El Cañizar de Villarquemado

Obtain corrected `MI` from reconstructed `MI` and past & modern temperature and CO2

```
out <- mi_input %>%
  dplyr::mutate(ca_temp = past_temp - present_t,
                ca_co2 = past_co2 / modern_co2) %>%
  purrr::pmap(function(ca_temp, present_t, recon_mi, ca_co2, ...) {
    codos:::P_model_inverter$new(ca_temp, present_t, recon_mi, ca_co2)$calculate_m_true()
  }) %>% purrr::transpose() %>%
  tibble::as_tibble()

knitr::kable(head(out))
```

mi	cph	ci
0.528581	TRUE	45.15672
0.5566239	TRUE	45.29001
0.5550583	TRUE	45.73162
0.5730361	TRUE	45.59425
0.6659247	TRUE	49.82797
0.650894	TRUE	49.37501

Load files with `MTCO`, `GDD_0`, and `recontructed MI`:

```
gdd0 <- readr::read_csv(here::here("inst/extdata/gdd0.csv"))
mtco <- readr::read_csv(here::here("inst/extdata/mtco.csv"))
recon_mi <- readr::read_csv(here::here("inst/extdata/recon_mi.csv"))
```

Load input and output of the MI adjuster script:

```
mi_input <- readr::read_csv(here::here("inst/extdata/mi_input.csv"))
mi_output <- readr::read_csv(here::here("inst/extdata/mi_output.csv"))
```

Solve relation between `GDD0`, `Tmin` and `Tmax`:

```
GDD0 <- dplyr::pull(gdd0[, 1])
MTCO <- dplyr::pull(mtco[, 1]) # Tmin
MAT <- rep(NA, length(GDD0))
# ============================================================================
# If Tmin >= 0 MAT = GDD0/(2*pi)
# ============================================================================
MAT[MTCO >= 0] <- GDD0[MTCO >= 0] / (2 * pi)
# ============================================================================
# If Tmin < 0 and GDD0 = 0, MAT = less than Tmin/2 but cannot be accurately
# determined
# ============================================================================
if (length(MTCO[(MTCO < 0) & (GDD0 == 0.0)]) > 0)
  message("There are values where MTCO < 0 and GDD0 = 0. ",
          "Only the maximum MAT can be determined (Tmin/2). ",
```

```
          "Return -9999 as values")
MAT[(MTCO < 0) & (GDDO == 0.0)] <- -9999
# ============================================================================
# If Tmin >= 0 and GDDO = 0, something is fishy
# ============================================================================
if (length(MAT[(MTCO >= 0) & (GDDO == 0.0)]) > 0)
  message("There seems to be some values where Tmin >= 0 and GDDO = 0; ",
          "This is very fishy and should never happen (would mean that ",
          "MTCO was not really MTCO)")
# ============================================================================
# If Tmin < 0 and GDDO > 0, MAT can be calculated using the optimise method
# ============================================================================
t0 <- GDDO / MTCO
min_u <- -1 # minimum valid value for 'u' is -1
max_u <- 0.9999999999 # maximum valid value for 'u' is 1

t0_input = t0[(MTCO < 0) & (GDDO > 0)]

u <- purrr::map(.x = t0_input,
                .f = find_u,
                min_u = min_u,
                max_u = max_u,
                method = "Brent") %>%
  purrr::transpose("par") %>%
  purrr::pluck("par") %>%
  purrr::flatten_dbl()

MAT[(MTCO < 0) & (GDDO > 0)] <- -MTCO[(MTCO < 0) & (GDDO > 0)] * u / (1 - u)
```

Calculate u for all values pf `GDDDO / MTCO`:

```
x <- GDDO / MTCO
x[x > 0] <- -x[x > 0]
u <- purrr::map(.x = x, .f = find_u) %>%
  purrr::transpose("par") %>%
  purrr::pluck("par") %>%
  purrr::flatten_dbl()
```

Calculate growing season length (GSL):

```
GSL <- (365 / pi) * acos(-u)
ggplot2::qplot(y = GSL) +
  ggplot2::geom_line() +
  ggplot2::labs(title = "Growing season length",
                x = NULL,
                y = "GSL") +
  ggplot2::theme_bw()
```

Calculate the mean growing season temperature:

```
gs <- GDDO / GSL
data.frame(x = rep(seq_len(332), 2),
                y = c(gs, MAT * 2 * pi / 365),
                cat = rep(c("GDDO/GSL", "MAT"), each = 332)) %>%
  ggplot2::ggplot(., ggplot2::aes(x, y, )) +
    ggplot2::geom_line(ggplot2::aes(color = cat)) +
```

```
    ggplot2::labs(title = "Mean growing season temperature",
                  x = NULL,
                  y = "GS [°C]") +
    ggplot2::scale_color_brewer(name = "Growing Season",
                                palette = "Set1",
                                direction = -1) +
    ggplot2::theme_bw()
```

CRU TS 4.04

Solve relation between `GDD0`, `Tmin` and `Tmax`:

```
path <- "~/Desktop/iCloud/UoR/Data/CRU/4.04/"
GDD0 <- matrix(codos:::nc_var_get(file.path(path,
                                            "cru_ts4.04-clim-1961-1990-daily.tmp-gdd0.nc"),
                                  "tmp")$data, ncol = 1, byrow = TRUE)
MTCO <- matrix(codos:::nc_var_get(file.path(path,
                                            "cru_ts4.04.1901.2019.tmn.dat-clim-1961-1990-int-gs.nc"),
                                  "tmn")$data, ncol = 1, byrow = TRUE)
Tmp <- matrix(codos:::nc_var_get(file.path(path,
                                           "cru_ts4.04-clim-1961-1990-daily.tmp-gs.nc"),
                                 "tmp")$data, ncol = 1, byrow = TRUE)

# Remove NAs
idx <- !is.na(GDD0) & !is.na(MTCO)
GDD0 <- GDD0[idx]
MTCO <- MTCO[idx]
MAT <- rep(NA, length(GDD0))
Tmp <- Tmp[idx]
# ============================================================================
# If Tmin >= 0 MAT = GDD0/(2*pi)
# ============================================================================
MAT[MTCO >= 0] <- GDD0[MTCO >= 0] / (2 * pi)
# ============================================================================
# If Tmin < 0 and GDD0 = 0, MAT = less than Tmin/2 but cannot be accurately
# determined
# ============================================================================
if (length(MTCO[(MTCO < 0) & (GDD0 == 0.0)]) > 0)
  message("There are values where MTCO < 0 and GDD0 = 0. ",
          "Only the maximum MAT can be determined (Tmin/2). ",
          "Return -9999 as values")
MAT[(MTCO < 0) & (GDD0 == 0.0)] <- -9999
# ============================================================================
# If Tmin >= 0 and GDD0 = 0, something is fishy
# ============================================================================
if (length(MAT[(MTCO >= 0) & (GDD0 == 0.0)]) > 0)
  message("There seems to be some values where Tmin >= 0 and GDD0 = 0; ",
          "This is very fishy and should never happen (would mean that ",
          "MTCO was not really MTCO)")
# # ============================================================================
# # If Tmin < 0 and GDD0 > 0, MAT can be calculated using the optimise method
# # ============================================================================
# t0 <- GDD0 / MTCO
```

```
# min_u <- -1 # minimum valid value for 'u' is -1
# max_u <- 0.9999999999 # maximum valid value for 'u' is 1
#
# t0_input = t0[(MTCO < 0) & (GDD0 > 0)]
#
# u <- purrr::map(.x = t0_input,
#                 .f = find_u,
#                 min_u = min_u,
#                 max_u = max_u,
#                 method = "Brent") %>%
#   purrr::transpose("par") %>%
#   purrr::pluck("par") %>%
#   purrr::flatten_dbl()
#
# MAT[(MTCO < 0) & (GDD0 > 0)] <- -MTCO[(MTCO < 0) & (GDD0 > 0)] * u / (1 - u)
```

Calculate `u` for all values of `GDDD0 / MTCO`:

```
x <- GDD0 / MTCO
x[x > 0] <- -x[x > 0]
u <- purrr::map(.x = x, .f = codos:::find_u) %>%
  purrr::transpose("par") %>%
  purrr::pluck("par") %>%
  purrr::flatten_dbl()
MTCO_cat <- ifelse(is.na(MTCO), "UNK",
            ifelse(MTCO >= 0 & MTCO <= 5, "0-5",
              ifelse(MTCO > 5 & MTCO <= 10, "5-10",
                ifelse(MTCO > 10 & MTCO <= 15, "10-15",
                  ifelse(MTCO > 15 & MTCO <= 20, "15-20",
                    ifelse(MTCO > 20 & MTCO <= 25, "20-25",
                      ifelse(MTCO > 25 & MTCO <= 30, "25-30",
                        ifelse(MTCO > 30 & MTCO <= 35, "30-35", "35+")))))))
```

Calculate growing season length (GSL):

```
GSL <- (365 / pi) * acos(-u)
ggplot2::qplot(y = GSL) +
  ggplot2::geom_line(ggplot2::aes(color = MTCO_cat)) +
  ggplot2::labs(title = "Growing season length",
                x = NULL,
                y = "GSL") +
  ggplot2::theme_bw()
```

Calculate the mean growing season temperature:

```
gs <- GDD0 / GSL
data.frame(x = rep(seq_len(length(GDD0)), 2),
                y = c(gs, Tmp),#GDD0* 2 * pi / 365), #MAT * 2 * pi / 365),
                cat = rep(c("GDD0/GSL", "Tmp [T0]"), each = length(GDD0))) %>%
  ggplot2::ggplot(., ggplot2::aes(x, y, )) +
    ggplot2::geom_point(ggplot2::aes(color = cat), alpha = 0.3) +
    ggplot2::labs(title = "Mean growing season temperature",
                  x = NULL,
                  y = "GS [°C]") +
    ggplot2::scale_color_brewer(name = "Growing Season",
                                palette = "Set1",
```

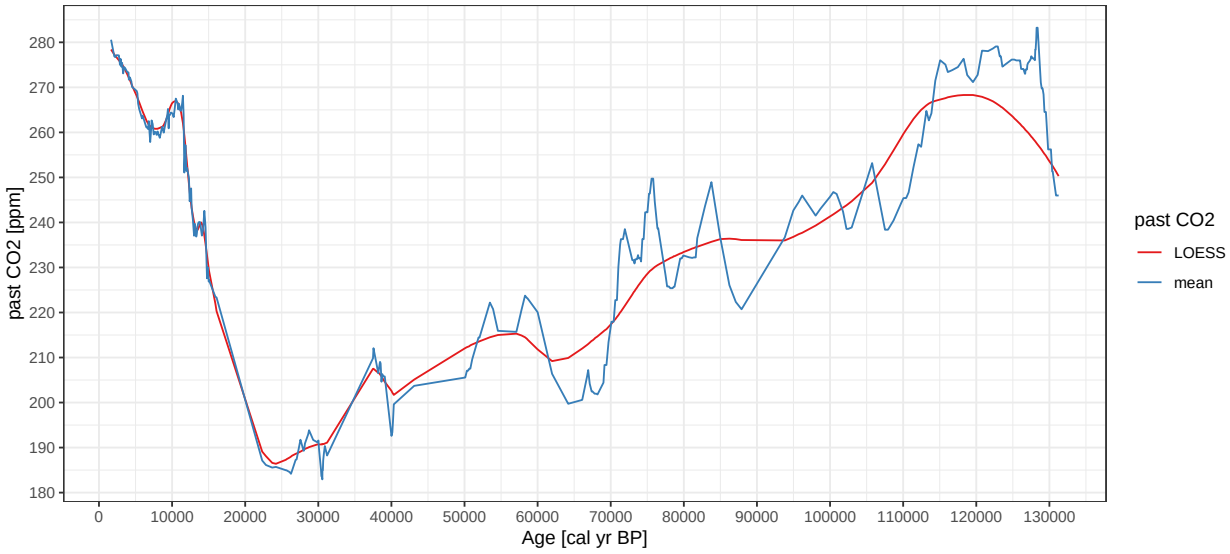
```
                                direction = -1) +
    ggplot2::theme_bw()

data.frame(x = Tmp,
           y = gs) %>%
  ggplot2::ggplot(., ggplot2::aes(x, y, )) +
    ggplot2::geom_point(alpha = 0.3) +
    ggplot2::labs(title = "Mean growing season temperature",
                  x = "Tmp [°C]",
                  y = "GDD0/GSL [°C]") +
    ggplot2::scale_color_brewer(name = "Growing Season",
                                palette = "Set1",
                                direction = -1) +
    ggplot2::theme_bw()
```

Obtain past CO2 from (Bereiter et al. 2015)

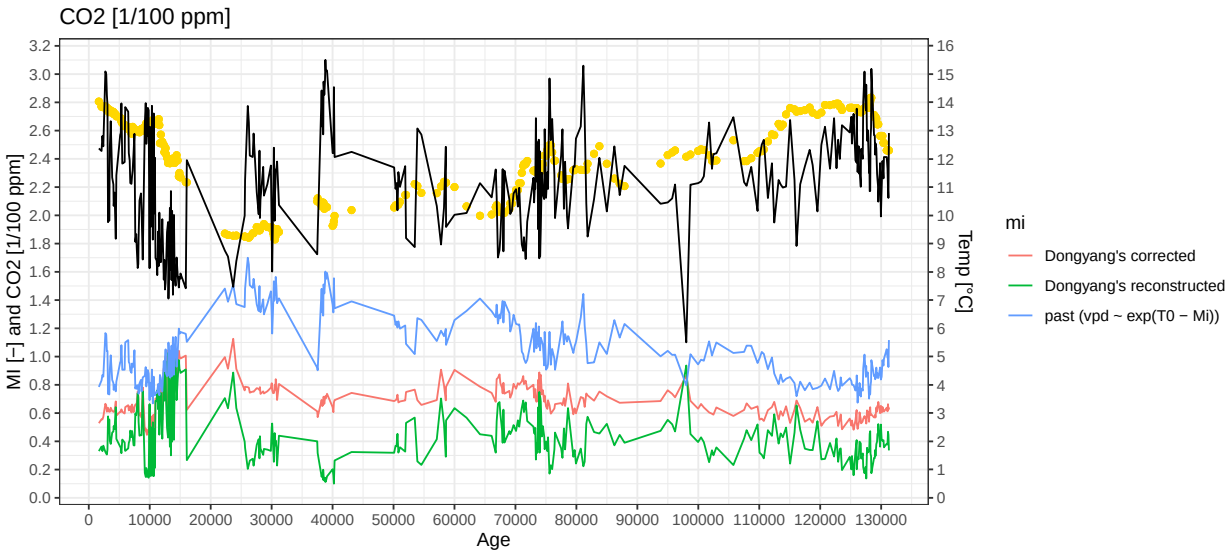
```
past_co2 <- purrr::map_dbl(m0$age, codos::past_co2)
```

Compare to original values (past CO2 calculated using LOESS with `span = 0.1`)

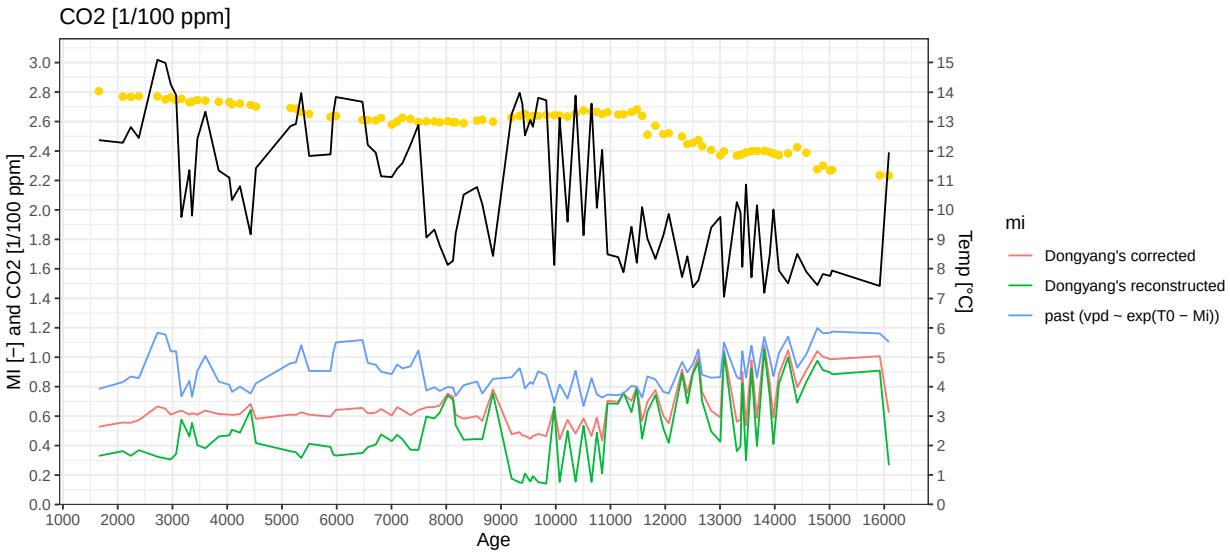


Corrected MI

```
codos::corrected_mi(m0$present_t, m0$past_temp, m0$recon_mi, m0$modern_co2, m0$past_co2)
```



- `age < 20k`



Appendix

A1. El Cañizar de Villarquemado Data

Download the CSV file: villarquemado-with-corrected-mi.csv

age	past_temp	past_co2	modern_co2	present_t	recon_mi
1655.9	12.369315	280.575	340	11.57957	0.3307945
2093.5	12.278883	276.900	340	11.57957	0.3625546
2239.4	12.810336	276.700	340	11.57957	0.3305932
2385.3	12.444368	277.150	340	11.57957	0.3691501
2725.7	15.095334	277.100	340	11.57957	0.3245905
2871.7	14.988073	275.000	340	11.57957	0.3128479
2968.9	14.261389	276.300	340	11.57957	0.3063976
3066.1	13.898441	274.600	340	11.57957	0.3425738
3163.4	9.759079	275.450	340	11.57957	0.5767323
3309.3	11.348229	273.100	340	11.57957	0.4623578
3358.0	9.804685	273.550	340	11.57957	0.5547067
3455.3	12.411282	274.500	340	11.57957	0.4033150
3601.1	13.331929	274.200	340	11.57957	0.3817716
3844.3	11.337097	273.450	340	11.57957	0.4620254
4038.9	11.094700	273.300	340	11.57957	0.4696227
4087.5	10.334675	271.700	340	11.57957	0.5076132
4233.3	10.804928	272.200	340	11.57957	0.4872196
4427.9	9.170901	271.300	340	11.57957	0.6418646
4525.1	11.419825	270.100	340	11.57957	0.4171207
5157.3	12.846909	269.200	340	11.57957	0.3618640
5254.5	12.916914	268.700	340	11.57957	0.3549761
5351.9	13.963937	266.450	340	11.57957	0.3160562
5497.7	11.831268	265.200	340	11.57957	0.4124906
5886.7	11.885894	263.100	340	11.57957	0.3911332
5935.4	13.246767	263.700	340	11.57957	0.3398986
5984.1	13.832036	263.700	340	11.57957	0.3322531
6470.4	13.670727	261.150	340	11.57957	0.3500736
6567.6	12.204609	261.100	340	11.57957	0.3891459
6713.5	11.941244	260.750	340	11.57957	0.4073953
6810.9	11.141880	262.500	340	11.57957	0.4758337
7005.4	11.113891	257.850	340	11.57957	0.4303563
7102.6	11.398241	259.950	340	11.57957	0.4730562
7199.9	11.584645	262.650	340	11.57957	0.4424756
7345.8	12.203061	261.850	340	11.57957	0.3720489
7491.9	12.886010	259.550	340	11.57957	0.3707632
7637.8	9.064651	260.100	340	11.57957	0.5970890
7783.9	9.333725	260.050	340	11.57957	0.5846541
7881.1	8.794354	259.450	340	11.57957	0.6243717
8027.1	8.134635	260.200	340	11.57957	0.7404645
8124.3	8.275212	259.450	340	11.57957	0.7124126
8173.0	9.205571	259.450	340	11.57957	0.5383318
8319.0	10.518044	258.800	340	11.57957	0.4397843
8562.3	10.775916	260.700	340	11.57957	0.4446193
8659.5	10.190446	261.250	340	11.57957	0.4427591
8854.2	8.437032	259.950	340	11.57957	0.7546913
9194.8	13.250141	262.850	340	11.57957	0.1760948
9340.7	13.973423	263.750	340	11.57957	0.1497491

age	past_temp	past_co2	modern_co2	present_t	recon_mi
9389.3	13.607278	264.500	340	11.57957	0.1469599
9437.9	12.531811	265.200	340	11.57957	0.2107913
9535.1	13.051673	260.900	340	11.57957	0.1563338
9583.8	12.821860	263.800	340	11.57957	0.1930016
9681.0	13.805595	263.800	340	11.57957	0.1519674
9827.0	13.720574	264.400	340	11.57957	0.1421782
9973.1	8.128312	264.300	340	11.57957	0.6634363
10070.4	13.126319	264.100	340	11.57957	0.1540338
10216.0	9.600080	263.400	340	11.57957	0.4991893
10361.9	13.877804	265.300	340	11.57957	0.1559303
10507.8	9.140485	267.500	340	11.57957	0.5349011
10653.8	13.606814	266.900	340	11.57957	0.1535654
10751.0	10.069871	266.450	340	11.57957	0.4885950
10848.1	12.039321	265.100	340	11.57957	0.2113163
10945.4	8.492277	266.350	340	11.57957	0.6864394
11140.0	8.396249	264.800	340	11.57957	0.6837062
11237.4	7.884818	264.850	340	11.57957	0.7609682
11383.4	9.427713	266.500	340	11.57957	0.6274929
11480.7	8.205430	268.135	340	11.57957	0.7882028
11577.7	10.095936	263.895	340	11.57957	0.4470606
11675.0	9.024050	251.085	340	11.57957	0.6320223
11820.9	8.340856	257.170	340	11.57957	0.7428901
11966.7	9.145960	251.455	340	11.57957	0.5152480
12064.0	9.864316	252.065	340	11.57957	0.4188326
12307.3	7.724061	249.825	340	11.57957	0.8880351
12404.3	8.423341	244.700	340	11.57957	0.6878457
12504.6	7.375107	245.580	340	11.57957	0.8860412
12605.1	7.612779	247.555	340	11.57957	0.9680625
12672.1	8.088368	243.240	340	11.57957	0.7039221
12839.2	9.401961	240.750	340	11.57957	0.4969051
13006.4	9.762096	237.050	340	11.57957	0.4267234
13073.4	7.053631	239.735	340	11.57957	1.0281220
13307.2	10.263005	236.860	340	11.57957	0.3620700
13374.3	9.914492	237.345	340	11.57957	0.3961118
13407.8	8.067141	237.830	340	11.57957	0.8231219
13474.6	10.860577	239.040	340	11.57957	0.3008432
13575.0	7.712268	239.845	340	11.57957	0.9210171
13675.2	10.158509	240.070	340	11.57957	0.3975393
13809.1	7.188131	240.095	340	11.57957	1.0522505
13909.1	8.483453	239.260	340	11.57957	0.7325919
13976.1	10.014395	238.245	340	11.57957	0.4108065
14076.5	7.939903	237.075	340	11.57957	0.8198612
14243.7	7.508673	238.405	340	11.57957	0.9986810
14410.8	8.507830	242.575	340	11.57957	0.6918874
14577.8	7.896280	238.870	340	11.57957	0.8328343
14778.5	7.447235	227.590	340	11.57957	0.9761591
14878.8	7.823516	230.035	340	11.57957	0.9132437
15012.4	7.759372	226.875	340	11.57957	0.8967411
15046.0	7.941690	227.185	340	11.57957	0.8843613
15917.7	7.418364	223.510	340	11.57957	0.9088824
16085.0	11.952913	223.325	340	11.57957	0.2668348
22327.5	8.750205	187.120	340	11.57957	0.7058565

age	past_temp	past_co2	modern_co2	present_t	recon_mi
22836.3	8.543124	186.130	340	11.57957	0.6342902
23698.0	7.468590	185.560	340	11.57957	0.8869676
24206.4	8.378137	185.705	340	11.57957	0.6353440
25577.7	9.989920	184.960	340	11.57957	0.3974651
25644.2	11.253377	184.960	340	11.57957	0.3543274
26087.0	13.873164	184.545	340	11.57957	0.2049368
26264.1	13.282281	184.170	340	11.57957	0.2355576
26414.2	12.115212	184.890	340	11.57957	0.2632106
26897.0	12.064585	187.255	340	11.57957	0.2765760
27038.9	12.897021	187.390	340	11.57957	0.2278315
27558.3	10.820076	191.740	340	11.57957	0.3752458
27876.4	10.039848	189.930	340	11.57957	0.4149764
28006.3	12.289988	189.290	340	11.57957	0.2795443
28076.8	9.905440	189.625	340	11.57957	0.4359976
28171.0	10.564054	190.890	340	11.57957	0.3486645
28618.7	11.715219	192.960	340	11.57957	0.3040983
28736.5	10.698934	193.845	340	11.57957	0.3461706
29301.3	11.100536	191.700	340	11.57957	0.3412641
29877.0	11.763727	191.175	340	11.57957	0.3325954
30017.8	9.334366	191.570	340	11.57957	0.4997758
30087.9	8.011005	189.910	340	11.57957	0.5259534
30227.7	10.168890	187.500	340	11.57957	0.3811223
30367.4	12.394092	185.145	340	11.57957	0.2548525
30426.1	10.313403	183.620	340	11.57957	0.3838142
30495.4	9.807597	183.620	340	11.57957	0.4584769
30554.7	10.726282	182.940	340	11.57957	0.4130350
30566.5	10.815237	185.040	340	11.57957	0.3708856
30624.2	11.110922	185.040	340	11.57957	0.3727746
30671.2	11.620636	187.140	340	11.57957	0.4051214
30768.4	11.619156	188.735	340	11.57957	0.3649415
30896.8	11.904116	190.330	340	11.57957	0.2286723
31202.7	10.365645	188.240	340	11.57957	0.4397610
37481.6	8.621657	209.840	340	11.57957	0.4000060
37550.9	9.294491	212.070	340	11.57957	0.3170805
38201.9	14.421833	206.520	340	11.57957	0.1493365
38313.3	13.141346	207.705	340	11.57957	0.1723462
38432.8	14.293103	209.010	340	11.57957	0.1284056
38457.9	12.868215	209.010	340	11.57957	0.1989467
38522.7	14.733764	208.655	340	11.57957	0.1564022
38643.0	14.270195	204.625	340	11.57957	0.1221898
38755.5	14.773426	206.315	340	11.57957	0.1421253
38822.4	15.504293	205.870	340	11.57957	0.1120892
38898.8	15.105936	205.820	340	11.57957	0.1163882
39088.6	15.129874	205.800	340	11.57957	0.1517927
40010.6	12.204042	192.600	340	11.57957	0.2024871
40128.3	12.203207	193.385	340	11.57957	0.1598597
40213.5	14.539820	195.795	340	11.57957	0.1003031
40328.2	12.063683	199.610	340	11.57957	0.2643187
43112.3	12.246828	203.710	340	11.57957	0.3242764
50103.4	11.696752	205.560	340	11.57957	0.3190148
50327.5	10.941627	207.075	340	11.57957	0.3684263
50494.6	11.141554	207.075	340	11.57957	0.3648163

age	past_temp	past_co2	modern_co2	present_t	recon_mi
50644.9	10.180739	207.525	340	11.57957	0.4529321
50794.7	11.530990	207.525	340	11.57957	0.3202555
51054.1	11.008871	209.605	340	11.57957	0.3578349
51917.3	11.742056	214.450	340	11.57957	0.3271515
52051.3	9.194942	214.450	340	11.57957	0.5305394
53474.9	8.876912	222.200	340	11.57957	0.5679505
53907.5	13.076114	220.755	340	11.57957	0.2584301
54566.8	12.859886	215.925	340	11.57957	0.2331515
57094.6	10.331462	215.700	340	11.57957	0.4149566
57790.9	8.968028	220.550	340	11.57957	0.7033494
58278.8	10.272022	223.750	340	11.57957	0.5240653
58577.4	12.426316	223.150	340	11.57957	0.2909741
58615.8	9.588726	223.150	340	11.57957	0.5477740
60003.3	10.020254	220.055	340	11.57957	0.6348289
61978.6	10.083173	206.380	340	11.57957	0.5670943
64182.3	11.139135	199.730	340	11.57957	0.4498343
66099.6	10.637245	200.590	340	11.57957	0.4389652
66764.1	11.624901	205.800	340	11.57957	0.3199585
66916.3	10.665397	207.210	340	11.57957	0.5410475
67125.4	8.508066	204.175	340	11.57957	0.6663479
67390.9	8.770875	202.450	340	11.57957	0.6777624
67520.0	9.207820	202.450	340	11.57957	0.5947340
67794.3	10.612339	201.965	340	11.57957	0.4859353
67904.8	11.637044	201.965	340	11.57957	0.3898162
68027.8	8.725631	201.965	340	11.57957	0.6242590
68193.9	11.581364	201.800	340	11.57957	0.3914754
69007.2	10.553958	204.425	340	11.57957	0.4723161
69145.4	10.047083	208.340	340	11.57957	0.4507478
69417.4	10.163476	208.340	340	11.57957	0.4758250
69696.6	10.773337	213.405	340	11.57957	0.5149073
70097.5	10.925563	217.940	340	11.57957	0.4734601
70400.9	10.309700	217.940	340	11.57957	0.5485271
70623.0	10.975304	222.750	340	11.57957	0.5041285
70849.2	9.755560	222.750	340	11.57957	0.5846889
71044.4	8.968506	230.095	340	11.57957	0.6387306
71279.3	8.744081	235.020	340	11.57957	0.6886381
71393.0	9.227673	236.290	340	11.57957	0.6071532
71680.6	8.453658	236.290	340	11.57957	0.6754146
71931.0	9.776834	238.510	340	11.57957	0.5436850
72956.6	11.326985	231.610	340	11.57957	0.5036510
73060.4	10.458458	231.610	340	11.57957	0.4576930
73179.3	10.989212	231.610	340	11.57957	0.4549346
73247.8	10.941738	230.890	340	11.57957	0.4949586
73356.3	13.442654	231.815	340	11.57957	0.2707729
73444.2	11.199767	231.815	340	11.57957	0.3894941
73581.4	12.588539	231.815	340	11.57957	0.3181739
73736.8	9.509299	232.740	340	11.57957	0.6411193
73826.7	12.678039	232.035	340	11.57957	0.3478307
73915.0	8.479175	232.035	340	11.57957	0.7494196
73970.2	12.276665	232.035	340	11.57957	0.3200138
74049.2	8.547721	232.035	340	11.57957	0.7173744
74151.0	9.458208	231.330	340	11.57957	0.6813508

age	past_temp	past_co2	modern_co2	present_t	recon_mi
74327.6	11.509762	236.285	340	11.57957	0.4341816
74502.5	10.737438	236.285	340	11.57957	0.5070661
74714.2	10.575667	242.255	340	11.57957	0.4342481
74796.0	13.048755	242.255	340	11.57957	0.3442720
75018.3	10.619914	242.255	340	11.57957	0.3992279
75239.4	11.524815	246.395	340	11.57957	0.3303299
75345.2	10.935489	246.395	340	11.57957	0.4284520
75588.4	14.846786	249.730	340	11.57957	0.1713302
75805.0	12.662761	249.730	340	11.57957	0.2305014
76022.3	13.413114	244.640	340	11.57957	0.2030110
76388.6	11.436550	238.675	340	11.57957	0.3437086
76495.4	9.903207	238.675	340	11.57957	0.4619456
77497.2	12.112341	228.300	340	11.57957	0.3505447
77713.4	13.046182	225.785	340	11.57957	0.2832527
77950.7	10.231403	225.785	340	11.57957	0.4914191
78145.2	11.897598	225.395	340	11.57957	0.3428379
78468.6	9.943644	225.395	340	11.57957	0.5440420
78624.9	9.541531	225.720	340	11.57957	0.6353780
78728.2	9.839326	225.720	340	11.57957	0.5913819
79501.5	11.735255	232.000	340	11.57957	0.2908238
79708.0	11.719221	232.000	340	11.57957	0.3382297
79925.7	12.717413	232.670	340	11.57957	0.2429352
80714.2	13.147530	232.260	340	11.57957	0.3485051
81138.2	15.298229	232.125	340	11.57957	0.2231823
81358.7	13.444687	232.230	340	11.57957	0.2558755
81623.3	10.430003	232.230	340	11.57957	0.5230418
81835.0	9.250155	236.510	340	11.57957	0.5738022
82893.5	10.571488	243.595	340	11.57957	0.4656391
83775.9	12.035906	248.945	340	11.57957	0.4550853
84990.7	10.140096	236.555	340	11.57957	0.5238723
86230.5	12.440668	226.070	340	11.57957	0.3716611
87105.7	10.715734	222.345	340	11.57957	0.4457432
87895.4	11.753042	220.715	340	11.57957	0.3899515
93808.8	10.410122	236.685	340	11.57957	0.4740581
94979.1	10.456716	242.660	340	11.57957	0.5520538
95716.6	10.600032	244.555	340	11.57957	0.5204242
96188.0	11.092232	245.980	340	11.57957	0.4698490
98027.5	5.505091	241.520	340	11.57957	0.9367636
98709.7	11.084283	243.085	340	11.57957	0.4517865
99962.7	11.140097	245.630	340	11.57957	0.3949553
100449.4	11.198743	246.750	340	11.57957	0.4284302
100904.9	11.380754	246.315	340	11.57957	0.3944682
101773.9	13.286853	242.415	340	11.57957	0.2523240
102241.3	11.646840	238.570	340	11.57957	0.3364483
102482.3	12.169420	238.570	340	11.57957	0.3010117
102962.7	12.193900	238.875	340	11.57957	0.3568660
105756.1	13.473646	253.180	340	11.57957	0.2320112
107516.1	11.171422	238.385	340	11.57957	0.4205639
107923.1	11.046191	238.385	340	11.57957	0.4789961
108683.1	11.716369	240.435	340	11.57957	0.4083472
109721.8	10.156338	244.285	340	11.57957	0.5195532
110046.0	12.049625	245.410	340	11.57957	0.3193626

age	past_temp	past_co2	modern_co2	present_t	recon_mi
110410.7	12.501412	245.410	340	11.57957	0.3047066
110749.0	12.672051	246.690	340	11.57957	0.2793597
111417.7	10.613031	252.310	340	11.57957	0.4788444
112079.2	11.843707	257.360	340	11.57957	0.4390066
112458.6	9.746313	256.790	340	11.57957	0.5915523
113175.1	11.252501	264.750	340	11.57957	0.3840202
113513.0	11.094049	262.665	340	11.57957	0.4556566
113866.9	10.983418	264.240	340	11.57957	0.4291493
114396.6	11.019463	271.485	340	11.57957	0.4971717
115062.8	13.374749	276.015	340	11.57957	0.2422746
115781.1	11.247739	275.060	340	11.57957	0.4615568
116113.1	8.916917	273.395	340	11.57957	0.6540708
116716.3	11.098259	273.830	340	11.57957	0.4825078
117485.2	11.733925	274.505	340	11.57957	0.3476749
118271.7	12.318627	276.350	340	11.57957	0.3389485
118760.7	11.777267	272.730	340	11.57957	0.3380108
119547.2	10.139371	271.165	340	11.57957	0.5426767
120190.6	12.496893	272.775	340	11.57957	0.2724931
120787.0	13.136676	278.150	340	11.57957	0.2756974
121607.2	11.650312	278.045	340	11.57957	0.3882158
122274.4	13.440054	278.625	340	11.57957	0.2925180
122671.2	11.669329	279.080	340	11.57957	0.4202409
122942.9	12.675596	279.080	340	11.57957	0.2549743
123213.8	11.996490	276.880	340	11.57957	0.3442714
123363.9	12.540655	276.880	340	11.57957	0.3500401
123573.2	13.190911	274.600	340	11.57957	0.1964624
124848.8	12.935335	276.165	340	11.57957	0.2900541
125110.0	13.489674	276.165	340	11.57957	0.2012962
125205.7	12.541094	276.165	340	11.57957	0.2958522
125476.3	13.591386	275.980	340	11.57957	0.1598915
125785.6	11.940332	275.980	340	11.57957	0.3295856
125975.8	11.867022	275.980	340	11.57957	0.4087338
125989.1	13.775263	275.980	340	11.57957	0.2023650
126136.8	11.534696	274.085	340	11.57957	0.2844772
126303.9	12.446690	274.085	340	11.57957	0.2735865
126390.5	11.472391	274.085	340	11.57957	0.3450203
126448.8	11.714258	274.085	340	11.57957	0.3974307
126654.0	11.011898	273.020	340	11.57957	0.3848220
126690.4	12.199358	273.020	340	11.57957	0.2856841
126747.1	12.358087	273.975	340	11.57957	0.2776502
126937.0	12.067514	273.975	340	11.57957	0.3042270
126980.1	12.003555	274.930	340	11.57957	0.3141509
127060.4	14.010011	275.355	340	11.57957	0.2159125
127265.1	15.088981	275.780	340	11.57957	0.1742387
127457.6	13.818278	276.330	340	11.57957	0.2195273
127505.4	13.717524	276.880	340	11.57957	0.2053141
127541.7	14.612987	276.880	340	11.57957	0.1659228
127553.3	14.624963	276.880	340	11.57957	0.1368882
127678.4	12.644108	276.455	340	11.57957	0.3543054
127814.3	13.013749	276.455	340	11.57957	0.3211588
128021.0	11.504513	276.030	340	11.57957	0.3291535
128071.6	11.835843	278.375	340	11.57957	0.3817783

age	past_temp	past_co2	modern_co2	present_t	recon_mi
128117.9	10.853437	278.375	340	11.57957	0.4528403
128204.0	10.865302	280.720	340	11.57957	0.4715989
128253.7	12.735311	283.240	340	11.57957	0.3114563
128341.2	13.093253	283.240	340	11.57957	0.2952943
128392.1	15.185115	283.240	340	11.57957	0.1744310
128828.1	12.839272	271.080	340	11.57957	0.2819079
128949.6	12.831106	269.760	340	11.57957	0.2810622
129007.1	12.150213	269.760	340	11.57957	0.3385382
129070.4	12.546970	269.760	340	11.57957	0.2960820
129202.7	12.377524	268.440	340	11.57957	0.3801613
129328.7	11.473793	264.525	340	11.57957	0.3988137
129389.1	11.290671	264.525	340	11.57957	0.4514543
129476.1	11.061393	264.525	340	11.57957	0.4595776
129526.9	10.485338	264.525	340	11.57957	0.5219006
129828.4	11.849087	256.225	340	11.57957	0.3622487
129954.4	9.962512	256.225	340	11.57957	0.5187317
130075.3	10.911969	256.225	340	11.57957	0.4170323
130212.2	11.923132	256.225	340	11.57957	0.4023872
130382.3	11.308777	251.340	340	11.57957	0.4083790
130454.1	12.064393	251.340	340	11.57957	0.3574991
130909.1	12.063293	245.985	340	11.57957	0.3830676
131044.0	11.647268	245.985	340	11.57957	0.3776099
131118.7	10.959157	245.985	340	11.57957	0.4675718
131192.4	10.617069	245.985	340	11.57957	0.4461614
131270.6	12.914141	245.985	340	11.57957	0.3357231

References

Bereiter, Bernhard, Sarah Eggleston, Jochen Schmitt, Christoph Nehrbass-Ahles, Thomas F. Stocker, Hubertus Fischer, Sepp Kipfstuhl, and Jerome Chappellaz. 2015. "Revision of the EPICA Dome c CO2 Record from 800 to 6000.167emkyr Before Present." *Geophysical Research Letters* 42 (2): 542–49. https://doi.org/10.1002/2014gl061957.