Arranging logger data from HoboLink

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Contents

Intro

The data exports for the temperature and humidity MX loggers from Hobo needs a bit of data wrangling before it can be used. The different data streams from each logger all get a separate column. Here we develop a script to turn this into a more usable long format.

Read in data

I have a single export with many loggers, as a csv file.

```
inputFile <- "../rawData/All_MX_2020_2020_06_26_09_20_43_UTC_1.csv"

rawDat <- read_csv(inputFile,col_types = cols(.default = "c"))

dat <- rawDat %>%
  select(-"Line#") %>%
  mutate(date = as.POSIXct(Date, format = "%m/%d/%y %H:%M:%S")) %>%
  mutate_if(is_character, as.double) %>%
  select(-Date)
```

```
## Warning: NAs introduced by coercion
```

```
dat
```

```
## # A tibble: 6,889 x 64
##    `Temperature (M~ `RH (MX-RH-2 20~ `Dew Point (MX-~ `Temperature (M~
##               <dbl>            <dbl>            <dbl>            <dbl>
##  1              NA               NA               NA                NA
##  2            NA              NA              NA                NA
##  3            22.3            28.2             3.05             NA
##  4            NA              NA              NA                NA
##  5            24.7            25.6             3.69             NA
##  6            NA              NA              NA                NA
##  7            25.5            24.4             3.72             NA
##  8            NA              NA              NA                NA
##  9            26.1            24.0             3.95             NA
## 10            NA              NA              NA                NA
## # ... with 6,879 more rows, and 60 more variables: `RH (MX-RH-2
## #   20835815:20835815-2), %, 20835815` <dbl>, `Dew Point (MX-TEMP-2
## #   20835815:20835815-4), *C, 20835815` <dbl>, `Temperature (MX-TEMP-2
## #   20835816:20835816-1), *C, 20835816` <dbl>, `RH (MX-RH-2
## #   20835816:20835816-2), %, 20835816` <dbl>, `Dew Point (MX-TEMP-2
## #   20835816:20835816-4), *C, 20835816` <dbl>, `Temperature (MX-TEMP-2
## #   20835817:20835817-1), *C, 20835817` <dbl>, `RH (MX-RH-2
## #   20835817:20835817-2), %, 20835817` <dbl>, `Dew Point (MX-TEMP-2
## #   20835817:20835817-4), *C, 20835817` <dbl>, `Temperature (MX-TEMP-2
## #   20835818:20835818-1), *C, 20835818` <dbl>, `RH (MX-RH-2
## #   20835818:20835818-2), %, 20835818` <dbl>, `Dew Point (MX-TEMP-2
## #   20835818:20835818-4), *C, 20835818` <dbl>, `Temperature (MX-TEMP-2
## #   20835819:20835819-1), *C, 20835819` <dbl>, `RH (MX-RH-2
## #   20835819:20835819-2), %, 20835819` <dbl>, `Dew Point (MX-TEMP-2
## #   20835819:20835819-4), *C, 20835819` <dbl>, `Temperature (MX-TEMP-2
## #   20835820:20835820-1), *C, 20835820` <dbl>, `RH (MX-RH-2
## #   20835820:20835820-2), %, 20835820` <dbl>, `Dew Point (MX-TEMP-2
## #   20835820:20835820-4), *C, 20835820` <dbl>, `Temperature (MX-TEMP-2
## #   20835821:20835821-1), *C, 20835821` <dbl>, `RH (MX-RH-2
## #   20835821:20835821-2), %, 20835821` <dbl>, `Dew Point (MX-TEMP-2
## #   20835821:20835821-4), *C, 20835821` <dbl>, `Temperature (MX-TEMP-2
## #   20835822:20835822-1), *C, 20835822` <dbl>, `RH (MX-RH-2
## #   20835822:20835822-2), %, 20835822` <dbl>, `Dew Point (MX-TEMP-2
## #   20835822:20835822-4), *C, 20835822` <dbl>, `Temperature (MX-TEMP-2
## #   20835823:20835823-1), *C, 20835823` <dbl>, `RH (MX-RH-2
## #   20835823:20835823-2), %, 20835823` <dbl>, `Dew Point (MX-TEMP-2
## #   20835823:20835823-4), *C, 20835823` <dbl>, `Temperature (MX-TEMP-2
## #   20835824:20835824-1), *C, 20835824` <dbl>, `RH (MX-RH-2
## #   20835824:20835824-2), %, 20835824` <dbl>, `Dew Point (MX-TEMP-2
## #   20835824:20835824-4), *C, 20835824` <dbl>, `Temperature (MX-TEMP-2
## #   20835825:20835825-1), *C, 20835825` <dbl>, `RH (MX-RH-2
## #   20835825:20835825-2), %, 20835825` <dbl>, `Dew Point (MX-TEMP-2
## #   20835825:20835825-4), *C, 20835825` <dbl>, `Temperature (MX-TEMP-2
## #   20843228:20843228-1), *C, 20843228` <dbl>, `RH (MX-RH-2
## #   20843228:20843228-2), %, 20843228` <dbl>, `Dew Point (MX-TEMP-2
## #   20843228:20843228-4), *C, 20843228` <dbl>, `Temperature (MX-TEMP-2
## #   20843229:20843229-1), *C, 20843229` <dbl>, `RH (MX-RH-2
## #   20843229:20843229-2), %, 20843229` <dbl>, `Dew Point (MX-TEMP-2
## #   20843229:20843229-4), *C, 20843229` <dbl>, `Temperature (MX-TEMP-2
## #   20843230:20843230-1), *C, 20843230` <dbl>, `RH (MX-RH-2
## #   20843230:20843230-2), %, 20843230` <dbl>, `Dew Point (MX-TEMP-2
## #   20843230:20843230-4), *C, 20843230` <dbl>, `Temperature (MX-TEMP-2
## #   20843231:20843231-1), *C, 20843231` <dbl>, `RH (MX-RH-2
## #   20843231:20843231-2), %, 20843231` <dbl>, `Dew Point (MX-TEMP-2
## #   20843231:20843231-4), *C, 20843231` <dbl>, `Temperature (MX-TEMP-2
## #   20843233:20843233-1), *C, 20843233` <dbl>, `RH (MX-RH-2
## #   20843233:20843233-2), %, 20843233` <dbl>, `Dew Point (MX-TEMP-2
## #   20843233:20843233-4), *C, 20843233` <dbl>, `Temperature (MX-TEMP-2
## #   20843235:20843235-1), *C, 20843235` <dbl>, `RH (MX-RH-2
## #   20843235:20843235-2), %, 20843235` <dbl>, `Dew Point (MX-TEMP-2
## #   20843235:20843235-4), *C, 20843235` <dbl>, `Temperature (MX-TEMP-2
## #   20843236:20843236-1), *C, 20843236` <dbl>, `RH (MX-RH-2
## #   20843236:20843236-2), %, 20843236` <dbl>, `Dew Point (MX-TEMP-2
## #   20843236:20843236-4), *C, 20843236` <dbl>, `Temperature (MX-TEMP-2
## #   20843238:20843238-1), *C, 20843238` <dbl>, `RH (MX-RH-2
## #   20843238:20843238-2), %, 20843238` <dbl>, `Dew Point (MX-TEMP-2
## #   20843238:20843238-4), *C, 20843238` <dbl>, `Temperature (MX-TEMP-2
## #   20843239:20843239-1), *C, 20843239` <dbl>, `RH (MX-RH-2
## #   20843239:20843239-2), %, 20843239` <dbl>, `Dew Point (MX-TEMP-2
## #   20843239:20843239-4), *C, 20843239` <dbl>, date <dttm>
```

That's quite the number of columns…

We have to pivot this data set to a longer format. We also get rid of the rows with no data.

```
temp <- dat %>%
  pivot_longer(cols = starts_with("Temperature"),
               names_to = "logger",
               values_to = "temperature") %>%
  select(date,
         logger,
         temperature) %>%
  filter(!is.na(temperature))

rh <- dat %>%
  pivot_longer(cols = starts_with("RH"),
               names_to = "logger",
               values_to = "rh") %>%
  select(date,
         logger,
         rh)%>%
  filter(!is.na(rh))
```

```
dew  <- dat %>%
  pivot_longer(cols = starts_with("Dew"),
               names_to = "logger",
               values_to = "dew") %>%
  select(date,
         logger,
         dew) %>%
  filter(!is.na(dew))
```

The data now looks like this

```
temp
```

```
## # A tibble: 6,889 x 3
##    date                logger                                    temperature
##    <dttm>              <chr>                                           <dbl>
##  1 2020-05-14 08:21:51 Temperature (MX-TEMP-2 20843236:2084323~         20.8
##  2 2020-05-14 08:41:51 Temperature (MX-TEMP-2 20843236:2084323~         22.2
##  3 2020-05-14 08:54:29 Temperature (MX-TEMP-2 20835814:2083581~         22.3
##  4 2020-05-14 09:01:51 Temperature (MX-TEMP-2 20843236:2084323~         24.9
##  5 2020-05-14 09:14:29 Temperature (MX-TEMP-2 20835814:2083581~         24.7
##  6 2020-05-14 09:21:51 Temperature (MX-TEMP-2 20843236:2084323~         26.2
##  7 2020-05-14 09:34:29 Temperature (MX-TEMP-2 20835814:2083581~         25.5
##  8 2020-05-14 09:41:51 Temperature (MX-TEMP-2 20843236:2084323~         26.6
##  9 2020-05-14 09:54:29 Temperature (MX-TEMP-2 20835814:2083581~         26.1
## 10 2020-05-14 10:01:51 Temperature (MX-TEMP-2 20843236:2084323~         27.2
## # ... with 6,879 more rows
```

Time to strip the logger names and merge the tables

```
temp <- temp %>%
  mutate(logger = str_extract(logger,
                              "[^, ]+$"))

rh <- rh %>%
  mutate(logger = str_extract(logger,
                              "[^, ]+$"))
dew <- dew %>%
  mutate(logger = str_extract(logger,
                              "[^, ]+$"))
```

Check to see that the dates are the same for the datasets

```
all(all(temp$date == rh$date),
all(rh$date == dew$date))
```

```
## [1] TRUE
```

```r
combDat <- temp %>%
  full_join(rh,
            by = c("date" = "date",
                   "logger" = "logger")) %>%
  full_join(dew,
           by = c("date" = "date",
                   "logger" = "logger")) %>%
  arrange(logger,
          date)
```

```r
combDat
```

```
## # A tibble: 6,889 x 5
##    date                logger   temperature    rh   dew
##    <dttm>              <chr>          <dbl> <dbl> <dbl>
##  1 2020-05-14 08:54:29 20835814       22.3   28.2  3.05
##  2 2020-05-14 09:14:29 20835814       24.7   25.6  3.69
##  3 2020-05-14 09:34:29 20835814       25.5   24.4  3.72
##  4 2020-05-14 09:54:29 20835814       26.1   24.0  3.95
##  5 2020-05-14 10:14:29 20835814       26.5   23.2  3.83
##  6 2020-05-14 10:34:29 20835814       26.5   23.3  3.91
##  7 2020-05-14 10:54:29 20835814       20.6   19.5 -3.47
##  8 2020-05-14 11:14:29 20835814        5.32  47.9 -4.83
##  9 2020-05-14 11:34:29 20835814        4.53  53.3 -4.13
## 10 2020-05-14 14:39:05 20835814        1.88  79.3 -1.32
## # ... with 6,879 more rows
```

Package this into a function

```r
longerHobo <- function(inputFile){

  rawDat <- read_csv(inputFile,col_types = cols(.default = "c"))

  dat <- rawDat %>%
    select(-"Line#") %>%
    mutate(date = as.POSIXct(Date, format = "%m/%d/%y %H:%M:%S")) %>%
    mutate_if(is_character, as.double) %>%
    select(-Date)

    dat <- rawDat %>%
  select(-"Line#") %>%
  mutate(date = as.POSIXct(Date, format = "%m/%d/%y %H:%M:%S")) %>%
  mutate_if(is_character, as.double) %>%
  select(-Date)
```

```
temp <- dat %>%
  pivot_longer(cols = starts_with("Temperature"),
             names_to = "logger",
             values_to = "temperature") %>%
  select(date,
       logger,
       temperature) %>%
  filter(!is.na(temperature))

rh <- dat %>%
  pivot_longer(cols = starts_with("RH"),
               names_to = "logger",
               values_to = "rh") %>%
  select(date,
         logger,
         rh)%>%
  filter(!is.na(rh))

dew  <- dat %>%
  pivot_longer(cols = starts_with("Dew"),
               names_to = "logger",
               values_to = "dew") %>%
  select(date,
         logger,
         dew) %>%
  filter(!is.na(dew))


temp <- temp %>%
  mutate(logger = str_extract(logger,
                            "[^, ]+$"))
rh <- rh %>%
  mutate(logger = str_extract(logger,
                              "[^, ]+$"))
dew <- dew %>%
  mutate(logger = str_extract(logger,
                              "[^, ]+$"))

if(!all(all(temp$date == rh$date),
all(rh$date == dew$date))) stop("Tables datetimes doesn't match")

combDat <- temp %>%
full_join(rh,
           by = c("date" = "date",
                  "logger" = "logger")) %>%
```

```r
  full_join(dew,
            by = c("date" = "date",
                   "logger" = "logger")) %>%
  arrange(logger,
          date)

  return(combDat)
}
```

We can check that it produces the same results as the script.

```r
combDat2 <- longerHobo("../rawData/All_MX_2020_2020_06_26_09_20_43_UTC_1.csv")
```

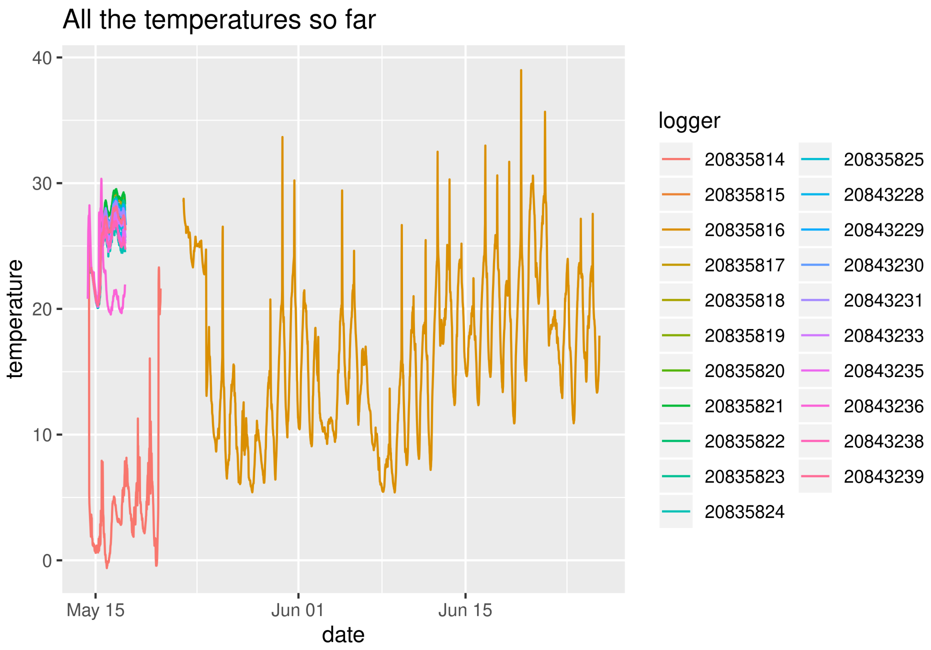
```
## Warning: NAs introduced by coercion

## Warning: NAs introduced by coercion
```

```r
all(combDat == combDat2)
```

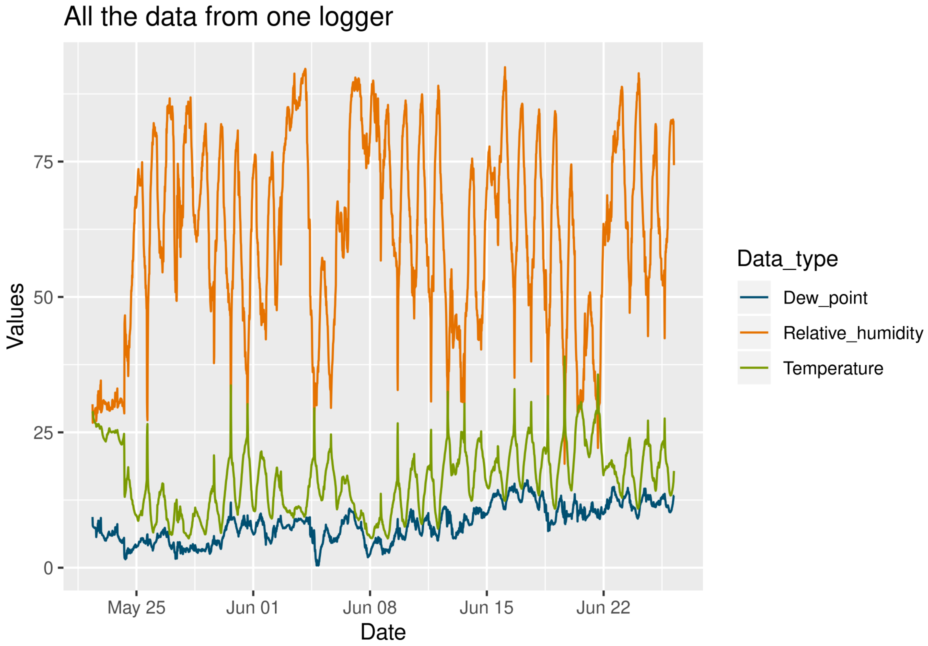
```
## [1] TRUE
```

Check the data out

```r
ggplot(combDat) +
  geom_line(aes(x = date, y = temperature, color = logger)) +
  ggtitle("All the temperatures so far")
```



```
oneLogger <- combDat %>%
  filter(logger == "20835816") %>%
  select(Date = date,
         logger,
         Temperature = temperature,
         Relative_humidity = rh,
         Dew_point = dew) %>%
  pivot_longer(-c(Date, logger),
               names_to = "Data_type",
               values_to = "Values")

ggplot(oneLogger) +
  geom_line(aes(x = Date, y = Values, color = Data_type)) +
  scale_color_nina() +
  ggtitle("All the data from one logger")
```



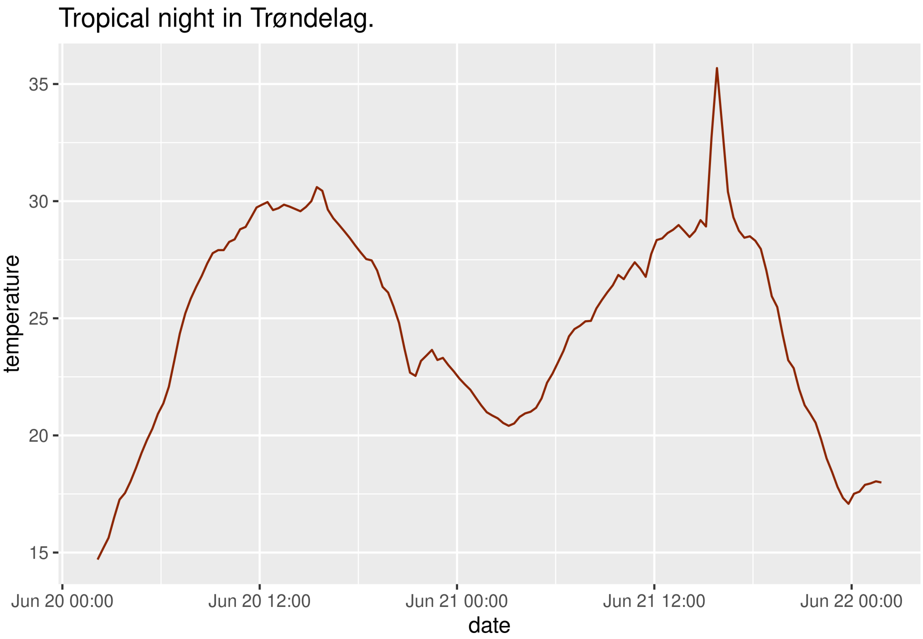
That looks like some days were pretty warm. This logger was placed outside my house and gets some sun in the evening. Let's look at the hottest day. We can add columns with the highest temperature per day and lowest. I'll look at dates later than 25/5 since I think I had it indoors until then.

```
minMaxTemp <- combDat %>%
  mutate(day = as.Date(date)) %>%
  group_by(logger, day) %>%
  mutate(dailyMaxTemp = max(temperature),
         dailyMinTemp = min(temperature)) %>%
  ungroup()


minMaxTemp %>%
  filter(logger == "20835816") %>%
  filter(day > '2020-05-25') %>%
  filter(dailyMinTemp == max(dailyMinTemp))
```

```
## # A tibble: 72 x 8
##    date                logger temperature    rh   dew day
##    <dttm>              <chr>        <dbl> <dbl> <dbl> <date>
##  1 2020-06-21 02:08:33 20835~        20.8  48.7  9.66 2020-06-21
##  2 2020-06-21 02:28:33 20835~        20.7  48.9  9.62 2020-06-21
##  3 2020-06-21 02:48:33 20835~        20.5  50.2  9.83 2020-06-21
##  4 2020-06-21 03:08:33 20835~        20.4  50.1  9.69 2020-06-21
##  5 2020-06-21 03:28:33 20835~        20.5  50.1  9.77 2020-06-21
##  6 2020-06-21 03:48:33 20835~        20.8  49.8  9.94 2020-06-21
##  7 2020-06-21 04:08:33 20835~        20.9  50.4 10.3  2020-06-21
##  8 2020-06-21 04:28:33 20835~        21.0  50.8 10.5  2020-06-21
##  9 2020-06-21 04:48:33 20835~        21.2  50.3 10.4  2020-06-21
## 10 2020-06-21 05:08:33 20835~        21.6  49   10.4  2020-06-21
## # ... with 62 more rows, and 2 more variables: dailyMaxTemp <dbl>,
## #   dailyMinTemp <dbl>
```

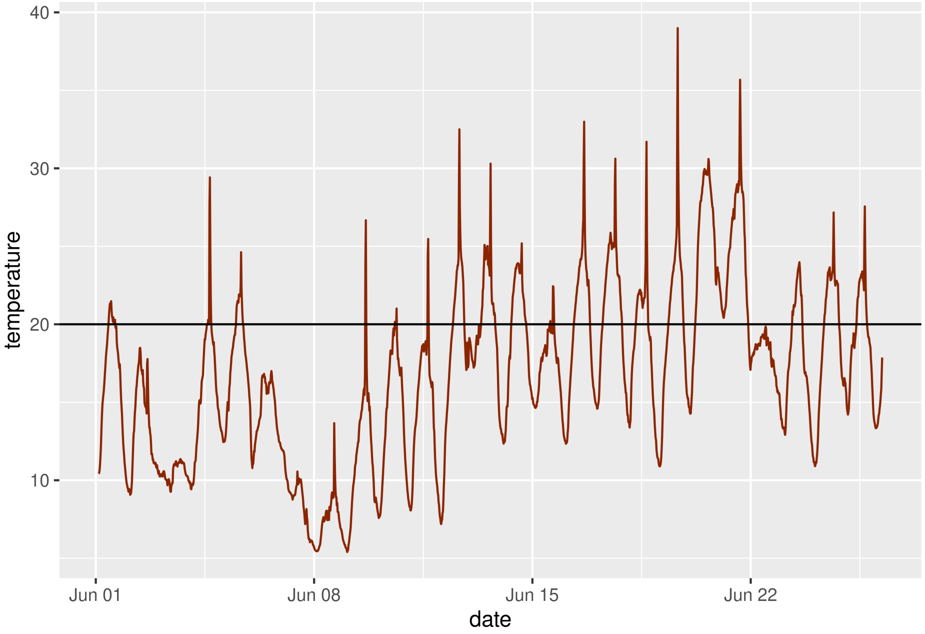
So it looks like 2020-06-21 had the “highest lowest” daily temperature. A little poking around shows that the night up to the 21/6 actually was a “tropical night”, with temperatures above 20° Celsius. The sharp spike above 35 degrees at about 16:00 on 22/6 is when the sun hit the logger.

```
minMaxTemp %>%
  filter(logger == "20835816") %>%
  filter(day >= '2020-06-20' &
           day <= '2020-06-21') %>%
  ggplot(.) +
  geom_line(aes(x = date, y = temperature), color = "orangered4") +
  ggtitle("Tropical night in Trøndelag.")
```



This seems to have been the only night so far this warm.

```
minMaxTemp %>%
  filter(logger == "20835816") %>%
  filter(day >= '2020-06-01' &
           day <= '2020-06-30') %>%
  ggplot(.) +
  geom_line(aes(x = date, y = temperature), color = "orangered4") +
  geom_hline(yintercept = 20)
```


temperature
Jun 01
Jun 08
Jun 15
Jun 22
date