Moritz-Ivo Will Plant Science Data

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Report for Greenhouse X1

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Jargon

- the X1 is greenhouse 1, (there are also larger datasets with X2) .
- The c, b and p behind X1 are the location of the sensors.
- PAR stands for photosynthetic active radiation (basically a measure of sunlight),
- T is temperature in degrees Celsius, and
- RH is relative humidity.

```r
rm(list = ls())
plant_science <- read_csv("./file.csv") %>%
  janitor::clean_names()
```

```
## New names:
## * '' -> ...1
```

```
## Rows: 1000 Columns: 38
```

```
## -- Column specification ---------------------------------------------------
## Delimiter: ","
## dbl (38): ...1, time, X1c.PAR1, X1c.PAR2, X1c.PAR3, X1c.PAR4, X1c.T1, X1c.T2...
```

```
##
## 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.
```

```r
plant_science <- plant_science %>% janitor::remove_empty(which = c("rows","cols"))
```
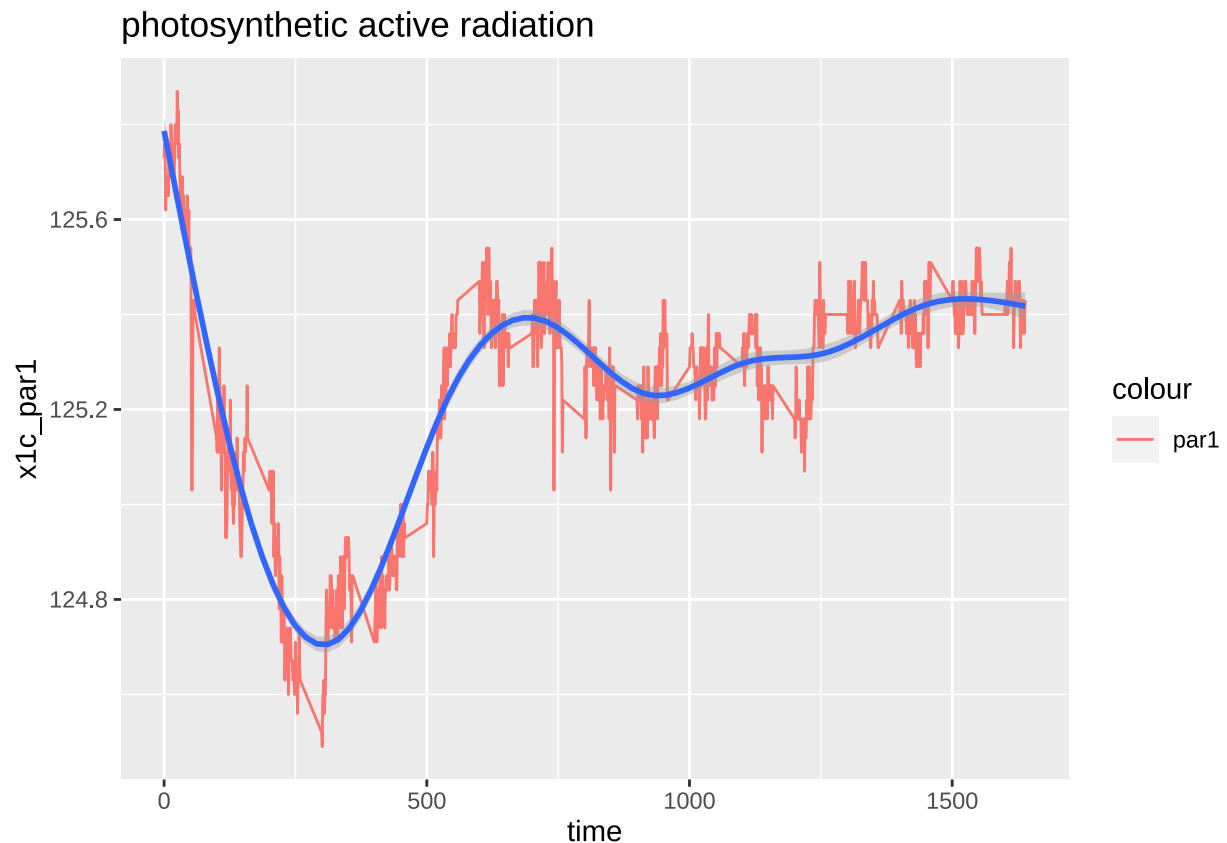
Sensor X1C

```r
sensor_x1c <- plant_science %>% select(time:x1c_rh4)
sensor_x1c %>% dlookr::diagnose_numeric()
```

```
## # A tibble: 13 x 10
##    variables    min    Q1    mean median     Q3    max  zero minus outlier
##    <chr>      <dbl> <dbl>   <dbl>  <dbl>  <dbl>  <dbl> <int> <int>   <int>
##  1 time           0  410.   813.   820.  1229.  1639      1     0       0
##  2 x1c_par1    124.  125.   125.   125.   125.   126.     0     0      47
##  3 x1c_par2    27.1  27.3   27.4   27.4   27.5   27.6     0     0       0
##  4 x1c_par3    9.88  9.95   10.0   10.0   10.1   10.3     0     0       1
##  5 x1c_par4    0.03  0.07  0.0698   0.07   0.07   0.07     0     0       4
##  6 x1c_t1      21.2  21.3   21.4   21.4   21.4   21.5     0     0       0
##  7 x1c_t2      20.1  20.3   20.3   20.3   20.3   20.4     0     0      76
##  8 x1c_t3      19.9  20.0   20.0   20.1   20.1   20.1     0     0       0
##  9 x1c_t4      20.4  20.5   20.5   20.5   20.6   20.6     0     0       0
## 10 x1c_rh1     72.4    74   75.0   74.8   75.8   79.0     0     0      14
## 11 x1c_rh2     81.6  84.4   85.3   85.4   86.5   88.4     0     0       0
## 12 x1c_rh3     82.4  83.0   83.8   83.4   84.4   87.7     0     0      34
## 13 x1c_rh4     76.2  77.2   77.7   77.5   78.2   80.2     0     0      31
```

```
ggplot(sensor_x1c) + geom_line(aes(x=time,y=x1c_par1,col="par1")) +
  geom_smooth(aes(x=time,y=x1c_par1)) +
  labs(title = "photosynthetic active radiation")
```

```
## 'geom_smooth()' using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

```
ggplot(sensor_x1c) + geom_point(aes(x=time,y=x1c_t1,col="t1")) +
  geom_smooth(aes(x=time,y=x1c_t1)) +
  labs(title ="T is temperature in degrees Celsius")
```
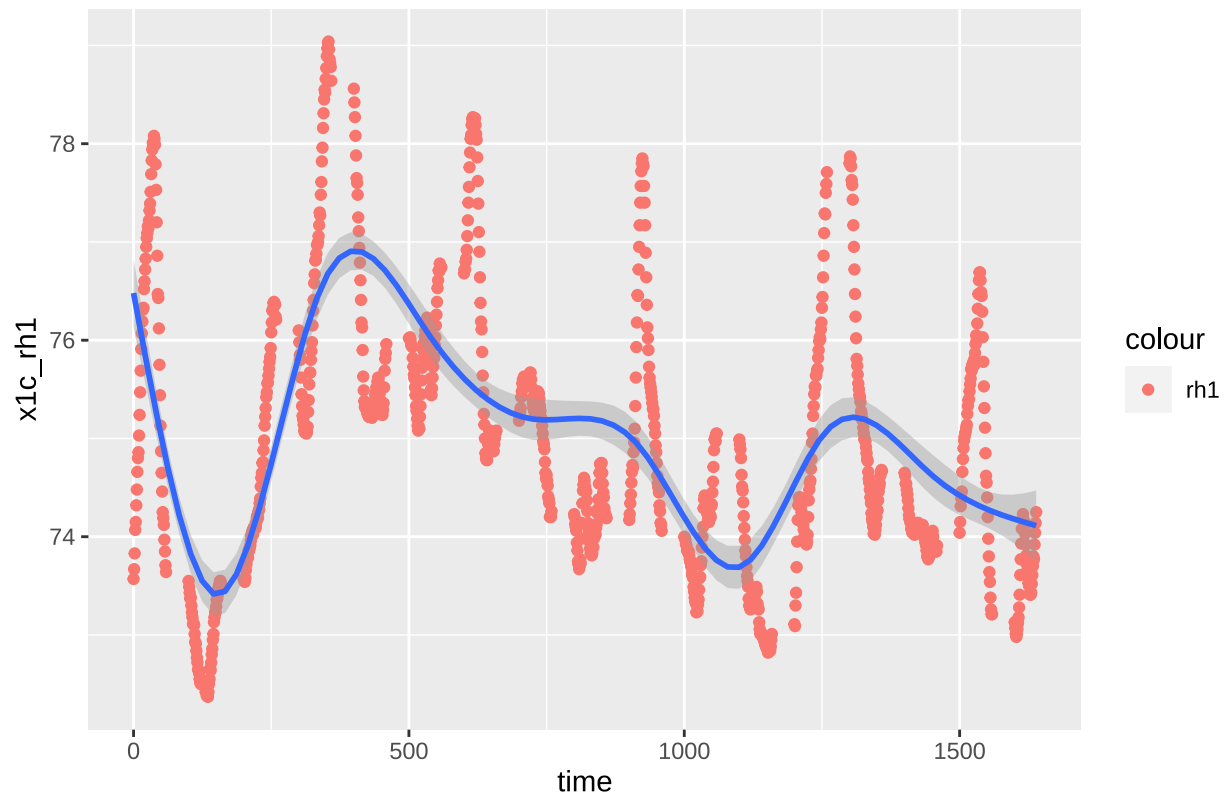
`geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

T is temperature in degrees Celsius
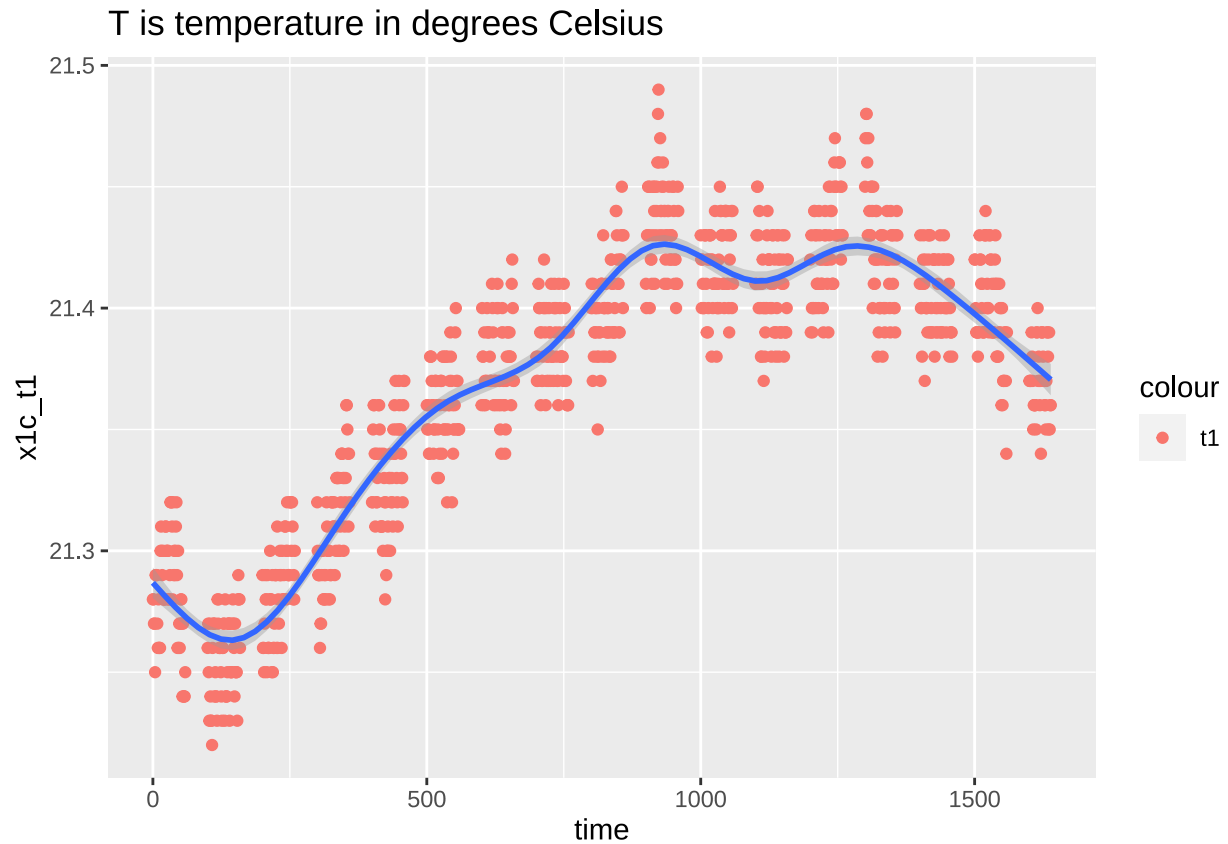

```
ggplot(sensor_x1c) + geom_point(aes(x=time,y=x1c_rh1,col="rh1")) +
  geom_smooth(aes(x=time,y=x1c_rh1)) +
  labs(title ="RH is relative humidity")
```
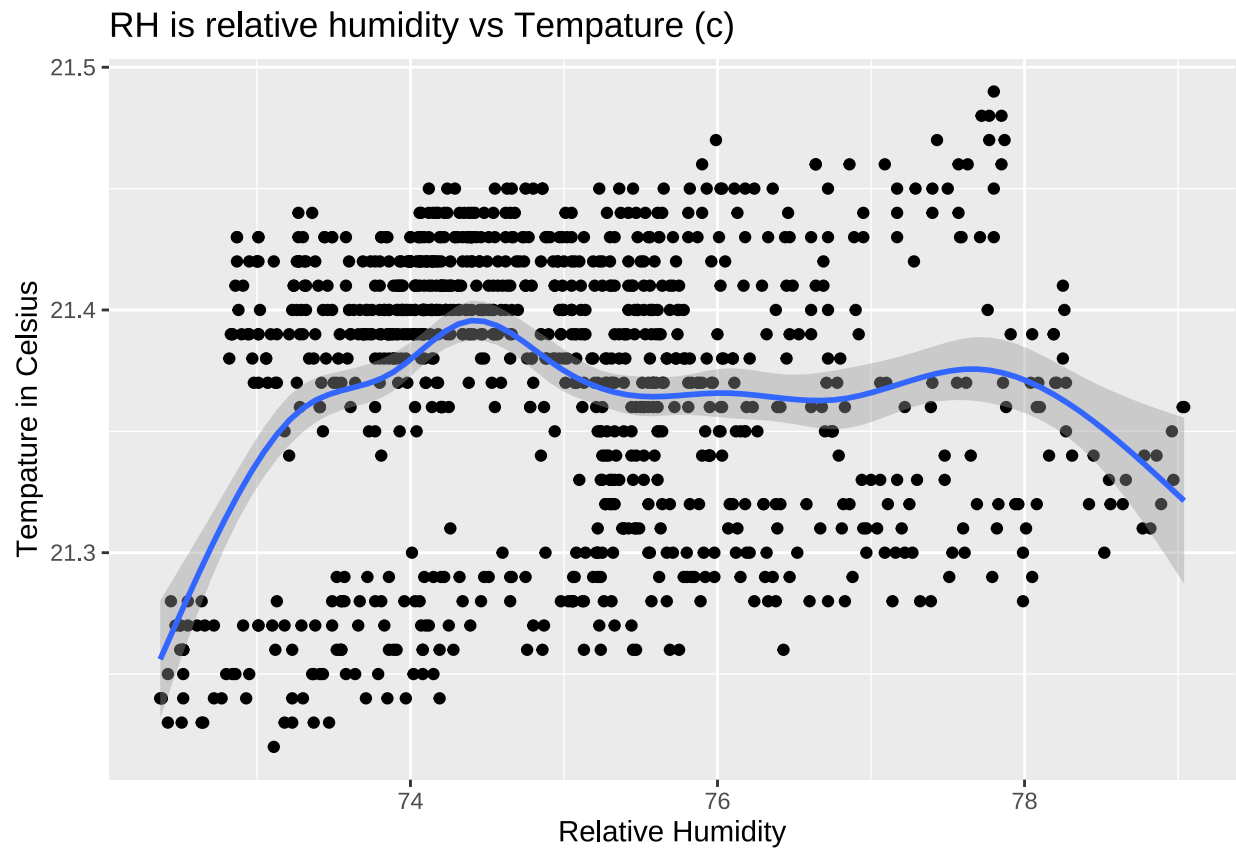
`geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

RH is relative humidity


```
ggplot(sensor_x1c) + geom_point(aes(y=x1c_t1,x=x1c_rh1)) +
  labs(title ="RH is relative humidity vs Tempature (c)",
       y="Tempature in Celsius",x="Relative Humidity") +
  geom_smooth(aes(x=x1c_rh1,y=x1c_t1))
```

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

RH is relative humidity vs Tempature (c)


```
ggplot(sensor_x1c) + geom_point(aes(x=x1c_t1,y=x1c_rh1)) +
  labs(title ="RH is relative humidity vs Tempature (c)",
       y="Tempature in Celsius",x="Relative Humidity") +
  geom_smooth(aes(x=x1c_t1,y=x1c_rh1))
```

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

RH is relative humidity vs Tempature (c)
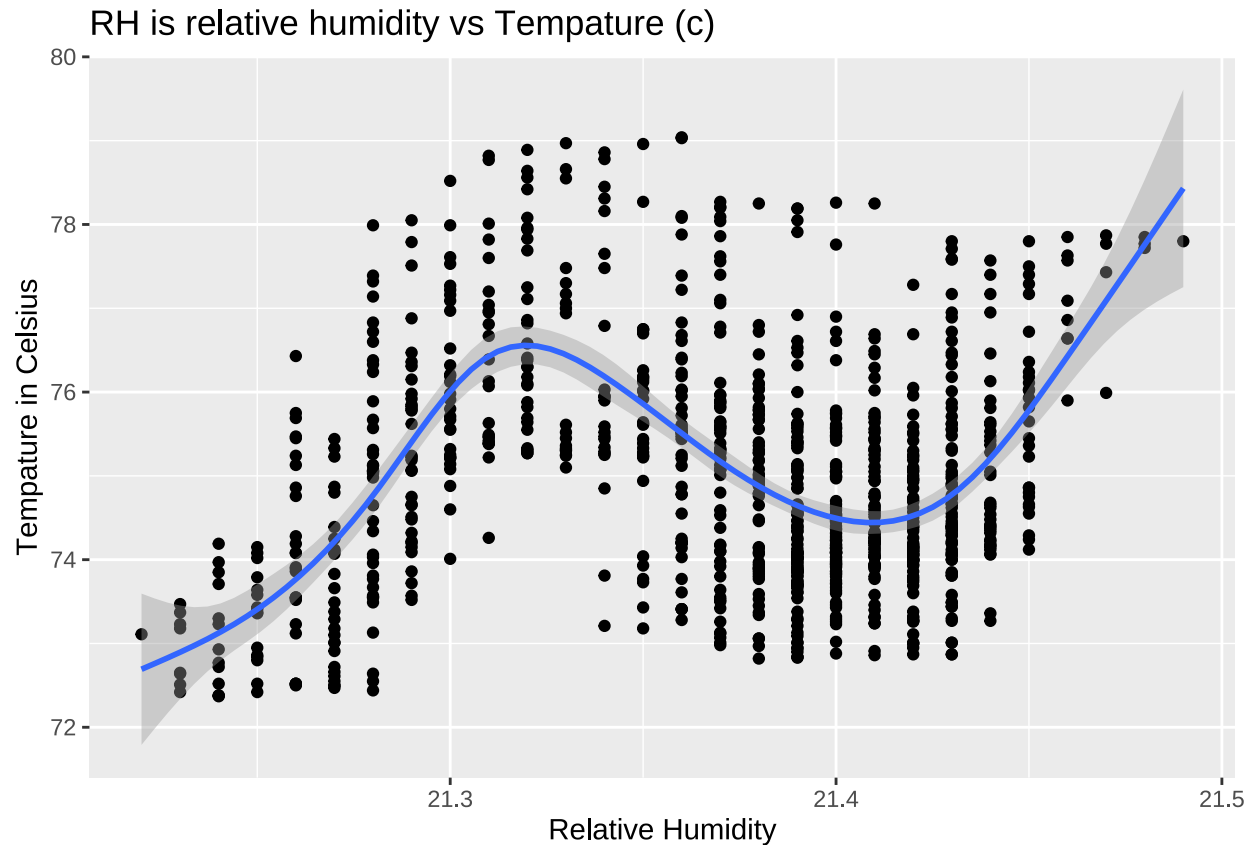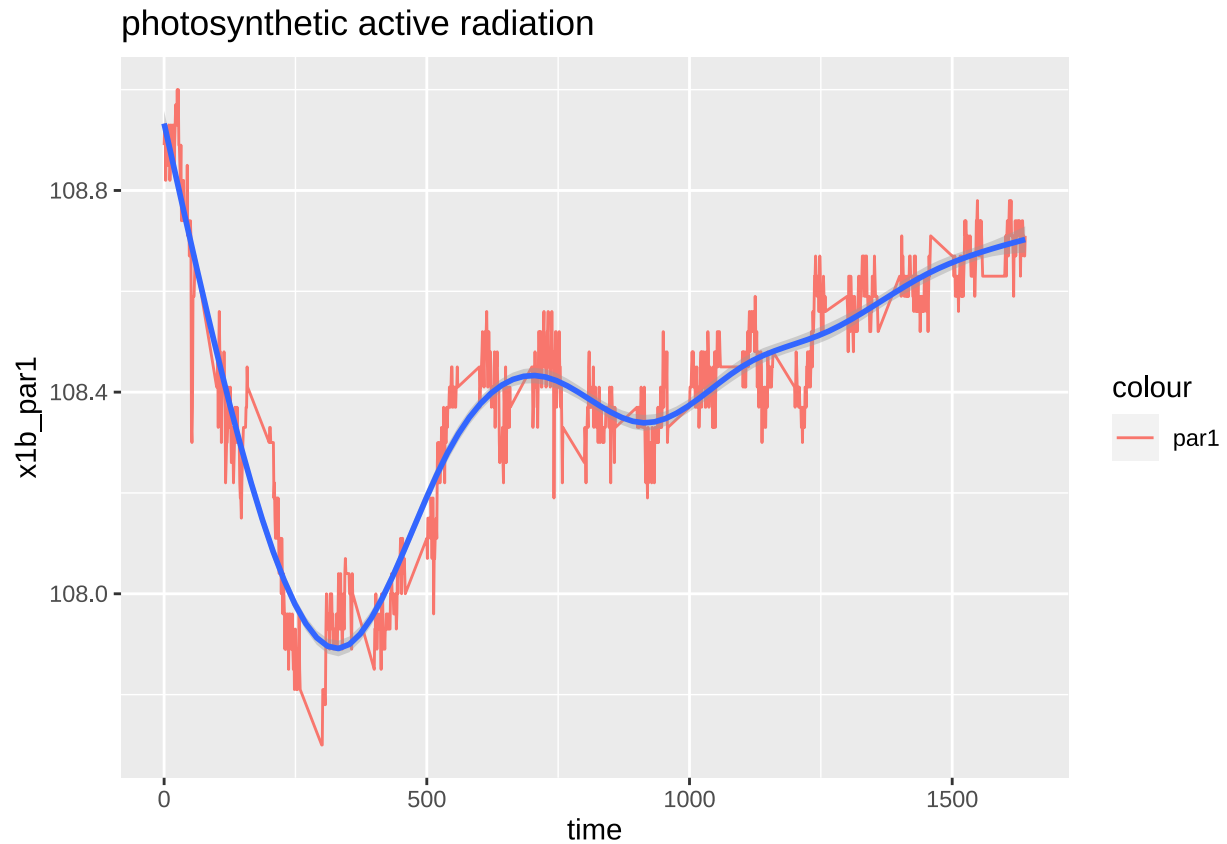

Sensor X1B

```
sensor_x1b <- plant_science %>% select(time,starts_with("x1b_"))
sensor_x1b %>% dlookr::diagnose_numeric()
```

```
## # A tibble: 13 x 10
##    variables    min     Q1     mean median     Q3    max  zero minus outlier
##    <chr>      <dbl>  <dbl>    <dbl>  <dbl>  <dbl>  <dbl> <int> <int>   <int>
##  1 time           0   410.   813.    820.  1229.   1639     1     0       0
##  2 x1b_par1    108.   108.   108.    108.   109.    109     0     0      20
##  3 x1b_par2    61.1   61.5   61.5    61.5   61.6   61.9     0     0     142
##  4 x1b_par3    39.7   39.8   39.9    39.9   40.0   40.1     0     0       7
##  5 x1b_par4    0.06   0.06   0.0616  0.06   0.06    0.1     0     0      39
##  6 x1b_t1      20.4   20.6   20.6    20.6   20.7   20.8     0     0      14
##  7 x1b_t2      20.2   20.4   20.4    20.4   20.5   20.5     0     0       1
##  8 x1b_t3      20.6   20.7   20.7    20.8   20.8   20.9     0     0       2
##  9 x1b_t4      20.8   20.9   20.9    20.9   21.0   21.1     0     0       0
## 10 x1b_rh1     75.7   77.4   78.4    78.2   79.2   82.4     0     0      10
## 11 x1b_rh2     77.8   79.7   80.6    80.5   81.6   83.8     0     0       0
## 12 x1b_rh3     74.7   76.1   77.0    76.9   77.9   79.2     0     0       0
## 13 x1b_rh4     73.2   74.6   75.4    75.4   76.2   77.8     0     0       0
```

```
ggplot(sensor_x1b) + geom_line(aes(x=time,y=x1b_par1,col="par1")) +
  geom_smooth(aes(x=time,y=x1b_par1)) +
  labs(title = "photosynthetic active radiation")
```
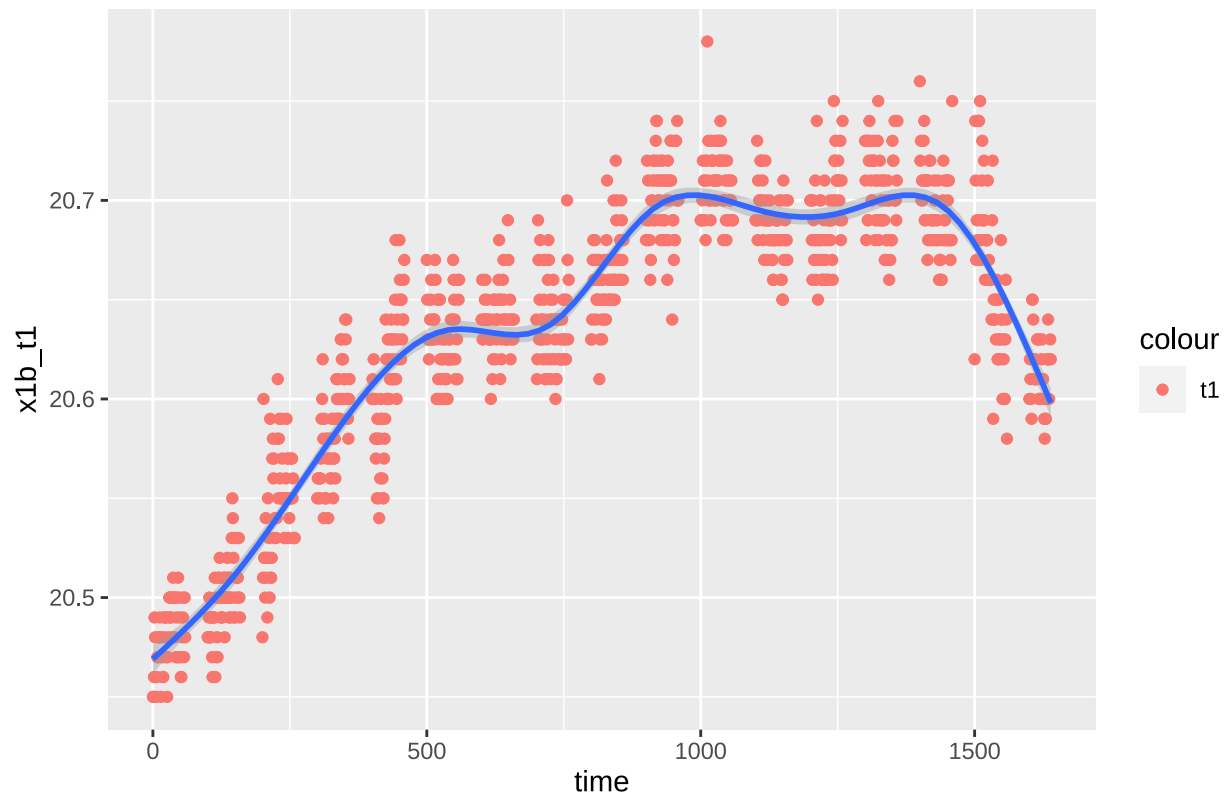
`geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

photosynthetic active radiation


```
ggplot(sensor_x1b) + geom_point(aes(x=time,y=x1b_t1,col="t1")) +
  geom_smooth(aes(x=time,y=x1b_t1)) +
  labs(title ="T is temperature in degrees Celsius")
```

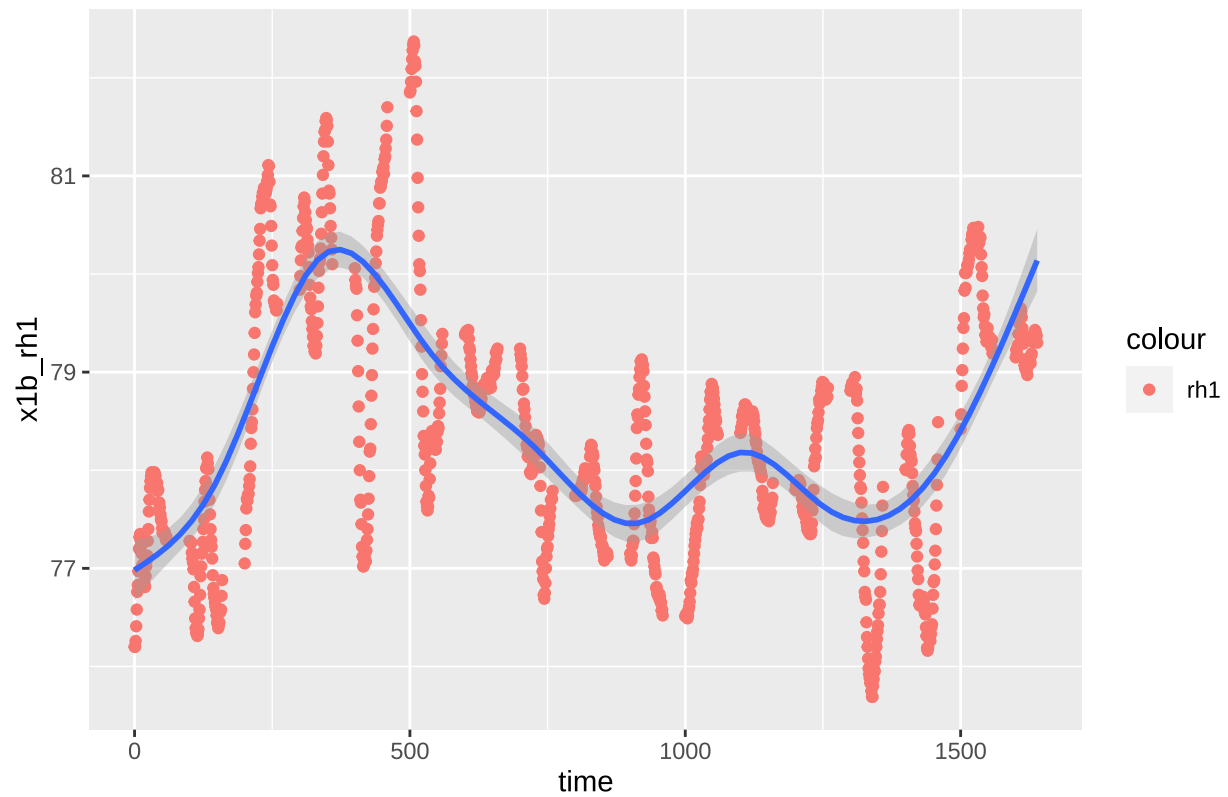## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

T is temperature in degrees Celsius


```
ggplot(sensor_x1b) + geom_point(aes(x=time,y=x1b_rh1,col="rh1")) +
  geom_smooth(aes(x=time,y=x1b_rh1)) +
  labs(title ="RH is relative humidity")
```

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```
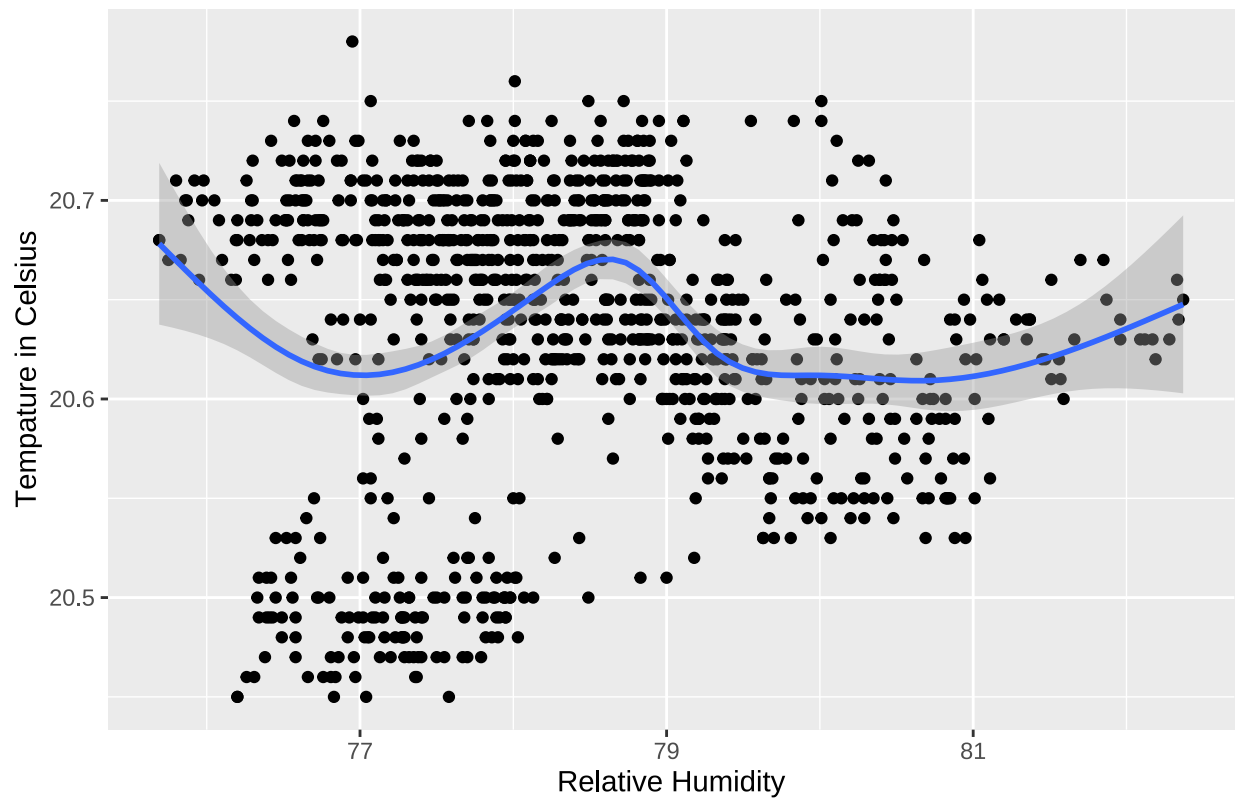
RH is relative humidity


```
ggplot(sensor_x1b) + geom_point(aes(y=x1b_t1,x=x1b_rh1)) +
  labs(title ="RH is relative humidity vs Tempature (c)",
       y="Tempature in Celsius",x="Relative Humidity") +
  geom_smooth(aes(x=x1b_rh1,y=x1b_t1))
```

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```
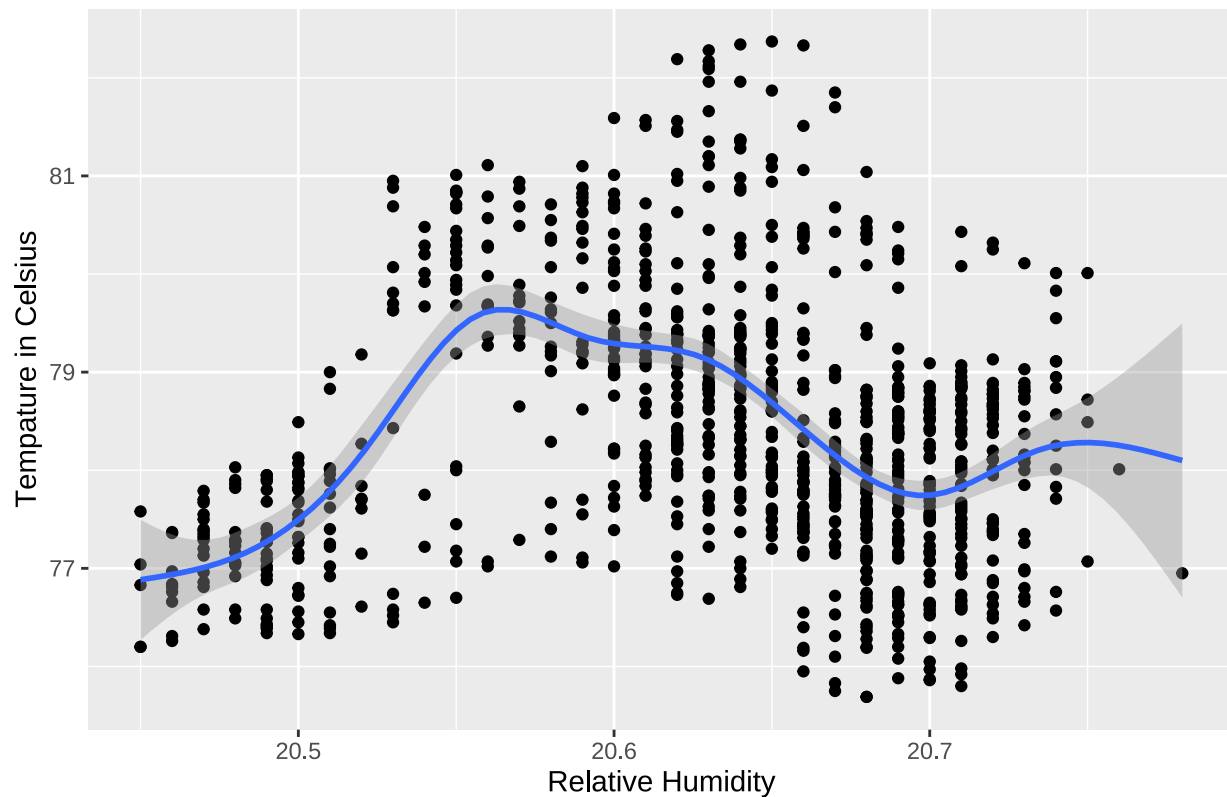
RH is relative humidity vs Tempature (c)


```
ggplot(sensor_x1b) + geom_point(aes(x=x1b_t1,y=x1b_rh1)) +
  labs(title ="RH is relative humidity vs Tempature (c)",
       y="Tempature in Celsius",x="Relative Humidity") +
  geom_smooth(aes(x=x1b_t1,y=x1b_rh1))
```

```
## 'geom_smooth()' using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

# RH is relative humidity vs Tempature (c)

Sensor X1P

```
sensor_x1p <- plant_science %>% select(time,starts_with("x1p_"))
sensor_x1p %>% dlookr::diagnose_numeric()
```

```
## # A tibble: 13 x 10
##    variables     min     Q1   mean median      Q3     max  zero minus outlier
##    <chr>       <dbl>  <dbl>  <dbl>  <dbl>   <dbl>   <dbl> <int> <int>   <int>
##  1 time            0   410.   813.   820.   1229.    1639     1     0       0
##  2 x1p_par1     143.   144.   144.   144.    145.    145.     0     0      27
##  3 x1p_par2     116.   116.   116.   116.    117.    117.     0     0      28
##  4 x1p_par3    84.3    84.7   84.8   84.8    84.9    85.3     0     0     125
##  5 x1p_par4    2.66    2.69   2.71   2.69    2.73    2.73     0     0       0
##  6 x1p_t1      20.5    20.6   20.7   20.7    20.7    20.8     0     0       2
##  7 x1p_t2      20.6    20.7   20.7   20.7    20.8    20.8     0     0       0
##  8 x1p_t3      20.0    20.1   20.1   20.1    20.1    20.2     0     0       0
##  9 x1p_t4      20.1    20.2   20.3   20.2    20.3    20.4     0     0       0
## 10 x1p_rh1     75.2    76.9   77.9   78.0    78.9    80.1     0     0       0
## 11 x1p_rh2     75.4    77.3   78.1   78.2    78.8    79.8     0     0       0
## 12 x1p_rh3     79.0    82.1   82.7   82.8    83.5    84.7     0     0      41
## 13 x1p_rh4     75.1    78.5   80.0   80.5    81.7    82.9     0     0       0
```

```
ggplot(sensor_x1p) + geom_line(aes(x=time,y=x1p_par1,col="par1")) +
  geom_smooth(aes(x=time,y=x1p_par1)) +
  labs(title = "photosynthetic active radiation")
```
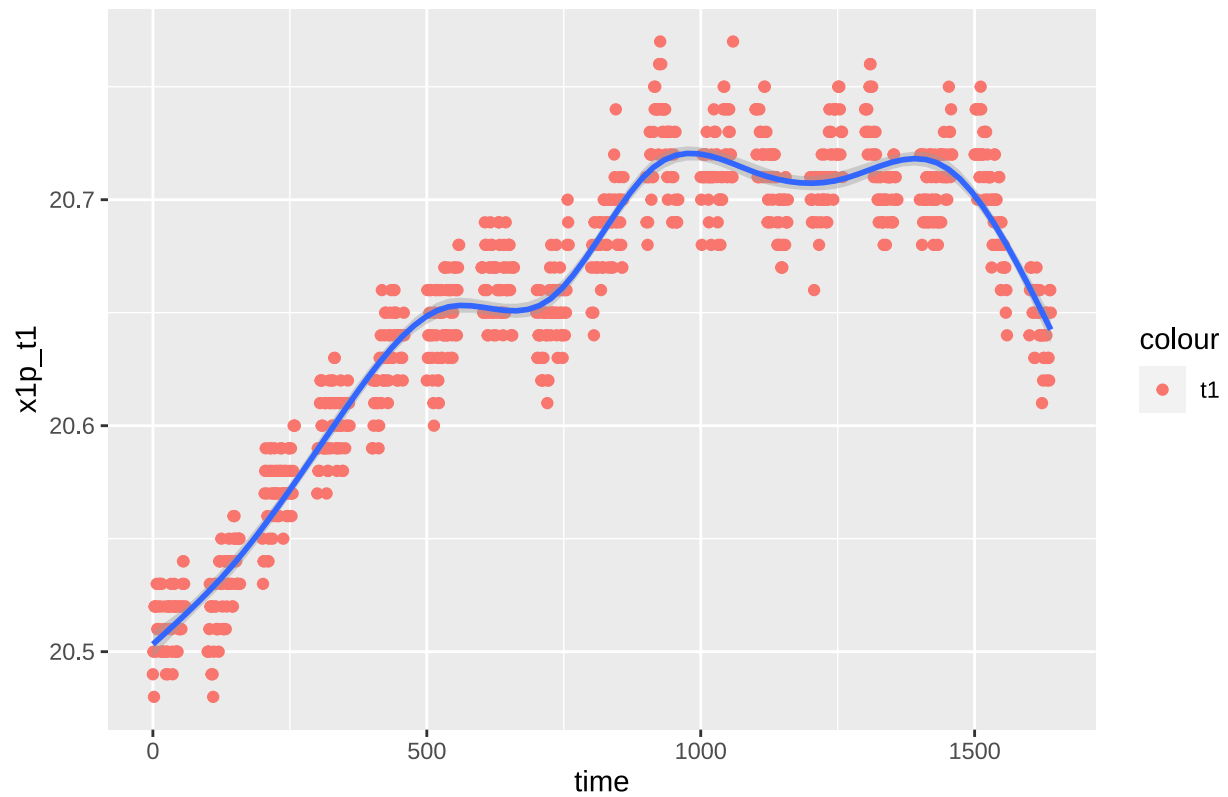
`geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

photosynthetic active radiation
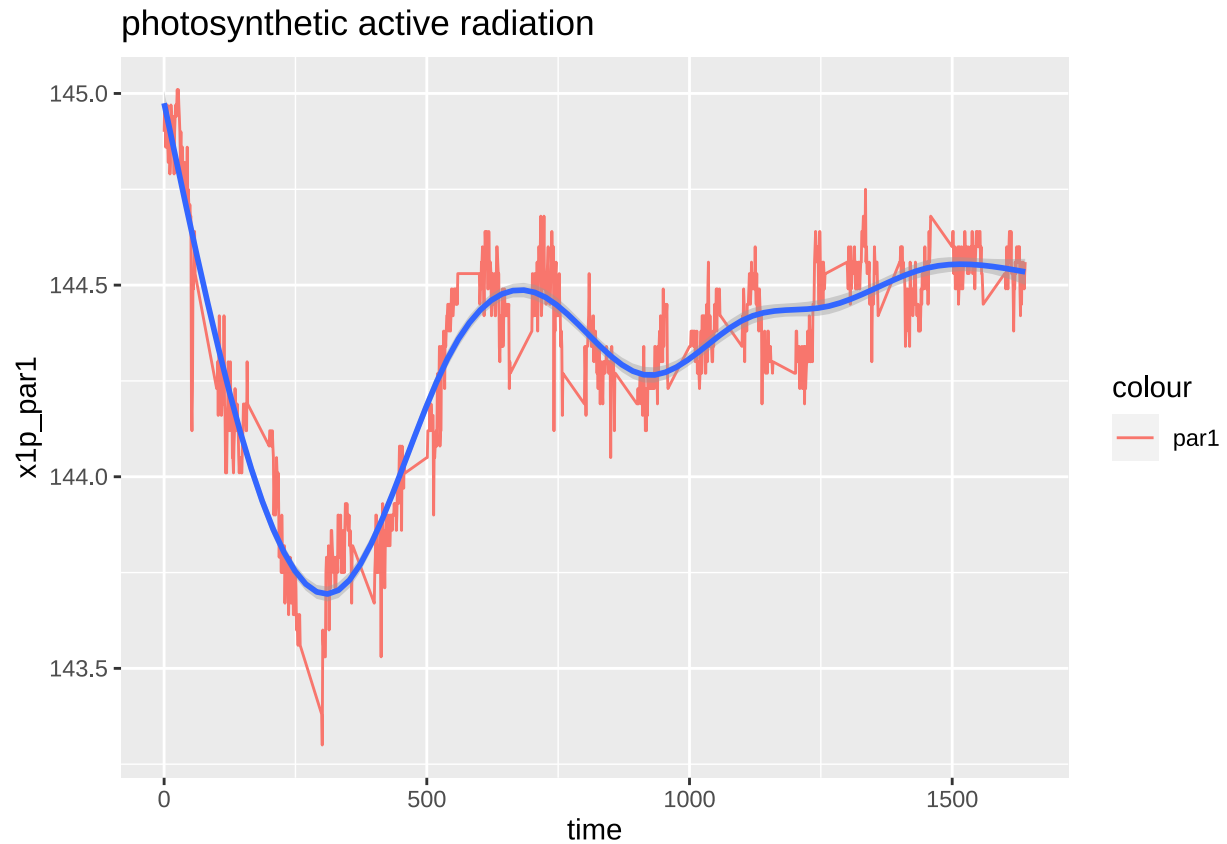
```
ggplot(sensor_x1p) + geom_point(aes(x=time,y=x1p_t1,col="t1")) +
  geom_smooth(aes(x=time,y=x1p_t1)) +
  labs(title ="T is temperature in degrees Celsius")
```

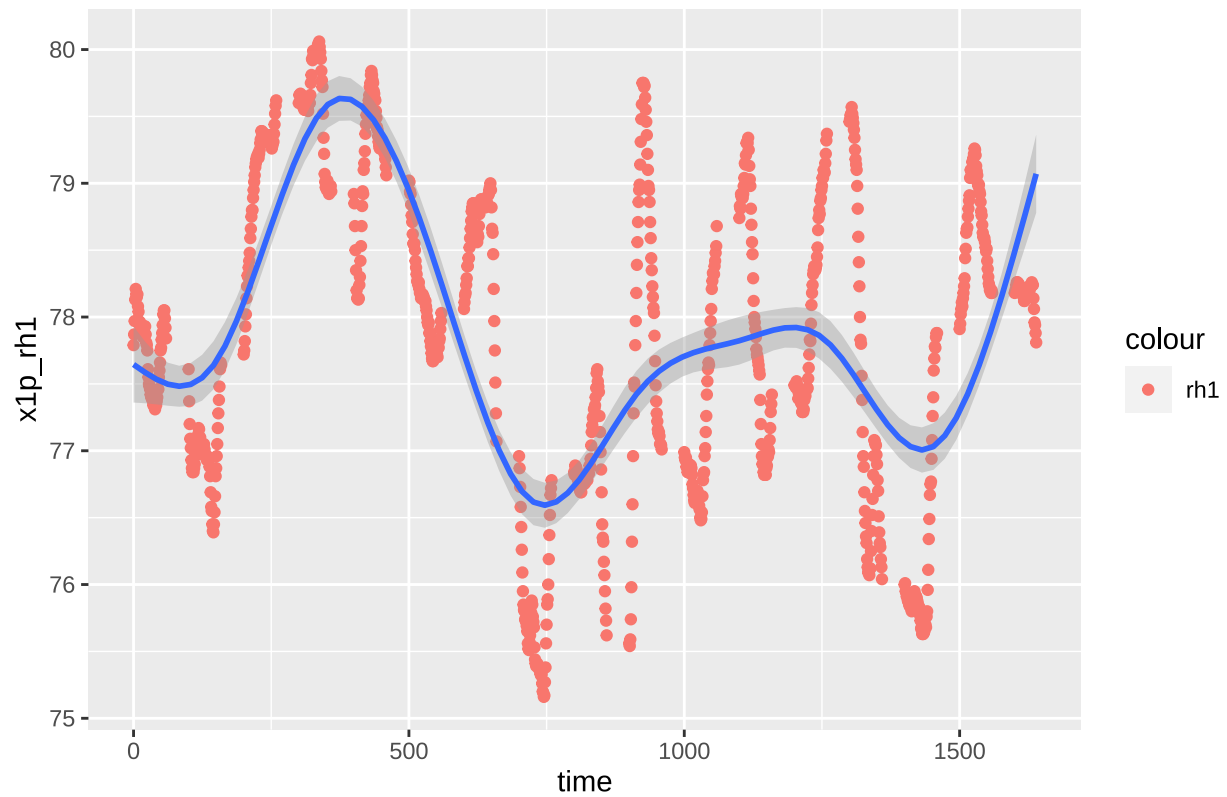## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'

T is temperature in degrees Celsius


```
ggplot(sensor_x1p) + geom_point(aes(x=time,y=x1p_rh1,col="rh1")) +
  geom_smooth(aes(x=time,y=x1p_rh1)) +
  labs(title ="RH is relative humidity")
```

```
## 'geom_smooth()' using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```
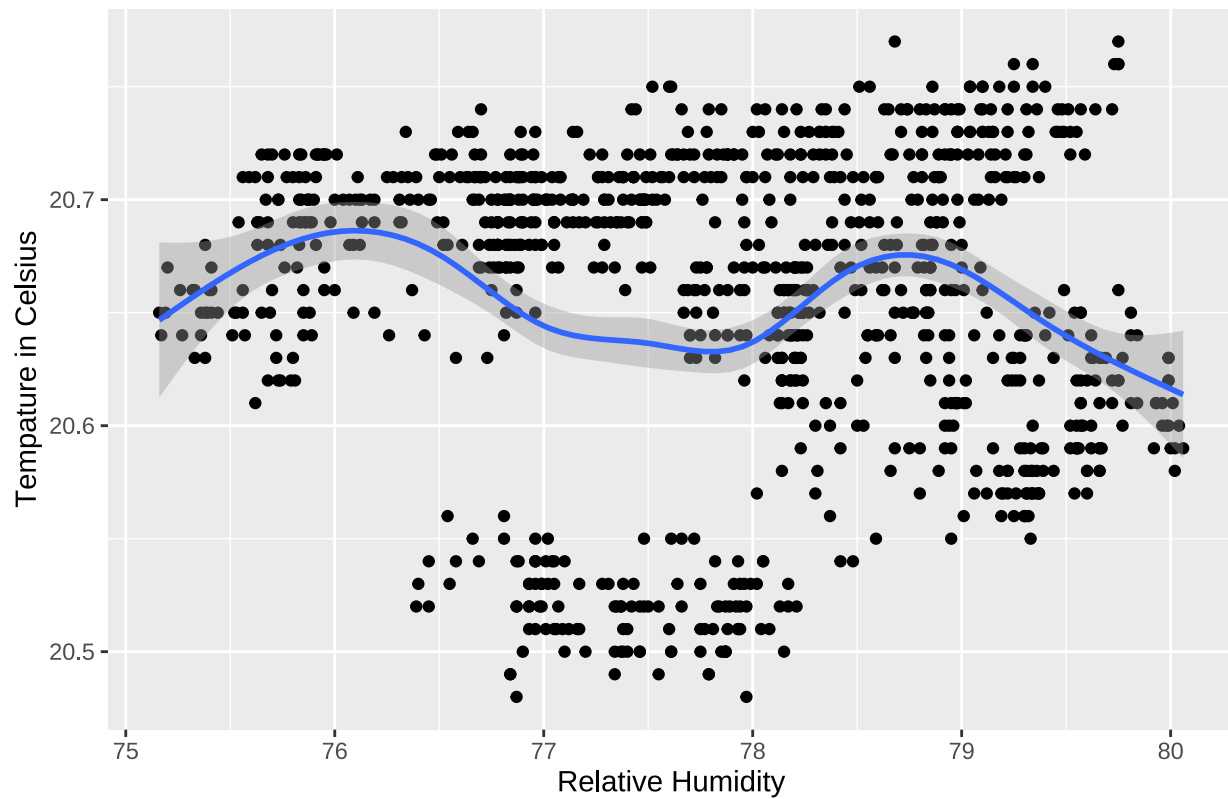
RH is relative humidity


```
ggplot(sensor_x1p) + geom_point(aes(y=x1p_t1,x=x1p_rh1)) +
  labs(title ="RH is relative humidity vs Tempature (c)",
       y="Tempature in Celsius",x="Relative Humidity") +
  geom_smooth(aes(x=x1p_rh1,y=x1p_t1))
```

```
## `geom_smooth()` using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

RH is relative humidity vs Tempature (c)


```
ggplot(sensor_x1p) + geom_point(aes(x=x1p_t1,y=x1p_rh1)) +
  labs(title ="RH is relative humidity vs Tempature (c)",
       y="Tempature in Celsius",x="Relative Humidity") +
  geom_smooth(aes(x=x1p_t1,y=x1p_rh1))
```

```
## 'geom_smooth()' using method = 'gam' and formula 'y ~ s(x, bs = "cs")'
```

RH is relative humidity vs Tempature (c)