

## **What the “Snowball Earth” Events of the Past May Offer in 2018 in the Accelerating Face of Excessive Greenhouse Gases and Continued Ozone Layer Issues**

In the Geo sciences, the study of how increased oxygen levels oxidized off the greenhouse gas layer and triggered cooling and glaciation may offer a similar opportunity in present day discussions on taking action to halt global warming by again removing greenhouse species<sup>1</sup>. The fossil record shows us that the main oxidants must come from oxygen, and that they were very effective at those times. Today, atmospheric oxidants are unequivocally relied upon for species removal of all kinds, including methane and most synthetic greenhouse gases<sup>2</sup>.

“The hydroxyl radical (OH) is the primary atmospheric oxidant, and reaction with tropospheric OH is the most important removal process for many ozone-depleting substances (ODSs), their replacements, and other gases that contain one or more hydrogen atoms, for example, hydrochlorofluorocarbons (HCFCs) and hydrofluorocarbons (HFCs). Many of these compounds are also potent greenhouse gases (GHGs) and can exert significant impacts on climate. The rates at which these long-lived gases are removed from the atmosphere, and therefore their lifetimes, are dependent on the atmospheric OH abundance<sup>2</sup>.

Oxygen is photolytically split into O atoms, made reactive by solar radiation, and becomes an oxidant through excitation in the presence of water:  $O(1D) + H_2O \rightarrow 2OH + O_2$ ,<sup>3</sup>. From this point it reacts with all oxidizable species, including most greenhouse gases (mainly excluding CO<sub>2</sub> and water). Synthetic greenhouse gases (SGHGs) are estimated to make up at least 78 ppm of CO<sub>2</sub> equivalent warming and bring the total actual warming effect to at least 478 ppm of CO<sub>2</sub> equivalents<sup>4,5</sup>. This is 40% of the post industrial warming on record.

The snowball earth phenomenon could be brought to bear on these synthetic gases, as well as methane by an oxygen release at 18-22 Km altitude, where these gases are situated, and creating the greenhouse effect, (while they are attacking the ozone layer at the same time). To restore oxygen levels enough to these altitudes would restore ozone levels at the same time as providing oxidation of the greenhouse gases. If, as Dr. Peter L Ward teaches, global warming is also caused by ozone depletion, and if the consensus is still that no, greenhouse gases are, an oxygen airlift to the lower stratosphere would treat both theories directly, and we would have restoration for both of the major global warming postulations in science<sup>6</sup>.

Ozone layer depletion is well described by retired Geophysicist and Professor Peter L. Ward on his web site and in his publications. In summary ozone receives UVB and UVC radiation which is 48 times hotter than infrared and in its reaction to the UV, it oscillates and gives off converted heat as kinetic energy to its surroundings, which effectively removes this heat from the equation. This function serves to cool the atmosphere beneath it, thereby causing less heat to enter the lower altitudes. By direct association less ozone means less of this function is happening. A correlating fact is that when ozone levels are higher, the surrounding stratosphere is warmer. It may be very important that heat removal high up like this nearer to space where there are fewer species to interfere with heat escape occurs as

the temperature differential leverages heat removal to space at that altitude in the natural system. This natural phenomenon of ozone cannot be ignored. 400 MT of ozone or 12% is made by the Sun every day, and for every 1% of ozone depletion, a 2% increase in the radiance reaches the ground (or “heat”). This would result in a significant warming phenomenon especially if we combine it with an overabundance of species in the atmosphere like aerosols and more gases that interfere with radiative cooling. Ozone effectively does what proposed SRM aerosol spraying might attempt to do, but it is nontoxic and natural, focuses on blocking damaging UV triggered heat and burning radiation that overheats by a relative factor of two upon being extinguished<sup>6</sup>. It is well known that the poles are where the fastest warming is occurring and is also where the largest “ozone holes” are formed so the two problems must be conjoined with the problem of ozone depletion.

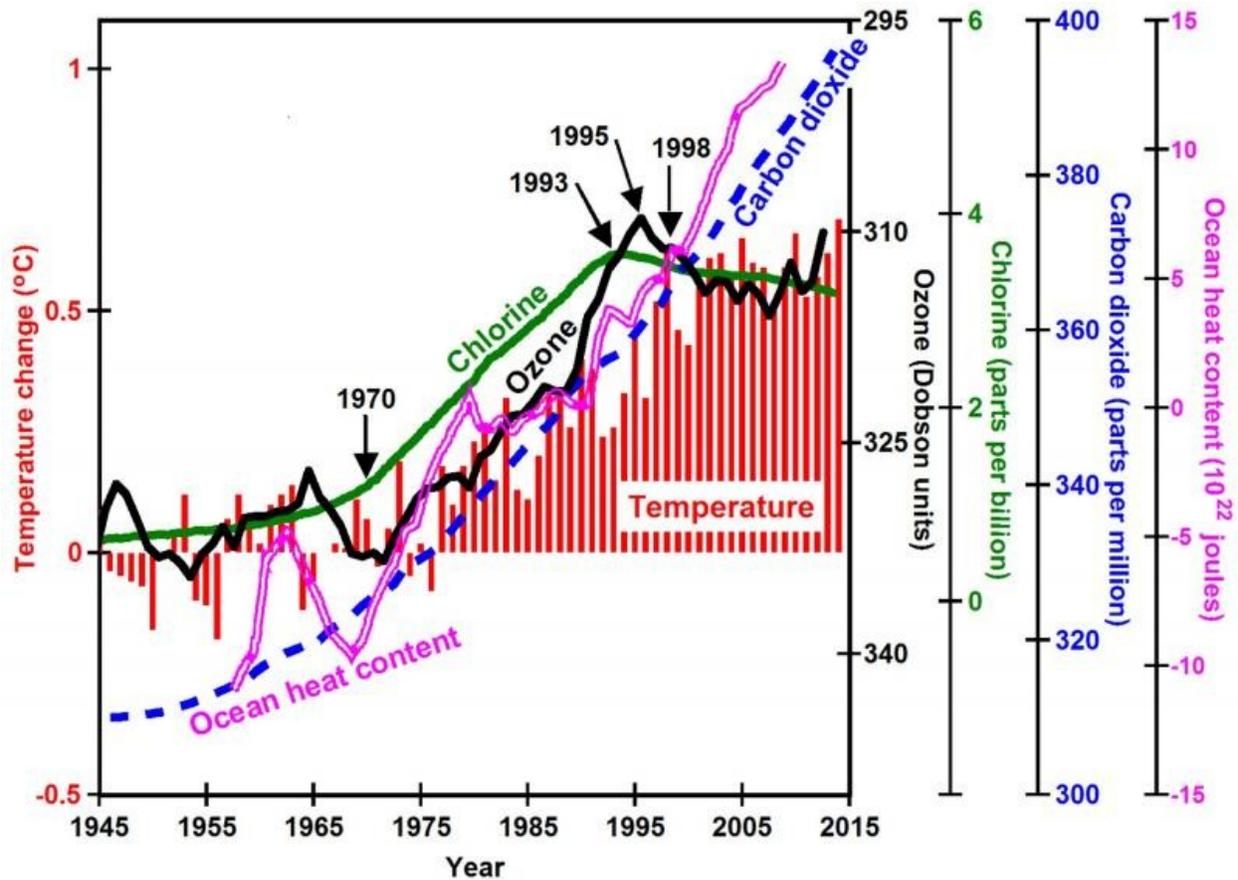


Figure 1. Peter L Ward data graph showing historical relationship with ozone depletion trajectory and global warming temperature trajectory<sup>6</sup>.

Perhaps the greenhouse gases and the ozone depletion need to be taken together as deficiencies to rectify with an airlift of oxygen to the lower stratosphere as we witness a lagging ozone recovery along with increasing greenhouse gases. We don't have the luxury of time, and the snowball Earth events caused oxygen to increase at this altitude and created global cooling towards glaciation. This was back when methane was the offending GHG<sup>7,8</sup> so we can surmise that with our dangerously increasing methane levels, we would at least cover that base as well. Methane absorbs similar frequencies to

ozone as seen below. Oxidizing methane at the level of the ozone layer and increasing ozone levels to replace it means the GWP heat escape blocking impact is removed at the same time, similar to the snowball earth phenomenon.

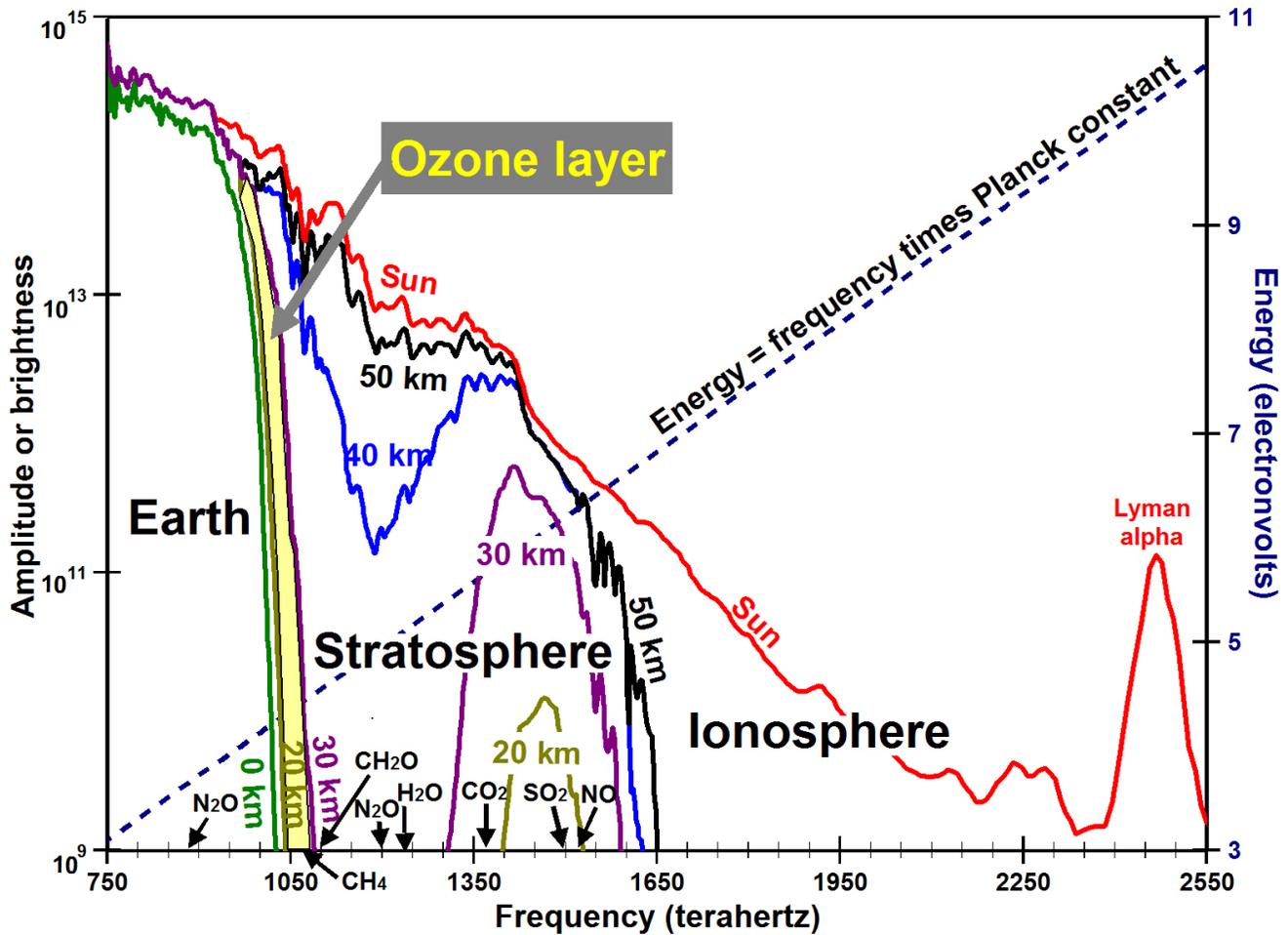
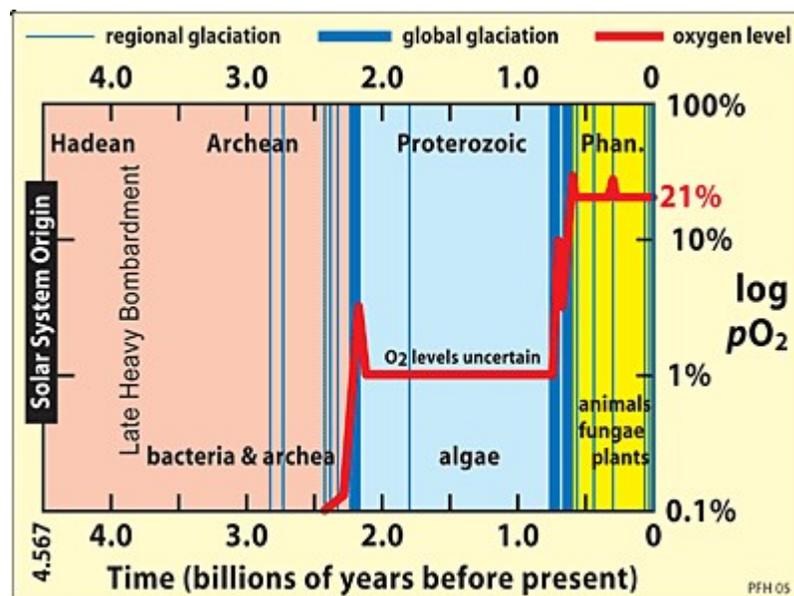


Figure 2. The amount (flux) of radiation from the Sun (red line) decreases rapidly as the wavelength of ultraviolet energy decreases. The most energetic wavelengths are progressively absorbed (filtered out) by the time the radiation reaches altitudes of 50 km (black line), 40 km (blue), 30 km (purple), 20 km (olive), and Earth's surface (0 km, navy blue) (DeMore et al., 1997). Note that essentially all radiation with frequencies greater than 1034 terahertz has been absorbed by the time sunshine reaches Earth. Global warming occurs when some of this energy normally absorbed by ozone in the stratosphere reaches Earth's surface. Source: <https://ozonedepletiontheory.info/primary-cause-of-warming.html>

As the below graph shows, oxygen levels are pivotally tied to glaciation.



Source: Figure 3. <http://www.snowballearth.org/when.html>, reported in 1997 by David Evans, Nic Beukes and Joe Kirschvink (who named and recognized the cyclic nature of snowball earths).

From line 75, W. T. Ball et al writes, “Suggestions of a decrease in lower stratospheric ozone have been presented elsewhere (Kyrölä et al., 2013; Gebhardt et al., 2014; Sioris et al., 2014; Nair et al., 2015; Vigouroux et al., 2015).

However, it has been difficult to confirm (WMO, 2014) because: (i) ozone is typically integrated over wide latitude bands and/or total column ozone (TCO) is considered, both of which may lead to cancellation of opposing trends; (ii) large dynamical variability unaccounted for in regression 80 analysis together with shorter timeseries lead to higher uncertainties...<sup>10</sup>. So here we see that there are emerging understandings of the flaws in present ozone measurement which is critical at this juncture.

With the onset of the emerging field of geoengineering, the prospect of aerosol spraying and all of its attending negative repercussions, including more ozone layer depletion, we need another equally affordable and preferably, historically proven option<sup>9</sup>. This is where the science of the snowball earth phenomenon may serve us in our time of need.

A request for computer modeling of an airlift of oxygen from existing industrial oxygen capacity has been made to several computer climate modeling groups. Something in the order of a gradual 6-12 MT airlift of oxygen to the lower stratosphere at 17-24 Km over 10 years was made. Before embarking on this kind of action, the airlift calculations need to be assessed in detail by several third parties, and presented to global and international bodies in science and policy making. The amount of oxygen required should be weighed with present atmospheric composition and losses to secondary reactions. To be sure, the losses from CO<sub>2</sub> emissions created in the airlift and oxygen manufacture can be considered alongside the generally non toxic nature of this measure. It is speculated that present carbon levels (CO<sub>2</sub> and CH<sub>4</sub>) provide a “warm envelope” that would act as a significant partial buffer to creating any kind of overshoot in cooling and can be calculated relatively precisely. The amount of

oxygen used relative to the 30 B Tonnes of oxygen estimated to be produced by plants annually should be relatively small by comparison. We have a significant oxygen content in the atmosphere estimated at 1,200,000B Tonnes and the most is available at ground where we can manufacture it.

Oxygen is the only species widely noted as a trigger for long term global cooling in the fossil record and is conjoined to the formation of an ozone layer in the fossil record<sup>6</sup>.

The oxygen airlift, as it is suggested, deserves an in depth review and consideration before we embark on further efforts to halt global warming with popularized interventions that have so many wide ranging negative consequences. We could be looking at addressing this notable list of problems:

1. Reduction and removal of synthetic greenhouse gases which are causing 80 ppm of CO<sub>2</sub> equivalent warming to the planet.
2. Ozone depleting substances removal or reduction.
3. Thickening up the ozone layer, increasing needed UV protection by reducing the relative chlorine, fluorine and bromine fractions.
4. Methane gas removal which appears to be becoming extremely urgent.
5. Reduce acceleration of global warming and species extinction.
6. Slow and may even reverse ice loss.

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