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Vollsveien 109
1358 Jar, Norway
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Correspondence:
zak@chemi.muni.cz

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Question About 280 ppm CO_2 Background Level

A Note to the Comment of F. Engelbeen

Zdirad Žák

Department of Chemistry, Masaryk University

Brno, Czech Republic

Abstract

The late Ernst-Georg Beck wrote a rather controversial but very interesting article titled *"Reconstruction of Atmospheric CO_2 Background Levels since 1826 from Direct Measurements near Ground* ", published in this journal (Beck, 2022) that raised several comments, the most extensive being from Engelbeen (2023). However, he repeats the same objections (Engelbeen 2007) he had already raised to Beck's (2007) first paper. On the other hand, he missed some logical consequence of his arguments.

Keywords: Chemical analysis, historical CO_2 levels

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1. Introduction

In his comment to E.-G. Beck's paper (Beck 2022) Ferdinand Engelbeen raises the same objections as he did to the first paper of E.-G. Beck,"180 Years of Atmospheric CO_2 Gas Analysis by Chemical Methods". He objects namely to reliability of historical chemical analyses and to an existence of increased CO_2 levels in 1940 – 1943. This latter objection has already been commented by others (Solheim 2023). Surprisingly, F. Engelbeen does not comment the outcome of Beck's paper – the reconstruction of historical CO_2 levels.

2. Chemical Analysis

Chemical analyses may not be the most sensitive procedures, but they are definitely reliable and give true values. They determine directly the substances (by weighting, titration etc.) while instrumental methods, often very sensitive, determine the substances from their properties – absorption, emission of a radiation etc. However, this objection of F. Engelbeen makes no sense at all – until to the sixties chemical methods were the only available means of analysis. On the other hand, F. Engelbeen has not realized that doubting reliability of chemical analysis may have an interesting logical consequence: If historical chemical analyses of CO_2 levels are not reliable, then the values used by G. S. Callendar (Callendar 1940, 1958) to determine a pre-industrial concentration of atmospheric carbon dioxide are also unreliable and, as a consequence, the Callendar's value of 290 ppm (today 280 ppm) cannot be true!

3. Reconstruction of historical CO_2 levels

What surprises me the most, is the lack of any comment to the results of Beck's reconstruction of

CO_2 levels in the span of 134 years 1826 – 1960. The results are summarized in the table reproduced from Beck 2022:

Table 11. Annual CO_2 MBL estimations from 1826 to 1960 from direct measurements

1	2	3	1	2	3	1	2	3	1	2	3	1	2	3
1826	364.50	72.90	1856	335.20	33.52	1886	299.00	8.97	1916	323.40	9.33	1946	336.00	47.04
1827	359.00	71.80	1857	337.00	33.70	1887	302.80	9.08	1917	321.60	10.20	1947	338.00	47.32
1828	358.00	70.80	1858	335.20	33.35	1888	300.00	9.00	1918	317.00	10.46	1948	328.40	45.98
1829	339.00	67.80	1859	333.50	33.50	1889	300.80	6.02	1919	320.20	10.44	1949	316.00	9.48
1830	339.90	67.98	1860	331.80	33.30	1890	302.40	6.05	1920	323.40	10.43	1950	308.85	9.27
1831	340.80	102.24	1861	330.10	33.10	1891	308.10	9.24	1921	305.80	3.07	1951	314.50	9.44
1832	341.70	102.51	1862	328.40	32.90	1892	311.30	9.34	1922	289.40	2.90	1952	314.50	6.29
1833	342.60	102.78	1863	326.70	32.70	1893	310.00	6.30	1923	305.10	3.02	1953	318.90	6.36
1834	343.50	103.05	1864	325.00	32.50	1894	317.00	9.51	1924	330.00	3.20	1954	321.90	6.44
1835	344.40	103.32	1865	310.00	31.00	1895	305.00	9.15	1925	321.30	3.18	1955	318.80	6.38
1836	345.30	103.59	1866	301.20	9.04	1896	313.80	9.41	1926	321.90	3.22	1956	320.50	6.41
1837	346.20	103.86	1867	300.00	9.00	1897	312.00	9.36	1927	327.00	5.89	1957	320.20	6.43
1838	347.10	104.13	1868	298.00	8.94	1898	317.30	9.52	1928	327.00	6.54	1958	318.40	6.37
1839	348.00	174.00	1869	290.00	8.70	1899	313.60	9.41	1929	328.00	6.56	1959	317.80	6.36
1840	347.00	173.50	1870	291.00	8.73	1900	307.50	9.23	1930	328.00	6.56			
1841	341.50	170.75	1871	300.00	9.00	1901	311.50	9.35	1931	329.25	6.58			
1842	336.00	168.00	1872	313.90	9.42	1902	305.90	9.18	1932	326.40	4.90			
1843	325.00	162.50	1873	311.00	9.33	1903	306.50	9.19	1933	328.00	4.89			
1844	328.50	164.25	1874	317.50	9.52	1904	305.50	9.17	1934	331.00	4.96			
1845	332.10	166.05	1875	324.00	9.72	1905	307.00	9.21	1935	357.00	5.36			
1846	335.60	167.80	1876	311.00	9.33	1906	306.00	9.18	1936	349.50	6.99			
1847	339.30	169.65	1877	298.00	8.94	1907	307.10	9.23	1937	354.00	7.08			
1848	319.90	63.98	1878	303.50	9.11	1908	306.50	9.26	1938	354.00	7.08			
1849	330.00	66.00	1879	309.90	9.30	1909	303.30	7.75	1939	382.40	5.74			
1850	330.00	66.00	1880	300.00	9.00	1910	307.80	7.72	1940	376.50	5.65			
1851	323.60	64.72	1881	309.00	9.27	1911	308.20	7.69	1941	376.00	5.64			
1852	325.30	65.06	1882	312.00	9.36	1912	318.50	15.21	1942	379.50	15.18			
1853	328.30	65.66	1883	312.00	9.32	1913	329.00	9.24	1943	383.00	15.32			
1854	331.60	66.32	1884	312.00	9.36	1914	327.15	9.35	1944	367.30	14.69			
1855	333.60	66.70	1885	303.60	9.11	1915	325.30	9.46	1945	352.00	14.08			

1: year; 2: CO_2 MBL estimation; 3: ±error (ppm) of method

As follows from the table, only 6 CO_2 concentrations have values less than 300 ppm, 29 have 300 - 310 ppm, 57 have between 310 – 320 ppm, and 45 have more than 320 ppm. And, moreover, the values hold a nearly flat level with only random variations, except higher levels (>340ppm) before 1840 and a peak 1935-1945 (>350ppm). The level 1826-1900 is 322.67 and 1901-2000 is 331.38 ppm, which is a growth rate of only 2.6%.

Callendar (1940,1958) published two papers summarizing some historical data of carbon dioxide levels. The data published in 1940 (Callendar 1940) give an average of 300 ppm, the data published in 1958 (Callendar 1958) yield an average of 291 ppm for the 19th century values and 322 ppm for the 20th century, joined average being 307 ppm. Both concentrations 300 ppm and 307 ppm fit well with Beck's findings.

Now an important question arises. Has not already come the time to change our mind about 280 ppm?

Co-Editor: Prof. J.-E. Solheim.

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