DECARBONISATION? The fatal error caused by false Carbon Models

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Critical official reviewer of the IPCC-TAR (2001) Scientific Basis, Radiation and Carbon Models

This article, which was originally intended to appear at the German Website KalteSonne [ColdSun], also provides additions to https://kaltesonne.de/die-sonne-im-juli-2019-die-erde-wird-gruener-die-ausblei-bende-katastrophe/ and https://kaltesonne.de/zur-co2-neutralitaet/, in addition to explanations of the methods of a carbon model. There, Roy Spencer's carbon model was applied, available at http://www.drroyspencer.com/2019/04/a-simple-model-of-the-atmospheric-co2-budget.

In particular, explanations of modelling with concentration-dependent sink flows are provided here - in stark contrast to IPCC models, which do not know a stabilization at constant emission, but incorrectly assume some accumulation and thus require decarbonisation according to a residual budget (i.e. maximum still permissible cumulative emission).

First, let's look at the graphic in KalteSonne "Balance of sources and sinks". In 2018, the emission per year amounts to about 40 GtCO2 (10.9 GtC for division by 3,667), of which 22 Gt (55%) go into the sinks and 45% stays as "airborne fraction" supposedly remaining for a long time in the atmosphere. The absorption of 55% is only due to the current situation (ppm and emission) and increases in principle with ppm and constant emission. However, the modelers (who treat the oceans like large swimming pools) tend to the wrong assumption that nature's current "absorption strength" will decrease significantly in the future due to overloading of the sinks.

For example, Prof. Stocker (Bern, Switzerland) calculated a "residual budget" of 195 GtC (715 $GtCO_2$) for Paris COP21 in 2015 for the 2 degC target, which for an emission of 10.9 GtC will only last for 18 years and would have to be divided compulsory among all states. This value is easily comprehensible if one calculates with 3 degrees for CO2-doubling and 3*ln(ppm/280)/ln(2)=2 degrees yielding a permissible ppm value of 445 and thus an increase from 400 by 45 ppm. This results - on the premise that supposedly 49% of our emissions remain in the atmosphere - in a (grossly incorrect) residual budget of 45*2,123/0.49=195 GtC of emissions.

These types of residual budget calculations (even those which then yielded higher values taking into account higher reduction contributions of biomass and/or a slightly less CO_2 doubling sensitivity) are indeed - in contrast to the defamatory claims of German Prof. Rahmstorf at https://sci-logs.spektrum.de/klimalounge/wie-fritz-vahrenholt-den-bundestag-fuer-dumm-verkau-fen-wollte/ - the flawed “diarygirl calculations” (as Germans say). This can be easily demonstrated with a realistic carbon model. Here the sink flows are not proportional to the emission but to the ppm increase in relation to the equilibrium (280 ppm). The almost infinite sink in the model works in view of the gigantic absorption capacity of the oceans for our emission (cold water under extreme pressure, which also takes about 600 years before it comes out again, outgassing the absorbed CO_2 surplus). That was proved not only by the 1986 CO_2 outburst and degassing experiment of Lake Nyos but also by tests of disposing CO_2 in the extremely under-saturated deep sea (Google: Monterey bay co2 ocean).

With a correct carbon model, for example, for the maximum achievable increment to 500 ppm (without CO_2 reduction), i.e. by 220 ppm, with about 1 GtC per 20 ppm, a sink flow of 11 GtC/a results. Thus we have a stabilization which permits a constant emission of 11 GtC per year, which will, however, hardly be possible beyond 2100 due to exhaustion of the usable fossil reserves.

Let's now move on to the arithmetic principle of a realistic carbon model (although this unfortunately requires a bit of mathematics). The basis is very simple:

Imagine a bucket filled with water, which has a small hole at about 68% of the height (280 ppm equilibrium vs. 410 ppm). The content may be 10 litres and just 1.3 l/h may run out, and we assume that the bucket is cylindrical and that the outflow is proportional to the pressure difference (ppm to 280). The water content above the hole will decrease according to an e-function (exp(-t/tau) with tau=10*130/410/1,3=2.44 hours). The time constant tau is generally buffer content/sink flow, i.e. the time after which the buffer content C has reduced to 1/e (36.8%). The "halflife time" is tau*ln(2).

It is clear that the sink flow in the event of an emission stop (which nature cannot even detect) does not become zero, as is the case with the false assumption of a sink flow proportional to the emission. Also, no one who observes the increasing water level while pouring into the bucket just twice as much water as it drains, would come up with the absurd idea (similar to IPCC) that half remains permanently in the bucket and therefore the inflow would have to be reduced to zero (!) if a further level rise has to be avoided. A water accumulation can be excluded.

In the carbon model, the atmosphere is considered as the fast buffer which has the content C (we only look at the anthropogenic share above 280 ppm). The oceans (especially the deep sea) and biomass are the sinks. Since their sink flows C/tau act additively, i.e. like for two different sized holes in the bucket, a total of 1/tau=1/tau1+1/tau2 does apply. Under no circumstances a mean tau value as calculated by IPCC holds or the atmosphere can be divided into added partitions with different time constants (and thus different ppm after some time) together with some remaining portion.

For the realistic model of Roy Spencer KalteSonne took tau=65 years (the halflife time is about 45 years in the left IPCC curve of box 6.1 Fig.1 of the AR5). The Dietze model is using tau=55 years. For comparison: Halperin calculated a halflife time of 40 years in 2015 (tau=57.7 a), see http://defyccc.com/docs/se/MDACCD-Halperin.pdf

The value of 55 a (quasi a natural constant) was determined three times about 25 years ago with excellent agreement by regression analysis of CDIAC data and also from a CO_2 flow graph of the IPCC (Fig.1) as well as by optimal adaptation to the Mauna Loa curve with Excel. The net sink flow of the (heavy) biomass is about 1/3 of the oceanic absorption. Both are similarly modeled proportionally to the ppm rise. The temporal change of the anthropogenic carbon content in Gt in the fast atmospheric buffer is the linear model differential equation

dC/dt=E-C/tau with E=emission and C/tau=sink flow as well as C=delta_ppm*2,123*1,33.

The factor 2,123 is the C content of the atmosphere in GtC per ppm. The factor 1.33 stands for an atmospheric additional buffer (surface water, soil moisture, snow and light biomass) in the Dietze model, which achieves an optimal approximation of observed values. The model dynamics are shown in Fig.2 using an example. Until 1948, the emission is zero at 280 ppm. Then a constant emission of 7 GtC/a is assumed. The concentration increases to 350 ppm (real value) by 1988 according to the e-function 1-exp(-t/tau).

Three further ppm curves are shown: a) further on E=7 GtC, whereafter the concentration stabilizes at 280+136=416 ppm at a sink flow of 7 GtC, b) halving of E and c) after E=0 with a ppm decay according to exp(-t/tau) - i.e. within 165 years to 5%. As shown in the graph, the time constant can be determined by attaching any tangent to the e function and measuring the distance between the nadir of the touch point and the intersection of the tangent on the stabilization asymptote.

The difference between an assumed accumulation with an airborne fraction f=0.5 and the course of the ppm curve with the real strongly decreasing values of f can be seen clearly. The equilibrium temperature, which rises only slightly with the concentration, is also indicated (zero point is 1988 at 350 ppm, the doubling sensitivity is 0.6 degC including clouds, water vapor and feedback).

On the basis of curve a) or the model differential equation, a stabilization results if dC/dt=0, whereby E=C/tau or C=E*tau. Since the anthropogenic buffer content is C=delta_ppm*2,123*1,33 GtC, delta_ppm can be calculated from a continuous emission of E*tau/2,123/1,33. For E=7 GtC this is 136 ppm and for 11.3 GtC 220 ppm (which makes 500 ppm after addition of 280 ppm).

Fig.3 shows what the result of a realistic simulation calculation looks like for the scenario IS92a modified beyond 2025 by the author. The curves were calculated in 2002. The increasing global emission up to 10.6 GtC in 2017 resulted in a concentration increment to 400 ppm (!). The available fossil reserves which were estimated to be 1320 GtC in 2000, were burnt here (with a peak emission of 12 GtC around 2035) yielding a maximum of only 470 ppm – without any political restrictions on CO_2. For the CO_2 reduction until 2150 and thereafter, nuclear breeding reactors using thorium and fusion energy were assumed. A significant proportion of solar and wind energy was not considered realistic at that time. For comparison, Fig.3 also shows the highly growing and far too high ppm values over time, which were calculated approximating IPCC (using two best matching parameters).

Conclusion: Realistic carbon models with sink flows proportional to the ppm increment, yield for example a stabilization at only 500 ppm with a continuous emission of about 11 GtC. Thus CO_2 reductions or even a complete decarbonization (whose calculation for Germany results in only 0.01 degC or for USA in 0.065 degC) according to some flawed "residual budget" are unnecessary and the same holds for energy transition, coal and oil phase-out, electric mobility and the cost of many trillion USD.

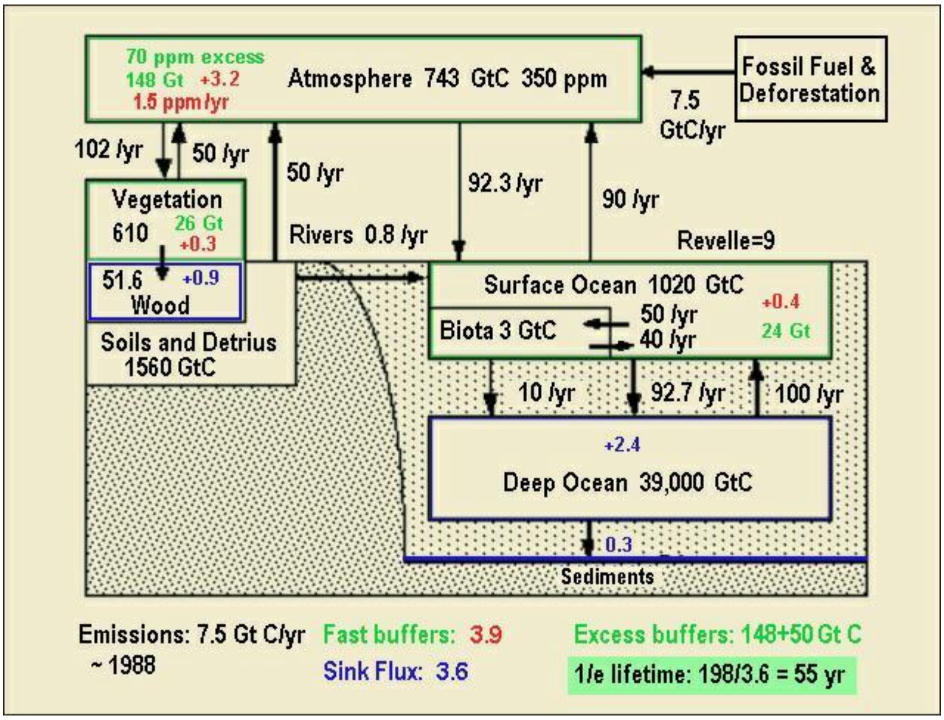

Fig.1: The carbon flows and buffer contents in 1988 at 350 ppm were one of the three basics for determining the 1/e time-constant

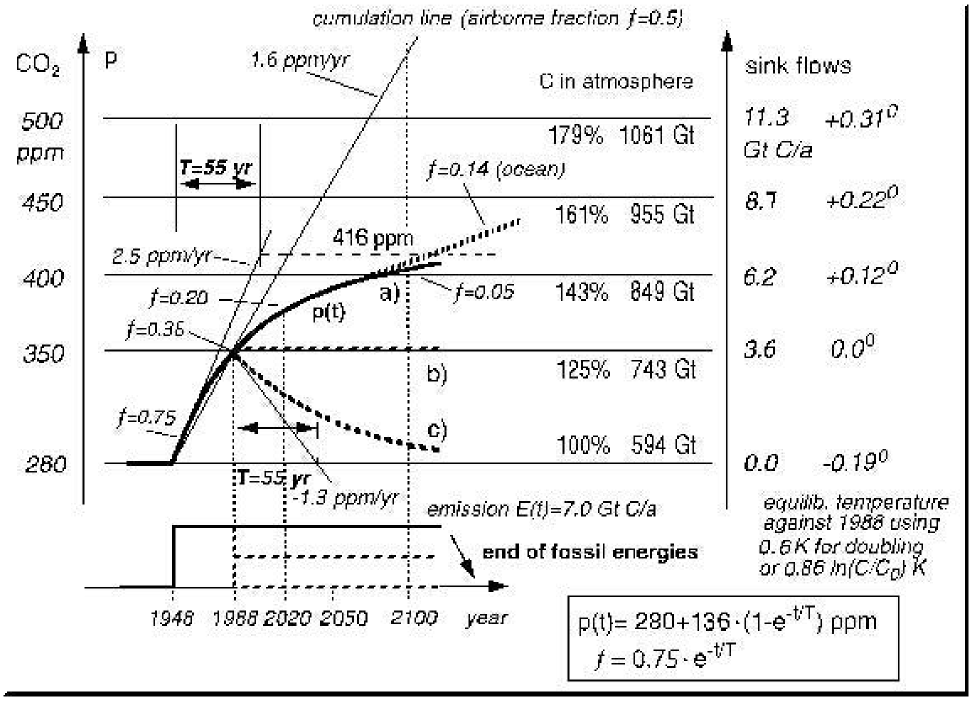

Fig.2: Example of model dynamics at constant emission. The sink flows in GtC/a are (ppm-280)/19.43 at tau=55 a

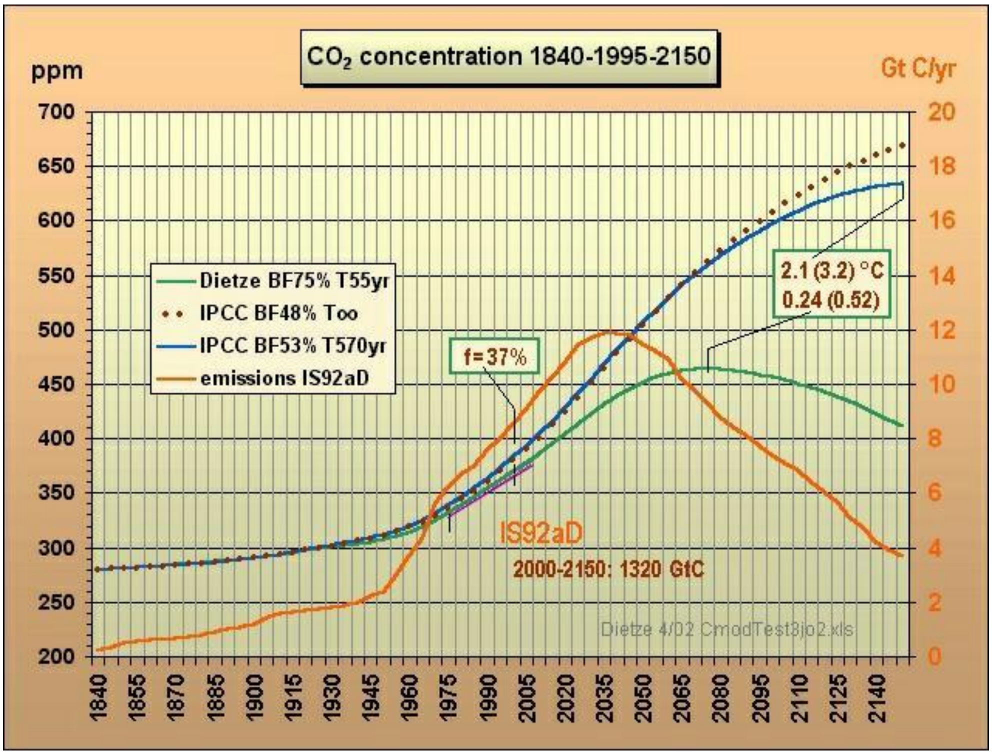

Fig.3: Calculation of the IS92a scenario in 2002, which was modified by the author beyond 2025 to reduce the emission to 3.5 GtC by 2150 and not to burn more than available 1320 GtC. Parameters: T=time-constant tau, BF=buffer factor (share of atmosphere in the total buffer, e.g. 1/1,33=75%)