Global Climate Experiment Associated with COVID-19 Pandemic

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Abstract

The coronavirus pandemic allowed a global climate experiment by shutting down the global economy and hence stopping the CO_2 production. The drop in CO_2 concentrations was observed at the Mauna Loa Observatory 35 days after the Chinese holidays and stop of production. The increase of CO_2 concentration to the previous values, which followed the secular trend and the annual cycle, confirmed the hypothesis that the anthropogenic CO_2 is not the essential reason for the long-time increase in CO_2 concentration, but it only moved the stable balance on the ocean surface by the constant value, but without any influence on the secular trend.

Introduction

The present coronavirus pandemic enabled an otherwise unthinkable global experiment – a complete shutdown of the largest economies of the world for a period of time long enough to measure changes in CO_2 concentration at the Mauna Loa Observatory.

Macroeconomic indicators

According to the Bloomberg agency (2020) the economy in China dropped 80% after the Lunar New Year (January 25, 2020), when traditional holidays were followed by the outbreak of the coronavirus pandemic, lasting through the whole February and a part of March (Fig. 1).

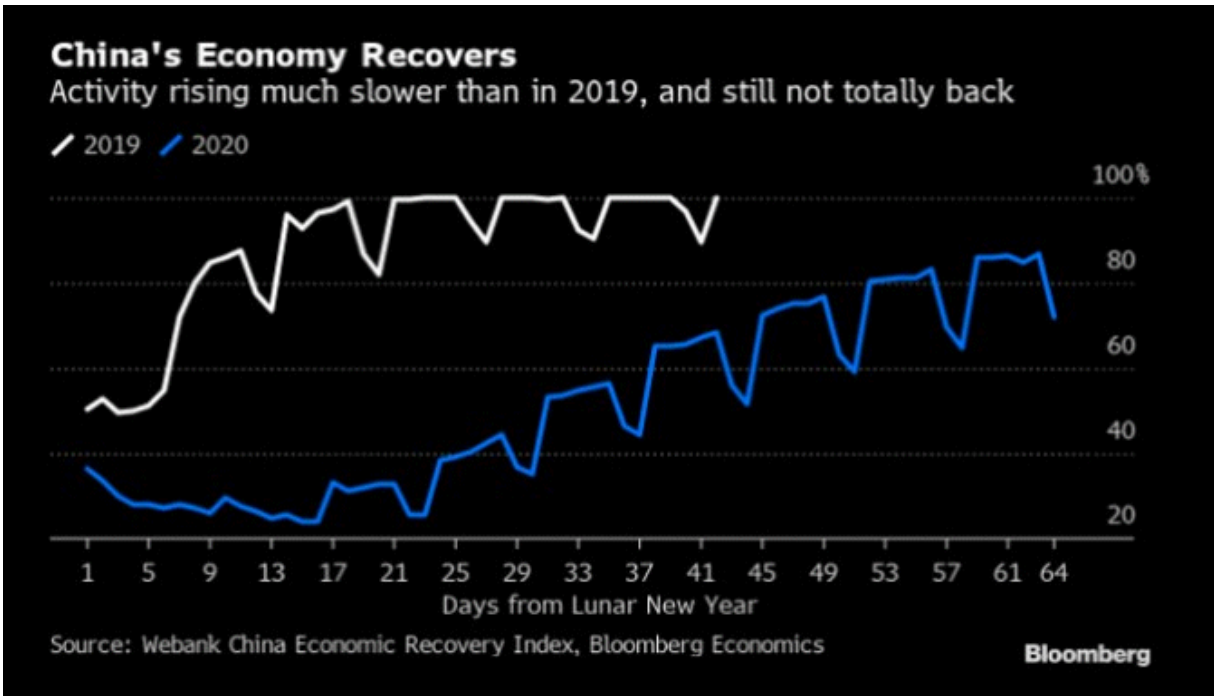

Fig. 1 – China's economic recovery after the Lunar New Year (time 0). Comparison of year 2020 (blue) with year 2019 (white). (source - Bloomberg 2020)

In February and March the production in most enterprises in Europe was down, and so was the international air transport after the spread of COVID-19 in Italy and eventually in all Europe. The US production only went down at the end of March. China accounts for the largest output globally, so carbon emissions should be driven mainly by the Chinese economy and less so by the European and US economies.

Analysis of CO_2 concentrations data

If the assumptions of all the IPCC models were correct, the drop in carbon emissions in China should be also seen in the data, measured mainly at the Mauna Loa Observatory, Hawaii (ESRL 2020).

Daily, weekly and monthly carbon dioxide concentrations for the last year between March 1, 2019 and March 30, 2020 are in Fig. 2.

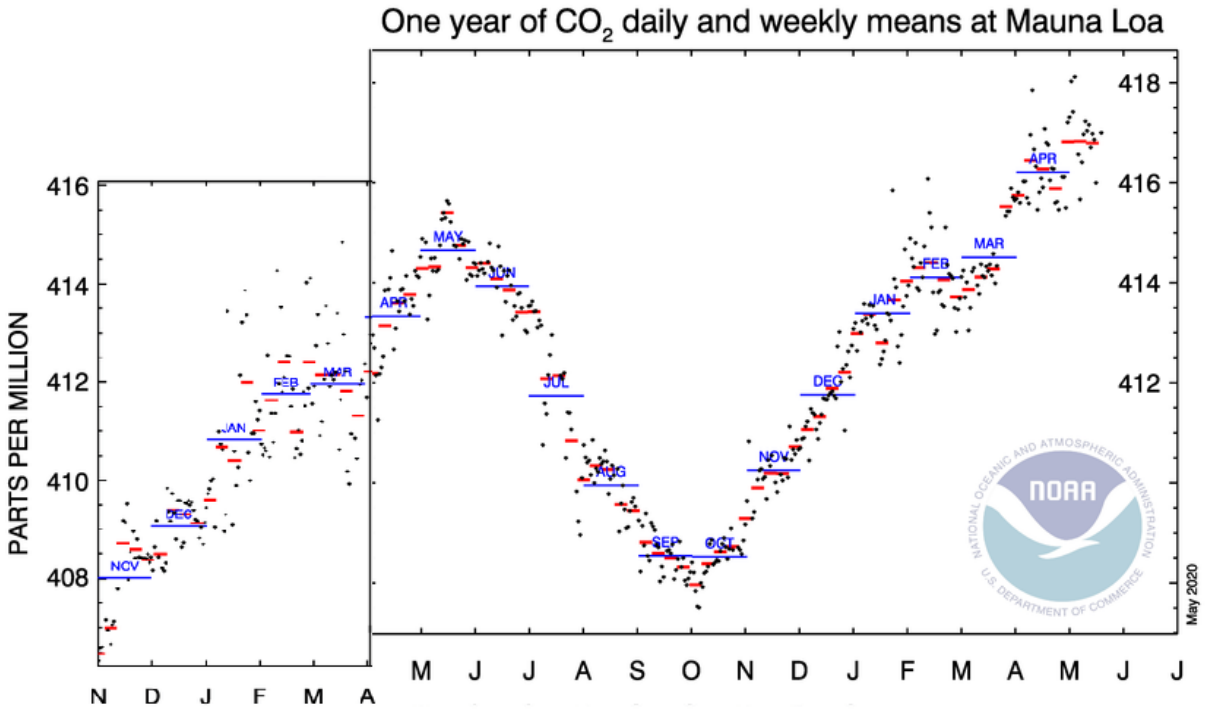

Fig. 2 – Daily, weekly and monthly CO2 concentrations at Mauna Loa Observatory between November 1,2018 and May 19, 2020 (ESRL 2020)

A turn in the development of CO_2 concentrations is clearly apparent since the middle of February 2020, but the trend and the annual course of CO_2 concentrations need to be taken away for the exact analysis of the size of the anomaly.

Firstly, the monthly CO_2 means were reduced by the secular trend, archived in the ESRL database (2020) (see Fig. 3 – red curve). Linear approximation of the trend ($y = 0.0078\ t + 407.13$ ppm) was taken away from the weekly data from the period between January 1, 2020 and April 15, 2020. The resulting values of concentration (Fig. 3 – violet curve) were bind to the curve of the annual course (Fig. 3 – blue curve) by subtracting the 0.4 ppm CO_2 (natural fluctuations of CO_2 concentrations).

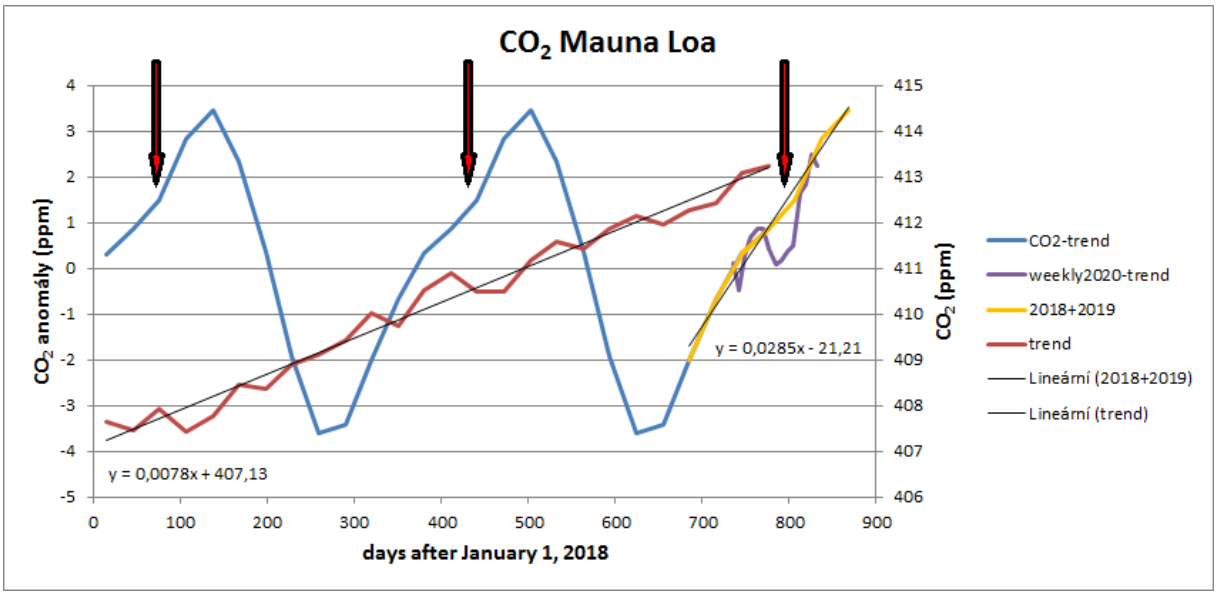

Fig.3 – Changes in CO_2 concentrations measured at Mauna Loa. Red curve – monthly means of the secular trend after the removal of the annual course, blue curve – monthly means corrected to the secular trend, violet curve – weekly means of CO_2 concentrations after subtracting the linear approximation of the trend and natural fluctuation (correction = -0.4 ppm), yellow – the rising part of the annual course (between December and May) during 2018 and 2019 and shifted in time by 730 or 365 days (ESRL 2020). Arrows mark the periods of annual mild variation (drop) in CO_2 concentrations possibly related to the Chinese Lunar New Year.

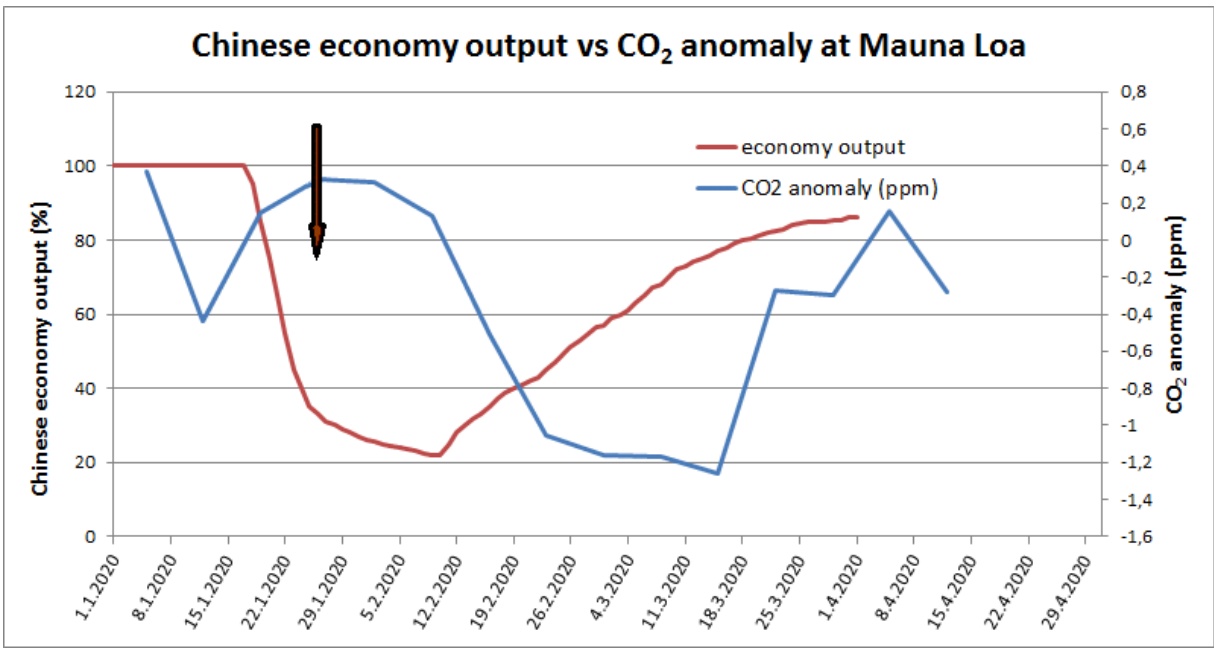

Fig.4 – China's economy output (red) (credit Bloomberg 2020) and anomaly of CO_2 concentrations at Mauna Loa in 2020 (credit ESRL 2020). The arrow marks the Chinese Lunar New Year (January 25, 2020).

Subsequently, both parts of the annual courses of monthly means of concentrations in the period between December and May 2018 and 2019 were moved forward by 730 and 365 days respectively (Fig. 3 – yellow curve). Both curves completely overlap, which cannot be recognised in the thickness of the curve and they also follow up the curve of monthly means of concentration at the beginning of 2020. This yellow curve, that is the rising part of the annual course of CO_2 concentrations (dependence on the annual course of temperatures and photosynthesis), was interpolated with a straight line (y = 0,0285 t – 21,21 ppm), which is taken as a "basis" for the measurements of anomalous deviations of weekly CO_2 concentrations in 2020 (see Fig. 4).

Results

The clear anomaly of CO_2 concentrations at the Mauna Loa Observatory starts one month after the Chinese Lunar New Year and the depth of the anomaly is approximately 1.6 ppm (Fig. 4). A similar drop in CO_2 concentration after the Chinese holidays has been seen every year (drop in the Chinese production approx. 20%), but the depths of anomalies have been at the level of natural variations, i.e. totally insignificant (see arrows in Fig.3).

An assumption can be made that if any human production completely stopped (and the CO_2 production as well), CO_2 concentrations could drop by even 10 ppm, which is to the value of about 403 ppm. However, as it is evident from both the curve of the annual course (Fig. 3) and the curve of the anomalous development in 2020 (Fig. 4), after the economy recovery, the CO_2 concentration was at the same level as before the production decline. It can be concluded that anthropogenic CO_2 and its amount does not affect substantially either the dynamic balance on the surface of the world's oceans or the long term trend in concentrations, which can be explained by the changes in temperatures of the oceans and atmosphere and the equality of partial pressures of CO_2 at the surface (Salby 2012).

References

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