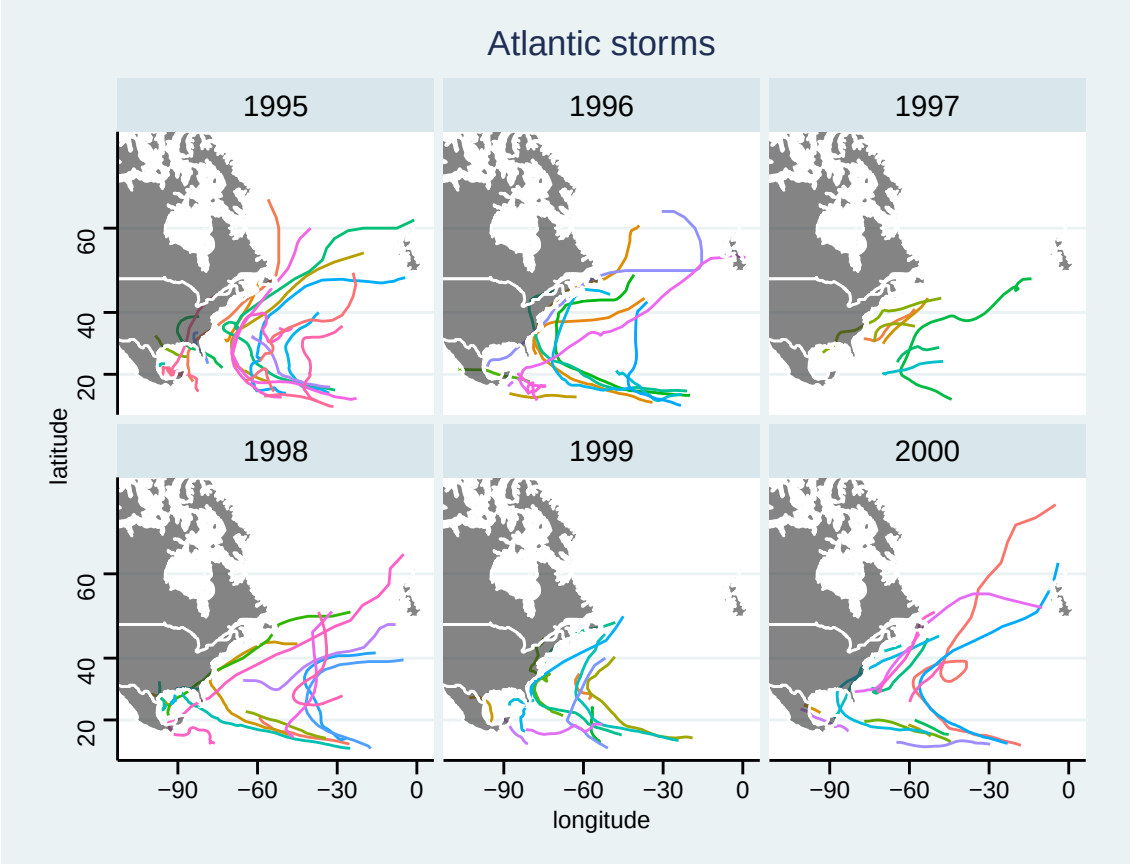
Add a map of the US, Mexico, Canada and the UK to your map in (a) so you can get a better idea where these storms are traveling, truncating the longitude as suggested in the hints.

Hints:

- Look at the help file for `?map_data`. To create map data with only the counties around the storm paths, use data from the the `world` map from `map_data` with the following `region`s specified: `usa`, `mexico`, `canada` and `uk`.
- Add the map data for the regions of interest using `geom_polygon`. (Hint: make sure your paths map doesn't have `color` as a global `aes`.)
- Modify your `coord_map` from part (a) to add the arguments `xlim` and `ylim` to set the min and max limits of your graph to the min/max latitude and longitude of the `storms`.

answer: First pull the map data for the countries of interest

```
> ctry <- map_data("world",
+                  region = c(
+                    "usa",
+                    "mexico",
+                    "canada",
+                    "uk"
+                  ))
> dplyr::glimpse(ctry)
Rows: 19,331
Columns: 6
$ long      <dbl> -59.78760, -59.92227, -60.03775, -60.11426, -60.11748, -59.9~
$ lat       <dbl> 43.93960, 43.90391, 43.90664, 43.93911, 43.95337, 43.93960, ~
$ group     <dbl> 1, 1, 1, 1, 1, 1, 1, 1, 1, 2, 2, 2, 2, 2, 2, 3, 3, 3, 3, 3, ~
$ order     <int> 1, 2, 3, 4, 5, 6, 7, 8, 9, 11, 12, 13, 14, 15, 16, 18, 19, 2~
$ region    <chr> "Canada", "Canada", "Canada", "Canada", "Canada", "Canada", ~
$ subregion <chr> "Sable Island", "Sable Island", "Sable Island", "Sable Islan~
> storm_plot +
+   geom_polygon(data = ctry,
+                aes(x = long,
+                    y = lat,
+                    group = group), alpha = 0.6, color = "white") +
+   coord_map(xlim  = c(min(storms$long), max(storms$long)),
+             ylim  = c(min(storms$lat), max(storms$lat)))
```



Problem 4: explain command (no R needed)

Consider the data set shown in the table below. Each row represents a class and `classType` of `S` denotes a statistics class and `C` denotes a CS class. The variable `m` counts the number of mac users in the class and `w` counts the number of windows users.

classType	m	w
C	10	4
C	3	1
C	7	3
S	2	7
S	7	10

What data set will be produced by the following commands? Describe (**in words**) how the original data set is being modified and show what it looks like using an R Markdown table (like the one used above) to display the new data set. Assume the original data set is named `mydata`. (No credit will be given creating the fake data frame and just running the code chunks.)

a.

```
> mydata %>%
+   filter(classType == "C") %>%
+   select(m, w)
```

answer: This data set only looks at the number of mac/windows users in CS classes.

m	w
10	4
3	1
7	3

b.

```
> mydata %>%
+   mutate(ratioW = w/sum(w))
```

answer: The `sum(w)` denominator equals 25, so the ratios are 4/25, 1/25, etc. The value of 25 gives the total number of windows users in all classes so `ratioW` records the proportion of all windows users who are in a given class.

classType	m	w	ratioW
C	10	4	0.16
C	3	1	0.04
C	7	3	0.12
S	2	7	0.28
S	7	10	0.40

c.

```
> mydata %>%
+   group_by(classType) %>%
+   mutate(ratioW = w/sum(w))
```

answer: The `sum(w)` denominator equals the sum of `w` for each `classType` group. The total for `C` classes is 8 windows users in all CS classes listed and for `S` classes is 17 windows users in stats classes. `ratioW` records the proportion of all windows users in a given class type (CS or stats) who are in a specific class.

classType	m	w	ratioW
C	10	4	0.50
C	3	1	0.125
C	7	3	0.375
S	2	7	0.412
S	7	10	0.588

d.

```
> mydata %>%
+   group_by(classType) %>%
+   summarize(Y = sum(w+m))
```

answer: We are grouping by `classType` then summarizing the class totals `w+m` with the `sum` function. This will produce a small data frame that gives the total number of CS and stats students:

classType	Y
C	28

classType	Y
S	26

e.

```
> mydata %>%
+   group_by(classType) %>%
+   mutate(X = w+m, Y = sum(w+m))
```

answer:

We are grouping by `classType` which will only effect the output for any command that summarizes variables like `sum`. The `mutate` command preserves the original data frame and adds the variable `X` that records the total number of mac and windows users in a given class (row). The `Y` variable sums the values of `X` for all entries in each `classType` (grouping variable). These values are repeated (28 CS students and 26 stats students) for all classes in each `classType`.

classType	m	w	X	Y
C	10	4	14	28
C	3	1	4	28
C	7	3	10	28
S	2	7	9	26
S	7	10	17	26
