A new look at current climate science and carbon dioxide [1]

Enormous benefits to people and the environment come from the energy in burning of fossil fuels. The resulting carbon dioxide enhances the growth rate of plants, is greening planet Earth and enhancing food security. With such vital benefits, why are fossil fuels being demonized? The problem began in the IPCC First Assessment Report (FAR) of 1990 with the statement that water vapor amplifies warming by carbon dioxide. This was expanded in the Fifth Assessment Report (AR5) in 2013 to state that water vapor amplifies warming of CO_2 typically by two to three times. In both examples the scientists did not use all the science that was available, such as the gas laws, a psychrometric chart and measurements of back radiation. This study uses all three to provide evidence that water vapor does not amplify warming by CO_2 and CO_2 concentration has little, if any, effect on warming of the atmosphere.

One method uses the gas laws to show air becomes warmer towards the Tropics and CO_2 concentration becomes less; concentration is the amount of a substance in a defined space. However, as the air warms it can hold more water vapor and its concentration and warming effect increase. Thus, as CO_2 goes down, water vapor goes up and vice versa. The second method confirms the results of the first method using back radiation and the absolute value of warming by CO_2 at current levels. Back radiation only became usefully available after publication of FAR.

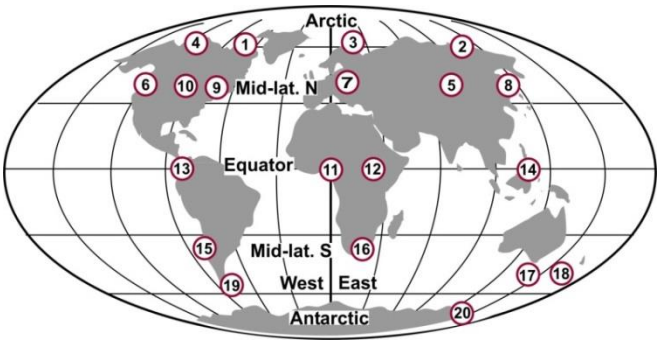

Figure 1. 20 cities in representative climates of Earth [1]

The first method uses a coherent set of data from 20 locations spaced relatively uniformly around the Earth as in Figure 1 to provide representative value ranges for temperature, relative humidity (RH), CO_2 concentration and water vapor concentration. Temperature and RH are recorded at the same time at each location using AccuWeather on a smartphone. These values are used to calculate the concentrations of CO_2 and water vapor that are plotted in Figure 3 using the gas laws and a psychrometric program. The black dots of CO_2 concentration go down as the triangles for water vapor go up and vice versa, opposite to the claim by the IPCC.

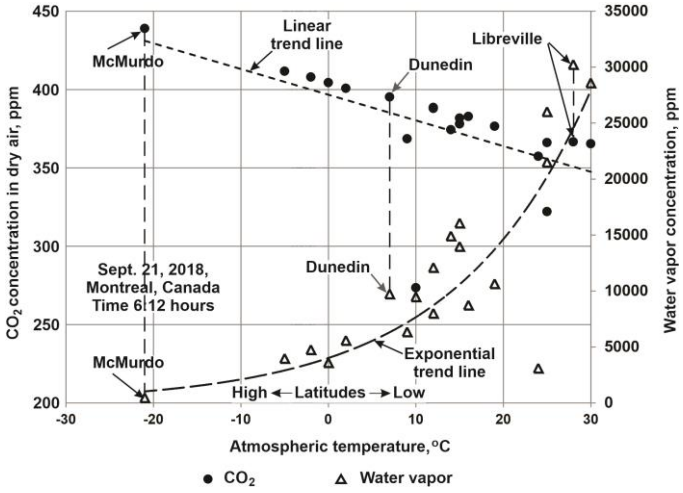

Figure 3. CO_2 and water vapor concentrations

The concentrations of CO_2 and water vapor in Figure 3 are determined by atmospheric temperature. The temperature is controlled by the sun angle that varies from -23° at the Poles to 90° above the Equator. Typically, atmospheric temperature follows the sun angle and water vapor concentration follows the temperature as in Figure 4 for Toronto, Canada.

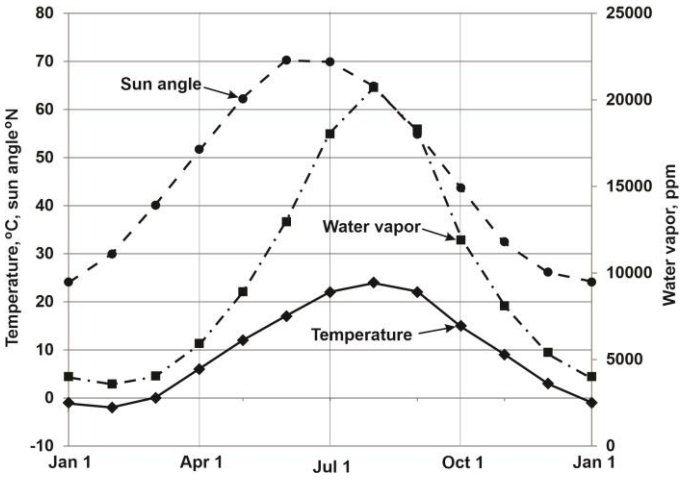

Figure 4 Toronto: temperature, CO_2 and water vapor

The sun angle increases water vapor exponentially; it decreases CO_2 by what appears to be linearly because of the short range of the quadratic from Figure 6. Observe in Figure 3 that from McMurdo to Libreville CO_2 drops by 102.3 from 438.9 to 366.6 ppmv. Over the same temperature range, water vapor increased by 29,863 from 466 to 30,230 ppmv. The increase in molecules of water vapor per molecule of CO_2 increased from 1.1 to 82.5. In Figure 3, water vapor is strong and positive with increasing atmospheric temperature whereas by comparison CO_2 is weak and negative.

The second method uses back radiation, the sum of radiation back to the Earth from all of the GHG as in Equation (1) to compare the warming effects of each GHG directly in Watts per square meter (W m^{-2}).

$$BR = WV + CO_2 + \text{remaining ideal GHG} \quad . . . (1)$$

The radiative forcing (RF) or warming effect of CO_2 is approximately equal to the warming effect of the sum of the remaining ideal GHG as in Equations (2) and (3):

$$BR = WV + 2CO_2 \quad . . . . . (2)$$

$$\text{Rewriting: } WV = BR - 2CO_2 \quad . . . . . (3)$$

Figure 5 is adapted from Wild (2001). Two lines are added to show the level of warming by CO_2 and that of the remaining GHG in the atmosphere that act as ideal gases. The warming effect of CO_2 at current levels and its drop from the Poles to the Tropics of ≈0.9 W m^{-2} comes from Figure 6.

Warming by back radiation is positive and dynamic as it increases by approximately (≈) 320 W m^{-2} from the Poles to the Tropics, and increases atmospheric temperature by ≈50°C. In comparison, warming by CO_2 drops by ≈0.9 W m^{-2} and its effect on atmospheric temperature is ≈(50 x (0.9/320) ≈0.14°C. This is negative compared to the increase by back radiation and it appears CO_2 is insignificant as a GHG.

There is no doubt that the sun controls Earth's temperature through water vapor. This is confirmed in IPCC AR5 by K. Willett et al. See pages 38 and 42.

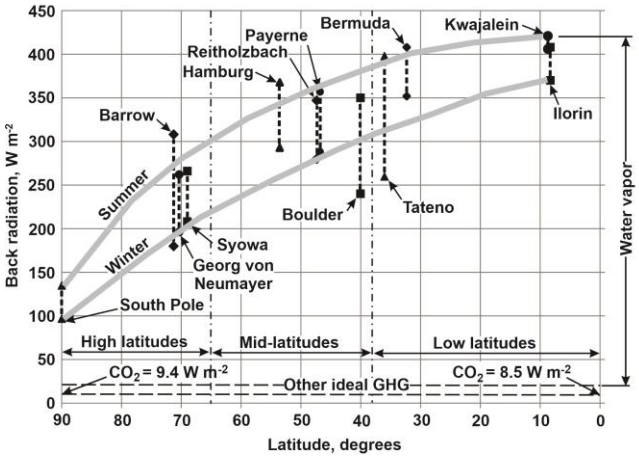

Figure5 Back radiation vs. latitude

From Figure 6, the current actual RF of CO_2 is ≈9 W m^{-2} and the maximum is ≈10.5 W m^{-2}, which is the upper limit to warming by CO_2. Until better information is developed, Figure 6 is used in this study.

The quadratic curve of Figure 6 [2] starts at zero, exactly replicates the logarithmic curve over the range 275 to 378 ppmv and reaches an asymptote at approximately 655 ppmv. There is an asymptote for practical purposes because the amount of radiation is limited. Thus, each additional CO_2 molecule added has less radiation available than the previous molecule.

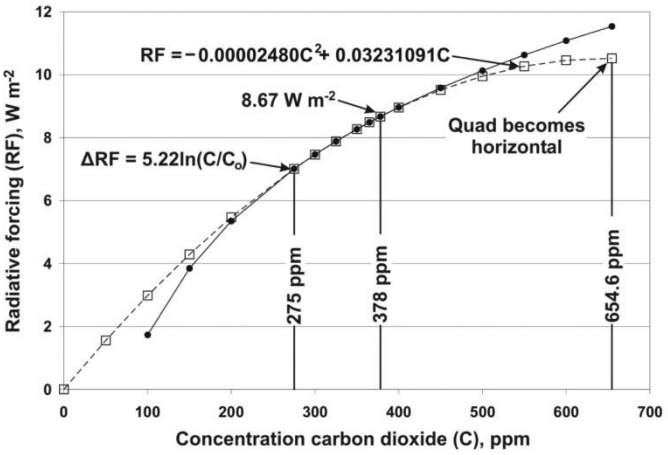

Figure 6 Radiative forcing vs. CO_2 concentration

Conclusions:

1. The gas laws and a psychrometric program to calculate water vapor concentration show the concept first introduced by the IPCC in 1990 that warming by CO_2 is amplified by water vapor is incorrect.

2. From the Poles to the Tropics, warming by back radiation increases by ≈320 W m^{-2} and increases atmospheric temperature by ≈50°C. In comparison, warming by CO_2 decreases by 0.9 W m^{-2}, equivalent to a drop in temperature of ≈0.14°C.

3. When all of the relevant science is taken into account, CO_2 does not warm the atmosphere and cause climate change; it does not cause temperature, it responds to temperature.

4. The sun angle controls Earth's temperature and its climates annually. Temperature follows the sun angle by approximately six weeks. Water vapor concentration and its large warming effect follow the temperature.

5. IPCC AR5 shows water vapor concentration correlates well with temperature over decades. Thus, the sun has always been firmly in control of Earth's temperature and climate.

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September 14, 2019

[1] Figure numbers are as in the full length paper.

[2] Lightfoot HD, Mamer OA. Calculation of atmospheric radiative forcing (warming effect) of carbon dioxide at any concentration. *Energy & Environment.* 2014;25(8). Figure 4.