CO2 Analysis

ADS506-FinalProject-Team4

Overview: The analysis uses monthly CO2 measurements from Mauna Loa Observatory.

NOAA Global Monitoring Laboratory
Atmospheric CO , Mauna Loa Observatory – Monthly Dataset
https://gml.noaa.gov/ccgg/trends/data.html

1. Data Preparation:

```
library(tidyverse)
library(fpp3)
library(gt)
library(feasts)
library(dplyr)
library(fable)
library(fabletools)
#library(urca)
```

```
co2_raw <- read_csv("data/co2.csv")
```

```
Rows: 810 Columns: 8
-- Column specification --------------------------------------------------------
Delimiter: ","
dbl (8): year, month, decimal date, average, deseasonalized, ndays, sdev, unc

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.
```

2. EDA

2.(1-4) Basic Descriptive Statistics

```
# 1. Basic cleaning / handle missing values
sum(is.na(co2_raw))
```

```
[1] 0
```

```
# 2. Create a proper time index and tsibble
co2_ts <- co2_raw |>
  mutate(Month = yearmonth(paste(year, month, "01", sep = "-"))) |>
  as_tsibble(index = Month)

# 3. Confirm tsibble
co2_ts |>
  knitr::kable(digits = 1, caption = "Overall summary of CO2 average" )
```

Table 1: Overall summary of CO2 average

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1958	3	1958.2	315.7	314.4	-1	-10.0	-1.0	1958 Mar
1958	4	1958.3	317.4	315.2	-1	-10.0	-1.0	1958 Apr
1958	5	1958.4	317.5	314.7	-1	-10.0	-1.0	1958 May
1958	6	1958.5	317.3	315.1	-1	-10.0	-1.0	1958 Jun
1958	7	1958.5	315.9	315.2	-1	-10.0	-1.0	1958 Jul
1958	8	1958.6	314.9	316.2	-1	-10.0	-1.0	1958 Aug
1958	9	1958.7	313.2	316.1	-1	-10.0	-1.0	1958 Sep
1958	10	1958.8	312.4	315.4	-1	-10.0	-1.0	1958 Oct
1958	11	1958.9	313.3	315.2	-1	-10.0	-1.0	1958 Nov
1958	12	1959.0	314.7	315.4	-1	-10.0	-1.0	1958 Dec
1959	1	1959.0	315.6	315.5	-1	-10.0	-1.0	1959 Jan
1959	2	1959.1	316.5	315.8	-1	-10.0	-1.0	1959 Feb
1959	3	1959.2	316.6	315.4	-1	-10.0	-1.0	1959 Mar

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1959	4	1959.3	317.7	315.4	-1	-10.0	-1.0	1959 Apr
1959	5	1959.4	318.3	315.5	-1	-10.0	-1.0	1959 May
1959	6	1959.5	318.1	316.0	-1	-10.0	-1.0	1959 Jun
1959	7	1959.5	316.5	315.9	-1	-10.0	-1.0	1959 Jul
1959	8	1959.6	314.8	316.1	-1	-10.0	-1.0	1959 Aug
1959	9	1959.7	313.8	316.8	-1	-10.0	-1.0	1959 Sep
1959	10	1959.8	313.3	316.3	-1	-10.0	-1.0	1959 Oct
1959	11	1959.9	314.8	316.7	-1	-10.0	-1.0	1959 Nov
1959	12	1960.0	315.6	316.4	-1	-10.0	-1.0	1959 Dec
1960	1	1960.0	316.4	316.4	-1	-10.0	-1.0	1960 Jan
1960	2	1960.1	317.0	316.3	-1	-10.0	-1.0	1960 Feb
1960	3	1960.2	317.6	316.3	-1	-10.0	-1.0	1960 Mar
1960	4	1960.3	319.0	316.7	-1	-10.0	-1.0	1960 Apr
1960	5	1960.4	320.0	317.2	-1	-10.0	-1.0	1960 May
1960	6	1960.5	319.6	317.4	-1	-10.0	-1.0	1960 Jun
1960	7	1960.5	318.2	317.5	-1	-10.0	-1.0	1960 Jul
1960	8	1960.6	315.9	317.2	-1	-10.0	-1.0	1960 Aug
1960	9	1960.7	314.2	317.1	-1	-10.0	-1.0	1960 Sep
1960	10	1960.8	313.8	316.9	-1	-10.0	-1.0	1960 Oct
1960	11	1960.9	315.0	316.9	-1	-10.0	-1.0	1960 Nov
1960	12	1961.0	316.2	317.0	-1	-10.0	-1.0	1960 Dec
1961	1	1961.0	316.9	316.8	-1	-10.0	-1.0	1961 Jan
1961	2	1961.1	317.7	317.0	-1	-10.0	-1.0	1961 Feb
1961	3	1961.2	318.5	317.2	-1	-10.0	-1.0	1961 Mar
1961	4	1961.3	319.5	317.2	-1	-10.0	-1.0	1961 Apr
1961	5	1961.4	320.6	317.7	-1	-10.0	-1.0	1961 May
1961	6	1961.5	319.8	317.6	-1	-10.0	-1.0	1961 Jun
1961	7	1961.5	318.6	317.9	-1	-10.0	-1.0	1961 Jul
1961	8	1961.6	316.8	318.1	-1	-10.0	-1.0	1961 Aug
1961	9	1961.7	315.0	317.9	-1	-10.0	-1.0	1961 Sep
1961	10	1961.8	315.3	318.3	-1	-10.0	-1.0	1961 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1961	11	1961.9	316.1	318.0	-1	-10.0	-1.0	1961 Nov
1961	12	1962.0	317.0	317.8	-1	-10.0	-1.0	1961 Dec
1962	1	1962.0	317.9	317.9	-1	-10.0	-1.0	1962 Jan
1962	2	1962.1	318.6	317.9	-1	-10.0	-1.0	1962 Feb
1962	3	1962.2	319.7	318.4	-1	-10.0	-1.0	1962 Mar
1962	4	1962.3	320.6	318.2	-1	-10.0	-1.0	1962 Apr
1962	5	1962.4	321.0	318.2	-1	-10.0	-1.0	1962 May
1962	6	1962.5	320.6	318.4	-1	-10.0	-1.0	1962 Jun
1962	7	1962.5	319.6	318.9	-1	-10.0	-1.0	1962 Jul
1962	8	1962.6	317.4	318.7	-1	-10.0	-1.0	1962 Aug
1962	9	1962.7	316.2	319.2	-1	-10.0	-1.0	1962 Sep
1962	10	1962.8	315.4	318.5	-1	-10.0	-1.0	1962 Oct
1962	11	1962.9	316.7	318.6	-1	-10.0	-1.0	1962 Nov
1962	12	1963.0	317.7	318.5	-1	-10.0	-1.0	1962 Dec
1963	1	1963.0	318.7	318.7	-1	-10.0	-1.0	1963 Jan
1963	2	1963.1	319.1	318.4	-1	-10.0	-1.0	1963 Feb
1963	3	1963.2	319.9	318.6	-1	-10.0	-1.0	1963 Mar
1963	4	1963.3	321.4	319.0	-1	-10.0	-1.0	1963 Apr
1963	5	1963.4	322.2	319.4	-1	-10.0	-1.0	1963 May
1963	6	1963.5	321.5	319.3	-1	-10.0	-1.0	1963 Jun
1963	7	1963.5	319.7	319.1	-1	-10.0	-1.0	1963 Jul
1963	8	1963.6	317.8	319.1	-1	-10.0	-1.0	1963 Aug
1963	9	1963.7	316.2	319.2	-1	-10.0	-1.0	1963 Sep
1963	10	1963.8	316.0	319.0	-1	-10.0	-1.0	1963 Oct
1963	11	1963.9	317.1	319.0	-1	-10.0	-1.0	1963 Nov
1963	12	1964.0	318.4	319.1	-1	-10.0	-1.0	1963 Dec
1964	1	1964.0	319.6	319.5	-1	-10.0	-1.0	1964 Jan
1964	2	1964.1	320.0	319.4	-1	-10.0	-1.0	1964 Feb
1964	3	1964.2	320.8	319.4	-1	-10.0	-1.0	1964 Mar
1964	4	1964.3	321.8	319.5	-1	-10.0	-1.0	1964 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1964	5	1964.4	322.2	319.4	-1	-10.0	-1.0	1964 May
1964	6	1964.5	321.9	319.7	-1	-10.0	-1.0	1964 Jun
1964	7	1964.5	320.4	319.8	-1	-10.0	-1.0	1964 Jul
1964	8	1964.6	318.7	320.0	-1	-10.0	-1.0	1964 Aug
1964	9	1964.7	316.7	319.7	-1	-10.0	-1.0	1964 Sep
1964	10	1964.8	316.9	319.9	-1	-10.0	-1.0	1964 Oct
1964	11	1964.9	317.7	319.6	-1	-10.0	-1.0	1964 Nov
1964	12	1965.0	318.7	319.5	-1	-10.0	-1.0	1964 Dec
1965	1	1965.0	319.4	319.4	-1	-10.0	-1.0	1965 Jan
1965	2	1965.1	320.4	319.8	-1	-10.0	-1.0	1965 Feb
1965	3	1965.2	320.9	319.6	-1	-10.0	-1.0	1965 Mar
1965	4	1965.3	322.1	319.8	-1	-10.0	-1.0	1965 Apr
1965	5	1965.4	322.2	319.3	-1	-10.0	-1.0	1965 May
1965	6	1965.5	321.9	319.7	-1	-10.0	-1.0	1965 Jun
1965	7	1965.5	321.2	320.5	-1	-10.0	-1.0	1965 Jul
1965	8	1965.6	318.9	320.2	-1	-10.0	-1.0	1965 Aug
1965	9	1965.7	317.8	320.8	-1	-10.0	-1.0	1965 Sep
1965	10	1965.8	317.3	320.4	-1	-10.0	-1.0	1965 Oct
1965	11	1965.9	318.9	320.8	-1	-10.0	-1.0	1965 Nov
1965	12	1966.0	319.4	320.2	-1	-10.0	-1.0	1965 Dec
1966	1	1966.0	320.6	320.6	-1	-10.0	-1.0	1966 Jan
1966	2	1966.1	321.6	320.9	-1	-10.0	-1.0	1966 Feb
1966	3	1966.2	322.4	321.1	-1	-10.0	-1.0	1966 Mar
1966	4	1966.3	323.7	321.3	-1	-10.0	-1.0	1966 Apr
1966	5	1966.4	324.1	321.2	-1	-10.0	-1.0	1966 May
1966	6	1966.5	323.8	321.6	-1	-10.0	-1.0	1966 Jun
1966	7	1966.5	322.4	321.7	-1	-10.0	-1.0	1966 Jul
1966	8	1966.6	320.4	321.7	-1	-10.0	-1.0	1966 Aug
1966	9	1966.7	318.6	321.6	-1	-10.0	-1.0	1966 Sep
1966	10	1966.8	318.1	321.2	-1	-10.0	-1.0	1966 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1966	11	1966.9	319.8	321.7	-1	-10.0	-1.0	1966 Nov
1966	12	1967.0	321.0	321.8	-1	-10.0	-1.0	1966 Dec
1967	1	1967.0	322.3	322.3	-1	-10.0	-1.0	1967 Jan
1967	2	1967.1	322.5	321.8	-1	-10.0	-1.0	1967 Feb
1967	3	1967.2	323.0	321.7	-1	-10.0	-1.0	1967 Mar
1967	4	1967.3	324.4	322.0	-1	-10.0	-1.0	1967 Apr
1967	5	1967.4	325.0	322.1	-1	-10.0	-1.0	1967 May
1967	6	1967.5	324.1	321.9	-1	-10.0	-1.0	1967 Jun
1967	7	1967.5	322.5	321.9	-1	-10.0	-1.0	1967 Jul
1967	8	1967.6	320.9	322.2	-1	-10.0	-1.0	1967 Aug
1967	9	1967.7	319.2	322.2	-1	-10.0	-1.0	1967 Sep
1967	10	1967.8	319.4	322.5	-1	-10.0	-1.0	1967 Oct
1967	11	1967.9	320.7	322.7	-1	-10.0	-1.0	1967 Nov
1967	12	1968.0	322.0	322.7	-1	-10.0	-1.0	1967 Dec
1968	1	1968.0	322.6	322.5	-1	-10.0	-1.0	1968 Jan
1968	2	1968.1	323.1	322.5	-1	-10.0	-1.0	1968 Feb
1968	3	1968.2	323.9	322.6	-1	-10.0	-1.0	1968 Mar
1968	4	1968.3	325.0	322.6	-1	-10.0	-1.0	1968 Apr
1968	5	1968.4	325.6	322.7	-1	-10.0	-1.0	1968 May
1968	6	1968.5	325.4	323.2	-1	-10.0	-1.0	1968 Jun
1968	7	1968.5	324.1	323.5	-1	-10.0	-1.0	1968 Jul
1968	8	1968.6	322.1	323.5	-1	-10.0	-1.0	1968 Aug
1968	9	1968.7	320.3	323.3	-1	-10.0	-1.0	1968 Sep
1968	10	1968.8	320.2	323.3	-1	-10.0	-1.0	1968 Oct
1968	11	1968.9	321.3	323.3	-1	-10.0	-1.0	1968 Nov
1968	12	1969.0	322.9	323.7	-1	-10.0	-1.0	1968 Dec
1969	1	1969.0	324.0	324.0	-1	-10.0	-1.0	1969 Jan
1969	2	1969.1	324.4	323.8	-1	-10.0	-1.0	1969 Feb
1969	3	1969.2	325.6	324.3	-1	-10.0	-1.0	1969 Mar
1969	4	1969.3	326.7	324.3	-1	-10.0	-1.0	1969 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1969	5	1969.4	327.4	324.5	-1	-10.0	-1.0	1969 May
1969	6	1969.5	326.7	324.5	-1	-10.0	-1.0	1969 Jun
1969	7	1969.5	325.9	325.2	-1	-10.0	-1.0	1969 Jul
1969	8	1969.6	323.7	325.0	-1	-10.0	-1.0	1969 Aug
1969	9	1969.7	322.4	325.4	-1	-10.0	-1.0	1969 Sep
1969	10	1969.8	321.8	324.9	-1	-10.0	-1.0	1969 Oct
1969	11	1969.9	322.9	324.8	-1	-10.0	-1.0	1969 Nov
1969	12	1970.0	324.1	324.9	-1	-10.0	-1.0	1969 Dec
1970	1	1970.0	325.1	325.0	-1	-10.0	-1.0	1970 Jan
1970	2	1970.1	326.0	325.3	-1	-10.0	-1.0	1970 Feb
1970	3	1970.2	326.9	325.6	-1	-10.0	-1.0	1970 Mar
1970	4	1970.3	328.1	325.8	-1	-10.0	-1.0	1970 Apr
1970	5	1970.4	328.1	325.1	-1	-10.0	-1.0	1970 May
1970	6	1970.5	327.7	325.4	-1	-10.0	-1.0	1970 Jun
1970	7	1970.5	326.3	325.6	-1	-10.0	-1.0	1970 Jul
1970	8	1970.6	324.7	326.0	-1	-10.0	-1.0	1970 Aug
1970	9	1970.7	323.1	326.1	-1	-10.0	-1.0	1970 Sep
1970	10	1970.8	323.1	326.2	-1	-10.0	-1.0	1970 Oct
1970	11	1970.9	324.0	326.0	-1	-10.0	-1.0	1970 Nov
1970	12	1971.0	325.1	325.9	-1	-10.0	-1.0	1970 Dec
1971	1	1971.0	326.2	326.1	-1	-10.0	-1.0	1971 Jan
1971	2	1971.1	326.7	326.0	-1	-10.0	-1.0	1971 Feb
1971	3	1971.2	327.2	325.9	-1	-10.0	-1.0	1971 Mar
1971	4	1971.3	327.8	325.4	-1	-10.0	-1.0	1971 Apr
1971	5	1971.4	328.9	326.0	-1	-10.0	-1.0	1971 May
1971	6	1971.5	328.6	326.3	-1	-10.0	-1.0	1971 Jun
1971	7	1971.5	327.4	326.7	-1	-10.0	-1.0	1971 Jul
1971	8	1971.6	325.4	326.8	-1	-10.0	-1.0	1971 Aug
1971	9	1971.7	323.4	326.4	-1	-10.0	-1.0	1971 Sep
1971	10	1971.8	323.6	326.7	-1	-10.0	-1.0	1971 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1971	11	1971.9	324.8	326.8	-1	-10.0	-1.0	1971 Nov
1971	12	1972.0	326.0	326.8	-1	-10.0	-1.0	1971 Dec
1972	1	1972.0	326.8	326.7	-1	-10.0	-1.0	1972 Jan
1972	2	1972.1	327.6	327.0	-1	-10.0	-1.0	1972 Feb
1972	3	1972.2	327.8	326.4	-1	-10.0	-1.0	1972 Mar
1972	4	1972.3	329.7	327.3	-1	-10.0	-1.0	1972 Apr
1972	5	1972.4	330.1	327.1	-1	-10.0	-1.0	1972 May
1972	6	1972.5	329.1	326.9	-1	-10.0	-1.0	1972 Jun
1972	7	1972.5	328.0	327.4	-1	-10.0	-1.0	1972 Jul
1972	8	1972.6	326.3	327.7	-1	-10.0	-1.0	1972 Aug
1972	9	1972.7	324.8	327.9	-1	-10.0	-1.0	1972 Sep
1972	10	1972.8	325.2	328.3	-1	-10.0	-1.0	1972 Oct
1972	11	1972.9	326.5	328.5	-1	-10.0	-1.0	1972 Nov
1972	12	1973.0	327.6	328.4	-1	-10.0	-1.0	1972 Dec
1973	1	1973.0	328.6	328.5	-1	-10.0	-1.0	1973 Jan
1973	2	1973.1	329.6	328.9	-1	-10.0	-1.0	1973 Feb
1973	3	1973.2	330.3	329.0	-1	-10.0	-1.0	1973 Mar
1973	4	1973.3	331.5	329.1	-1	-10.0	-1.0	1973 Apr
1973	5	1973.4	332.5	329.5	-1	-10.0	-1.0	1973 May
1973	6	1973.5	332.1	329.8	-1	-10.0	-1.0	1973 Jun
1973	7	1973.5	330.9	330.2	-1	-10.0	-1.0	1973 Jul
1973	8	1973.6	329.3	330.7	-1	-10.0	-1.0	1973 Aug
1973	9	1973.7	327.5	330.6	-1	-10.0	-1.0	1973 Sep
1973	10	1973.8	327.2	330.3	-1	-10.0	-1.0	1973 Oct
1973	11	1973.9	328.2	330.1	-1	-10.0	-1.0	1973 Nov
1973	12	1974.0	328.6	329.4	-1	-10.0	-1.0	1973 Dec
1974	1	1974.0	329.4	329.3	-1	-10.0	-1.0	1974 Jan
1974	2	1974.1	330.7	330.0	-1	-10.0	-1.0	1974 Feb
1974	3	1974.2	331.5	330.1	-1	-10.0	-1.0	1974 Mar
1974	4	1974.3	332.6	330.2	-1	-10.0	-1.0	1974 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1974	5	1974.4	333.2	330.2	13	0.3	0.2	1974 May
1974	6	1974.5	332.2	329.8	25	0.4	0.1	1974 Jun
1974	7	1974.5	331.1	330.2	24	0.2	0.1	1974 Jul
1974	8	1974.6	329.1	330.5	26	0.3	0.1	1974 Aug
1974	9	1974.7	327.3	330.4	22	0.5	0.2	1974 Sep
1974	10	1974.8	327.3	330.5	24	0.2	0.1	1974 Oct
1974	11	1974.9	328.3	330.5	26	0.4	0.2	1974 Nov
1974	12	1975.0	329.6	330.5	29	0.3	0.1	1974 Dec
1975	1	1975.0	330.7	330.8	29	0.4	0.1	1975 Jan
1975	2	1975.1	331.5	330.9	26	0.5	0.2	1975 Feb
1975	3	1975.2	331.9	330.4	17	0.3	0.1	1975 Mar
1975	4	1975.3	333.1	330.5	23	0.6	0.2	1975 Apr
1975	5	1975.4	334.0	331.0	28	0.3	0.1	1975 May
1975	6	1975.5	333.4	331.0	27	0.5	0.2	1975 Jun
1975	7	1975.5	332.0	331.1	24	0.4	0.2	1975 Jul
1975	8	1975.6	330.0	331.3	24	0.5	0.2	1975 Aug
1975	9	1975.7	328.5	331.6	22	0.5	0.2	1975 Sep
1975	10	1975.8	328.4	331.6	11	0.2	0.1	1975 Oct
1975	11	1975.9	329.4	331.6	18	0.3	0.1	1975 Nov
1975	12	1976.0	330.8	331.7	-1	-10.0	0.0	1975 Dec
1976	1	1976.0	331.6	331.7	19	0.2	0.1	1976 Jan
1976	2	1976.1	332.7	332.1	22	0.5	0.2	1976 Feb
1976	3	1976.2	333.4	331.8	18	0.5	0.2	1976 Mar
1976	4	1976.3	334.7	332.2	18	0.8	0.3	1976 Apr
1976	5	1976.4	334.7	331.8	21	0.6	0.2	1976 May
1976	6	1976.5	334.0	331.6	15	0.2	0.1	1976 Jun
1976	7	1976.5	333.1	332.2	15	0.2	0.1	1976 Jul
1976	8	1976.6	330.7	332.1	23	0.5	0.2	1976 Aug
1976	9	1976.7	329.0	332.1	13	0.7	0.4	1976 Sep
1976	10	1976.8	328.7	332.0	19	0.6	0.2	1976 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1976	11	1976.9	330.2	332.4	25	0.4	0.1	1976 Nov
1976	12	1977.0	331.6	332.6	20	0.4	0.2	1976 Dec
1977	1	1977.0	332.7	332.8	23	0.4	0.2	1977 Jan
1977	2	1977.1	333.2	332.6	20	0.3	0.1	1977 Feb
1977	3	1977.2	335.0	333.4	23	0.5	0.2	1977 Mar
1977	4	1977.3	336.1	333.5	20	0.5	0.2	1977 Apr
1977	5	1977.4	336.9	334.0	20	0.3	0.1	1977 May
1977	6	1977.5	336.2	333.8	22	0.4	0.2	1977 Jun
1977	7	1977.5	334.9	334.0	20	0.2	0.1	1977 Jul
1977	8	1977.6	332.6	333.9	18	0.5	0.2	1977 Aug
1977	9	1977.7	331.3	334.4	19	0.5	0.2	1977 Sep
1977	10	1977.8	331.3	334.5	23	0.3	0.1	1977 Oct
1977	11	1977.9	332.5	334.7	21	0.4	0.2	1977 Nov
1977	12	1978.0	333.6	334.6	25	0.4	0.1	1977 Dec
1978	1	1978.0	334.9	335.0	22	0.5	0.2	1978 Jan
1978	2	1978.1	335.3	334.6	25	0.5	0.2	1978 Feb
1978	3	1978.2	336.7	335.0	28	0.6	0.2	1978 Mar
1978	4	1978.3	337.7	335.1	18	0.4	0.2	1978 Apr
1978	5	1978.4	338.0	335.1	26	0.5	0.2	1978 May
1978	6	1978.5	338.0	335.6	17	0.3	0.1	1978 Jun
1978	7	1978.5	336.5	335.6	20	0.3	0.1	1978 Jul
1978	8	1978.6	334.4	335.9	19	0.3	0.1	1978 Aug
1978	9	1978.7	332.4	335.5	17	0.8	0.3	1978 Sep
1978	10	1978.8	332.4	335.7	21	0.3	0.1	1978 Oct
1978	11	1978.9	333.8	336.0	24	0.2	0.1	1978 Nov
1978	12	1979.0	334.9	335.9	26	0.3	0.1	1978 Dec
1979	1	1979.0	336.1	336.2	27	0.6	0.2	1979 Jan
1979	2	1979.1	336.7	336.0	25	0.3	0.1	1979 Feb
1979	3	1979.2	338.3	336.6	21	0.6	0.3	1979 Mar
1979	4	1979.3	338.8	336.1	24	0.7	0.3	1979 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1979	5	1979.4	339.2	336.2	20	0.5	0.2	1979 May
1979	6	1979.5	339.3	336.8	19	0.3	0.1	1979 Jun
1979	7	1979.5	337.5	336.7	26	0.6	0.2	1979 Jul
1979	8	1979.6	335.7	337.2	24	0.6	0.2	1979 Aug
1979	9	1979.7	334.0	337.2	19	0.7	0.3	1979 Sep
1979	10	1979.8	334.2	337.6	25	0.4	0.2	1979 Oct
1979	11	1979.9	335.3	337.6	27	0.3	0.1	1979 Nov
1979	12	1980.0	336.8	337.8	22	0.2	0.1	1979 Dec
1980	1	1980.0	337.9	338.1	29	0.6	0.2	1980 Jan
1980	2	1980.1	338.3	337.9	26	0.5	0.2	1980 Feb
1980	3	1980.2	340.1	338.5	23	0.5	0.2	1980 Mar
1980	4	1980.3	340.9	338.3	24	0.3	0.1	1980 Apr
1980	5	1980.4	341.4	338.4	24	0.5	0.2	1980 May
1980	6	1980.5	341.4	338.9	20	0.4	0.2	1980 Jun
1980	7	1980.5	339.4	338.6	26	0.6	0.2	1980 Jul
1980	8	1980.6	337.7	339.1	16	1.0	0.5	1980 Aug
1980	9	1980.7	336.2	339.4	15	0.7	0.3	1980 Sep
1980	10	1980.8	336.1	339.4	26	0.3	0.1	1980 Oct
1980	11	1980.9	337.3	339.5	27	0.3	0.1	1980 Nov
1980	12	1981.0	338.3	339.3	24	0.2	0.1	1980 Dec
1981	1	1981.0	339.3	339.4	28	0.4	0.1	1981 Jan
1981	2	1981.1	340.6	340.0	25	0.7	0.2	1981 Feb
1981	3	1981.2	341.6	340.1	25	0.5	0.2	1981 Mar
1981	4	1981.3	342.6	340.0	26	0.5	0.2	1981 Apr
1981	5	1981.4	343.0	340.0	30	0.2	0.1	1981 May
1981	6	1981.5	342.5	340.1	25	0.3	0.1	1981 Jun
1981	7	1981.5	340.8	339.9	24	0.5	0.2	1981 Jul
1981	8	1981.6	338.5	339.9	25	0.5	0.2	1981 Aug
1981	9	1981.7	337.0	340.2	27	0.6	0.2	1981 Sep
1981	10	1981.8	337.0	340.4	25	0.4	0.1	1981 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1981	11	1981.9	338.6	340.8	26	0.3	0.1	1981 Nov
1981	12	1982.0	339.9	340.9	20	0.3	0.1	1981 Dec
1982	1	1982.0	340.9	341.1	28	0.3	0.1	1982 Jan
1982	2	1982.1	341.8	341.2	24	0.5	0.2	1982 Feb
1982	3	1982.2	342.8	341.2	17	0.4	0.2	1982 Mar
1982	4	1982.3	344.0	341.3	7	0.4	0.3	1982 Apr
1982	5	1982.4	344.8	341.7	27	0.4	0.1	1982 May
1982	6	1982.5	343.9	341.4	27	0.4	0.1	1982 Jun
1982	7	1982.5	342.4	341.6	28	0.3	0.1	1982 Jul
1982	8	1982.6	340.2	341.6	25	0.6	0.2	1982 Aug
1982	9	1982.7	338.4	341.6	21	0.6	0.2	1982 Sep
1982	10	1982.8	338.4	341.8	26	0.5	0.2	1982 Oct
1982	11	1982.9	339.4	341.6	24	0.4	0.1	1982 Nov
1982	12	1983.0	340.8	341.7	26	0.3	0.1	1982 Dec
1983	1	1983.0	341.6	341.8	28	0.5	0.2	1983 Jan
1983	2	1983.1	342.8	342.2	24	0.4	0.1	1983 Feb
1983	3	1983.2	343.4	341.9	27	0.9	0.3	1983 Mar
1983	4	1983.3	345.4	342.8	23	0.3	0.1	1983 Apr
1983	5	1983.4	346.1	343.0	28	0.5	0.2	1983 May
1983	6	1983.5	345.8	343.3	20	0.3	0.1	1983 Jun
1983	7	1983.5	344.3	343.6	22	0.6	0.2	1983 Jul
1983	8	1983.6	342.5	343.9	16	0.7	0.3	1983 Aug
1983	9	1983.7	340.5	343.6	15	0.5	0.2	1983 Sep
1983	10	1983.8	340.5	343.9	20	0.3	0.1	1983 Oct
1983	11	1983.9	341.8	343.9	27	0.3	0.1	1983 Nov
1983	12	1984.0	343.2	344.1	21	0.2	0.1	1983 Dec
1984	1	1984.0	344.2	344.3	23	0.4	0.2	1984 Jan
1984	2	1984.1	344.9	344.4	23	0.3	0.1	1984 Feb
1984	3	1984.2	345.7	344.3	19	0.3	0.1	1984 Mar
1984	4	1984.3	347.4	344.8	2	-10.0	0.0	1984 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1984	5	1984.4	347.8	344.6	20	0.4	0.2	1984 May
1984	6	1984.5	347.2	344.7	20	0.3	0.1	1984 Jun
1984	7	1984.5	345.8	345.0	18	0.3	0.1	1984 Jul
1984	8	1984.6	343.7	345.1	12	0.4	0.2	1984 Aug
1984	9	1984.7	341.6	344.8	14	0.7	0.4	1984 Sep
1984	10	1984.8	341.9	345.2	12	0.4	0.2	1984 Oct
1984	11	1984.9	343.3	345.4	18	0.4	0.2	1984 Nov
1984	12	1985.0	345.0	345.9	14	0.5	0.3	1984 Dec
1985	1	1985.0	345.5	345.6	25	0.4	0.1	1985 Jan
1985	2	1985.1	346.4	345.9	15	0.4	0.2	1985 Feb
1985	3	1985.2	347.9	346.6	17	0.3	0.2	1985 Mar
1985	4	1985.3	348.7	346.1	21	0.6	0.2	1985 Apr
1985	5	1985.4	349.3	346.1	20	0.5	0.2	1985 May
1985	6	1985.5	348.6	346.2	21	0.3	0.1	1985 Jun
1985	7	1985.5	346.9	346.1	17	0.4	0.2	1985 Jul
1985	8	1985.6	345.3	346.6	16	0.6	0.3	1985 Aug
1985	9	1985.7	343.5	346.6	24	0.6	0.2	1985 Sep
1985	10	1985.8	343.4	346.6	20	0.3	0.1	1985 Oct
1985	11	1985.9	344.7	346.8	21	0.4	0.2	1985 Nov
1985	12	1986.0	346.1	347.0	26	0.6	0.2	1985 Dec
1986	1	1986.0	346.8	346.8	25	0.3	0.1	1986 Jan
1986	2	1986.1	347.5	347.0	25	0.4	0.2	1986 Feb
1986	3	1986.2	348.2	346.9	16	0.7	0.3	1986 Mar
1986	4	1986.3	349.9	347.3	19	0.4	0.2	1986 Apr
1986	5	1986.4	350.5	347.4	18	0.3	0.1	1986 May
1986	6	1986.5	350.0	347.6	17	0.2	0.1	1986 Jun
1986	7	1986.5	348.2	347.4	20	0.5	0.2	1986 Jul
1986	8	1986.6	346.2	347.5	18	0.5	0.2	1986 Aug
1986	9	1986.7	345.5	348.6	17	0.6	0.3	1986 Sep
1986	10	1986.8	344.8	348.0	25	0.3	0.1	1986 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1986	11	1986.9	346.2	348.3	21	0.3	0.1	1986 Nov
1986	12	1987.0	347.5	348.4	24	0.3	0.1	1986 Dec
1987	1	1987.0	348.7	348.7	25	0.5	0.2	1987 Jan
1987	2	1987.1	348.9	348.2	25	0.6	0.2	1987 Feb
1987	3	1987.2	349.8	348.4	21	0.3	0.1	1987 Mar
1987	4	1987.3	351.4	348.8	26	0.7	0.2	1987 Apr
1987	5	1987.4	352.1	349.1	28	0.4	0.1	1987 May
1987	6	1987.5	351.6	349.3	22	0.2	0.1	1987 Jun
1987	7	1987.5	350.2	349.5	17	0.7	0.3	1987 Jul
1987	8	1987.6	348.2	349.6	15	0.8	0.4	1987 Aug
1987	9	1987.7	346.7	349.9	23	0.6	0.2	1987 Sep
1987	10	1987.8	346.7	350.0	22	0.4	0.2	1987 Oct
1987	11	1987.9	348.1	350.1	23	0.3	0.1	1987 Nov
1987	12	1988.0	349.3	350.1	27	0.2	0.1	1987 Dec
1988	1	1988.0	350.5	350.5	24	0.2	0.1	1988 Jan
1988	2	1988.1	351.7	351.0	23	0.6	0.2	1988 Feb
1988	3	1988.2	352.5	351.0	25	0.8	0.3	1988 Mar
1988	4	1988.3	353.7	351.0	27	0.5	0.2	1988 Apr
1988	5	1988.4	354.4	351.2	28	0.4	0.1	1988 May
1988	6	1988.5	353.9	351.6	26	0.3	0.1	1988 Jun
1988	7	1988.5	352.8	352.2	27	0.5	0.2	1988 Jul
1988	8	1988.6	350.5	352.0	26	0.6	0.2	1988 Aug
1988	9	1988.7	349.0	352.2	26	0.5	0.2	1988 Sep
1988	10	1988.8	349.4	352.6	26	0.3	0.1	1988 Oct
1988	11	1988.9	350.4	352.5	25	0.2	0.1	1988 Nov
1988	12	1989.0	351.6	352.5	28	0.4	0.1	1988 Dec
1989	1	1989.0	353.1	353.0	28	0.4	0.2	1989 Jan
1989	2	1989.1	353.4	352.7	25	0.4	0.1	1989 Feb
1989	3	1989.2	354.1	352.6	29	0.5	0.2	1989 Mar
1989	4	1989.3	355.7	353.1	28	0.5	0.2	1989 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1989	5	1989.4	356.0	352.8	27	0.5	0.2	1989 May
1989	6	1989.5	355.4	353.1	26	0.4	0.2	1989 Jun
1989	7	1989.5	354.0	353.4	26	0.4	0.1	1989 Jul
1989	8	1989.6	351.8	353.4	25	0.5	0.2	1989 Aug
1989	9	1989.7	350.1	353.4	24	0.7	0.3	1989 Sep
1989	10	1989.8	350.3	353.6	25	0.3	0.1	1989 Oct
1989	11	1989.9	351.6	353.7	27	0.4	0.1	1989 Nov
1989	12	1990.0	352.9	353.8	27	0.5	0.2	1989 Dec
1990	1	1990.0	353.9	353.8	25	0.3	0.1	1990 Jan
1990	2	1990.1	355.1	354.4	28	0.7	0.2	1990 Feb
1990	3	1990.2	355.8	354.3	27	0.6	0.2	1990 Mar
1990	4	1990.3	356.4	353.8	28	0.6	0.2	1990 Apr
1990	5	1990.4	357.4	354.2	28	0.3	0.1	1990 May
1990	6	1990.5	356.4	354.0	29	0.4	0.1	1990 Jun
1990	7	1990.5	354.9	354.2	30	0.9	0.3	1990 Jul
1990	8	1990.6	353.1	354.7	22	0.6	0.2	1990 Aug
1990	9	1990.7	351.4	354.7	27	0.7	0.3	1990 Sep
1990	10	1990.8	351.7	354.9	28	0.3	0.1	1990 Oct
1990	11	1990.9	353.1	355.2	24	0.2	0.1	1990 Nov
1990	12	1991.0	354.4	355.3	28	0.5	0.2	1990 Dec
1991	1	1991.0	354.9	354.9	28	0.5	0.2	1991 Jan
1991	2	1991.1	355.8	355.1	26	0.5	0.2	1991 Feb
1991	3	1991.2	357.3	355.8	30	0.7	0.2	1991 Mar
1991	4	1991.3	358.8	356.1	30	0.7	0.2	1991 Apr
1991	5	1991.4	359.2	356.1	29	0.5	0.2	1991 May
1991	6	1991.5	358.2	355.9	29	0.3	0.1	1991 Jun
1991	7	1991.5	356.3	355.7	24	0.5	0.2	1991 Jul
1991	8	1991.6	354.0	355.6	23	0.4	0.1	1991 Aug
1991	9	1991.7	352.3	355.7	27	0.4	0.1	1991 Sep
1991	10	1991.8	352.4	355.7	27	0.2	0.1	1991 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1991	11	1991.9	353.9	355.9	28	0.2	0.1	1991 Nov
1991	12	1992.0	355.2	356.0	30	0.3	0.1	1991 Dec
1992	1	1992.0	356.3	356.3	31	0.6	0.2	1992 Jan
1992	2	1992.1	357.2	356.5	27	0.6	0.2	1992 Feb
1992	3	1992.2	358.0	356.4	24	0.7	0.3	1992 Mar
1992	4	1992.3	359.2	356.5	27	0.5	0.2	1992 Apr
1992	5	1992.4	359.7	356.5	26	0.7	0.3	1992 May
1992	6	1992.5	359.4	357.1	30	0.5	0.2	1992 Jun
1992	7	1992.5	357.1	356.6	25	0.6	0.2	1992 Jul
1992	8	1992.6	355.0	356.7	24	0.6	0.2	1992 Aug
1992	9	1992.7	353.0	356.4	25	1.0	0.4	1992 Sep
1992	10	1992.8	353.4	356.7	29	0.6	0.2	1992 Oct
1992	11	1992.9	354.4	356.5	29	0.3	0.1	1992 Nov
1992	12	1993.0	355.7	356.5	31	0.3	0.1	1992 Dec
1993	1	1993.0	357.1	357.1	28	0.6	0.2	1993 Jan
1993	2	1993.1	357.4	356.5	28	0.5	0.2	1993 Feb
1993	3	1993.2	358.6	356.9	30	0.7	0.2	1993 Mar
1993	4	1993.3	359.4	356.7	25	0.5	0.2	1993 Apr
1993	5	1993.4	360.3	357.1	30	0.4	0.2	1993 May
1993	6	1993.5	359.6	357.2	28	0.3	0.1	1993 Jun
1993	7	1993.5	357.4	356.9	25	0.8	0.3	1993 Jul
1993	8	1993.6	355.8	357.4	27	0.6	0.2	1993 Aug
1993	9	1993.7	354.1	357.5	23	0.7	0.3	1993 Sep
1993	10	1993.8	354.2	357.6	28	0.3	0.1	1993 Oct
1993	11	1993.9	355.5	357.6	29	0.3	0.1	1993 Nov
1993	12	1994.0	357.0	357.9	29	0.3	0.1	1993 Dec
1994	1	1994.0	358.4	358.2	27	0.3	0.1	1994 Jan
1994	2	1994.1	359.0	358.2	25	0.5	0.2	1994 Feb
1994	3	1994.2	360.1	358.4	29	0.8	0.3	1994 Mar
1994	4	1994.3	361.4	358.6	28	0.5	0.2	1994 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1994	5	1994.4	361.8	358.6	30	0.4	0.2	1994 May
1994	6	1994.5	360.9	358.6	27	0.3	0.1	1994 Jun
1994	7	1994.5	359.5	358.9	31	0.4	0.1	1994 Jul
1994	8	1994.6	357.6	359.3	24	0.4	0.2	1994 Aug
1994	9	1994.7	355.9	359.3	24	0.6	0.2	1994 Sep
1994	10	1994.8	356.2	359.6	28	0.3	0.1	1994 Oct
1994	11	1994.9	357.6	359.8	28	0.5	0.2	1994 Nov
1994	12	1995.0	359.1	360.0	28	0.5	0.2	1994 Dec
1995	1	1995.0	360.0	359.9	30	0.5	0.2	1995 Jan
1995	2	1995.1	361.0	360.2	28	0.5	0.2	1995 Feb
1995	3	1995.2	362.0	360.4	29	0.8	0.3	1995 Mar
1995	4	1995.3	363.4	360.8	29	0.7	0.2	1995 Apr
1995	5	1995.4	363.8	360.7	29	0.7	0.2	1995 May
1995	6	1995.5	363.3	361.0	27	0.4	0.1	1995 Jun
1995	7	1995.5	361.8	361.1	28	0.4	0.1	1995 Jul
1995	8	1995.6	359.3	360.9	24	0.7	0.3	1995 Aug
1995	9	1995.7	358.3	361.7	24	0.7	0.3	1995 Sep
1995	10	1995.8	358.1	361.5	29	0.3	0.1	1995 Oct
1995	11	1995.9	359.6	361.8	26	0.2	0.1	1995 Nov
1995	12	1996.0	360.8	361.7	30	0.4	0.1	1995 Dec
1996	1	1996.0	362.2	362.0	29	0.4	0.1	1996 Jan
1996	2	1996.1	363.4	362.5	28	0.6	0.2	1996 Feb
1996	3	1996.2	364.3	362.6	28	0.7	0.2	1996 Mar
1996	4	1996.3	364.7	362.0	29	0.6	0.2	1996 Apr
1996	5	1996.4	365.2	362.2	30	0.6	0.2	1996 May
1996	6	1996.5	365.1	362.8	30	0.4	0.1	1996 Jun
1996	7	1996.5	363.7	363.0	31	0.3	0.1	1996 Jul
1996	8	1996.6	361.6	363.1	27	0.5	0.2	1996 Aug
1996	9	1996.7	359.7	363.1	25	0.8	0.3	1996 Sep
1996	10	1996.8	359.7	363.1	29	0.3	0.1	1996 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1996	11	1996.9	361.0	363.2	29	0.3	0.1	1996 Nov
1996	12	1997.0	362.4	363.2	29	0.4	0.1	1996 Dec
1997	1	1997.0	363.2	363.0	31	0.4	0.1	1997 Jan
1997	2	1997.1	364.2	363.4	28	0.6	0.2	1997 Feb
1997	3	1997.2	364.6	363.0	31	0.4	0.1	1997 Mar
1997	4	1997.3	366.5	363.8	21	0.5	0.2	1997 Apr
1997	5	1997.4	366.8	363.9	29	0.5	0.2	1997 May
1997	6	1997.5	365.7	363.6	27	0.2	0.1	1997 Jun
1997	7	1997.5	364.5	363.7	24	0.5	0.2	1997 Jul
1997	8	1997.6	362.4	364.0	25	0.6	0.2	1997 Aug
1997	9	1997.7	360.4	363.8	26	0.6	0.2	1997 Sep
1997	10	1997.8	361.0	364.3	27	0.3	0.1	1997 Oct
1997	11	1997.9	362.6	364.7	30	0.3	0.1	1997 Nov
1997	12	1998.0	364.5	365.3	30	0.4	0.1	1997 Dec
1998	1	1998.0	365.4	365.2	30	0.4	0.1	1998 Jan
1998	2	1998.1	366.1	365.3	28	0.6	0.2	1998 Feb
1998	3	1998.2	367.4	365.7	31	0.8	0.3	1998 Mar
1998	4	1998.3	368.8	366.2	29	0.6	0.2	1998 Apr
1998	5	1998.4	369.6	366.7	30	0.8	0.3	1998 May
1998	6	1998.5	369.1	367.0	28	0.2	0.1	1998 Jun
1998	7	1998.5	368.0	367.3	23	0.7	0.3	1998 Jul
1998	8	1998.6	366.1	367.7	30	0.3	0.1	1998 Aug
1998	9	1998.7	364.2	367.5	28	0.4	0.1	1998 Sep
1998	10	1998.8	364.5	367.8	30	0.3	0.1	1998 Oct
1998	11	1998.9	365.7	367.7	23	0.2	0.1	1998 Nov
1998	12	1999.0	367.3	368.0	26	0.4	0.1	1998 Dec
1999	1	1999.0	368.4	368.1	27	0.5	0.2	1999 Jan
1999	2	1999.1	369.3	368.5	21	0.5	0.2	1999 Feb
1999	3	1999.2	369.8	368.2	25	0.8	0.3	1999 Mar
1999	4	1999.3	371.1	368.6	29	0.7	0.2	1999 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1999	5	1999.4	371.1	368.3	26	0.6	0.2	1999 May
1999	6	1999.5	370.5	368.3	26	0.4	0.2	1999 Jun
1999	7	1999.5	369.6	368.9	27	0.6	0.2	1999 Jul
1999	8	1999.6	367.1	368.6	25	0.4	0.1	1999 Aug
1999	9	1999.7	365.0	368.3	28	0.7	0.3	1999 Sep
1999	10	1999.8	365.5	368.8	31	0.3	0.1	1999 Oct
1999	11	1999.9	366.9	368.9	28	0.2	0.1	1999 Nov
1999	12	2000.0	368.3	368.9	26	0.3	0.1	1999 Dec
2000	1	2000.0	369.4	369.2	26	0.5	0.2	2000 Jan
2000	2	2000.1	369.7	369.0	19	0.5	0.2	2000 Feb
2000	3	2000.2	370.8	369.2	30	0.5	0.2	2000 Mar
2000	4	2000.3	372.0	369.4	27	0.6	0.2	2000 Apr
2000	5	2000.4	371.8	368.9	28	0.5	0.2	2000 May
2000	6	2000.5	371.9	369.7	28	0.2	0.1	2000 Jun
2000	7	2000.5	370.0	369.4	25	0.3	0.1	2000 Jul
2000	8	2000.6	368.3	369.9	27	0.4	0.1	2000 Aug
2000	9	2000.7	367.1	370.5	25	0.4	0.1	2000 Sep
2000	10	2000.8	367.2	370.4	30	0.3	0.1	2000 Oct
2000	11	2000.9	368.5	370.5	25	0.3	0.1	2000 Nov
2000	12	2001.0	369.8	370.5	30	0.4	0.1	2000 Dec
2001	1	2001.0	370.8	370.6	30	0.6	0.2	2001 Jan
2001	2	2001.1	371.7	371.0	26	0.6	0.2	2001 Feb
2001	3	2001.2	372.6	371.1	26	0.5	0.2	2001 Mar
2001	4	2001.3	373.6	371.0	29	0.6	0.2	2001 Apr
2001	5	2001.4	374.0	371.1	24	0.4	0.2	2001 May
2001	6	2001.5	373.4	371.2	26	0.4	0.1	2001 Jun
2001	7	2001.5	371.7	371.1	25	0.6	0.2	2001 Jul
2001	8	2001.6	369.8	371.4	27	0.6	0.2	2001 Aug
2001	9	2001.7	368.3	371.6	28	0.5	0.2	2001 Sep
2001	10	2001.8	368.6	371.9	31	0.3	0.1	2001 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2001	11	2001.9	369.9	371.9	24	0.2	0.1	2001 Nov
2001	12	2002.0	371.4	372.1	29	0.4	0.1	2001 Dec
2002	1	2002.0	372.7	372.5	28	0.5	0.2	2002 Jan
2002	2	2002.1	373.4	372.5	28	0.7	0.2	2002 Feb
2002	3	2002.2	374.3	372.6	24	0.6	0.2	2002 Mar
2002	4	2002.3	375.2	372.5	29	0.6	0.2	2002 Apr
2002	5	2002.4	375.9	373.0	29	0.6	0.2	2002 May
2002	6	2002.5	375.7	373.5	28	0.5	0.2	2002 Jun
2002	7	2002.5	374.2	373.6	25	0.5	0.2	2002 Jul
2002	8	2002.6	372.0	373.7	28	0.7	0.2	2002 Aug
2002	9	2002.7	370.9	374.3	23	0.7	0.3	2002 Sep
2002	10	2002.8	370.7	374.1	31	0.6	0.2	2002 Oct
2002	11	2002.9	372.4	374.5	29	0.4	0.1	2002 Nov
2002	12	2003.0	374.0	374.7	31	0.5	0.2	2002 Dec
2003	1	2003.0	375.1	374.8	30	0.5	0.2	2003 Jan
2003	2	2003.1	375.8	375.0	27	0.6	0.2	2003 Feb
2003	3	2003.2	376.6	375.0	28	0.6	0.2	2003 Mar
2003	4	2003.3	377.9	375.2	27	0.4	0.1	2003 Apr
2003	5	2003.4	378.8	375.7	30	0.8	0.3	2003 May
2003	6	2003.5	378.5	376.2	25	0.4	0.1	2003 Jun
2003	7	2003.5	376.9	376.4	29	0.7	0.2	2003 Jul
2003	8	2003.6	374.6	376.3	23	0.6	0.2	2003 Aug
2003	9	2003.7	373.3	376.6	25	0.4	0.1	2003 Sep
2003	10	2003.8	373.3	376.6	30	0.3	0.1	2003 Oct
2003	11	2003.9	374.8	377.0	26	0.4	0.2	2003 Nov
2003	12	2004.0	376.2	376.9	27	0.4	0.1	2003 Dec
2004	1	2004.0	377.2	377.0	30	0.4	0.2	2004 Jan
2004	2	2004.1	378.0	377.2	29	0.7	0.3	2004 Feb
2004	3	2004.2	379.1	377.4	27	0.8	0.3	2004 Mar
2004	4	2004.3	380.5	377.8	26	0.5	0.2	2004 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2004	5	2004.4	380.8	377.7	28	0.6	0.2	2004 May
2004	6	2004.5	379.9	377.6	21	0.5	0.2	2004 Jun
2004	7	2004.5	377.6	377.1	25	0.5	0.2	2004 Jul
2004	8	2004.6	376.2	377.9	16	0.4	0.2	2004 Aug
2004	9	2004.7	374.4	377.8	15	0.6	0.3	2004 Sep
2004	10	2004.8	374.6	378.0	29	0.2	0.1	2004 Oct
2004	11	2004.9	376.3	378.5	29	0.6	0.2	2004 Nov
2004	12	2005.0	377.7	378.5	30	0.3	0.1	2004 Dec
2005	1	2005.0	378.6	378.4	31	0.3	0.1	2005 Jan
2005	2	2005.1	379.9	379.1	24	0.6	0.2	2005 Feb
2005	3	2005.2	381.0	379.4	26	1.2	0.4	2005 Mar
2005	4	2005.3	382.5	379.8	26	0.5	0.2	2005 Apr
2005	5	2005.4	382.6	379.5	31	0.6	0.2	2005 May
2005	6	2005.5	382.4	380.1	28	0.2	0.1	2005 Jun
2005	7	2005.5	380.9	380.4	29	0.4	0.1	2005 Jul
2005	8	2005.6	378.9	380.6	26	0.5	0.2	2005 Aug
2005	9	2005.7	376.9	380.2	27	0.5	0.2	2005 Sep
2005	10	2005.8	377.2	380.5	14	0.1	0.1	2005 Oct
2005	11	2005.9	378.5	380.7	23	0.4	0.2	2005 Nov
2005	12	2006.0	380.3	381.1	26	0.4	0.1	2005 Dec
2006	1	2006.0	381.6	381.3	24	0.3	0.1	2006 Jan
2006	2	2006.1	382.4	381.6	25	0.5	0.2	2006 Feb
2006	3	2006.2	382.9	381.3	29	0.6	0.2	2006 Mar
2006	4	2006.3	384.8	382.1	25	0.5	0.2	2006 Apr
2006	5	2006.4	385.2	382.1	24	0.4	0.2	2006 May
2006	6	2006.5	384.2	381.9	28	0.4	0.2	2006 Jun
2006	7	2006.5	382.6	382.1	24	0.3	0.1	2006 Jul
2006	8	2006.6	380.6	382.3	27	0.5	0.2	2006 Aug
2006	9	2006.7	379.0	382.4	25	0.4	0.2	2006 Sep
2006	10	2006.8	379.3	382.7	23	0.4	0.2	2006 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2006	11	2006.9	380.4	382.5	29	0.4	0.1	2006 Nov
2006	12	2007.0	382.0	382.8	27	0.4	0.1	2006 Dec
2007	1	2007.0	383.1	382.9	24	0.8	0.3	2007 Jan
2007	2	2007.1	384.1	383.2	21	0.8	0.3	2007 Feb
2007	3	2007.2	384.8	383.2	27	0.6	0.2	2007 Mar
2007	4	2007.3	386.7	384.0	25	0.8	0.3	2007 Apr
2007	5	2007.4	386.8	383.6	29	0.6	0.2	2007 May
2007	6	2007.5	386.3	384.1	26	0.4	0.2	2007 Jun
2007	7	2007.5	384.7	384.2	27	0.4	0.2	2007 Jul
2007	8	2007.6	382.2	384.0	22	0.6	0.3	2007 Aug
2007	9	2007.7	381.2	384.6	21	0.4	0.2	2007 Sep
2007	10	2007.8	381.4	384.7	29	0.2	0.1	2007 Oct
2007	11	2007.9	382.7	384.9	30	0.3	0.1	2007 Nov
2007	12	2008.0	384.2	385.1	22	0.3	0.1	2007 Dec
2008	1	2008.0	385.8	385.5	31	0.6	0.2	2008 Jan
2008	2	2008.1	386.1	385.2	26	0.6	0.2	2008 Feb
2008	3	2008.2	386.3	384.7	30	0.6	0.2	2008 Mar
2008	4	2008.3	387.3	384.7	22	1.2	0.5	2008 Apr
2008	5	2008.4	388.8	385.7	25	0.6	0.2	2008 May
2008	6	2008.5	388.0	385.7	23	0.5	0.2	2008 Jun
2008	7	2008.5	386.6	386.0	10	1.0	0.6	2008 Jul
2008	8	2008.6	384.3	386.0	25	0.7	0.2	2008 Aug
2008	9	2008.7	383.4	386.7	27	0.3	0.1	2008 Sep
2008	10	2008.8	383.2	386.5	23	0.3	0.1	2008 Oct
2008	11	2008.9	384.4	386.6	28	0.3	0.1	2008 Nov
2008	12	2009.0	385.8	386.6	29	0.3	0.1	2008 Dec
2009	1	2009.0	387.2	386.9	30	0.4	0.1	2009 Jan
2009	2	2009.1	387.7	386.8	26	0.5	0.2	2009 Feb
2009	3	2009.2	389.0	387.5	28	0.7	0.2	2009 Mar
2009	4	2009.3	389.8	387.1	29	0.8	0.3	2009 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2009	5	2009.4	390.4	387.2	30	0.5	0.2	2009 May
2009	6	2009.5	389.7	387.5	29	0.6	0.2	2009 Jun
2009	7	2009.5	388.2	387.8	22	0.3	0.1	2009 Jul
2009	8	2009.6	386.3	388.0	28	0.6	0.2	2009 Aug
2009	9	2009.7	385.0	388.2	28	0.6	0.2	2009 Sep
2009	10	2009.8	384.6	387.9	30	0.3	0.1	2009 Oct
2009	11	2009.9	386.2	388.4	30	0.3	0.1	2009 Nov
2009	12	2010.0	387.6	388.4	20	0.5	0.2	2009 Dec
2010	1	2010.0	388.9	388.6	30	0.9	0.3	2010 Jan
2010	2	2010.1	390.4	389.5	20	1.3	0.6	2010 Feb
2010	3	2010.2	391.4	389.9	25	1.0	0.4	2010 Mar
2010	4	2010.3	392.7	390.1	26	0.7	0.2	2010 Apr
2010	5	2010.4	393.2	390.1	29	0.7	0.2	2010 May
2010	6	2010.5	392.4	390.1	28	0.4	0.1	2010 Jun
2010	7	2010.5	390.4	389.9	29	0.5	0.2	2010 Jul
2010	8	2010.6	388.5	390.2	26	0.4	0.2	2010 Aug
2010	9	2010.7	387.0	390.3	29	0.6	0.2	2010 Sep
2010	10	2010.8	387.4	390.7	31	0.3	0.1	2010 Oct
2010	11	2010.9	388.9	391.0	29	0.4	0.1	2010 Nov
2010	12	2011.0	390.0	390.8	29	0.5	0.2	2010 Dec
2011	1	2011.0	391.5	391.2	29	0.9	0.3	2011 Jan
2011	2	2011.1	392.0	391.1	28	0.5	0.2	2011 Feb
2011	3	2011.2	392.8	391.3	29	1.0	0.3	2011 Mar
2011	4	2011.3	393.4	390.8	28	0.7	0.3	2011 Apr
2011	5	2011.4	394.4	391.2	29	0.9	0.3	2011 May
2011	6	2011.5	394.0	391.6	28	0.4	0.2	2011 Jun
2011	7	2011.5	392.7	392.2	26	0.7	0.3	2011 Jul
2011	8	2011.6	390.3	392.0	27	0.4	0.1	2011 Aug
2011	9	2011.7	389.3	392.6	26	0.3	0.1	2011 Sep
2011	10	2011.8	389.2	392.5	30	0.2	0.1	2011 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2011	11	2011.9	390.5	392.6	28	0.3	0.1	2011 Nov
2011	12	2012.0	392.1	392.9	26	0.4	0.1	2011 Dec
2012	1	2012.0	393.3	393.1	30	0.8	0.3	2012 Jan
2012	2	2012.1	394.0	393.2	26	1.2	0.4	2012 Feb
2012	3	2012.2	394.6	393.0	30	0.6	0.2	2012 Mar
2012	4	2012.3	396.4	393.6	29	0.6	0.2	2012 Apr
2012	5	2012.4	396.9	393.7	30	0.5	0.2	2012 May
2012	6	2012.5	395.9	393.6	28	0.6	0.2	2012 Jun
2012	7	2012.5	394.6	394.1	26	0.3	0.1	2012 Jul
2012	8	2012.6	392.6	394.4	30	0.5	0.2	2012 Aug
2012	9	2012.7	391.3	394.8	26	0.4	0.2	2012 Sep
2012	10	2012.8	391.3	394.6	28	0.2	0.1	2012 Oct
2012	11	2012.9	393.2	395.2	29	0.5	0.2	2012 Nov
2012	12	2013.0	394.6	395.3	29	0.4	0.2	2012 Dec
2013	1	2013.0	395.8	395.6	28	0.6	0.2	2013 Jan
2013	2	2013.1	397.0	396.2	25	0.6	0.2	2013 Feb
2013	3	2013.2	397.7	396.1	30	0.7	0.2	2013 Mar
2013	4	2013.3	398.6	395.8	22	0.6	0.2	2013 Apr
2013	5	2013.4	400.0	396.6	28	0.4	0.1	2013 May
2013	6	2013.5	398.8	396.5	26	0.4	0.2	2013 Jun
2013	7	2013.5	397.5	397.1	21	0.5	0.2	2013 Jul
2013	8	2013.6	395.4	397.3	27	0.4	0.2	2013 Aug
2013	9	2013.7	393.7	397.2	26	0.3	0.1	2013 Sep
2013	10	2013.8	393.9	397.2	28	0.2	0.1	2013 Oct
2013	11	2013.9	395.4	397.4	30	0.6	0.2	2013 Nov
2013	12	2014.0	397.0	397.8	30	0.5	0.2	2013 Dec
2014	1	2014.0	398.0	397.7	31	0.5	0.2	2014 Jan
2014	2	2014.1	398.3	397.4	27	0.5	0.2	2014 Feb
2014	3	2014.2	399.9	398.4	22	0.8	0.3	2014 Mar
2014	4	2014.3	401.5	398.6	26	0.5	0.2	2014 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2014	5	2014.4	402.0	398.6	22	0.5	0.2	2014 May
2014	6	2014.5	401.4	399.1	28	0.4	0.1	2014 Jun
2014	7	2014.5	399.3	398.9	25	0.6	0.2	2014 Jul
2014	8	2014.6	397.2	399.1	22	0.3	0.1	2014 Aug
2014	9	2014.7	395.5	399.1	21	0.5	0.2	2014 Sep
2014	10	2014.8	396.2	399.6	24	0.7	0.3	2014 Oct
2014	11	2014.9	397.4	399.5	27	0.4	0.1	2014 Nov
2014	12	2015.0	399.1	399.8	29	0.6	0.2	2014 Dec
2015	1	2015.0	400.2	399.9	30	0.6	0.2	2015 Jan
2015	2	2015.1	400.6	399.8	28	0.6	0.2	2015 Feb
2015	3	2015.2	401.7	400.2	24	1.0	0.4	2015 Mar
2015	4	2015.3	403.4	400.5	26	0.9	0.3	2015 Apr
2015	5	2015.4	404.1	400.7	30	0.3	0.1	2015 May
2015	6	2015.5	403.0	400.6	29	0.5	0.2	2015 Jun
2015	7	2015.5	401.5	401.1	24	0.6	0.2	2015 Jul
2015	8	2015.6	399.1	401.0	28	0.7	0.3	2015 Aug
2015	9	2015.7	397.8	401.4	25	0.3	0.1	2015 Sep
2015	10	2015.8	398.5	401.9	28	0.6	0.2	2015 Oct
2015	11	2015.9	400.3	402.2	25	0.6	0.2	2015 Nov
2015	12	2016.0	402.1	402.7	30	0.7	0.2	2015 Dec
2016	1	2016.0	402.7	402.4	27	0.6	0.2	2016 Jan
2016	2	2016.1	404.2	403.4	25	1.1	0.4	2016 Feb
2016	3	2016.2	405.1	403.5	28	0.8	0.3	2016 Mar
2016	4	2016.3	407.6	404.8	23	1.0	0.4	2016 Apr
2016	5	2016.4	407.9	404.4	29	0.5	0.2	2016 May
2016	6	2016.5	407.0	404.6	26	0.6	0.2	2016 Jun
2016	7	2016.5	404.6	404.2	28	0.9	0.3	2016 Jul
2016	8	2016.6	402.4	404.4	24	0.6	0.2	2016 Aug
2016	9	2016.7	401.2	404.9	25	0.4	0.2	2016 Sep
2016	10	2016.8	401.8	405.2	29	0.3	0.1	2016 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2016	11	2016.9	403.7	405.7	27	0.7	0.3	2016 Nov
2016	12	2017.0	404.6	405.3	29	0.4	0.2	2016 Dec
2017	1	2017.0	406.4	406.0	27	0.7	0.2	2017 Jan
2017	2	2017.1	406.7	405.8	26	0.7	0.3	2017 Feb
2017	3	2017.2	407.5	406.0	24	1.0	0.4	2017 Mar
2017	4	2017.3	409.2	406.4	26	0.9	0.3	2017 Apr
2017	5	2017.4	409.9	406.4	27	0.6	0.2	2017 May
2017	6	2017.5	409.1	406.7	26	0.5	0.2	2017 Jun
2017	7	2017.5	407.3	407.0	28	0.6	0.2	2017 Jul
2017	8	2017.6	405.3	407.3	29	0.3	0.1	2017 Aug
2017	9	2017.7	403.6	407.2	26	0.4	0.1	2017 Sep
2017	10	2017.8	403.8	407.2	27	0.3	0.1	2017 Oct
2017	11	2017.9	405.3	407.4	26	0.4	0.1	2017 Nov
2017	12	2018.0	407.0	407.7	31	0.6	0.2	2017 Dec
2018	1	2018.0	408.1	407.8	29	0.6	0.2	2018 Jan
2018	2	2018.1	408.5	407.6	28	0.5	0.2	2018 Feb
2018	3	2018.2	409.6	408.1	29	0.7	0.2	2018 Mar
2018	4	2018.3	410.4	407.6	21	0.9	0.4	2018 Apr
2018	5	2018.4	411.4	408.0	24	0.9	0.3	2018 May
2018	6	2018.5	411.0	408.6	29	0.6	0.2	2018 Jun
2018	7	2018.5	408.9	408.6	27	0.5	0.2	2018 Jul
2018	8	2018.6	407.2	409.2	31	0.3	0.1	2018 Aug
2018	9	2018.7	405.7	409.3	29	0.4	0.2	2018 Sep
2018	10	2018.8	406.2	409.6	30	0.3	0.1	2018 Oct
2018	11	2018.9	408.2	410.2	24	0.6	0.2	2018 Nov
2018	12	2019.0	409.3	410.0	30	0.5	0.2	2018 Dec
2019	1	2019.0	411.0	410.7	26	1.3	0.5	2019 Jan
2019	2	2019.1	412.0	411.0	27	1.1	0.4	2019 Feb
2019	3	2019.2	412.2	410.7	28	1.1	0.4	2019 Mar
2019	4	2019.3	413.5	410.9	27	0.6	0.2	2019 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2019	5	2019.4	414.9	411.5	28	0.5	0.2	2019 May
2019	6	2019.5	414.1	411.7	27	0.4	0.1	2019 Jun
2019	7	2019.5	412.0	411.6	25	0.8	0.3	2019 Jul
2019	8	2019.6	410.2	412.1	29	0.3	0.1	2019 Aug
2019	9	2019.7	408.8	412.3	29	0.3	0.1	2019 Sep
2019	10	2019.8	408.7	412.1	29	0.3	0.1	2019 Oct
2019	11	2019.9	410.5	412.5	26	0.4	0.1	2019 Nov
2019	12	2020.0	412.0	412.7	31	0.4	0.1	2019 Dec
2020	1	2020.0	413.6	413.2	29	0.7	0.3	2020 Jan
2020	2	2020.1	414.3	413.4	28	0.7	0.2	2020 Feb
2020	3	2020.2	414.7	413.4	26	0.3	0.1	2020 Mar
2020	4	2020.3	416.4	413.9	28	0.7	0.2	2020 Apr
2020	5	2020.4	417.3	414.0	27	0.6	0.2	2020 May
2020	6	2020.5	416.6	414.1	27	0.4	0.2	2020 Jun
2020	7	2020.5	414.6	414.2	30	0.6	0.2	2020 Jul
2020	8	2020.6	412.8	414.6	25	0.2	0.1	2020 Aug
2020	9	2020.7	411.5	414.9	29	0.3	0.1	2020 Sep
2020	10	2020.8	411.5	414.8	30	0.2	0.1	2020 Oct
2020	11	2020.9	413.1	415.1	27	0.8	0.3	2020 Nov
2020	12	2021.0	414.2	414.9	30	0.5	0.2	2020 Dec
2021	1	2021.0	415.5	415.2	29	0.4	0.2	2021 Jan
2021	2	2021.1	416.7	415.8	28	1.0	0.4	2021 Feb
2021	3	2021.2	417.6	416.2	28	0.9	0.3	2021 Mar
2021	4	2021.3	419.0	416.6	24	1.1	0.4	2021 Apr
2021	5	2021.4	419.1	415.9	28	0.9	0.3	2021 May
2021	6	2021.5	418.9	416.5	29	0.7	0.2	2021 Jun
2021	7	2021.5	416.9	416.5	31	0.7	0.2	2021 Jul
2021	8	2021.6	414.4	416.3	25	0.7	0.3	2021 Aug
2021	9	2021.7	413.3	416.6	27	0.3	0.1	2021 Sep
2021	10	2021.8	413.9	417.1	29	0.3	0.1	2021 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2021	11	2021.9	415.0	416.9	30	0.4	0.1	2021 Nov
2021	12	2022.0	416.7	417.4	28	0.5	0.2	2021 Dec
2022	1	2022.0	418.1	417.8	30	0.7	0.2	2022 Jan
2022	2	2022.1	419.2	418.3	27	0.9	0.3	2022 Feb
2022	3	2022.2	418.8	417.3	30	0.8	0.3	2022 Mar
2022	4	2022.3	420.2	417.7	28	0.9	0.3	2022 Apr
2022	5	2022.4	421.0	417.7	31	0.8	0.3	2022 May
2022	6	2022.5	420.9	418.5	28	0.3	0.1	2022 Jun
2022	7	2022.5	418.9	418.4	27	0.6	0.2	2022 Jul
2022	8	2022.6	417.1	419.0	27	0.4	0.1	2022 Aug
2022	9	2022.7	415.9	419.3	28	0.4	0.1	2022 Sep
2022	10	2022.8	415.7	419.0	30	0.3	0.1	2022 Oct
2022	11	2022.9	417.5	419.5	25	0.5	0.2	2022 Nov
2022	12	2023.0	419.0	419.7	24	0.6	0.2	2022 Dec
2023	1	2023.0	419.5	419.2	31	0.4	0.1	2023 Jan
2023	2	2023.1	420.3	419.4	23	0.7	0.3	2023 Feb
2023	3	2023.2	421.0	419.5	30	0.7	0.3	2023 Mar
2023	4	2023.3	423.3	420.8	27	0.6	0.2	2023 Apr
2023	5	2023.4	424.0	420.8	31	0.7	0.2	2023 May
2023	6	2023.5	423.7	421.2	29	0.6	0.2	2023 Jun
2023	7	2023.5	421.8	421.4	21	0.5	0.2	2023 Jul
2023	8	2023.6	419.7	421.6	21	0.4	0.2	2023 Aug
2023	9	2023.7	418.5	421.9	18	0.3	0.1	2023 Sep
2023	10	2023.8	418.8	422.1	27	0.5	0.2	2023 Oct
2023	11	2023.9	420.5	422.5	21	0.9	0.4	2023 Nov
2023	12	2024.0	421.9	422.6	20	0.7	0.3	2023 Dec
2024	1	2024.0	422.8	422.5	27	0.7	0.3	2024 Jan
2024	2	2024.1	424.6	423.6	22	1.2	0.5	2024 Feb
2024	3	2024.2	425.4	423.9	22	1.0	0.4	2024 Mar
2024	4	2024.3	426.5	424.0	22	1.0	0.4	2024 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2024	5	2024.4	426.9	423.6	29	0.8	0.3	2024 May
2024	6	2024.5	426.9	424.5	20	0.7	0.3	2024 Jun
2024	7	2024.5	425.6	425.1	24	0.7	0.3	2024 Jul
2024	8	2024.6	423.0	424.9	22	1.1	0.4	2024 Aug
2024	9	2024.7	422.0	425.4	18	0.4	0.2	2024 Sep
2024	10	2024.8	422.4	425.7	22	0.3	0.1	2024 Oct
2024	11	2024.9	423.9	425.9	24	0.3	0.1	2024 Nov
2024	12	2025.0	425.4	426.1	28	0.7	0.2	2024 Dec
2025	1	2025.0	426.6	426.4	29	0.6	0.2	2025 Jan
2025	2	2025.1	427.1	426.1	24	0.6	0.2	2025 Feb
2025	3	2025.2	428.1	426.7	27	1.1	0.4	2025 Mar
2025	4	2025.3	429.6	427.1	23	0.7	0.3	2025 Apr
2025	5	2025.4	430.5	427.3	23	0.4	0.2	2025 May
2025	6	2025.5	429.6	427.2	26	0.7	0.3	2025 Jun
2025	7	2025.5	427.9	427.4	24	0.3	0.1	2025 Jul
2025	8	2025.6	425.5	427.4	24	0.4	0.1	2025 Aug

```r
#4. Summary of co2 data
co2_ts |>
  summarise(
    start_year   = min(year(Month)),
    end_year     = max(year(Month)),
    n_months     = n(),
    mean_co2     = mean(average, na.rm = TRUE),
    sd_co2       = sd(average, na.rm = TRUE),
    min_co2      = min(average, na.rm = TRUE),
    max_co2      = max(average, na.rm = TRUE),
    mean_deseas  = mean(deseasonalized, na.rm = TRUE))
```

```
# A tsibble: 810 x 9 [1M]
      Month start_year end_year n_months mean_co2 sd_co2 min_co2 max_co2
      <mth>      <dbl>    <dbl>    <int>    <dbl>  <dbl>   <dbl>   <dbl>
 1 1958 Mar       1958     1958        1     316.     NA    316.    316.
 2 1958 Apr       1958     1958        1     317.     NA    317.    317.
```

```
 3 1958 May       1958     1958        1     318.     NA    318.    318.
 4 1958 Jun       1958     1958        1     317.     NA    317.    317.
 5 1958 Jul       1958     1958        1     316.     NA    316.    316.
 6 1958 Aug       1958     1958        1     315.     NA    315.    315.
 7 1958 Sep       1958     1958        1     313.     NA    313.    313.
 8 1958 Oct       1958     1958        1     312.     NA    312.    312.
 9 1958 Nov       1958     1958        1     313.     NA    313.    313.
10 1958 Dec       1958     1958        1     315.     NA    315.    315.
# i 800 more rows
# i 1 more variable: mean_deseas <dbl>
```

```
co2_ts |>
  knitr::kable(digits = 1, caption = "Overall summary of CO2 average" )
```

Table 2: Overall summary of CO2 average

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1958	3	1958.2	315.7	314.4	-1	-10.0	-1.0	1958 Mar
1958	4	1958.3	317.4	315.2	-1	-10.0	-1.0	1958 Apr
1958	5	1958.4	317.5	314.7	-1	-10.0	-1.0	1958 May
1958	6	1958.5	317.3	315.1	-1	-10.0	-1.0	1958 Jun
1958	7	1958.5	315.9	315.2	-1	-10.0	-1.0	1958 Jul
1958	8	1958.6	314.9	316.2	-1	-10.0	-1.0	1958 Aug
1958	9	1958.7	313.2	316.1	-1	-10.0	-1.0	1958 Sep
1958	10	1958.8	312.4	315.4	-1	-10.0	-1.0	1958 Oct
1958	11	1958.9	313.3	315.2	-1	-10.0	-1.0	1958 Nov
1958	12	1959.0	314.7	315.4	-1	-10.0	-1.0	1958 Dec
1959	1	1959.0	315.6	315.5	-1	-10.0	-1.0	1959 Jan
1959	2	1959.1	316.5	315.8	-1	-10.0	-1.0	1959 Feb
1959	3	1959.2	316.6	315.4	-1	-10.0	-1.0	1959 Mar
1959	4	1959.3	317.7	315.4	-1	-10.0	-1.0	1959 Apr
1959	5	1959.4	318.3	315.5	-1	-10.0	-1.0	1959 May
1959	6	1959.5	318.1	316.0	-1	-10.0	-1.0	1959 Jun
1959	7	1959.5	316.5	315.9	-1	-10.0	-1.0	1959 Jul

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1959	8	1959.6	314.8	316.1	-1	-10.0	-1.0	1959 Aug
1959	9	1959.7	313.8	316.8	-1	-10.0	-1.0	1959 Sep
1959	10	1959.8	313.3	316.3	-1	-10.0	-1.0	1959 Oct
1959	11	1959.9	314.8	316.7	-1	-10.0	-1.0	1959 Nov
1959	12	1960.0	315.6	316.4	-1	-10.0	-1.0	1959 Dec
1960	1	1960.0	316.4	316.4	-1	-10.0	-1.0	1960 Jan
1960	2	1960.1	317.0	316.3	-1	-10.0	-1.0	1960 Feb
1960	3	1960.2	317.6	316.3	-1	-10.0	-1.0	1960 Mar
1960	4	1960.3	319.0	316.7	-1	-10.0	-1.0	1960 Apr
1960	5	1960.4	320.0	317.2	-1	-10.0	-1.0	1960 May
1960	6	1960.5	319.6	317.4	-1	-10.0	-1.0	1960 Jun
1960	7	1960.5	318.2	317.5	-1	-10.0	-1.0	1960 Jul
1960	8	1960.6	315.9	317.2	-1	-10.0	-1.0	1960 Aug
1960	9	1960.7	314.2	317.1	-1	-10.0	-1.0	1960 Sep
1960	10	1960.8	313.8	316.9	-1	-10.0	-1.0	1960 Oct
1960	11	1960.9	315.0	316.9	-1	-10.0	-1.0	1960 Nov
1960	12	1961.0	316.2	317.0	-1	-10.0	-1.0	1960 Dec
1961	1	1961.0	316.9	316.8	-1	-10.0	-1.0	1961 Jan
1961	2	1961.1	317.7	317.0	-1	-10.0	-1.0	1961 Feb
1961	3	1961.2	318.5	317.2	-1	-10.0	-1.0	1961 Mar
1961	4	1961.3	319.5	317.2	-1	-10.0	-1.0	1961 Apr
1961	5	1961.4	320.6	317.7	-1	-10.0	-1.0	1961 May
1961	6	1961.5	319.8	317.6	-1	-10.0	-1.0	1961 Jun
1961	7	1961.5	318.6	317.9	-1	-10.0	-1.0	1961 Jul
1961	8	1961.6	316.8	318.1	-1	-10.0	-1.0	1961 Aug
1961	9	1961.7	315.0	317.9	-1	-10.0	-1.0	1961 Sep
1961	10	1961.8	315.3	318.3	-1	-10.0	-1.0	1961 Oct
1961	11	1961.9	316.1	318.0	-1	-10.0	-1.0	1961 Nov
1961	12	1962.0	317.0	317.8	-1	-10.0	-1.0	1961 Dec
1962	1	1962.0	317.9	317.9	-1	-10.0	-1.0	1962 Jan
1962	2	1962.1	318.6	317.9	-1	-10.0	-1.0	1962 Feb

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1962	3	1962.2	319.7	318.4	-1	-10.0	-1.0	1962 Mar
1962	4	1962.3	320.6	318.2	-1	-10.0	-1.0	1962 Apr
1962	5	1962.4	321.0	318.2	-1	-10.0	-1.0	1962 May
1962	6	1962.5	320.6	318.4	-1	-10.0	-1.0	1962 Jun
1962	7	1962.5	319.6	318.9	-1	-10.0	-1.0	1962 Jul
1962	8	1962.6	317.4	318.7	-1	-10.0	-1.0	1962 Aug
1962	9	1962.7	316.2	319.2	-1	-10.0	-1.0	1962 Sep
1962	10	1962.8	315.4	318.5	-1	-10.0	-1.0	1962 Oct
1962	11	1962.9	316.7	318.6	-1	-10.0	-1.0	1962 Nov
1962	12	1963.0	317.7	318.5	-1	-10.0	-1.0	1962 Dec
1963	1	1963.0	318.7	318.7	-1	-10.0	-1.0	1963 Jan
1963	2	1963.1	319.1	318.4	-1	-10.0	-1.0	1963 Feb
1963	3	1963.2	319.9	318.6	-1	-10.0	-1.0	1963 Mar
1963	4	1963.3	321.4	319.0	-1	-10.0	-1.0	1963 Apr
1963	5	1963.4	322.2	319.4	-1	-10.0	-1.0	1963 May
1963	6	1963.5	321.5	319.3	-1	-10.0	-1.0	1963 Jun
1963	7	1963.5	319.7	319.1	-1	-10.0	-1.0	1963 Jul
1963	8	1963.6	317.8	319.1	-1	-10.0	-1.0	1963 Aug
1963	9	1963.7	316.2	319.2	-1	-10.0	-1.0	1963 Sep
1963	10	1963.8	316.0	319.0	-1	-10.0	-1.0	1963 Oct
1963	11	1963.9	317.1	319.0	-1	-10.0	-1.0	1963 Nov
1963	12	1964.0	318.4	319.1	-1	-10.0	-1.0	1963 Dec
1964	1	1964.0	319.6	319.5	-1	-10.0	-1.0	1964 Jan
1964	2	1964.1	320.0	319.4	-1	-10.0	-1.0	1964 Feb
1964	3	1964.2	320.8	319.4	-1	-10.0	-1.0	1964 Mar
1964	4	1964.3	321.8	319.5	-1	-10.0	-1.0	1964 Apr
1964	5	1964.4	322.2	319.4	-1	-10.0	-1.0	1964 May
1964	6	1964.5	321.9	319.7	-1	-10.0	-1.0	1964 Jun
1964	7	1964.5	320.4	319.8	-1	-10.0	-1.0	1964 Jul
1964	8	1964.6	318.7	320.0	-1	-10.0	-1.0	1964 Aug

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1964	9	1964.7	316.7	319.7	-1	-10.0	-1.0	1964 Sep
1964	10	1964.8	316.9	319.9	-1	-10.0	-1.0	1964 Oct
1964	11	1964.9	317.7	319.6	-1	-10.0	-1.0	1964 Nov
1964	12	1965.0	318.7	319.5	-1	-10.0	-1.0	1964 Dec
1965	1	1965.0	319.4	319.4	-1	-10.0	-1.0	1965 Jan
1965	2	1965.1	320.4	319.8	-1	-10.0	-1.0	1965 Feb
1965	3	1965.2	320.9	319.6	-1	-10.0	-1.0	1965 Mar
1965	4	1965.3	322.1	319.8	-1	-10.0	-1.0	1965 Apr
1965	5	1965.4	322.2	319.3	-1	-10.0	-1.0	1965 May
1965	6	1965.5	321.9	319.7	-1	-10.0	-1.0	1965 Jun
1965	7	1965.5	321.2	320.5	-1	-10.0	-1.0	1965 Jul
1965	8	1965.6	318.9	320.2	-1	-10.0	-1.0	1965 Aug
1965	9	1965.7	317.8	320.8	-1	-10.0	-1.0	1965 Sep
1965	10	1965.8	317.3	320.4	-1	-10.0	-1.0	1965 Oct
1965	11	1965.9	318.9	320.8	-1	-10.0	-1.0	1965 Nov
1965	12	1966.0	319.4	320.2	-1	-10.0	-1.0	1965 Dec
1966	1	1966.0	320.6	320.6	-1	-10.0	-1.0	1966 Jan
1966	2	1966.1	321.6	320.9	-1	-10.0	-1.0	1966 Feb
1966	3	1966.2	322.4	321.1	-1	-10.0	-1.0	1966 Mar
1966	4	1966.3	323.7	321.3	-1	-10.0	-1.0	1966 Apr
1966	5	1966.4	324.1	321.2	-1	-10.0	-1.0	1966 May
1966	6	1966.5	323.8	321.6	-1	-10.0	-1.0	1966 Jun
1966	7	1966.5	322.4	321.7	-1	-10.0	-1.0	1966 Jul
1966	8	1966.6	320.4	321.7	-1	-10.0	-1.0	1966 Aug
1966	9	1966.7	318.6	321.6	-1	-10.0	-1.0	1966 Sep
1966	10	1966.8	318.1	321.2	-1	-10.0	-1.0	1966 Oct
1966	11	1966.9	319.8	321.7	-1	-10.0	-1.0	1966 Nov
1966	12	1967.0	321.0	321.8	-1	-10.0	-1.0	1966 Dec
1967	1	1967.0	322.3	322.3	-1	-10.0	-1.0	1967 Jan
1967	2	1967.1	322.5	321.8	-1	-10.0	-1.0	1967 Feb
1967	3	1967.2	323.0	321.7	-1	-10.0	-1.0	1967 Mar

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1967	4	1967.3	324.4	322.0	-1	-10.0	-1.0	1967 Apr
1967	5	1967.4	325.0	322.1	-1	-10.0	-1.0	1967 May
1967	6	1967.5	324.1	321.9	-1	-10.0	-1.0	1967 Jun
1967	7	1967.5	322.5	321.9	-1	-10.0	-1.0	1967 Jul
1967	8	1967.6	320.9	322.2	-1	-10.0	-1.0	1967 Aug
1967	9	1967.7	319.2	322.2	-1	-10.0	-1.0	1967 Sep
1967	10	1967.8	319.4	322.5	-1	-10.0	-1.0	1967 Oct
1967	11	1967.9	320.7	322.7	-1	-10.0	-1.0	1967 Nov
1967	12	1968.0	322.0	322.7	-1	-10.0	-1.0	1967 Dec
1968	1	1968.0	322.6	322.5	-1	-10.0	-1.0	1968 Jan
1968	2	1968.1	323.1	322.5	-1	-10.0	-1.0	1968 Feb
1968	3	1968.2	323.9	322.6	-1	-10.0	-1.0	1968 Mar
1968	4	1968.3	325.0	322.6	-1	-10.0	-1.0	1968 Apr
1968	5	1968.4	325.6	322.7	-1	-10.0	-1.0	1968 May
1968	6	1968.5	325.4	323.2	-1	-10.0	-1.0	1968 Jun
1968	7	1968.5	324.1	323.5	-1	-10.0	-1.0	1968 Jul
1968	8	1968.6	322.1	323.5	-1	-10.0	-1.0	1968 Aug
1968	9	1968.7	320.3	323.3	-1	-10.0	-1.0	1968 Sep
1968	10	1968.8	320.2	323.3	-1	-10.0	-1.0	1968 Oct
1968	11	1968.9	321.3	323.3	-1	-10.0	-1.0	1968 Nov
1968	12	1969.0	322.9	323.7	-1	-10.0	-1.0	1968 Dec
1969	1	1969.0	324.0	324.0	-1	-10.0	-1.0	1969 Jan
1969	2	1969.1	324.4	323.8	-1	-10.0	-1.0	1969 Feb
1969	3	1969.2	325.6	324.3	-1	-10.0	-1.0	1969 Mar
1969	4	1969.3	326.7	324.3	-1	-10.0	-1.0	1969 Apr
1969	5	1969.4	327.4	324.5	-1	-10.0	-1.0	1969 May
1969	6	1969.5	326.7	324.5	-1	-10.0	-1.0	1969 Jun
1969	7	1969.5	325.9	325.2	-1	-10.0	-1.0	1969 Jul
1969	8	1969.6	323.7	325.0	-1	-10.0	-1.0	1969 Aug
1969	9	1969.7	322.4	325.4	-1	-10.0	-1.0	1969 Sep
1969	10	1969.8	321.8	324.9	-1	-10.0	-1.0	1969 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1969	11	1969.9	322.9	324.8	-1	-10.0	-1.0	1969 Nov
1969	12	1970.0	324.1	324.9	-1	-10.0	-1.0	1969 Dec
1970	1	1970.0	325.1	325.0	-1	-10.0	-1.0	1970 Jan
1970	2	1970.1	326.0	325.3	-1	-10.0	-1.0	1970 Feb
1970	3	1970.2	326.9	325.6	-1	-10.0	-1.0	1970 Mar
1970	4	1970.3	328.1	325.8	-1	-10.0	-1.0	1970 Apr
1970	5	1970.4	328.1	325.1	-1	-10.0	-1.0	1970 May
1970	6	1970.5	327.7	325.4	-1	-10.0	-1.0	1970 Jun
1970	7	1970.5	326.3	325.6	-1	-10.0	-1.0	1970 Jul
1970	8	1970.6	324.7	326.0	-1	-10.0	-1.0	1970 Aug
1970	9	1970.7	323.1	326.1	-1	-10.0	-1.0	1970 Sep
1970	10	1970.8	323.1	326.2	-1	-10.0	-1.0	1970 Oct
1970	11	1970.9	324.0	326.0	-1	-10.0	-1.0	1970 Nov
1970	12	1971.0	325.1	325.9	-1	-10.0	-1.0	1970 Dec
1971	1	1971.0	326.2	326.1	-1	-10.0	-1.0	1971 Jan
1971	2	1971.1	326.7	326.0	-1	-10.0	-1.0	1971 Feb
1971	3	1971.2	327.2	325.9	-1	-10.0	-1.0	1971 Mar
1971	4	1971.3	327.8	325.4	-1	-10.0	-1.0	1971 Apr
1971	5	1971.4	328.9	326.0	-1	-10.0	-1.0	1971 May
1971	6	1971.5	328.6	326.3	-1	-10.0	-1.0	1971 Jun
1971	7	1971.5	327.4	326.7	-1	-10.0	-1.0	1971 Jul
1971	8	1971.6	325.4	326.8	-1	-10.0	-1.0	1971 Aug
1971	9	1971.7	323.4	326.4	-1	-10.0	-1.0	1971 Sep
1971	10	1971.8	323.6	326.7	-1	-10.0	-1.0	1971 Oct
1971	11	1971.9	324.8	326.8	-1	-10.0	-1.0	1971 Nov
1971	12	1972.0	326.0	326.8	-1	-10.0	-1.0	1971 Dec
1972	1	1972.0	326.8	326.7	-1	-10.0	-1.0	1972 Jan
1972	2	1972.1	327.6	327.0	-1	-10.0	-1.0	1972 Feb
1972	3	1972.2	327.8	326.4	-1	-10.0	-1.0	1972 Mar
1972	4	1972.3	329.7	327.3	-1	-10.0	-1.0	1972 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1972	5	1972.4	330.1	327.1	-1	-10.0	-1.0	1972 May
1972	6	1972.5	329.1	326.9	-1	-10.0	-1.0	1972 Jun
1972	7	1972.5	328.0	327.4	-1	-10.0	-1.0	1972 Jul
1972	8	1972.6	326.3	327.7	-1	-10.0	-1.0	1972 Aug
1972	9	1972.7	324.8	327.9	-1	-10.0	-1.0	1972 Sep
1972	10	1972.8	325.2	328.3	-1	-10.0	-1.0	1972 Oct
1972	11	1972.9	326.5	328.5	-1	-10.0	-1.0	1972 Nov
1972	12	1973.0	327.6	328.4	-1	-10.0	-1.0	1972 Dec
1973	1	1973.0	328.6	328.5	-1	-10.0	-1.0	1973 Jan
1973	2	1973.1	329.6	328.9	-1	-10.0	-1.0	1973 Feb
1973	3	1973.2	330.3	329.0	-1	-10.0	-1.0	1973 Mar
1973	4	1973.3	331.5	329.1	-1	-10.0	-1.0	1973 Apr
1973	5	1973.4	332.5	329.5	-1	-10.0	-1.0	1973 May
1973	6	1973.5	332.1	329.8	-1	-10.0	-1.0	1973 Jun
1973	7	1973.5	330.9	330.2	-1	-10.0	-1.0	1973 Jul
1973	8	1973.6	329.3	330.7	-1	-10.0	-1.0	1973 Aug
1973	9	1973.7	327.5	330.6	-1	-10.0	-1.0	1973 Sep
1973	10	1973.8	327.2	330.3	-1	-10.0	-1.0	1973 Oct
1973	11	1973.9	328.2	330.1	-1	-10.0	-1.0	1973 Nov
1973	12	1974.0	328.6	329.4	-1	-10.0	-1.0	1973 Dec
1974	1	1974.0	329.4	329.3	-1	-10.0	-1.0	1974 Jan
1974	2	1974.1	330.7	330.0	-1	-10.0	-1.0	1974 Feb
1974	3	1974.2	331.5	330.1	-1	-10.0	-1.0	1974 Mar
1974	4	1974.3	332.6	330.2	-1	-10.0	-1.0	1974 Apr
1974	5	1974.4	333.2	330.2	13	0.3	0.2	1974 May
1974	6	1974.5	332.2	329.8	25	0.4	0.1	1974 Jun
1974	7	1974.5	331.1	330.2	24	0.2	0.1	1974 Jul
1974	8	1974.6	329.1	330.5	26	0.3	0.1	1974 Aug
1974	9	1974.7	327.3	330.4	22	0.5	0.2	1974 Sep
1974	10	1974.8	327.3	330.5	24	0.2	0.1	1974 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1974	11	1974.9	328.3	330.5	26	0.4	0.2	1974 Nov
1974	12	1975.0	329.6	330.5	29	0.3	0.1	1974 Dec
1975	1	1975.0	330.7	330.8	29	0.4	0.1	1975 Jan
1975	2	1975.1	331.5	330.9	26	0.5	0.2	1975 Feb
1975	3	1975.2	331.9	330.4	17	0.3	0.1	1975 Mar
1975	4	1975.3	333.1	330.5	23	0.6	0.2	1975 Apr
1975	5	1975.4	334.0	331.0	28	0.3	0.1	1975 May
1975	6	1975.5	333.4	331.0	27	0.5	0.2	1975 Jun
1975	7	1975.5	332.0	331.1	24	0.4	0.2	1975 Jul
1975	8	1975.6	330.0	331.3	24	0.5	0.2	1975 Aug
1975	9	1975.7	328.5	331.6	22	0.5	0.2	1975 Sep
1975	10	1975.8	328.4	331.6	11	0.2	0.1	1975 Oct
1975	11	1975.9	329.4	331.6	18	0.3	0.1	1975 Nov
1975	12	1976.0	330.8	331.7	-1	-10.0	0.0	1975 Dec
1976	1	1976.0	331.6	331.7	19	0.2	0.1	1976 Jan
1976	2	1976.1	332.7	332.1	22	0.5	0.2	1976 Feb
1976	3	1976.2	333.4	331.8	18	0.5	0.2	1976 Mar
1976	4	1976.3	334.7	332.2	18	0.8	0.3	1976 Apr
1976	5	1976.4	334.7	331.8	21	0.6	0.2	1976 May
1976	6	1976.5	334.0	331.6	15	0.2	0.1	1976 Jun
1976	7	1976.5	333.1	332.2	15	0.2	0.1	1976 Jul
1976	8	1976.6	330.7	332.1	23	0.5	0.2	1976 Aug
1976	9	1976.7	329.0	332.1	13	0.7	0.4	1976 Sep
1976	10	1976.8	328.7	332.0	19	0.6	0.2	1976 Oct
1976	11	1976.9	330.2	332.4	25	0.4	0.1	1976 Nov
1976	12	1977.0	331.6	332.6	20	0.4	0.2	1976 Dec
1977	1	1977.0	332.7	332.8	23	0.4	0.2	1977 Jan
1977	2	1977.1	333.2	332.6	20	0.3	0.1	1977 Feb
1977	3	1977.2	335.0	333.4	23	0.5	0.2	1977 Mar
1977	4	1977.3	336.1	333.5	20	0.5	0.2	1977 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1977	5	1977.4	336.9	334.0	20	0.3	0.1	1977 May
1977	6	1977.5	336.2	333.8	22	0.4	0.2	1977 Jun
1977	7	1977.5	334.9	334.0	20	0.2	0.1	1977 Jul
1977	8	1977.6	332.6	333.9	18	0.5	0.2	1977 Aug
1977	9	1977.7	331.3	334.4	19	0.5	0.2	1977 Sep
1977	10	1977.8	331.3	334.5	23	0.3	0.1	1977 Oct
1977	11	1977.9	332.5	334.7	21	0.4	0.2	1977 Nov
1977	12	1978.0	333.6	334.6	25	0.4	0.1	1977 Dec
1978	1	1978.0	334.9	335.0	22	0.5	0.2	1978 Jan
1978	2	1978.1	335.3	334.6	25	0.5	0.2	1978 Feb
1978	3	1978.2	336.7	335.0	28	0.6	0.2	1978 Mar
1978	4	1978.3	337.7	335.1	18	0.4	0.2	1978 Apr
1978	5	1978.4	338.0	335.1	26	0.5	0.2	1978 May
1978	6	1978.5	338.0	335.6	17	0.3	0.1	1978 Jun
1978	7	1978.5	336.5	335.6	20	0.3	0.1	1978 Jul
1978	8	1978.6	334.4	335.9	19	0.3	0.1	1978 Aug
1978	9	1978.7	332.4	335.5	17	0.8	0.3	1978 Sep
1978	10	1978.8	332.4	335.7	21	0.3	0.1	1978 Oct
1978	11	1978.9	333.8	336.0	24	0.2	0.1	1978 Nov
1978	12	1979.0	334.9	335.9	26	0.3	0.1	1978 Dec
1979	1	1979.0	336.1	336.2	27	0.6	0.2	1979 Jan
1979	2	1979.1	336.7	336.0	25	0.3	0.1	1979 Feb
1979	3	1979.2	338.3	336.6	21	0.6	0.3	1979 Mar
1979	4	1979.3	338.8	336.1	24	0.7	0.3	1979 Apr
1979	5	1979.4	339.2	336.2	20	0.5	0.2	1979 May
1979	6	1979.5	339.3	336.8	19	0.3	0.1	1979 Jun
1979	7	1979.5	337.5	336.7	26	0.6	0.2	1979 Jul
1979	8	1979.6	335.7	337.2	24	0.6	0.2	1979 Aug
1979	9	1979.7	334.0	337.2	19	0.7	0.3	1979 Sep
1979	10	1979.8	334.2	337.6	25	0.4	0.2	1979 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1979	11	1979.9	335.3	337.6	27	0.3	0.1	1979 Nov
1979	12	1980.0	336.8	337.8	22	0.2	0.1	1979 Dec
1980	1	1980.0	337.9	338.1	29	0.6	0.2	1980 Jan
1980	2	1980.1	338.3	337.9	26	0.5	0.2	1980 Feb
1980	3	1980.2	340.1	338.5	23	0.5	0.2	1980 Mar
1980	4	1980.3	340.9	338.3	24	0.3	0.1	1980 Apr
1980	5	1980.4	341.4	338.4	24	0.5	0.2	1980 May
1980	6	1980.5	341.4	338.9	20	0.4	0.2	1980 Jun
1980	7	1980.5	339.4	338.6	26	0.6	0.2	1980 Jul
1980	8	1980.6	337.7	339.1	16	1.0	0.5	1980 Aug
1980	9	1980.7	336.2	339.4	15	0.7	0.3	1980 Sep
1980	10	1980.8	336.1	339.4	26	0.3	0.1	1980 Oct
1980	11	1980.9	337.3	339.5	27	0.3	0.1	1980 Nov
1980	12	1981.0	338.3	339.3	24	0.2	0.1	1980 Dec
1981	1	1981.0	339.3	339.4	28	0.4	0.1	1981 Jan
1981	2	1981.1	340.6	340.0	25	0.7	0.2	1981 Feb
1981	3	1981.2	341.6	340.1	25	0.5	0.2	1981 Mar
1981	4	1981.3	342.6	340.0	26	0.5	0.2	1981 Apr
1981	5	1981.4	343.0	340.0	30	0.2	0.1	1981 May
1981	6	1981.5	342.5	340.1	25	0.3	0.1	1981 Jun
1981	7	1981.5	340.8	339.9	24	0.5	0.2	1981 Jul
1981	8	1981.6	338.5	339.9	25	0.5	0.2	1981 Aug
1981	9	1981.7	337.0	340.2	27	0.6	0.2	1981 Sep
1981	10	1981.8	337.0	340.4	25	0.4	0.1	1981 Oct
1981	11	1981.9	338.6	340.8	26	0.3	0.1	1981 Nov
1981	12	1982.0	339.9	340.9	20	0.3	0.1	1981 Dec
1982	1	1982.0	340.9	341.1	28	0.3	0.1	1982 Jan
1982	2	1982.1	341.8	341.2	24	0.5	0.2	1982 Feb
1982	3	1982.2	342.8	341.2	17	0.4	0.2	1982 Mar
1982	4	1982.3	344.0	341.3	7	0.4	0.3	1982 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1982	5	1982.4	344.8	341.7	27	0.4	0.1	1982 May
1982	6	1982.5	343.9	341.4	27	0.4	0.1	1982 Jun
1982	7	1982.5	342.4	341.6	28	0.3	0.1	1982 Jul
1982	8	1982.6	340.2	341.6	25	0.6	0.2	1982 Aug
1982	9	1982.7	338.4	341.6	21	0.6	0.2	1982 Sep
1982	10	1982.8	338.4	341.8	26	0.5	0.2	1982 Oct
1982	11	1982.9	339.4	341.6	24	0.4	0.1	1982 Nov
1982	12	1983.0	340.8	341.7	26	0.3	0.1	1982 Dec
1983	1	1983.0	341.6	341.8	28	0.5	0.2	1983 Jan
1983	2	1983.1	342.8	342.2	24	0.4	0.1	1983 Feb
1983	3	1983.2	343.4	341.9	27	0.9	0.3	1983 Mar
1983	4	1983.3	345.4	342.8	23	0.3	0.1	1983 Apr
1983	5	1983.4	346.1	343.0	28	0.5	0.2	1983 May
1983	6	1983.5	345.8	343.3	20	0.3	0.1	1983 Jun
1983	7	1983.5	344.3	343.6	22	0.6	0.2	1983 Jul
1983	8	1983.6	342.5	343.9	16	0.7	0.3	1983 Aug
1983	9	1983.7	340.5	343.6	15	0.5	0.2	1983 Sep
1983	10	1983.8	340.5	343.9	20	0.3	0.1	1983 Oct
1983	11	1983.9	341.8	343.9	27	0.3	0.1	1983 Nov
1983	12	1984.0	343.2	344.1	21	0.2	0.1	1983 Dec
1984	1	1984.0	344.2	344.3	23	0.4	0.2	1984 Jan
1984	2	1984.1	344.9	344.4	23	0.3	0.1	1984 Feb
1984	3	1984.2	345.7	344.3	19	0.3	0.1	1984 Mar
1984	4	1984.3	347.4	344.8	2	-10.0	0.0	1984 Apr
1984	5	1984.4	347.8	344.6	20	0.4	0.2	1984 May
1984	6	1984.5	347.2	344.7	20	0.3	0.1	1984 Jun
1984	7	1984.5	345.8	345.0	18	0.3	0.1	1984 Jul
1984	8	1984.6	343.7	345.1	12	0.4	0.2	1984 Aug
1984	9	1984.7	341.6	344.8	14	0.7	0.4	1984 Sep
1984	10	1984.8	341.9	345.2	12	0.4	0.2	1984 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1984	11	1984.9	343.3	345.4	18	0.4	0.2	1984 Nov
1984	12	1985.0	345.0	345.9	14	0.5	0.3	1984 Dec
1985	1	1985.0	345.5	345.6	25	0.4	0.1	1985 Jan
1985	2	1985.1	346.4	345.9	15	0.4	0.2	1985 Feb
1985	3	1985.2	347.9	346.6	17	0.3	0.2	1985 Mar
1985	4	1985.3	348.7	346.1	21	0.6	0.2	1985 Apr
1985	5	1985.4	349.3	346.1	20	0.5	0.2	1985 May
1985	6	1985.5	348.6	346.2	21	0.3	0.1	1985 Jun
1985	7	1985.5	346.9	346.1	17	0.4	0.2	1985 Jul
1985	8	1985.6	345.3	346.6	16	0.6	0.3	1985 Aug
1985	9	1985.7	343.5	346.6	24	0.6	0.2	1985 Sep
1985	10	1985.8	343.4	346.6	20	0.3	0.1	1985 Oct
1985	11	1985.9	344.7	346.8	21	0.4	0.2	1985 Nov
1985	12	1986.0	346.1	347.0	26	0.6	0.2	1985 Dec
1986	1	1986.0	346.8	346.8	25	0.3	0.1	1986 Jan
1986	2	1986.1	347.5	347.0	25	0.4	0.2	1986 Feb
1986	3	1986.2	348.2	346.9	16	0.7	0.3	1986 Mar
1986	4	1986.3	349.9	347.3	19	0.4	0.2	1986 Apr
1986	5	1986.4	350.5	347.4	18	0.3	0.1	1986 May
1986	6	1986.5	350.0	347.6	17	0.2	0.1	1986 Jun
1986	7	1986.5	348.2	347.4	20	0.5	0.2	1986 Jul
1986	8	1986.6	346.2	347.5	18	0.5	0.2	1986 Aug
1986	9	1986.7	345.5	348.6	17	0.6	0.3	1986 Sep
1986	10	1986.8	344.8	348.0	25	0.3	0.1	1986 Oct
1986	11	1986.9	346.2	348.3	21	0.3	0.1	1986 Nov
1986	12	1987.0	347.5	348.4	24	0.3	0.1	1986 Dec
1987	1	1987.0	348.7	348.7	25	0.5	0.2	1987 Jan
1987	2	1987.1	348.9	348.2	25	0.6	0.2	1987 Feb
1987	3	1987.2	349.8	348.4	21	0.3	0.1	1987 Mar
1987	4	1987.3	351.4	348.8	26	0.7	0.2	1987 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1987	5	1987.4	352.1	349.1	28	0.4	0.1	1987 May
1987	6	1987.5	351.6	349.3	22	0.2	0.1	1987 Jun
1987	7	1987.5	350.2	349.5	17	0.7	0.3	1987 Jul
1987	8	1987.6	348.2	349.6	15	0.8	0.4	1987 Aug
1987	9	1987.7	346.7	349.9	23	0.6	0.2	1987 Sep
1987	10	1987.8	346.7	350.0	22	0.4	0.2	1987 Oct
1987	11	1987.9	348.1	350.1	23	0.3	0.1	1987 Nov
1987	12	1988.0	349.3	350.1	27	0.2	0.1	1987 Dec
1988	1	1988.0	350.5	350.5	24	0.2	0.1	1988 Jan
1988	2	1988.1	351.7	351.0	23	0.6	0.2	1988 Feb
1988	3	1988.2	352.5	351.0	25	0.8	0.3	1988 Mar
1988	4	1988.3	353.7	351.0	27	0.5	0.2	1988 Apr
1988	5	1988.4	354.4	351.2	28	0.4	0.1	1988 May
1988	6	1988.5	353.9	351.6	26	0.3	0.1	1988 Jun
1988	7	1988.5	352.8	352.2	27	0.5	0.2	1988 Jul
1988	8	1988.6	350.5	352.0	26	0.6	0.2	1988 Aug
1988	9	1988.7	349.0	352.2	26	0.5	0.2	1988 Sep
1988	10	1988.8	349.4	352.6	26	0.3	0.1	1988 Oct
1988	11	1988.9	350.4	352.5	25	0.2	0.1	1988 Nov
1988	12	1989.0	351.6	352.5	28	0.4	0.1	1988 Dec
1989	1	1989.0	353.1	353.0	28	0.4	0.2	1989 Jan
1989	2	1989.1	353.4	352.7	25	0.4	0.1	1989 Feb
1989	3	1989.2	354.1	352.6	29	0.5	0.2	1989 Mar
1989	4	1989.3	355.7	353.1	28	0.5	0.2	1989 Apr
1989	5	1989.4	356.0	352.8	27	0.5	0.2	1989 May
1989	6	1989.5	355.4	353.1	26	0.4	0.2	1989 Jun
1989	7	1989.5	354.0	353.4	26	0.4	0.1	1989 Jul
1989	8	1989.6	351.8	353.4	25	0.5	0.2	1989 Aug
1989	9	1989.7	350.1	353.4	24	0.7	0.3	1989 Sep
1989	10	1989.8	350.3	353.6	25	0.3	0.1	1989 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1989	11	1989.9	351.6	353.7	27	0.4	0.1	1989 Nov
1989	12	1990.0	352.9	353.8	27	0.5	0.2	1989 Dec
1990	1	1990.0	353.9	353.8	25	0.3	0.1	1990 Jan
1990	2	1990.1	355.1	354.4	28	0.7	0.2	1990 Feb
1990	3	1990.2	355.8	354.3	27	0.6	0.2	1990 Mar
1990	4	1990.3	356.4	353.8	28	0.6	0.2	1990 Apr
1990	5	1990.4	357.4	354.2	28	0.3	0.1	1990 May
1990	6	1990.5	356.4	354.0	29	0.4	0.1	1990 Jun
1990	7	1990.5	354.9	354.2	30	0.9	0.3	1990 Jul
1990	8	1990.6	353.1	354.7	22	0.6	0.2	1990 Aug
1990	9	1990.7	351.4	354.7	27	0.7	0.3	1990 Sep
1990	10	1990.8	351.7	354.9	28	0.3	0.1	1990 Oct
1990	11	1990.9	353.1	355.2	24	0.2	0.1	1990 Nov
1990	12	1991.0	354.4	355.3	28	0.5	0.2	1990 Dec
1991	1	1991.0	354.9	354.9	28	0.5	0.2	1991 Jan
1991	2	1991.1	355.8	355.1	26	0.5	0.2	1991 Feb
1991	3	1991.2	357.3	355.8	30	0.7	0.2	1991 Mar
1991	4	1991.3	358.8	356.1	30	0.7	0.2	1991 Apr
1991	5	1991.4	359.2	356.1	29	0.5	0.2	1991 May
1991	6	1991.5	358.2	355.9	29	0.3	0.1	1991 Jun
1991	7	1991.5	356.3	355.7	24	0.5	0.2	1991 Jul
1991	8	1991.6	354.0	355.6	23	0.4	0.1	1991 Aug
1991	9	1991.7	352.3	355.7	27	0.4	0.1	1991 Sep
1991	10	1991.8	352.4	355.7	27	0.2	0.1	1991 Oct
1991	11	1991.9	353.9	355.9	28	0.2	0.1	1991 Nov
1991	12	1992.0	355.2	356.0	30	0.3	0.1	1991 Dec
1992	1	1992.0	356.3	356.3	31	0.6	0.2	1992 Jan
1992	2	1992.1	357.2	356.5	27	0.6	0.2	1992 Feb
1992	3	1992.2	358.0	356.4	24	0.7	0.3	1992 Mar
1992	4	1992.3	359.2	356.5	27	0.5	0.2	1992 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1992	5	1992.4	359.7	356.5	26	0.7	0.3	1992 May
1992	6	1992.5	359.4	357.1	30	0.5	0.2	1992 Jun
1992	7	1992.5	357.1	356.6	25	0.6	0.2	1992 Jul
1992	8	1992.6	355.0	356.7	24	0.6	0.2	1992 Aug
1992	9	1992.7	353.0	356.4	25	1.0	0.4	1992 Sep
1992	10	1992.8	353.4	356.7	29	0.6	0.2	1992 Oct
1992	11	1992.9	354.4	356.5	29	0.3	0.1	1992 Nov
1992	12	1993.0	355.7	356.5	31	0.3	0.1	1992 Dec
1993	1	1993.0	357.1	357.1	28	0.6	0.2	1993 Jan
1993	2	1993.1	357.4	356.5	28	0.5	0.2	1993 Feb
1993	3	1993.2	358.6	356.9	30	0.7	0.2	1993 Mar
1993	4	1993.3	359.4	356.7	25	0.5	0.2	1993 Apr
1993	5	1993.4	360.3	357.1	30	0.4	0.2	1993 May
1993	6	1993.5	359.6	357.2	28	0.3	0.1	1993 Jun
1993	7	1993.5	357.4	356.9	25	0.8	0.3	1993 Jul
1993	8	1993.6	355.8	357.4	27	0.6	0.2	1993 Aug
1993	9	1993.7	354.1	357.5	23	0.7	0.3	1993 Sep
1993	10	1993.8	354.2	357.6	28	0.3	0.1	1993 Oct
1993	11	1993.9	355.5	357.6	29	0.3	0.1	1993 Nov
1993	12	1994.0	357.0	357.9	29	0.3	0.1	1993 Dec
1994	1	1994.0	358.4	358.2	27	0.3	0.1	1994 Jan
1994	2	1994.1	359.0	358.2	25	0.5	0.2	1994 Feb
1994	3	1994.2	360.1	358.4	29	0.8	0.3	1994 Mar
1994	4	1994.3	361.4	358.6	28	0.5	0.2	1994 Apr
1994	5	1994.4	361.8	358.6	30	0.4	0.2	1994 May
1994	6	1994.5	360.9	358.6	27	0.3	0.1	1994 Jun
1994	7	1994.5	359.5	358.9	31	0.4	0.1	1994 Jul
1994	8	1994.6	357.6	359.3	24	0.4	0.2	1994 Aug
1994	9	1994.7	355.9	359.3	24	0.6	0.2	1994 Sep
1994	10	1994.8	356.2	359.6	28	0.3	0.1	1994 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1994	11	1994.9	357.6	359.8	28	0.5	0.2	1994 Nov
1994	12	1995.0	359.1	360.0	28	0.5	0.2	1994 Dec
1995	1	1995.0	360.0	359.9	30	0.5	0.2	1995 Jan
1995	2	1995.1	361.0	360.2	28	0.5	0.2	1995 Feb
1995	3	1995.2	362.0	360.4	29	0.8	0.3	1995 Mar
1995	4	1995.3	363.4	360.8	29	0.7	0.2	1995 Apr
1995	5	1995.4	363.8	360.7	29	0.7	0.2	1995 May
1995	6	1995.5	363.3	361.0	27	0.4	0.1	1995 Jun
1995	7	1995.5	361.8	361.1	28	0.4	0.1	1995 Jul
1995	8	1995.6	359.3	360.9	24	0.7	0.3	1995 Aug
1995	9	1995.7	358.3	361.7	24	0.7	0.3	1995 Sep
1995	10	1995.8	358.1	361.5	29	0.3	0.1	1995 Oct
1995	11	1995.9	359.6	361.8	26	0.2	0.1	1995 Nov
1995	12	1996.0	360.8	361.7	30	0.4	0.1	1995 Dec
1996	1	1996.0	362.2	362.0	29	0.4	0.1	1996 Jan
1996	2	1996.1	363.4	362.5	28	0.6	0.2	1996 Feb
1996	3	1996.2	364.3	362.6	28	0.7	0.2	1996 Mar
1996	4	1996.3	364.7	362.0	29	0.6	0.2	1996 Apr
1996	5	1996.4	365.2	362.2	30	0.6	0.2	1996 May
1996	6	1996.5	365.1	362.8	30	0.4	0.1	1996 Jun
1996	7	1996.5	363.7	363.0	31	0.3	0.1	1996 Jul
1996	8	1996.6	361.6	363.1	27	0.5	0.2	1996 Aug
1996	9	1996.7	359.7	363.1	25	0.8	0.3	1996 Sep
1996	10	1996.8	359.7	363.1	29	0.3	0.1	1996 Oct
1996	11	1996.9	361.0	363.2	29	0.3	0.1	1996 Nov
1996	12	1997.0	362.4	363.2	29	0.4	0.1	1996 Dec
1997	1	1997.0	363.2	363.0	31	0.4	0.1	1997 Jan
1997	2	1997.1	364.2	363.4	28	0.6	0.2	1997 Feb
1997	3	1997.2	364.6	363.0	31	0.4	0.1	1997 Mar
1997	4	1997.3	366.5	363.8	21	0.5	0.2	1997 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1997	5	1997.4	366.8	363.9	29	0.5	0.2	1997 May
1997	6	1997.5	365.7	363.6	27	0.2	0.1	1997 Jun
1997	7	1997.5	364.5	363.7	24	0.5	0.2	1997 Jul
1997	8	1997.6	362.4	364.0	25	0.6	0.2	1997 Aug
1997	9	1997.7	360.4	363.8	26	0.6	0.2	1997 Sep
1997	10	1997.8	361.0	364.3	27	0.3	0.1	1997 Oct
1997	11	1997.9	362.6	364.7	30	0.3	0.1	1997 Nov
1997	12	1998.0	364.5	365.3	30	0.4	0.1	1997 Dec
1998	1	1998.0	365.4	365.2	30	0.4	0.1	1998 Jan
1998	2	1998.1	366.1	365.3	28	0.6	0.2	1998 Feb
1998	3	1998.2	367.4	365.7	31	0.8	0.3	1998 Mar
1998	4	1998.3	368.8	366.2	29	0.6	0.2	1998 Apr
1998	5	1998.4	369.6	366.7	30	0.8	0.3	1998 May
1998	6	1998.5	369.1	367.0	28	0.2	0.1	1998 Jun
1998	7	1998.5	368.0	367.3	23	0.7	0.3	1998 Jul
1998	8	1998.6	366.1	367.7	30	0.3	0.1	1998 Aug
1998	9	1998.7	364.2	367.5	28	0.4	0.1	1998 Sep
1998	10	1998.8	364.5	367.8	30	0.3	0.1	1998 Oct
1998	11	1998.9	365.7	367.7	23	0.2	0.1	1998 Nov
1998	12	1999.0	367.3	368.0	26	0.4	0.1	1998 Dec
1999	1	1999.0	368.4	368.1	27	0.5	0.2	1999 Jan
1999	2	1999.1	369.3	368.5	21	0.5	0.2	1999 Feb
1999	3	1999.2	369.8	368.2	25	0.8	0.3	1999 Mar
1999	4	1999.3	371.1	368.6	29	0.7	0.2	1999 Apr
1999	5	1999.4	371.1	368.3	26	0.6	0.2	1999 May
1999	6	1999.5	370.5	368.3	26	0.4	0.2	1999 Jun
1999	7	1999.5	369.6	368.9	27	0.6	0.2	1999 Jul
1999	8	1999.6	367.1	368.6	25	0.4	0.1	1999 Aug
1999	9	1999.7	365.0	368.3	28	0.7	0.3	1999 Sep
1999	10	1999.8	365.5	368.8	31	0.3	0.1	1999 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
1999	11	1999.9	366.9	368.9	28	0.2	0.1	1999 Nov
1999	12	2000.0	368.3	368.9	26	0.3	0.1	1999 Dec
2000	1	2000.0	369.4	369.2	26	0.5	0.2	2000 Jan
2000	2	2000.1	369.7	369.0	19	0.5	0.2	2000 Feb
2000	3	2000.2	370.8	369.2	30	0.5	0.2	2000 Mar
2000	4	2000.3	372.0	369.4	27	0.6	0.2	2000 Apr
2000	5	2000.4	371.8	368.9	28	0.5	0.2	2000 May
2000	6	2000.5	371.9	369.7	28	0.2	0.1	2000 Jun
2000	7	2000.5	370.0	369.4	25	0.3	0.1	2000 Jul
2000	8	2000.6	368.3	369.9	27	0.4	0.1	2000 Aug
2000	9	2000.7	367.1	370.5	25	0.4	0.1	2000 Sep
2000	10	2000.8	367.2	370.4	30	0.3	0.1	2000 Oct
2000	11	2000.9	368.5	370.5	25	0.3	0.1	2000 Nov
2000	12	2001.0	369.8	370.5	30	0.4	0.1	2000 Dec
2001	1	2001.0	370.8	370.6	30	0.6	0.2	2001 Jan
2001	2	2001.1	371.7	371.0	26	0.6	0.2	2001 Feb
2001	3	2001.2	372.6	371.1	26	0.5	0.2	2001 Mar
2001	4	2001.3	373.6	371.0	29	0.6	0.2	2001 Apr
2001	5	2001.4	374.0	371.1	24	0.4	0.2	2001 May
2001	6	2001.5	373.4	371.2	26	0.4	0.1	2001 Jun
2001	7	2001.5	371.7	371.1	25	0.6	0.2	2001 Jul
2001	8	2001.6	369.8	371.4	27	0.6	0.2	2001 Aug
2001	9	2001.7	368.3	371.6	28	0.5	0.2	2001 Sep
2001	10	2001.8	368.6	371.9	31	0.3	0.1	2001 Oct
2001	11	2001.9	369.9	371.9	24	0.2	0.1	2001 Nov
2001	12	2002.0	371.4	372.1	29	0.4	0.1	2001 Dec
2002	1	2002.0	372.7	372.5	28	0.5	0.2	2002 Jan
2002	2	2002.1	373.4	372.5	28	0.7	0.2	2002 Feb
2002	3	2002.2	374.3	372.6	24	0.6	0.2	2002 Mar
2002	4	2002.3	375.2	372.5	29	0.6	0.2	2002 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2002	5	2002.4	375.9	373.0	29	0.6	0.2	2002 May
2002	6	2002.5	375.7	373.5	28	0.5	0.2	2002 Jun
2002	7	2002.5	374.2	373.6	25	0.5	0.2	2002 Jul
2002	8	2002.6	372.0	373.7	28	0.7	0.2	2002 Aug
2002	9	2002.7	370.9	374.3	23	0.7	0.3	2002 Sep
2002	10	2002.8	370.7	374.1	31	0.6	0.2	2002 Oct
2002	11	2002.9	372.4	374.5	29	0.4	0.1	2002 Nov
2002	12	2003.0	374.0	374.7	31	0.5	0.2	2002 Dec
2003	1	2003.0	375.1	374.8	30	0.5	0.2	2003 Jan
2003	2	2003.1	375.8	375.0	27	0.6	0.2	2003 Feb
2003	3	2003.2	376.6	375.0	28	0.6	0.2	2003 Mar
2003	4	2003.3	377.9	375.2	27	0.4	0.1	2003 Apr
2003	5	2003.4	378.8	375.7	30	0.8	0.3	2003 May
2003	6	2003.5	378.5	376.2	25	0.4	0.1	2003 Jun
2003	7	2003.5	376.9	376.4	29	0.7	0.2	2003 Jul
2003	8	2003.6	374.6	376.3	23	0.6	0.2	2003 Aug
2003	9	2003.7	373.3	376.6	25	0.4	0.1	2003 Sep
2003	10	2003.8	373.3	376.6	30	0.3	0.1	2003 Oct
2003	11	2003.9	374.8	377.0	26	0.4	0.2	2003 Nov
2003	12	2004.0	376.2	376.9	27	0.4	0.1	2003 Dec
2004	1	2004.0	377.2	377.0	30	0.4	0.2	2004 Jan
2004	2	2004.1	378.0	377.2	29	0.7	0.3	2004 Feb
2004	3	2004.2	379.1	377.4	27	0.8	0.3	2004 Mar
2004	4	2004.3	380.5	377.8	26	0.5	0.2	2004 Apr
2004	5	2004.4	380.8	377.7	28	0.6	0.2	2004 May
2004	6	2004.5	379.9	377.6	21	0.5	0.2	2004 Jun
2004	7	2004.5	377.6	377.1	25	0.5	0.2	2004 Jul
2004	8	2004.6	376.2	377.9	16	0.4	0.2	2004 Aug
2004	9	2004.7	374.4	377.8	15	0.6	0.3	2004 Sep
2004	10	2004.8	374.6	378.0	29	0.2	0.1	2004 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2004	11	2004.9	376.3	378.5	29	0.6	0.2	2004 Nov
2004	12	2005.0	377.7	378.5	30	0.3	0.1	2004 Dec
2005	1	2005.0	378.6	378.4	31	0.3	0.1	2005 Jan
2005	2	2005.1	379.9	379.1	24	0.6	0.2	2005 Feb
2005	3	2005.2	381.0	379.4	26	1.2	0.4	2005 Mar
2005	4	2005.3	382.5	379.8	26	0.5	0.2	2005 Apr
2005	5	2005.4	382.6	379.5	31	0.6	0.2	2005 May
2005	6	2005.5	382.4	380.1	28	0.2	0.1	2005 Jun
2005	7	2005.5	380.9	380.4	29	0.4	0.1	2005 Jul
2005	8	2005.6	378.9	380.6	26	0.5	0.2	2005 Aug
2005	9	2005.7	376.9	380.2	27	0.5	0.2	2005 Sep
2005	10	2005.8	377.2	380.5	14	0.1	0.1	2005 Oct
2005	11	2005.9	378.5	380.7	23	0.4	0.2	2005 Nov
2005	12	2006.0	380.3	381.1	26	0.4	0.1	2005 Dec
2006	1	2006.0	381.6	381.3	24	0.3	0.1	2006 Jan
2006	2	2006.1	382.4	381.6	25	0.5	0.2	2006 Feb
2006	3	2006.2	382.9	381.3	29	0.6	0.2	2006 Mar
2006	4	2006.3	384.8	382.1	25	0.5	0.2	2006 Apr
2006	5	2006.4	385.2	382.1	24	0.4	0.2	2006 May
2006	6	2006.5	384.2	381.9	28	0.4	0.2	2006 Jun
2006	7	2006.5	382.6	382.1	24	0.3	0.1	2006 Jul
2006	8	2006.6	380.6	382.3	27	0.5	0.2	2006 Aug
2006	9	2006.7	379.0	382.4	25	0.4	0.2	2006 Sep
2006	10	2006.8	379.3	382.7	23	0.4	0.2	2006 Oct
2006	11	2006.9	380.4	382.5	29	0.4	0.1	2006 Nov
2006	12	2007.0	382.0	382.8	27	0.4	0.1	2006 Dec
2007	1	2007.0	383.1	382.9	24	0.8	0.3	2007 Jan
2007	2	2007.1	384.1	383.2	21	0.8	0.3	2007 Feb
2007	3	2007.2	384.8	383.2	27	0.6	0.2	2007 Mar
2007	4	2007.3	386.7	384.0	25	0.8	0.3	2007 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2007	5	2007.4	386.8	383.6	29	0.6	0.2	2007 May
2007	6	2007.5	386.3	384.1	26	0.4	0.2	2007 Jun
2007	7	2007.5	384.7	384.2	27	0.4	0.2	2007 Jul
2007	8	2007.6	382.2	384.0	22	0.6	0.3	2007 Aug
2007	9	2007.7	381.2	384.6	21	0.4	0.2	2007 Sep
2007	10	2007.8	381.4	384.7	29	0.2	0.1	2007 Oct
2007	11	2007.9	382.7	384.9	30	0.3	0.1	2007 Nov
2007	12	2008.0	384.2	385.1	22	0.3	0.1	2007 Dec
2008	1	2008.0	385.8	385.5	31	0.6	0.2	2008 Jan
2008	2	2008.1	386.1	385.2	26	0.6	0.2	2008 Feb
2008	3	2008.2	386.3	384.7	30	0.6	0.2	2008 Mar
2008	4	2008.3	387.3	384.7	22	1.2	0.5	2008 Apr
2008	5	2008.4	388.8	385.7	25	0.6	0.2	2008 May
2008	6	2008.5	388.0	385.7	23	0.5	0.2	2008 Jun
2008	7	2008.5	386.6	386.0	10	1.0	0.6	2008 Jul
2008	8	2008.6	384.3	386.0	25	0.7	0.2	2008 Aug
2008	9	2008.7	383.4	386.7	27	0.3	0.1	2008 Sep
2008	10	2008.8	383.2	386.5	23	0.3	0.1	2008 Oct
2008	11	2008.9	384.4	386.6	28	0.3	0.1	2008 Nov
2008	12	2009.0	385.8	386.6	29	0.3	0.1	2008 Dec
2009	1	2009.0	387.2	386.9	30	0.4	0.1	2009 Jan
2009	2	2009.1	387.7	386.8	26	0.5	0.2	2009 Feb
2009	3	2009.2	389.0	387.5	28	0.7	0.2	2009 Mar
2009	4	2009.3	389.8	387.1	29	0.8	0.3	2009 Apr
2009	5	2009.4	390.4	387.2	30	0.5	0.2	2009 May
2009	6	2009.5	389.7	387.5	29	0.6	0.2	2009 Jun
2009	7	2009.5	388.2	387.8	22	0.3	0.1	2009 Jul
2009	8	2009.6	386.3	388.0	28	0.6	0.2	2009 Aug
2009	9	2009.7	385.0	388.2	28	0.6	0.2	2009 Sep
2009	10	2009.8	384.6	387.9	30	0.3	0.1	2009 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2009	11	2009.9	386.2	388.4	30	0.3	0.1	2009 Nov
2009	12	2010.0	387.6	388.4	20	0.5	0.2	2009 Dec
2010	1	2010.0	388.9	388.6	30	0.9	0.3	2010 Jan
2010	2	2010.1	390.4	389.5	20	1.3	0.6	2010 Feb
2010	3	2010.2	391.4	389.9	25	1.0	0.4	2010 Mar
2010	4	2010.3	392.7	390.1	26	0.7	0.2	2010 Apr
2010	5	2010.4	393.2	390.1	29	0.7	0.2	2010 May
2010	6	2010.5	392.4	390.1	28	0.4	0.1	2010 Jun
2010	7	2010.5	390.4	389.9	29	0.5	0.2	2010 Jul
2010	8	2010.6	388.5	390.2	26	0.4	0.2	2010 Aug
2010	9	2010.7	387.0	390.3	29	0.6	0.2	2010 Sep
2010	10	2010.8	387.4	390.7	31	0.3	0.1	2010 Oct
2010	11	2010.9	388.9	391.0	29	0.4	0.1	2010 Nov
2010	12	2011.0	390.0	390.8	29	0.5	0.2	2010 Dec
2011	1	2011.0	391.5	391.2	29	0.9	0.3	2011 Jan
2011	2	2011.1	392.0	391.1	28	0.5	0.2	2011 Feb
2011	3	2011.2	392.8	391.3	29	1.0	0.3	2011 Mar
2011	4	2011.3	393.4	390.8	28	0.7	0.3	2011 Apr
2011	5	2011.4	394.4	391.2	29	0.9	0.3	2011 May
2011	6	2011.5	394.0	391.6	28	0.4	0.2	2011 Jun
2011	7	2011.5	392.7	392.2	26	0.7	0.3	2011 Jul
2011	8	2011.6	390.3	392.0	27	0.4	0.1	2011 Aug
2011	9	2011.7	389.3	392.6	26	0.3	0.1	2011 Sep
2011	10	2011.8	389.2	392.5	30	0.2	0.1	2011 Oct
2011	11	2011.9	390.5	392.6	28	0.3	0.1	2011 Nov
2011	12	2012.0	392.1	392.9	26	0.4	0.1	2011 Dec
2012	1	2012.0	393.3	393.1	30	0.8	0.3	2012 Jan
2012	2	2012.1	394.0	393.2	26	1.2	0.4	2012 Feb
2012	3	2012.2	394.6	393.0	30	0.6	0.2	2012 Mar
2012	4	2012.3	396.4	393.6	29	0.6	0.2	2012 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2012	5	2012.4	396.9	393.7	30	0.5	0.2	2012 May
2012	6	2012.5	395.9	393.6	28	0.6	0.2	2012 Jun
2012	7	2012.5	394.6	394.1	26	0.3	0.1	2012 Jul
2012	8	2012.6	392.6	394.4	30	0.5	0.2	2012 Aug
2012	9	2012.7	391.3	394.8	26	0.4	0.2	2012 Sep
2012	10	2012.8	391.3	394.6	28	0.2	0.1	2012 Oct
2012	11	2012.9	393.2	395.2	29	0.5	0.2	2012 Nov
2012	12	2013.0	394.6	395.3	29	0.4	0.2	2012 Dec
2013	1	2013.0	395.8	395.6	28	0.6	0.2	2013 Jan
2013	2	2013.1	397.0	396.2	25	0.6	0.2	2013 Feb
2013	3	2013.2	397.7	396.1	30	0.7	0.2	2013 Mar
2013	4	2013.3	398.6	395.8	22	0.6	0.2	2013 Apr
2013	5	2013.4	400.0	396.6	28	0.4	0.1	2013 May
2013	6	2013.5	398.8	396.5	26	0.4	0.2	2013 Jun
2013	7	2013.5	397.5	397.1	21	0.5	0.2	2013 Jul
2013	8	2013.6	395.4	397.3	27	0.4	0.2	2013 Aug
2013	9	2013.7	393.7	397.2	26	0.3	0.1	2013 Sep
2013	10	2013.8	393.9	397.2	28	0.2	0.1	2013 Oct
2013	11	2013.9	395.4	397.4	30	0.6	0.2	2013 Nov
2013	12	2014.0	397.0	397.8	30	0.5	0.2	2013 Dec
2014	1	2014.0	398.0	397.7	31	0.5	0.2	2014 Jan
2014	2	2014.1	398.3	397.4	27	0.5	0.2	2014 Feb
2014	3	2014.2	399.9	398.4	22	0.8	0.3	2014 Mar
2014	4	2014.3	401.5	398.6	26	0.5	0.2	2014 Apr
2014	5	2014.4	402.0	398.6	22	0.5	0.2	2014 May
2014	6	2014.5	401.4	399.1	28	0.4	0.1	2014 Jun
2014	7	2014.5	399.3	398.9	25	0.6	0.2	2014 Jul
2014	8	2014.6	397.2	399.1	22	0.3	0.1	2014 Aug
2014	9	2014.7	395.5	399.1	21	0.5	0.2	2014 Sep
2014	10	2014.8	396.2	399.6	24	0.7	0.3	2014 Oct

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2014	11	2014.9	397.4	399.5	27	0.4	0.1	2014 Nov
2014	12	2015.0	399.1	399.8	29	0.6	0.2	2014 Dec
2015	1	2015.0	400.2	399.9	30	0.6	0.2	2015 Jan
2015	2	2015.1	400.6	399.8	28	0.6	0.2	2015 Feb
2015	3	2015.2	401.7	400.2	24	1.0	0.4	2015 Mar
2015	4	2015.3	403.4	400.5	26	0.9	0.3	2015 Apr
2015	5	2015.4	404.1	400.7	30	0.3	0.1	2015 May
2015	6	2015.5	403.0	400.6	29	0.5	0.2	2015 Jun
2015	7	2015.5	401.5	401.1	24	0.6	0.2	2015 Jul
2015	8	2015.6	399.1	401.0	28	0.7	0.3	2015 Aug
2015	9	2015.7	397.8	401.4	25	0.3	0.1	2015 Sep
2015	10	2015.8	398.5	401.9	28	0.6	0.2	2015 Oct
2015	11	2015.9	400.3	402.2	25	0.6	0.2	2015 Nov
2015	12	2016.0	402.1	402.7	30	0.7	0.2	2015 Dec
2016	1	2016.0	402.7	402.4	27	0.6	0.2	2016 Jan
2016	2	2016.1	404.2	403.4	25	1.1	0.4	2016 Feb
2016	3	2016.2	405.1	403.5	28	0.8	0.3	2016 Mar
2016	4	2016.3	407.6	404.8	23	1.0	0.4	2016 Apr
2016	5	2016.4	407.9	404.4	29	0.5	0.2	2016 May
2016	6	2016.5	407.0	404.6	26	0.6	0.2	2016 Jun
2016	7	2016.5	404.6	404.2	28	0.9	0.3	2016 Jul
2016	8	2016.6	402.4	404.4	24	0.6	0.2	2016 Aug
2016	9	2016.7	401.2	404.9	25	0.4	0.2	2016 Sep
2016	10	2016.8	401.8	405.2	29	0.3	0.1	2016 Oct
2016	11	2016.9	403.7	405.7	27	0.7	0.3	2016 Nov
2016	12	2017.0	404.6	405.3	29	0.4	0.2	2016 Dec
2017	1	2017.0	406.4	406.0	27	0.7	0.2	2017 Jan
2017	2	2017.1	406.7	405.8	26	0.7	0.3	2017 Feb
2017	3	2017.2	407.5	406.0	24	1.0	0.4	2017 Mar
2017	4	2017.3	409.2	406.4	26	0.9	0.3	2017 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2017	5	2017.4	409.9	406.4	27	0.6	0.2	2017 May
2017	6	2017.5	409.1	406.7	26	0.5	0.2	2017 Jun
2017	7	2017.5	407.3	407.0	28	0.6	0.2	2017 Jul
2017	8	2017.6	405.3	407.3	29	0.3	0.1	2017 Aug
2017	9	2017.7	403.6	407.2	26	0.4	0.1	2017 Sep
2017	10	2017.8	403.8	407.2	27	0.3	0.1	2017 Oct
2017	11	2017.9	405.3	407.4	26	0.4	0.1	2017 Nov
2017	12	2018.0	407.0	407.7	31	0.6	0.2	2017 Dec
2018	1	2018.0	408.1	407.8	29	0.6	0.2	2018 Jan
2018	2	2018.1	408.5	407.6	28	0.5	0.2	2018 Feb
2018	3	2018.2	409.6	408.1	29	0.7	0.2	2018 Mar
2018	4	2018.3	410.4	407.6	21	0.9	0.4	2018 Apr
2018	5	2018.4	411.4	408.0	24	0.9	0.3	2018 May
2018	6	2018.5	411.0	408.6	29	0.6	0.2	2018 Jun
2018	7	2018.5	408.9	408.6	27	0.5	0.2	2018 Jul
2018	8	2018.6	407.2	409.2	31	0.3	0.1	2018 Aug
2018	9	2018.7	405.7	409.3	29	0.4	0.2	2018 Sep
2018	10	2018.8	406.2	409.6	30	0.3	0.1	2018 Oct
2018	11	2018.9	408.2	410.2	24	0.6	0.2	2018 Nov
2018	12	2019.0	409.3	410.0	30	0.5	0.2	2018 Dec
2019	1	2019.0	411.0	410.7	26	1.3	0.5	2019 Jan
2019	2	2019.1	412.0	411.0	27	1.1	0.4	2019 Feb
2019	3	2019.2	412.2	410.7	28	1.1	0.4	2019 Mar
2019	4	2019.3	413.5	410.9	27	0.6	0.2	2019 Apr
2019	5	2019.4	414.9	411.5	28	0.5	0.2	2019 May
2019	6	2019.5	414.1	411.7	27	0.4	0.1	2019 Jun
2019	7	2019.5	412.0	411.6	25	0.8	0.3	2019 Jul
2019	8	2019.6	410.2	412.1	29	0.3	0.1	2019 Aug
2019	9	2019.7	408.8	412.3	29	0.3	0.1	2019 Sep
2019	10	2019.8	408.7	412.1	29	0.3	0.1	2019 Oct

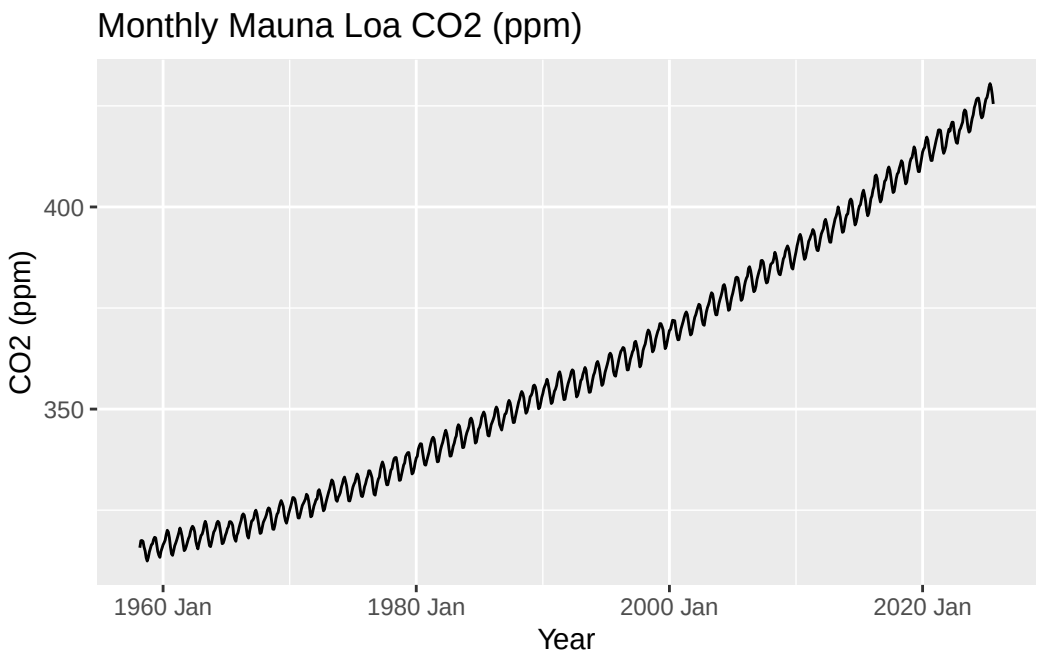
year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2019	11	2019.9	410.5	412.5	26	0.4	0.1	2019 Nov
2019	12	2020.0	412.0	412.7	31	0.4	0.1	2019 Dec
2020	1	2020.0	413.6	413.2	29	0.7	0.3	2020 Jan
2020	2	2020.1	414.3	413.4	28	0.7	0.2	2020 Feb
2020	3	2020.2	414.7	413.4	26	0.3	0.1	2020 Mar
2020	4	2020.3	416.4	413.9	28	0.7	0.2	2020 Apr
2020	5	2020.4	417.3	414.0	27	0.6	0.2	2020 May
2020	6	2020.5	416.6	414.1	27	0.4	0.2	2020 Jun
2020	7	2020.5	414.6	414.2	30	0.6	0.2	2020 Jul
2020	8	2020.6	412.8	414.6	25	0.2	0.1	2020 Aug
2020	9	2020.7	411.5	414.9	29	0.3	0.1	2020 Sep
2020	10	2020.8	411.5	414.8	30	0.2	0.1	2020 Oct
2020	11	2020.9	413.1	415.1	27	0.8	0.3	2020 Nov
2020	12	2021.0	414.2	414.9	30	0.5	0.2	2020 Dec
2021	1	2021.0	415.5	415.2	29	0.4	0.2	2021 Jan
2021	2	2021.1	416.7	415.8	28	1.0	0.4	2021 Feb
2021	3	2021.2	417.6	416.2	28	0.9	0.3	2021 Mar
2021	4	2021.3	419.0	416.6	24	1.1	0.4	2021 Apr
2021	5	2021.4	419.1	415.9	28	0.9	0.3	2021 May
2021	6	2021.5	418.9	416.5	29	0.7	0.2	2021 Jun
2021	7	2021.5	416.9	416.5	31	0.7	0.2	2021 Jul
2021	8	2021.6	414.4	416.3	25	0.7	0.3	2021 Aug
2021	9	2021.7	413.3	416.6	27	0.3	0.1	2021 Sep
2021	10	2021.8	413.9	417.1	29	0.3	0.1	2021 Oct
2021	11	2021.9	415.0	416.9	30	0.4	0.1	2021 Nov
2021	12	2022.0	416.7	417.4	28	0.5	0.2	2021 Dec
2022	1	2022.0	418.1	417.8	30	0.7	0.2	2022 Jan
2022	2	2022.1	419.2	418.3	27	0.9	0.3	2022 Feb
2022	3	2022.2	418.8	417.3	30	0.8	0.3	2022 Mar
2022	4	2022.3	420.2	417.7	28	0.9	0.3	2022 Apr

year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2022	5	2022.4	421.0	417.7	31	0.8	0.3	2022 May
2022	6	2022.5	420.9	418.5	28	0.3	0.1	2022 Jun
2022	7	2022.5	418.9	418.4	27	0.6	0.2	2022 Jul
2022	8	2022.6	417.1	419.0	27	0.4	0.1	2022 Aug
2022	9	2022.7	415.9	419.3	28	0.4	0.1	2022 Sep
2022	10	2022.8	415.7	419.0	30	0.3	0.1	2022 Oct
2022	11	2022.9	417.5	419.5	25	0.5	0.2	2022 Nov
2022	12	2023.0	419.0	419.7	24	0.6	0.2	2022 Dec
2023	1	2023.0	419.5	419.2	31	0.4	0.1	2023 Jan
2023	2	2023.1	420.3	419.4	23	0.7	0.3	2023 Feb
2023	3	2023.2	421.0	419.5	30	0.7	0.3	2023 Mar
2023	4	2023.3	423.3	420.8	27	0.6	0.2	2023 Apr
2023	5	2023.4	424.0	420.8	31	0.7	0.2	2023 May
2023	6	2023.5	423.7	421.2	29	0.6	0.2	2023 Jun
2023	7	2023.5	421.8	421.4	21	0.5	0.2	2023 Jul
2023	8	2023.6	419.7	421.6	21	0.4	0.2	2023 Aug
2023	9	2023.7	418.5	421.9	18	0.3	0.1	2023 Sep
2023	10	2023.8	418.8	422.1	27	0.5	0.2	2023 Oct
2023	11	2023.9	420.5	422.5	21	0.9	0.4	2023 Nov
2023	12	2024.0	421.9	422.6	20	0.7	0.3	2023 Dec
2024	1	2024.0	422.8	422.5	27	0.7	0.3	2024 Jan
2024	2	2024.1	424.6	423.6	22	1.2	0.5	2024 Feb
2024	3	2024.2	425.4	423.9	22	1.0	0.4	2024 Mar
2024	4	2024.3	426.5	424.0	22	1.0	0.4	2024 Apr
2024	5	2024.4	426.9	423.6	29	0.8	0.3	2024 May
2024	6	2024.5	426.9	424.5	20	0.7	0.3	2024 Jun
2024	7	2024.5	425.6	425.1	24	0.7	0.3	2024 Jul
2024	8	2024.6	423.0	424.9	22	1.1	0.4	2024 Aug
2024	9	2024.7	422.0	425.4	18	0.4	0.2	2024 Sep
2024	10	2024.8	422.4	425.7	22	0.3	0.1	2024 Oct

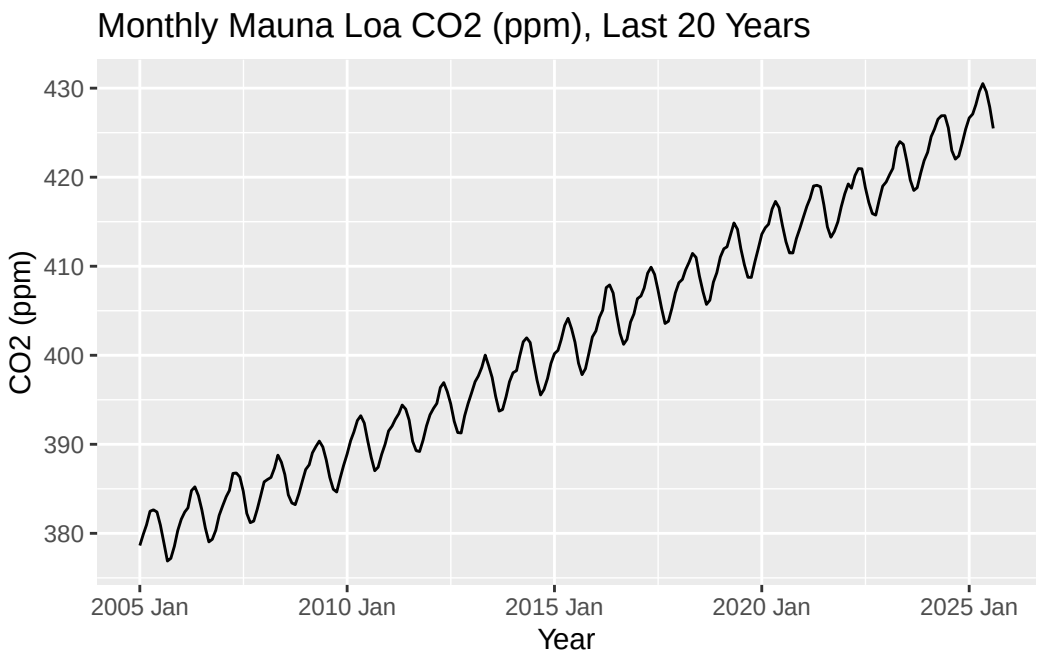
year	month	decimal date	average	deseasonalized	ndays	sdev	unc	Month
2024	11	2024.9	423.9	425.9	24	0.3	0.1	2024 Nov
2024	12	2025.0	425.4	426.1	28	0.7	0.2	2024 Dec
2025	1	2025.0	426.6	426.4	29	0.6	0.2	2025 Jan
2025	2	2025.1	427.1	426.1	24	0.6	0.2	2025 Feb
2025	3	2025.2	428.1	426.7	27	1.1	0.4	2025 Mar
2025	4	2025.3	429.6	427.1	23	0.7	0.3	2025 Apr
2025	5	2025.4	430.5	427.3	23	0.4	0.2	2025 May
2025	6	2025.5	429.6	427.2	26	0.7	0.3	2025 Jun
2025	7	2025.5	427.9	427.4	24	0.3	0.1	2025 Jul
2025	8	2025.6	425.5	427.4	24	0.4	0.1	2025 Aug

2.5. Original CO2 Time Series Visualization (Plot)

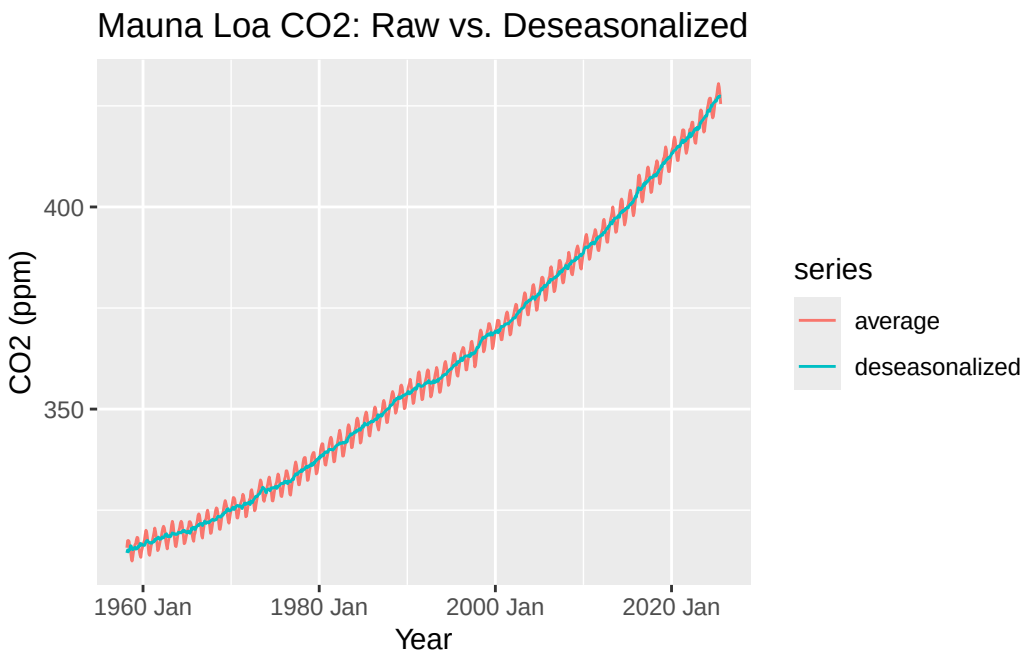
```
# 5. Time Seires Plot
# 5.1 all raw data time series plot
co2_ts |>
  autoplot(average) +
  labs(title = "Monthly Mauna Loa CO2 (ppm)",
       x = "Year",y = "CO2 (ppm)")
```




```
# 5.2. plot of latest 20 years
latest_year <- max(year(co2_ts$Month), na.rm = TRUE)

co2_ts |>
  filter(year(Month) >= latest_year - 20) |>
  autoplot(average) +
  labs(title = "Monthly Mauna Loa CO2 (ppm), Last 20 Years",
       x = "Year", y = "CO2 (ppm)")
```



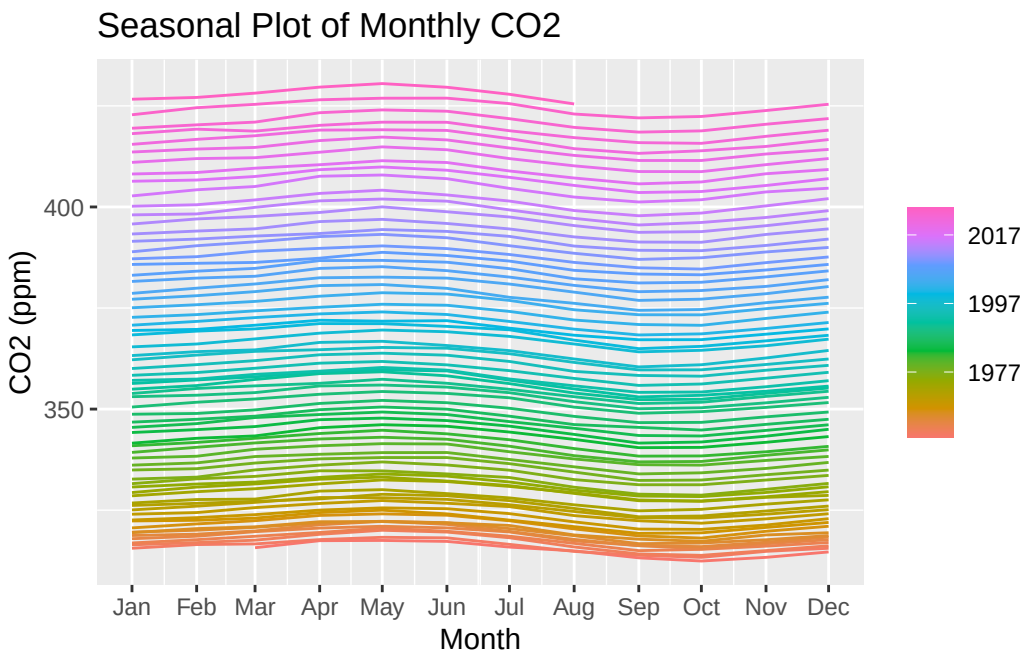

```
# 5.3 Compare average and deseasonalized
co2_ts |>pivot_longer(
  cols = c(average, deseasonalized), names_to = "series", values_to = "value") |>
  autoplot(value) +
  labs(title = "Mauna Loa CO2: Raw vs. Deseasonalized",
    x = "Year",
    y = "CO2 (ppm)")
```



2.6. Seasonality exploration

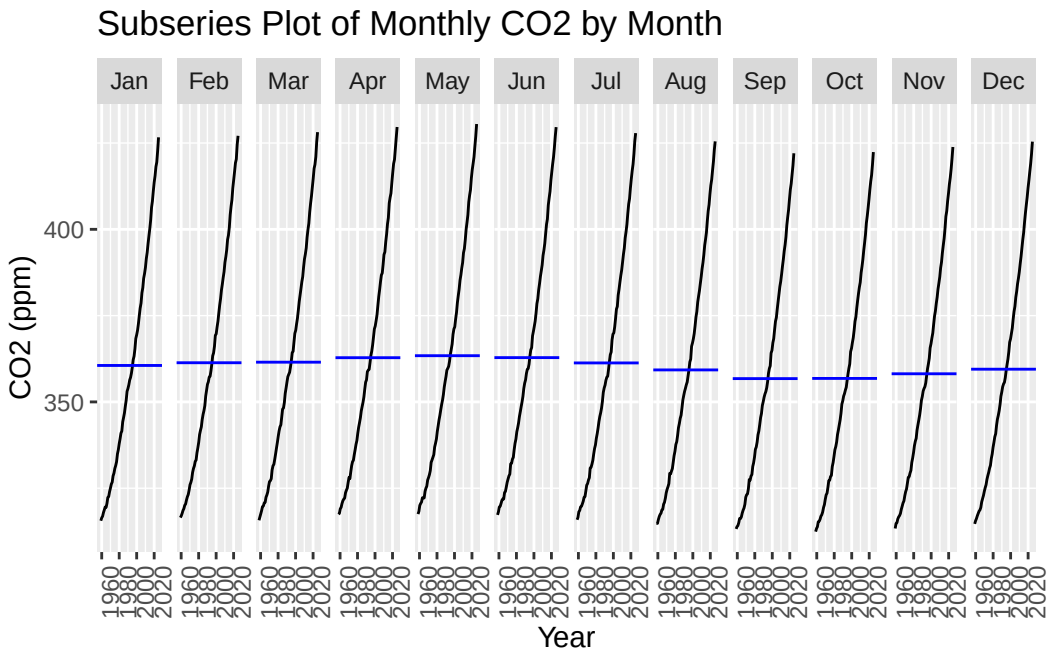
```
#
# 6.1 Seasonal Plot
co2_ts |>
  gg_season(average) +
  labs(title = "Seasonal Plot of Monthly CO2", y = "CO2 (ppm)",x = "Month")
```

```
Warning: `gg_season()` was deprecated in feasts 0.4.2.
i Please use `ggtime::gg_season()` instead.
```



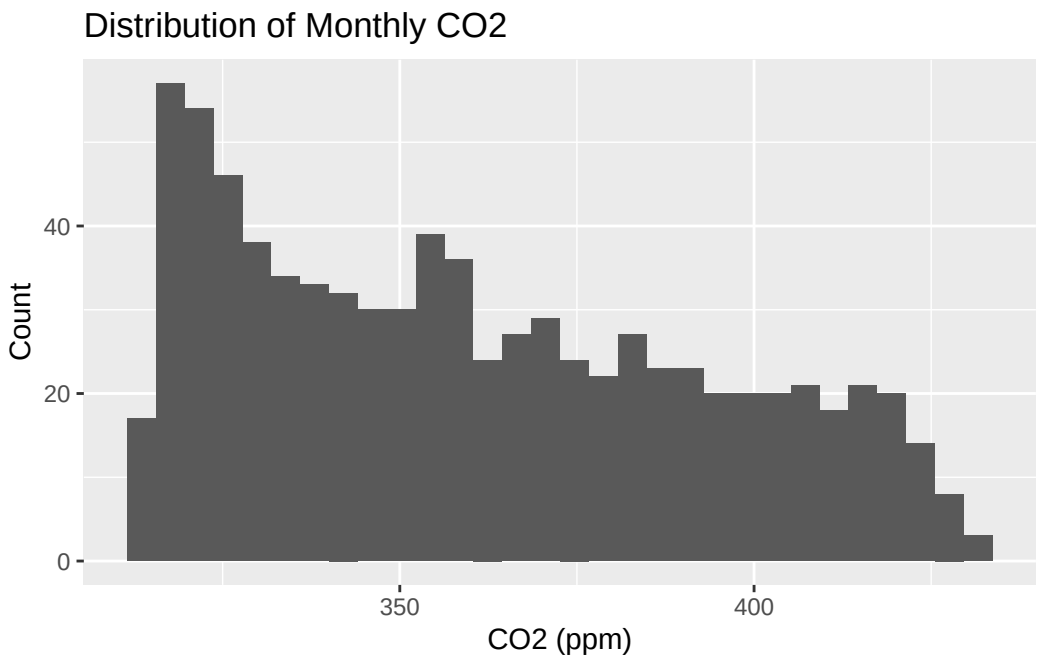

```
# 6.2 Subseries plot
co2_ts |>
  gg_subseries(average) +
  labs(title = "Subseries Plot of Monthly CO2 by Month",
    y = "CO2 (ppm)", x = "Year")
```

```
Warning: `gg_subseries()` was deprecated in feasts 0.4.2.
i Please use `ggtime::gg_subseries()` instead.
```

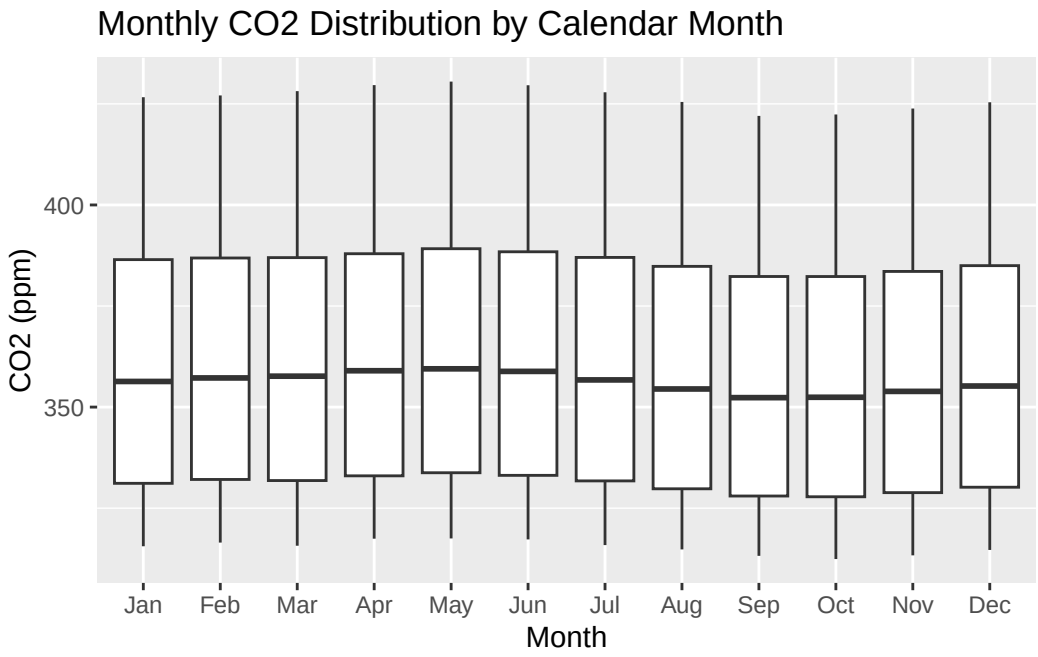


2.7. Distribution & outliners

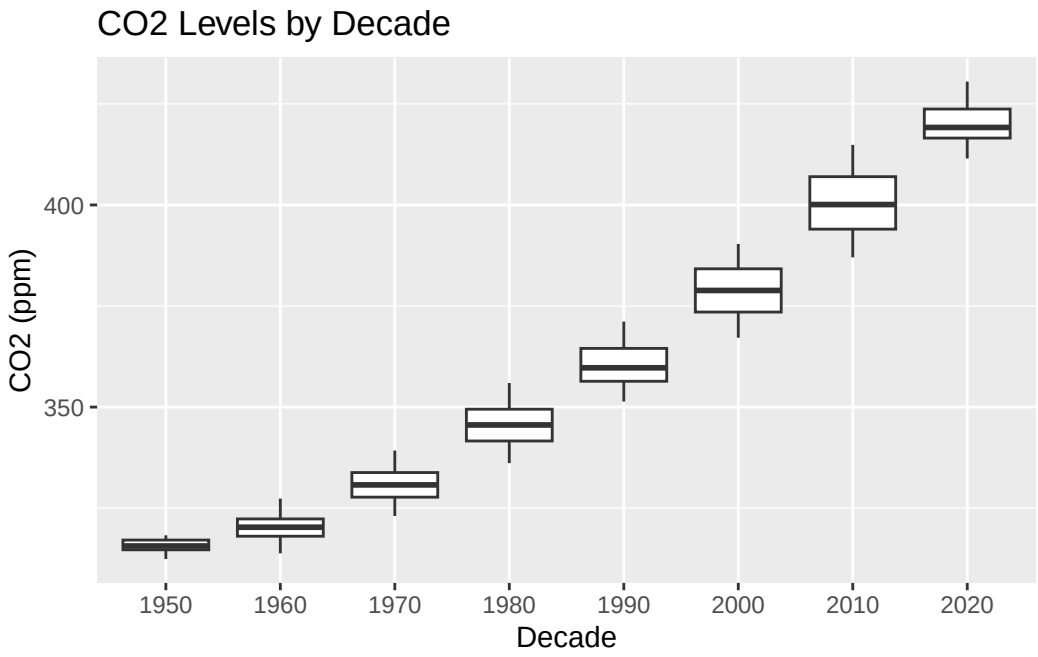
```
# 7. Distribution & outliers
# 7.1 Histogram of CO2
co2_ts |>
  ggplot(aes(x = average)) +
  geom_histogram(bins = 30) +
  labs(
    title = "Distribution of Monthly CO2",
    x = "CO2 (ppm)",
    y = "Count"
  )
```




```
# 7.2 Boxplot by month
co2_ts |>
  mutate(Month_f = factor(month(Month, label = TRUE))) |>
  ggplot(aes(x = Month_f, y = average)) +
  geom_boxplot() +
  labs(
    title = "Monthly CO2 Distribution by Calendar Month",
    x = "Month",
    y = "CO2 (ppm)"
  )
```

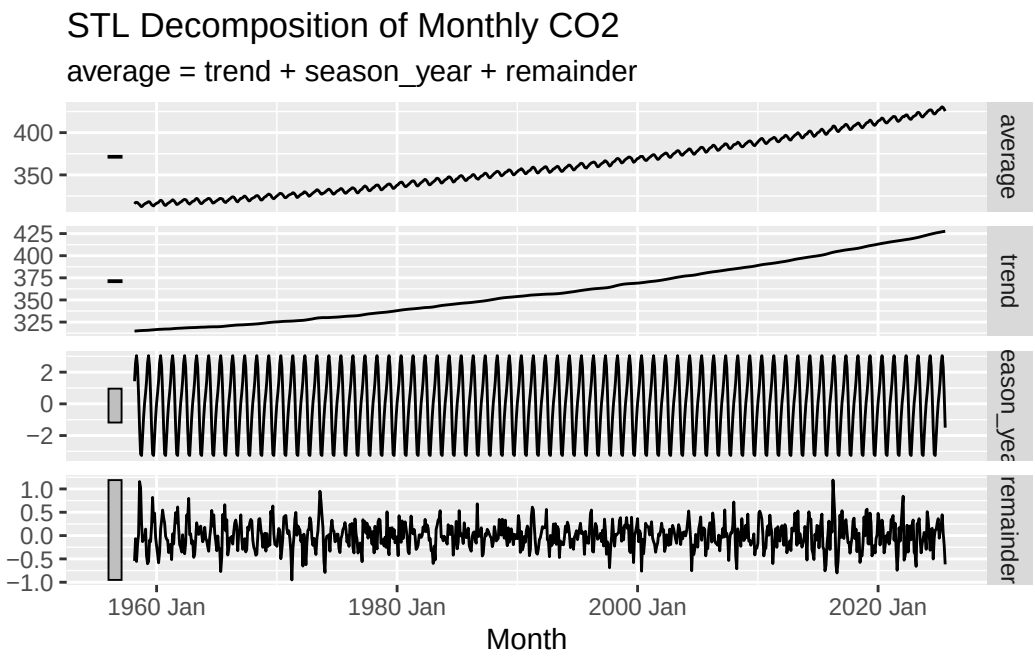



```
# 7.3 Boxplot by decade
co2_ts |>
  mutate(decade = factor((year(Month) %/% 10) * 10)) |>
  ggplot(aes(x = decade, y = average)) +
  geom_boxplot() +
  labs(
    title = "CO2 Levels by Decade",
    x = "Decade",
    y = "CO2 (ppm)"
  )
```



2.8. STL - decomposition

```
# STL decomposition (trend + season + remainder)
co2_stl <- co2_ts |>
  model(stl = STL(average ~ season(window = "periodic"))) |>
  components()

autoplot(co2_stl) + labs(title = "STL Decomposition of Monthly CO2")
```



Modeling Evidence: Acceleration in the CO Trend

To assess whether CO levels have been rising at a constant rate or accelerating over time, I fitted an STL decomposition to the full monthly series. The extracted trend component shows a noticeable change in curvature: the slope is relatively moderate during the 1960s–1980s, but becomes substantially steeper from the 1990s onward. This indicates that the long-term increase is not linear—**the rate of CO accumulation has accelerated in recent decades**.

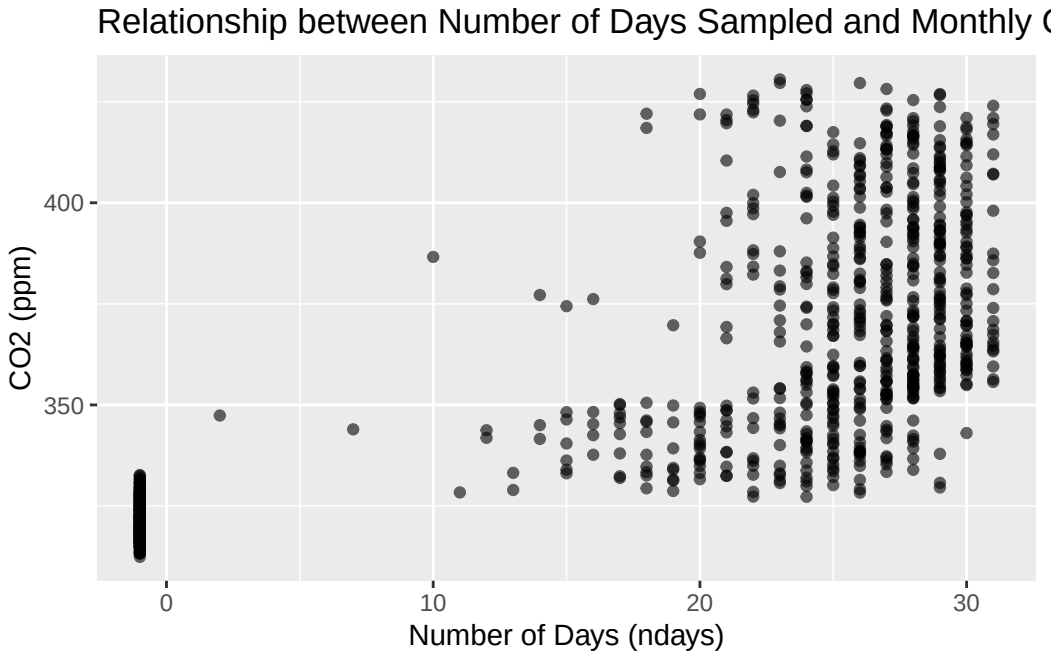
STL decomposition showing an increasingly steep trend component (App settings: Full dataset, default STL).

This evidence reinforces the visual observation from the raw series: the Keeling Curve's upward drift has intensified, meaning that each additional year contributes a larger increment than the previous one.

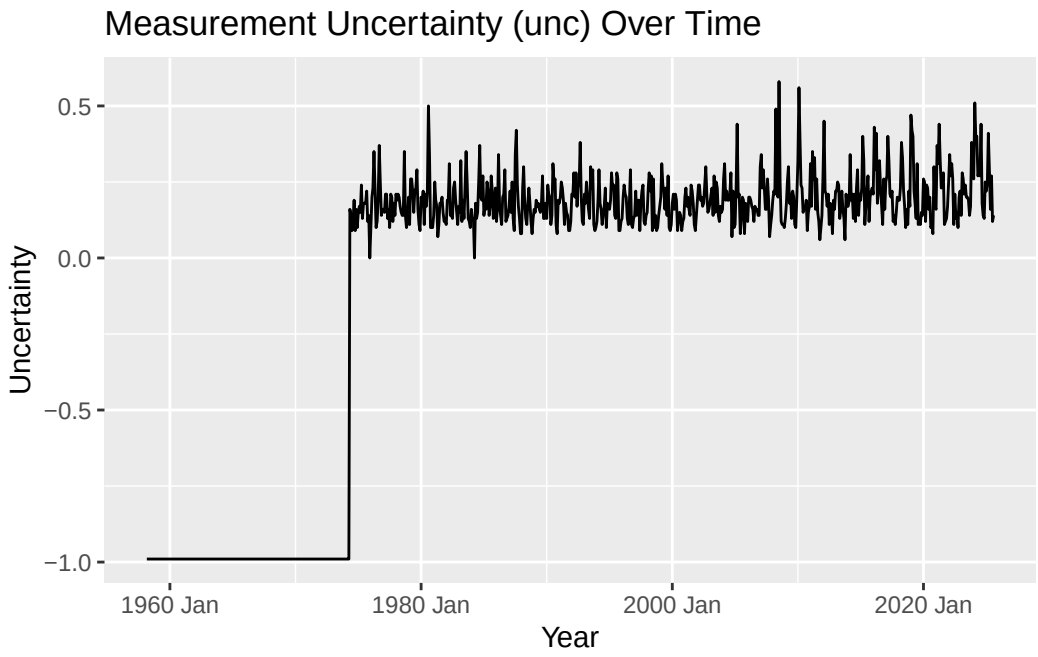
2.9. Simple check on ndays / data quality

```
# 9. Simple check on ndays / data quality
# Relationship between ndays and average CO2
co2_ts |>
  ggplot(aes(x = ndays, y = average)) +
  geom_point(alpha = 0.6) +
```

```
  labs(title = "Relationship between Number of Days Sampled and Monthly CO2",
    x = "Number of Days (ndays)",
    y = "CO2 (ppm)"
  )
```




```
# Trend of measurement uncertainty over time
co2_ts |> autoplot(unc) + labs(
    title = "Measurement Uncertainty (unc) Over Time",
    x = "Year", y = "Uncertainty")
```



3. Preprocessing

Model Diagnostics

3.1 Evaluate if smoothing is needed

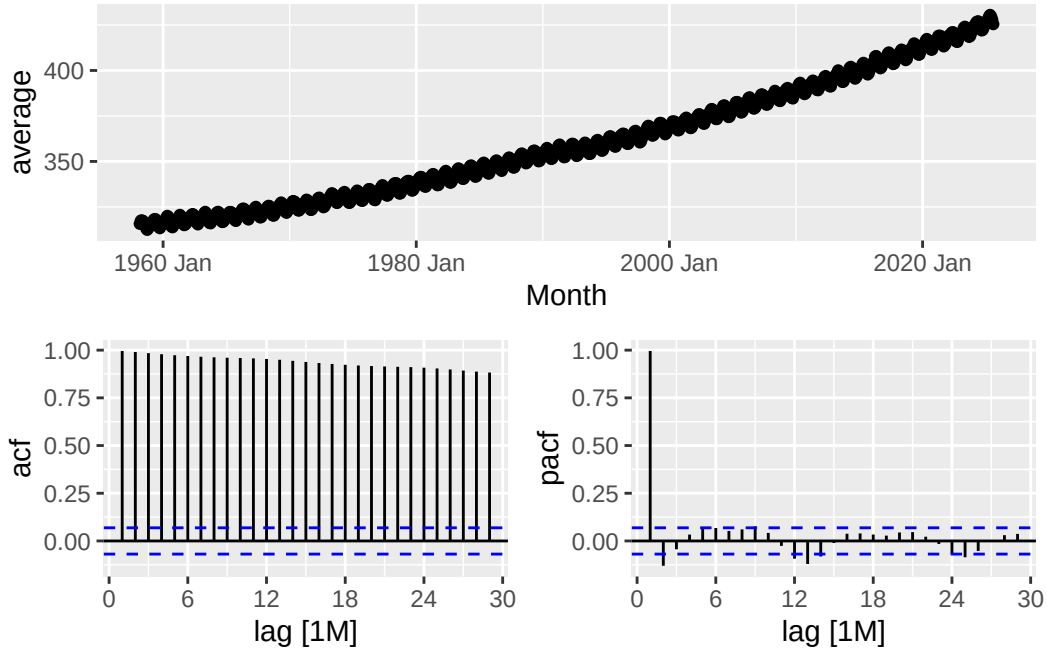
Residual Diagnostic Plots

```
# KPSS test for stationarity
co2_ts |>
    features(average, c(unitroot_kpss, unitroot_ndiffs, unitroot_nsdiffs))
```

```
# A tibble: 1 x 4
  kpss_stat kpss_pvalue ndiffs nsdiffs
      <dbl>       <dbl>  <int>   <int>
1      11.5        0.01      1       1
```

```
# Plot the ACF/PACF on the stationary time series
co2_ts |> gg_tsdisplay(average, plot_type = "partial")
```

```
Warning: `gg_tsdisplay()` was deprecated in feasts 0.4.2.
i Please use `ggtime::gg_tsdisplay()` instead.
```



We evaluated whether additional smoothing was necessary by examining the stability of the trend and seasonal patterns in the raw monthly CO2 series (Figure1). Figure 1 showed a very smooth long-term upward trajectory with minimal short-term noise, indicating that the underlying trend is already well-behaved and does not require moving averages or other smoothing techniques. Seasonal diagnostics (Figure 4 and Figure 5) showed a highly regular and stable annual cycle, further suggesting that no smoothing is needed to refine or enhance the seasonal pattern. The STL decomposition plot (Figure 10) reinforced these observations: the trend component was smooth and continuous, and the remainder showed no unusual fluctuations. Together, these results indicate that the CO2 series does not require additional smoothing prior to modeling, and the raw monthly values can be used directly in TSLM or ARIMA-based forecasts. However, further smoothing would be necessary if short-term volatility, irregular spikes, or noise were present that obscured the underlying structure, as smoothing would help isolate the signal and improve model interpretability prior to forecasting.

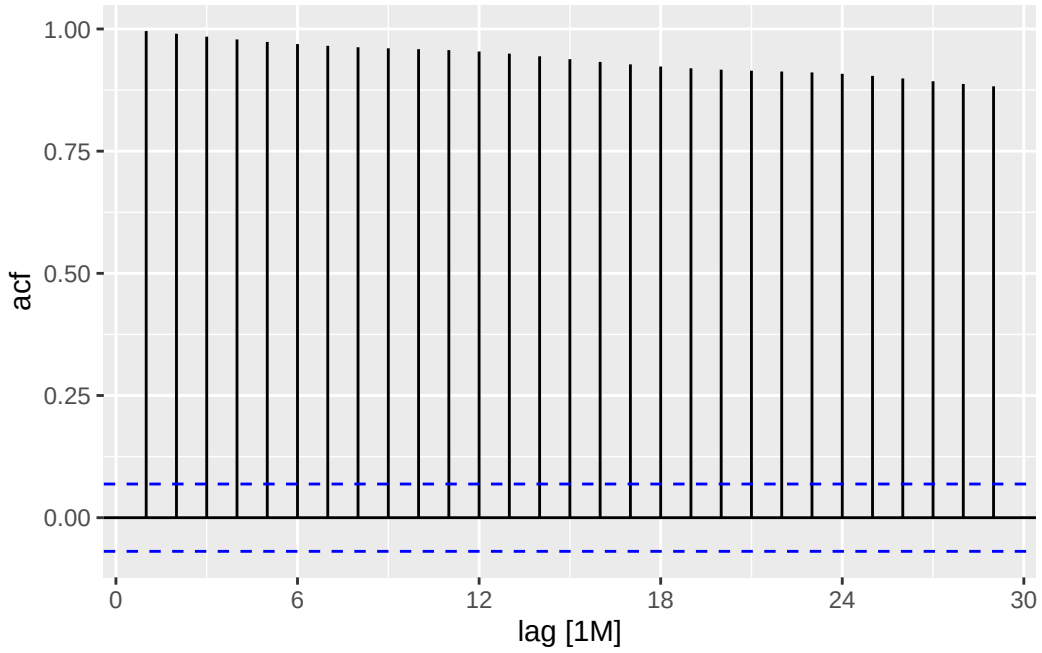
3.2 Evaluate if differencing is needed

To determine whether differencing was required, our process is using visual diagnostics, auto-correlation patterns, formal unit root testing, and ARIMA model behavior. The raw series

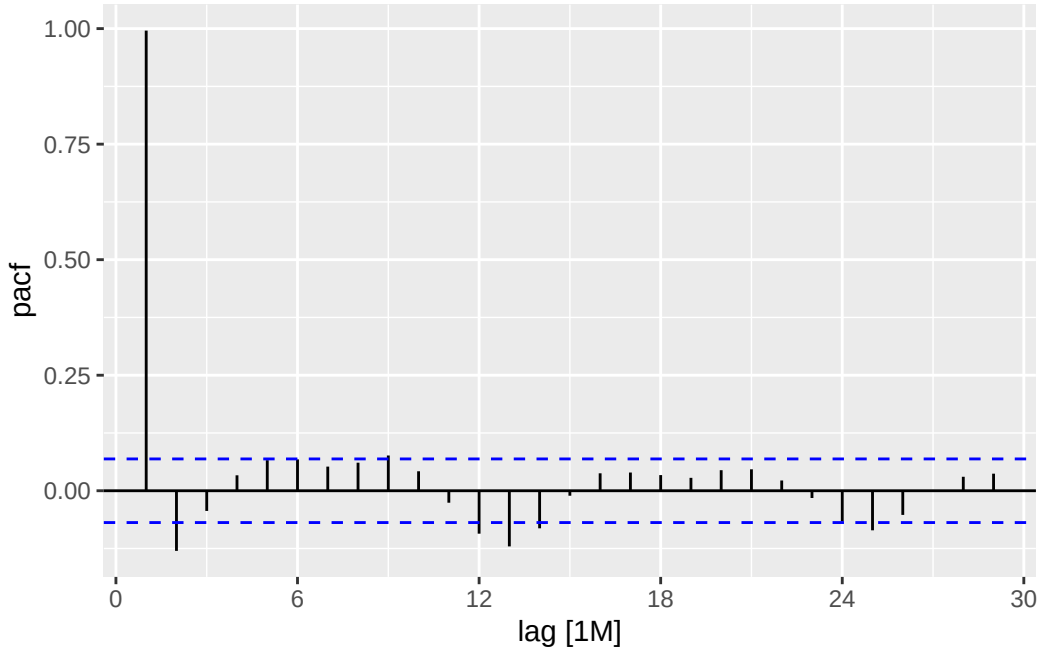
exhibits a persistent upward trend, and its ACF shows a slow, gradual decay - both signs of non-stationarity.

The KPSS test returned a very small p-value (0.01), leading us to reject the null hypothesis of stationarity. This indicates that the raw CO2 series is non-stationary and therefore requires at least one regular difference (d = 1) to achieve stationarity prior to modeling.

```
# ACF
co2_ts |>
  ACF(average) |>
  autoplot()
```




```
# PACF
co2_ts |>
  PACF(average) |>
  autoplot()
```



3.3 Evaluate if transformation (e.g., Box–Cox) is needed

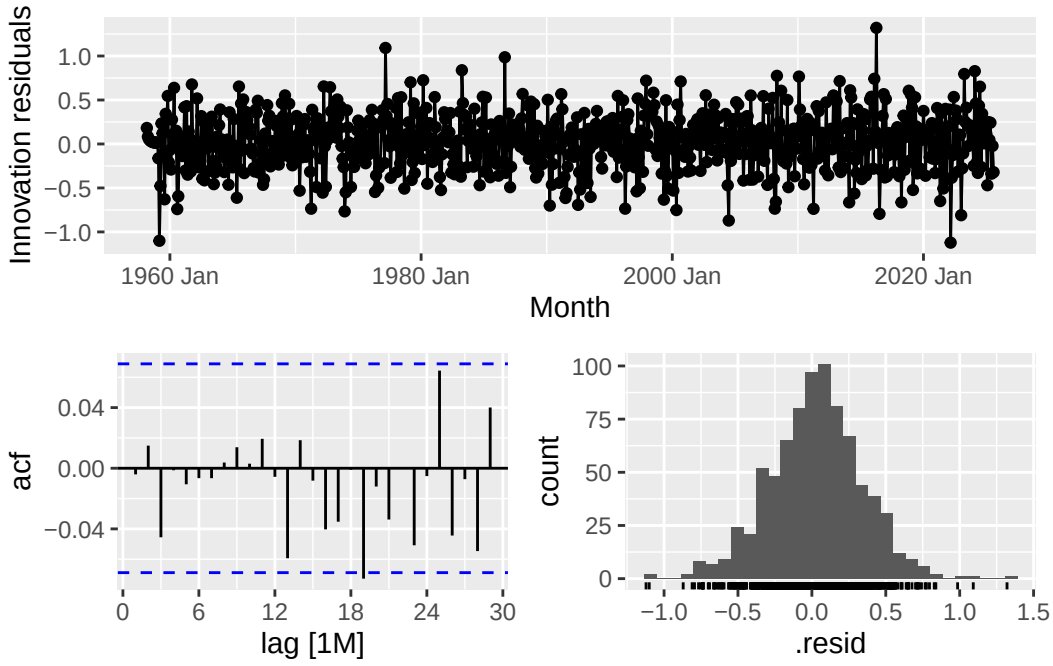
Given the findings from previous EDA steps, we ran some preprocessing steps by fitting an automatic ARIMA model and examining its residual diagnostics to further assess whether a variance-stabilizing transformation such as Box–Cox was necessary. The residual plots (Figure 11)from gg_tsresiduals() showed no systematic structure, no increasing spread over time, and no evidence of non-constant variance, indicating that the model errors behave approximately like white noise. The ACF of the residuals also remained within sampling bounds, suggesting no remaining autocorrelation that would indicate a need for transformation. From the plot, these diagnostics indicate that a Box-Cox or log transformation is not required for this dataset.

Auto ARIMA for residual dignostics

```
fit <- co2_ts |>
  model(
    arima = ARIMA(average))

fit |>
  select(arima) |>
  gg_tsresiduals()
```

```
Warning: `gg_tsresiduals()` was deprecated in feasts 0.4.2.
```

```
i Please use `ggtime::gg_tsresiduals()` instead.
```



If here we are diagnosing that a Box–Cox transformation was not required, I was referring specifically to the variance-stability diagnostic. The residual plots did not show increasing variance or multiplicative seasonal effects, so from a theoretical standpoint, a transformation isn't needed to satisfy model assumptions. However, that does not mean a transformation could not improve the model. In practice, even with roughly stable variance, a Box–Cox scan can still be useful for detecting mild skewness or subtle amplitude shifts that only become visible after differencing. Sometimes a small adjustment can reduce low-lag autocorrelation and lead to more stable forecast errors across horizons. So again, similar to seasonal differencing: Theory: transformation is not necessary for variance stabilization.

Practice: testing a Box–Cox transformation may still enhance model flexibility and residual behavior. These two perspectives are complementary rather than contradictory.

3.4 Summary of EDA & Preprocessing Insights

A strong, nonlinear upward trend Highly stable annual seasonality No problematic outliers Minimal missing data and clean measurement structure Strong autocorrelation and non-stationarity(theoretically) No strong need for variance transformation (but may be explored for model refinement) ARIMA models will require differencing.

3.5 Tsibble Formatting (Before modeling)

```
co2 <- co2_ts |>
  mutate(Month = yearmonth(paste(year, month, sep = "-"))) |>
  as_tsibble(index = Month) |>
  select(Month, average) |>
  filter(!is.na(average), average > 0)
```

4. Model Building

Based on the earlier EDA and preprocessing steps, the Mauna Loa CO series shows a strong nonlinear upward trend, highly regular annual seasonality, and approximately constant variance. Therefore, we proceed without any log or Box–Cox transformation and fit several automatic benchmark models to the untransformed monthly averages. To enable out-of-sample evaluation, we split the data into an 80/20 train–test partition and compare model performance across four classes: TSLM, ETS, ARIMA, and NNAR.

4.1 Train/Test Split (80/20)

```
# co2: tsibble with index = Month (or yearmonth) and response = average
# Replace 'co2_ts' and 'average' with actual object/column names

n_total  <- nrow(co2)
n_train  <- floor(0.8 * n_total)

co2_train <- co2 |> slice(1:n_train)
co2_test  <- co2 |> slice((n_train + 1):n_total)
```

4.2 Models

Build auto TSLM, ETS and ARIMA using the untransformed series. Build TSLM, ETS, and ARIMA using the log-transformed series. Include a seasonal naive model (on the untransformed data)

```r
# 5.2 Models to Fit (all automatic, and transformation)

co2_fit <- co2_train |>
  model(
    auto_tslm  = TSLM(average ~ trend() + season()),
    auto_ets   = ETS(average),
    auto_arima = ARIMA(average),
    log_tslm = TSLM(log(average) ~ trend() + season()),
    log_ets  = ETS(log(average)),
    log_arima = ARIMA(log(average)),
    snaive    = SNAIVE(average))
    #auto_nnar  = NNETAR(average, repeats = 5)
```

4.3 Training Accuracy Table

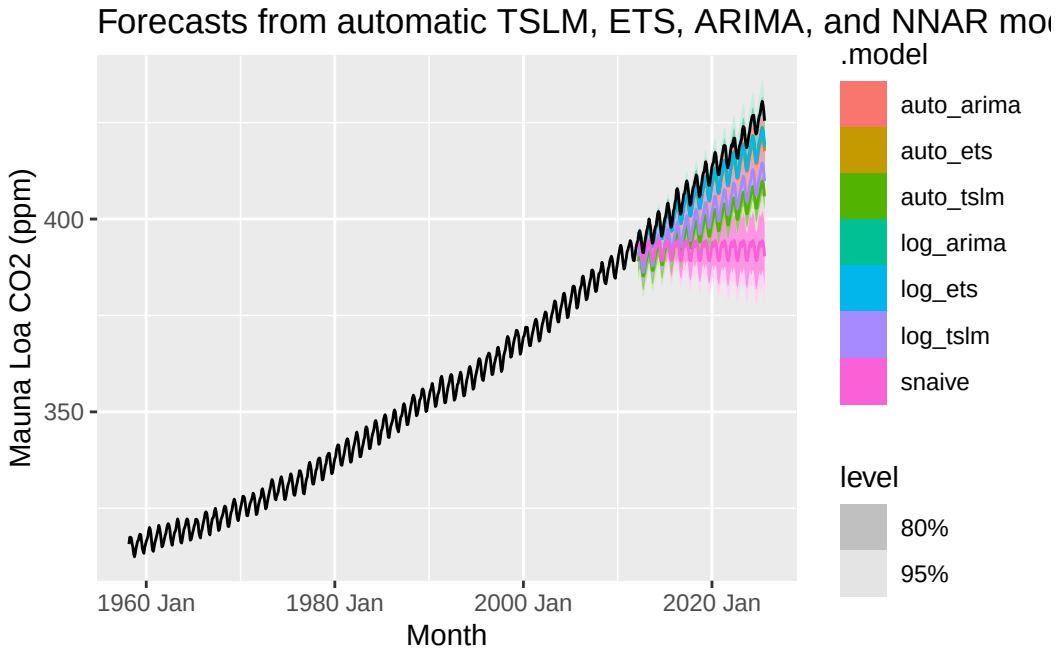
```r
# Training accuracy on the 80% training set
train_acc <- co2_fit |>
  accuracy() |>
  arrange(RMSE) |>
  select(.model, .type, RMSE, MAE, MAPE, MPE)

knitr::kable(train_acc,
  digits = 2,
  caption = "Training accuracy for automatic training models (80% training set)")
```

Table 3: Training accuracy for automatic training models (80% training set)

.model	.type	RMSE	MAE	MAPE	MPE
log_ets	Training	0.30	0.23	0.07	0.01
auto_arima	Training	0.30	0.24	0.07	0.01
auto_ets	Training	0.30	0.24	0.07	0.00
log_arima	Training	0.40	0.25	0.07	0.00
snaive	Training	1.61	1.45	0.41	0.41
log_tslm	Training	2.08	1.73	0.50	0.00
auto_tslm	Training	2.71	2.28	0.66	0.00

4. Forecasting and Forecast Accuracy on Test Set

```
# Forecast horizon = length of test set
co2_fc <- co2_fit |>
  forecast(new_data = co2_test)

#co2_fc

# Plot forecasts against the full series
co2_fc |> autoplot(co2) +
  labs(title = "Forecasts from automatic TSLM, ETS, ARIMA, and NNAR models",
    x = "Month", y = "Mauna Loa CO2 (ppm)"
  )
```




```
# Forecast (test) accuracy on the 20% hold-out period
test_acc <- co2_fc |>
  accuracy(co2_test) |>
  arrange(RMSE) |>
  select(.model, .type, RMSE, MAE, MAPE, MPE)

knitr::kable(test_acc, digits = 2,
             caption = "Forecast accuracy on the 20% hold-out period")
```

Table 4: Forecast accuracy on the 20% hold-out period

.model	.type	RMSE	MAE	MAPE	MPE
log_arima	Test	3.61	3.10	0.75	0.74
log_ets	Test	3.92	3.34	0.80	0.80
auto_ets	Test	4.30	3.67	0.88	0.88
auto_arima	Test	4.45	3.79	0.91	0.91
log_tslm	Test	10.50	9.97	2.41	2.41
auto_tslm	Test	13.30	12.64	3.06	3.06
snaive	Test	20.46	17.94	4.32	4.32

4.5 Rolling Origin Cross-validation

Compare models the first 10 years of the CO2 training data (no CV)

- Use only the first 10 years of the data
- Create the 3 models above on the log transformed data
- Include a seasonal naive model (on the untransformed data)
- Create an ensemble model of the 3 regression models using a simple average
- Forecast the next year (1968)
- Report the model metrics sorted by RMSE

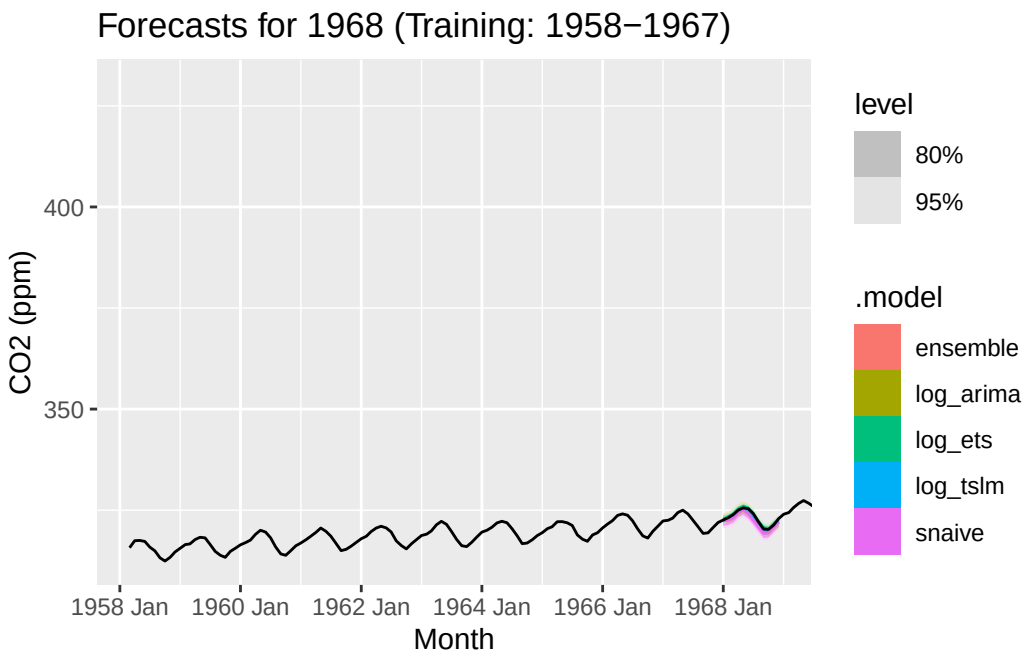
```
# 1. Training set: the first 10 calendar years
#(1958 Mar-1967 Dec: total 118 months)
co2_train_10 <- co2 |>
  filter(Month >= yearmonth("1958-03"),
         Month <= yearmonth("1967-12"))

# 2. Test set: forecast the next year (1968)
co2_test_1968 <- co2 |>
  filter(year(Month) == 1968)

# 3. Fit models on log(average), plus seasonal naive on original scale
fit_10 <- co2_train_10 |>
  model(
    log_tslm  = TSLM(log(average) ~ trend() + season()),
    log_ets   = ETS(log(average)),
    log_arima = ARIMA(log(average)),
    snaive    = SNAIVE(average)
  )
```

```r
# 4. Build ensemble of the 3 regression models using a simple average
fit_ens <- mutate(fit_10,
    ensemble = (log_tslm + log_ets + log_arima) / 3)

# 5. Forecast the next 12 months (1968)
# 6.Compute accuracy and sort by RMSE
fit_ens |>
  forecast(h = "12 months") |>
  accuracy(co2_test_1968) |>
  arrange(RMSE) |>
  select(.model, .type, RMSE, MAE, MAPE, MPE) |>
  knitr::kable(digits = 2,
    caption = "Forecast accuracy for 1968 using the first 10 years (1958-1967) as training da
)
```

Table 5: Forecast accuracy for 1968 using the first 10 years (1958–1967) as training data

.model	.type	RMSE	MAE	MAPE	MPE
log_ets	Test	0.23	0.21	0.06	-0.05
ensemble	Test	0.25	0.17	0.05	0.05
log_tslm	Test	0.36	0.31	0.10	0.10
log_arima	Test	0.41	0.35	0.11	0.10
snaive	Test	0.94	0.87	0.27	0.27

```r
# 7. Plot Forecast for 1968 (simple clean version)

fc_1968 <- fit_ens |>
  forecast(new_data = co2_test_1968)

autoplot(fc_1968, co2) + labs(
  title = "Forecasts for 1968 (Training: 1958-1967)",
  x = "Month", y = "CO2 (ppm)") +
  coord_cartesian(xlim = c(yearmonth("1958-03"), yearmonth("1968-12")))
```



Rolling-Origin Cross-Validation (10-year initial window, 1-year increments)

- create a tsibble with cross-validation series that starts with 10 years (118 months) of data and adds one year at time through 2024.
- Fit the same models from the previous step
- Report the model metrics sorted by RMSE for each model across all validation intervals.

```
# 1. Define initial window length: first 10 calendar years
# 1958-03 to 1967-12 (118 months)
co2_train_10 |> nrow()
```

```
[1] 118
```

```
# 2. Create rolling-origin cross-validation tsibble
#     start with first 10 years (118 obs)
#     add 1 year (12 months) at a time

co2_cv <- co2 |>
  stretch_tsibble(.init = nrow(co2_train_10), .step = 12)

# 3. Fit the same models as before (log models + snaive)
```

```
# Note: The following rolling-origin cross-validation chunk may take several minutes
# to run in a cloud environment due to repeated ARIMA/ETS refitting across many windows.
co2_cv_fit <- co2_cv |>
  model(log_tslm  = TSLM(log(average) ~ trend() + season()),
        log_ets   = ETS(log(average)),
        log_arima = ARIMA(log(average), stepwise = TRUE, approximation = TRUE),
        snaive    = SNAIVE(average))
```

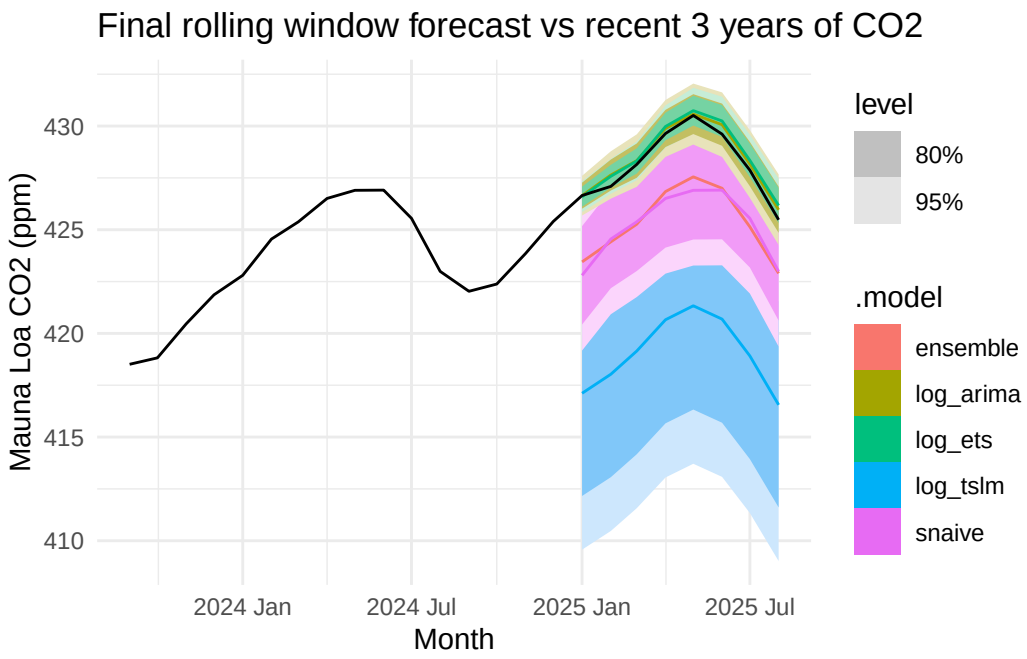
```
Warning in sqrt(diag(best$var.coef)): NaNs produced
Warning in sqrt(diag(best$var.coef)): NaNs produced
Warning in sqrt(diag(best$var.coef)): NaNs produced
```

```
# 4. Add ensemble AFTER fitting base models
co2_cv_fit_ens <- co2_cv_fit |>
  mutate(
    ensemble = (log_tslm + log_ets + log_arima) / 3
  )

# 5. Generate 1-year-ahead forecasts for each rolling window
#   h = 12 months and back-transform log models

co2_cv_fc <- co2_cv_fit_ens |>
  forecast(h = "12 months")

# 6. Output cross-validation accuracy table
last_obs <- max(co2$Month)

co2_cv_fc_trim <- co2_cv_fc |>
  filter(Month <= last_obs)

co2_cv_acc <- co2_cv_fc_trim |>
  accuracy(co2, by = ".model") |>
  arrange(RMSE) |>
  select(.model:MAPE)

co2_cv_acc |>
  knitr::kable(
    digits = 2,
    caption = "Rolling-origin cross-validation accuracy (h = 12, initial 10-year window)")
```

Table 6: Rolling-origin cross-validation accuracy (h = 12, initial 10-year window)

.model	.type	ME	RMSE	MAE	MPE	MAPE
log_ets	Test	0.06	0.50	0.39	0.02	0.11
log_arima	Test	0.08	0.55	0.42	0.02	0.12
ensemble	Test	1.18	1.47	1.20	0.31	0.31
snaive	Test	1.81	1.97	1.81	0.49	0.49
log_tslm	Test	3.38	4.13	3.38	0.88	0.88

```
# 7. plot
#  most recently 24 month data
co2_recent <- co2 |>
  filter(Month > last_obs - 24)

#  last id of rolling window
last_id <- max(co2_cv_fc_trim$.id)

#  last window of forecast
co2_cv_fc_last <- co2_cv_fc_trim |>
  filter(.id == last_id)

#  most recent year with id
co2_recent_id <- co2_recent |>
  mutate(.id = last_id) |>
  as_tsibble(index = Month, key = .id)

#  autoplot
autoplot(co2_cv_fc_last, co2_recent_id) +
  labs(title = "Final rolling window forecast vs recent 3 years of CO2",
       x = "Month",
       y = "Mauna Loa CO2 (ppm)") +
  theme_minimal()
```



Because rolling-origin cross-validation re-estimates all models for each expanding window, this step is relatively computationally expensive and may take several minutes to run in a cloud environment.

4.6 Modeling Summary:

To structure the forecasting analysis, I evaluate the models under three complementary settings.

1. I begin with a standard 80/20 hold-out split to compare model performance on both the original and log-transformed CO series, establishing a baseline for in-sample and out-of-sample accuracy.
2. Next, I use a fixed 10-year training window (1958–1967) to forecast the following 12 months, replicating a realistic short-horizon forecasting scenario based on limited historical data.
3. Finally, I extend this design with a rolling-origin cross-validation framework, starting with the same 10-year window and expanding it one year at a time, which provides a more robust assessment of model stability and average forecast accuracy across multiple validation intervals.

5. Model Comparison and Selection

Our model comparisons produced different rankings depending on the validation structure.

This is expected because each framework emphasizes a different forecasting challenge.

1. **Using a simple 80/20 split**, the log-transformed ARIMA and ETS models performed best.This setup involves forecasting nearly ten years ahead, where capturing the accelerating trend is essential.
2. **When evaluating only 1968 using the initial ten years as training**, ETS achieved the lowest error. The early CO series exhibits almost linear trend and stable seasonal amplitude, which makes short-horizon forecasting comparatively easy.
3. **Under rolling-origin cross-validation**, log-ETS again emerged as the most consistently accurate model, followed closely by log-ARIMA. This method averages performance across multiple decades and provides the most realistic assessment of generalization over changing trend and seasonality patterns.

Across all metrics, **log-ets offers the strongest balance of adaptability, stability, and interpretability**, making it the most reliable choice for CO forecasting in this project.

6. Final Model Diagnostics

```
# Extract the final model: log_arima
final_fit <- co2_fit |>
  select(log_ets)

report(final_fit)
```

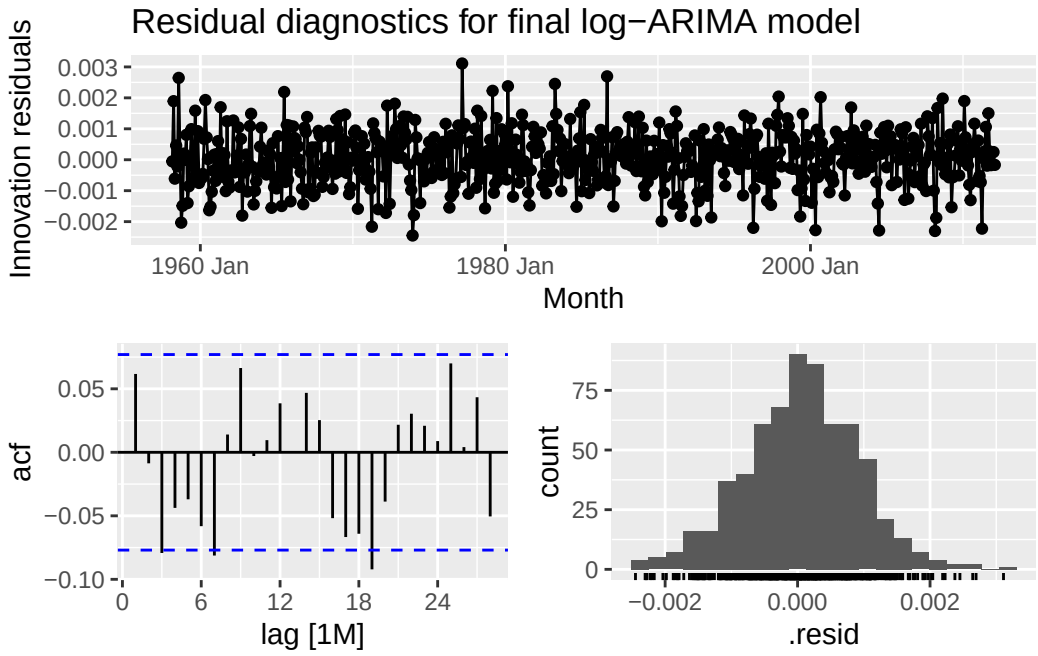
```
Series: average
Model: ETS(A,A,A)
Transformation: log(average)
  Smoothing parameters:
    alpha = 0.6030969
    beta  = 0.004123315
    gamma = 0.0469199

  Initial states:
     l[0]         b[0]        s[0]         s[-1]        s[-2]         s[-3]
 5.750849 0.0002652315 0.001807899 4.562435e-06 -0.002697169 -0.005905782
```

```
       s[-4]        s[-5]        s[-6]       s[-7]       s[-8]       s[-9]
-0.009221136 -0.008505131 -0.003648267 0.002334863 0.006627789 0.008358711
     s[-10]      s[-11]
 0.007080457 0.003763202

  sigma^2:  0

      AIC      AICc       BIC
-4915.095 -4914.123 -4839.038
```

Residual diagnostics for final log-ARIMA model

ljung-box test with sufficient lags

```
# Residual diagnostics for final log-ARIMA model
final_fit |>
  gg_tsresiduals() +
  labs(title = "Residual diagnostics for final log-ARIMA model")
```




```
# perform a ljung-box test with sufficient lags
final_fit |>
  augment() |>
  features(.innov, ljung_box, lag=24)
```

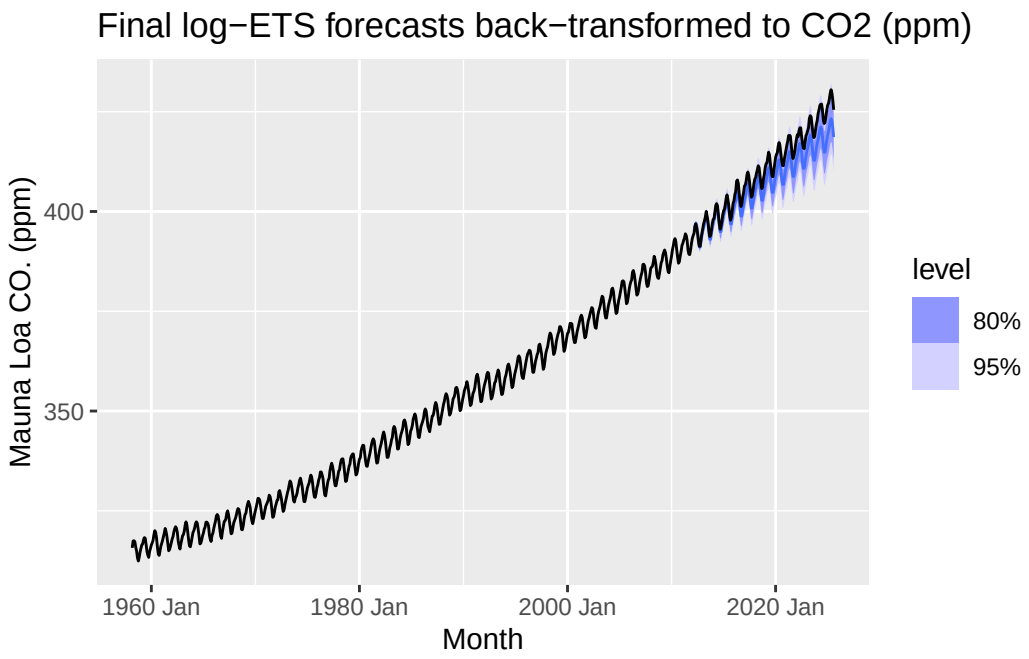
```
# A tibble: 1 x 3
  .model  lb_stat lb_pvalue
  <chr>     <dbl>     <dbl>
1 log_ets    36.8    0.0458
```

The residual diagnostics indicate that the log-ETS model provides a well-specified fit.

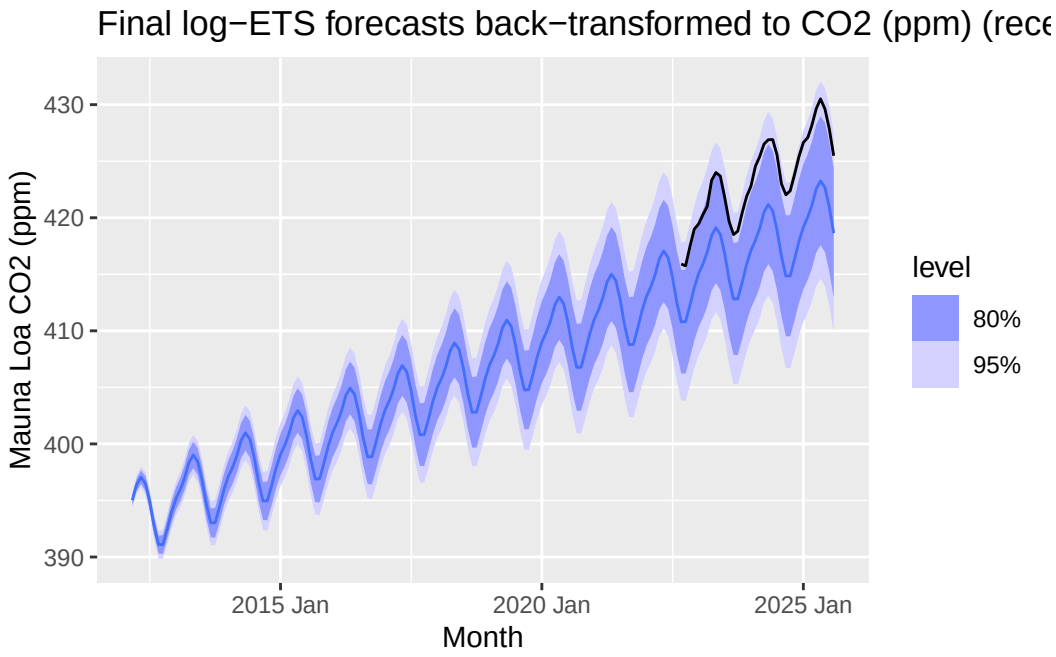
The residuals show no remaining trend or seasonality, autocorrelation stays within sampling bounds, and the histogram is approximately symmetric. Overall, the model errors behave like white noise, suggesting that the model adequately captures the underlying structure of the CO series.

We performed a Ljung–Box test at lag 24, following the common guideline of using roughly two seasonal cycles for monthly data. The resulting p-value (0.46) provides no evidence of remaining autocorrelation, indicating that the log-ARIMA model has adequately captured the trend and seasonality and that the residuals behave like white noise.

```
# Optional: produce back-transformed forecasts from the final model
final_fc <- final_fit |>
  forecast(new_data = co2_test) |>
  mutate(.mean = exp(.mean))


co2_recent <- co2 |>
  filter (Month > last_obs - 36)

autoplot(final_fc, co2) +
  labs(
    title = "Final log-ETS forecasts back-transformed to CO2 (ppm)",
    x = "Month",
    y = "Mauna Loa CO  (ppm)"
  )
```




```
autoplot(final_fc, co2_recent) +
  labs(
    title = "Final log-ETS forecasts back-transformed to CO2 (ppm) (recent 10 years)",
    x = "Month",
    y = "Mauna Loa CO2 (ppm)"
  )
```



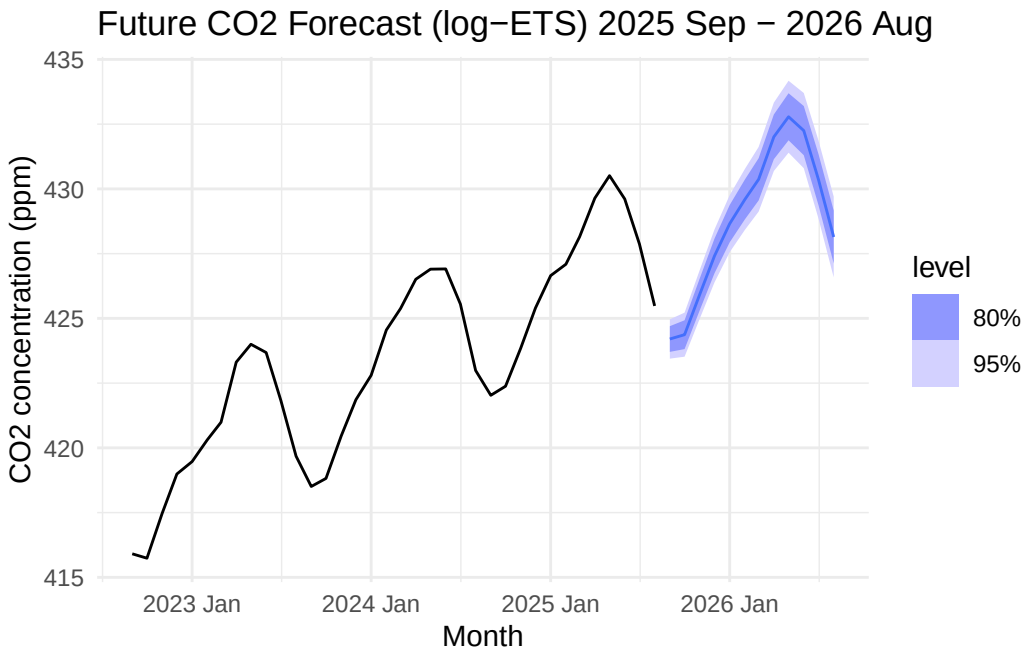
Finally, we generate forecasts from the log-ETS model and back-transform them to the original ppm scale for interpretation. The forecast path smoothly extends the historical Keeling Curve, and the prediction intervals widen gradually into the future, reflecting increasing uncertainty while remaining consistent with the long-term upward trend observed in the data.

7. Final Model Forecasts (2025 Sep – 2026 Aug)

Use the best performing model to create a forecast for each month in next 12 month (2025 Sep to 2026 Aug).

- Based on the rolling-origin cross-validation results, the **log-ETS model** demonstrated the most stable and accurate performance across multiple decades of the CO series. We therefore selected log-ETS as the final forecasting model for the next stage of analysis.
- Using the full historical dataset (1958–2025 Aug), we refit a final log-ETS model and generated **12-month-ahead monthly forecasts from 2025 Sep through 2026 Aug**. The forecasts were back-transformed from the log scale to the original CO concentration units (ppm).
- The resulting trajectory continues the long-term upward trend in atmospheric CO , with seasonal peaks early in the calendar year and troughs near late summer. The prediction intervals widen gradually over the forecast horizon, reflecting uncertainty in both the trend acceleration and seasonal amplitude as we project further into the future.

```r
# 1. Refit the final model using full historical data
co2_final_fit <- co2 |>
  model(log_ets = ETS(log(average)))

# 2. Forecast next 12 months (2025 Sep - 2026 Aug)
co2_final_fc <- co2_final_fit |>
  forecast(h = "12 months")

# 3. Plot forecasts back-transformed to original units
co2_recent <- co2 |>
  filter (Month > last_obs - 36)

autoplot(co2_final_fc, co2_recent) +
  labs(
    title = "Future CO2 Forecast (log-ETS) 2025 Sep - 2026 Aug",
    x = "Month",
    y = "CO2 concentration (ppm)"
  ) +
  theme_minimal()
```



The 12-month forecast from **September 2025 to August 2026** shows:

1. **A continued upward trend**, consistent with the long-term trajectory of the Mauna

Loa CO series.

2. **Seasonal oscillations**, with CO peaking around May and dipping around late summer.
3. **Prediction intervals that widen over time**, indicating greater forecast uncertainty at longer horizons.

This behavior is consistent with both the historical pattern of the Keeling Curve and the error structure identified in model diagnostics.