Historical snowpack

Roland Knapp

This file creates a dataset of the annual snowpack in Dana Meadows, Yosemite National Park. The data is from the Dana Meadows snow course (snow course number = DAN), and the annual 01-April data for the period 1927-to-present is downloaded from the California Data Exchange center using this link. Save the data displayed in browser window (right-click > Save Page As…) and don't add a file extension.

```r
library(tidyverse)
```

```
-- Attaching packages --------------------------------------- tidyverse 1.3.1 --

v ggplot2 3.3.6     v purrr   0.3.4
v tibble  3.1.7     v dplyr   1.0.9
v tidyr   1.2.0     v stringr 1.4.0
v readr   2.1.2     v forcats 0.5.1

-- Conflicts ------------------------------------------ tidyverse_conflicts() --
x dplyr::filter() masks stats::filter()
x dplyr::lag()    masks stats::lag()
```

```r
library(lubridate)
```

```
Attaching package: 'lubridate'

The following objects are masked from 'package:base':

    date, intersect, setdiff, union
```

Create dataset

Note that the data are in inches.

```
snowpack <- read_csv("snowQuery", na = "--") %>%
  mutate(Adjusted = ifelse(is.na(Adjusted), Water, Adjusted),
         year = year(my(Date)),
         date_measure = ymd(dmy(Meas.Date))) %>%
  rename(snow_depth = Depth,
         swe = Water,
         swe_adj = Adjusted) %>%
  select(year, date_measure, snow_depth, swe, swe_adj)
```

```
Rows: 96 Columns: 5
-- Column specification --------------------------------------------------------
Delimiter: ","
chr (2): Date, Meas.Date
dbl (3): Depth, Water, Adjusted

i Use `spec()` to retrieve the full column specification for this data.
i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

- year: year in which 01-April snow course measurement was made

- date_measure: date on with 01-April snow course measurement was made

- snow_depth: snow depth from snow course, in inches

- swe: snow water equivalent from snow course

- swe_adj: snow water equivalent from snow course, adjusted by jurisdiction that collected data

- swe_pave: adjusted snow water equivalent, as a percentage of the average

Add current-year snowpack from snow pillow

To include current snowpack measured prior to 01-April, use daily data from DAN snow pillow.

```
snow_current <- tibble("year" = 2023, date_measure = ymd("2023-03-04"), snow_depth = 146,

snowpack <- bind_rows(snowpack, snow_current)
```

Calculate snowpack as percent of long-term average

```r
swe_ave <- snowpack %>%
  filter(year != 2023) %>%
  summarise(swe_mean = mean(swe_adj))

snowpack <- snowpack %>%
  mutate(swe_pave = (swe_adj / swe_ave$swe_mean) * 100)
```

Plot data

```r
# Plot of snowpack from 1927 to current year
snowpack %>%
  ggplot(aes(x = year, y = swe_pave)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = seq(1925, 2025, 10)) +
  labs(x = "Year", y = "Snow water equivalent (% of average)") +
  geom_hline(yintercept = 100, color = "red")
```
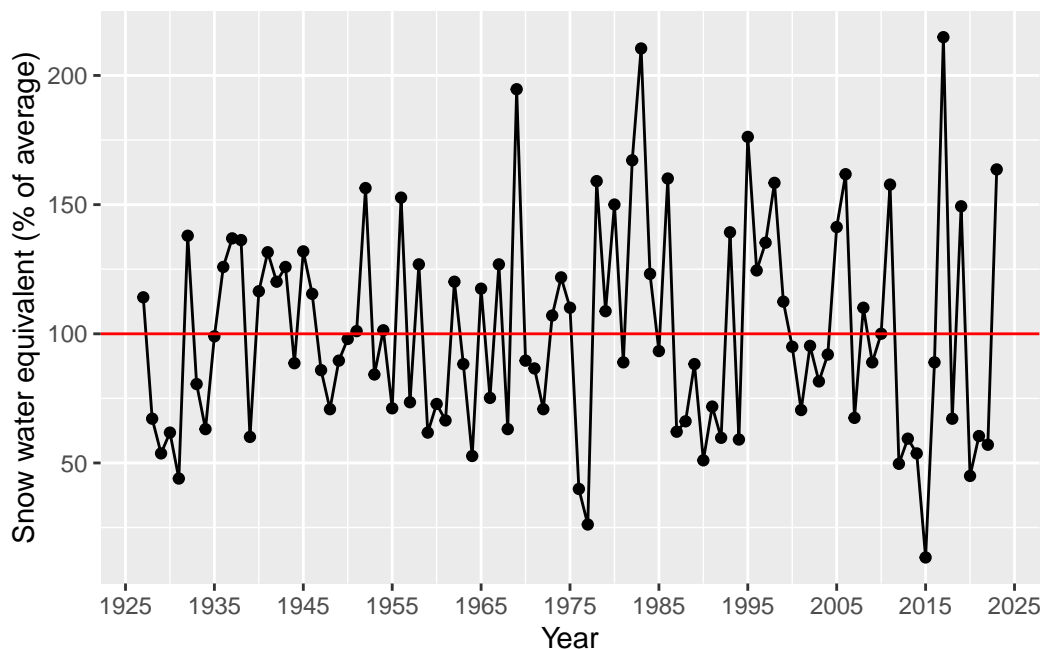
```
snowpack %>%
  ggplot(aes(x = year, y = swe_adj)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = seq(1925, 2025, 10)) +
  labs(x = "Year", y = "Snow water equivalent (inches)") +
  geom_hline(yintercept = swe_ave$swe_mean, color = "red")
```
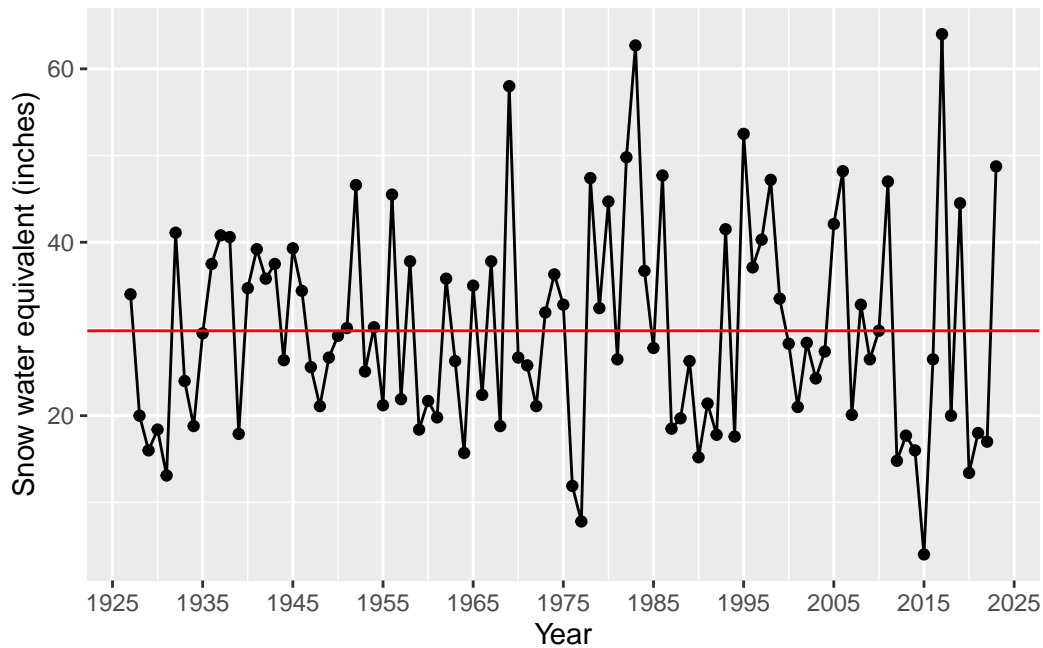


```
# Plot of snowpack from 2000 to current year
snowpack %>%
  filter(year >= 2000) %>%
  ggplot(aes(x = year, y = swe_pave)) +
  geom_line() +
  geom_point() +
  scale_x_continuous(breaks = seq(2000, 2024, 1), minor_breaks = NULL) +
  labs(x = "Year", y = "Snow water equivalent (% of average)") +
  geom_hline(yintercept = 100, color = "red") +
  theme(axis.text.x = element_text(angle = 90))
```