Climate Intervention

Message from discussion A Geochemical Approach to Global Warming?

Mike MacCracken View profile Translate to English More options Feb 6, 11:46 am

Aside from the triggering issue, it would be interesting to know if the formation of something like one of the Hawaiian islands or the ongoing formation of Iceland took out carbon at a rate that is near to what is being discussed. Related to removing carbon now as a result of island formation, it would be interesting to know if there might have been effects from this in the past. That is could island formation be something that should be considered an occasional factor in the carbon budget.

Mike MacCracken

On 2/5/10 12:43 AM, "Arcolo...@aol.com" <Arcolo...@aol.com> wrote:
> Hello, Andrew,

> Well, I can't disagree with your observations. I was hoping to get some
> advice somewhere on how to trigger an eruption of sufficient size. Lacking
> such information, I went ahead and calculated the size of eruption that would
> be needed to reach the desired scale of absorbing 1x10^14 kg of CO2. Result:
> It would require triggering of hundreds of volcanoes of medium size, all
> discharging ultrabasic magma. OR triggering of one supervolcano.

> A supervolcano is roughly one scoring a volcanic eruption index of VEI-8,
> which discharges at least 1000 cubic kilometers of magma. The density of the
> desired magma is about 3000 kg /cu.meter. From this, the mass of magma
from a
> supervolcano eruption is about 3x10^15 kg. I estimated the base equivalent
> weight of ultrabasic magma to be 100 kg (assuming 20% MgO composition).
> Dividing gives 3x10^13 kilogram equivalents from the eruption. That compares
> to a desired amount of 5x10^12 to absorb the CO2 -- that's a pretty good match
> considering the process will be very inefficient.

> OH, MY! I guess I didn't fully realize the magnitude of the problem!
> Eruption of a supervolcano, even at the bottom of the ocean, carries as much
> risk of annihilating us as does the atmospheric CO2.

> Still, the "solution," even if totally impractical, at least has the quality
> of being nearly big enough to do the job. And it's a reminder that we are
> playing a risky game on a planetary scale.

> Ernie Rogers

> In a message dated 2/4/2010 5:34:47 P.M. Mountain Standard Time,
> andrew.lock...@gmail.com writes:
>> That's a nice theory but what possible method is there to make a big hole in
>> the ocean crust. Even if you could drop an oil rig on the ocean floor,
>> drill a big hole in the crust, drop the world's biggest nuclear bomb in the
>> hole and then blast it - would that be enough? I don't think it would....

>> We discussed manipulating terrestrial volcanoes on these lists before, and
>> no-one could think of a way to do that. Surely it would be much harder to
>> engineer this idea?

>> Even if you could get the rock out of the mantle, there's nothing to suggest

>> it would come out in an easily-reactive form. Adjusting the weathering of
>> existing rock - for example by promoting frost shatter - may be a more
>> successful approach. However, this has also been analysed and has been
>> considered to be impractical.

>> A

>> On 4 February 2010 19:31, <Arcolo...@aol.com> wrote:

>>> Hello, folks,

>>> I am working on an idea to reset the earth's CO2 level back to normal.
>>> Currently, I'm seeking support from geologists and related disciplines.
>>> Here is the idea-- /Ernie Rogers

>>> Introduction

>>> In the discussion to follow, I am exploring the idea of
>>> "unwinding" the planet from its global warming problem by a geochemical
>>> approach—to remove the present excess CO2 from the atmosphere and
oceans
>>> with the aid of volcanic processes. This is not imagined as a permanent
>>> solution, but rather giving us time to find a more permanent one. The
>>> discussion looks at the solution first, assuming the problem is understood.
>>> Then background information about the problem is presented.

>>> A Geochemical Approach to Global Warming?

>>> When some kinds of minerals are hot enough, they decompose into
>>> basic and acidic parts. For example—

>>> MgSO4 → MgO + SO3,

>>> CaCO3 → CaO + CO2

>>> This sort of process occurs in volcanoes. The acidic part is often a gas
>>> and the basic part is a somewhat dense solid or liquid, depending on
>>> temperature. Now, consider the creation process of the earth—it was
>>> extremely hot in its early existence. This early molten planet, we should
>>> expect, separated out into a "basic" interior and an outer lighter,
>>> partially gaseous, "acidic" layer. The core and the mantle should largely
>>> retain this structure while the crust and atmosphere have been modified by
>>> biological processes to a somewhat less acidic state involving formation of
>>> free oxygen and some reduced materials like coal and hydrocarbons.

>>> Now, we are undoing millions of years of biological effort by
>>> burning up fossil energy stores in a few hundred years and re-acidifying
>>> the surface of the planet in the process. Atmospheric CO2 now stands at
>>> an unprecedented 390 ppm and the oceans are becoming dangerously
acidic,
>>> interfering with biological cycles. Of course we know we should stop
>>> making CO2. We will eventually do that but it will be too late when we
>>> actually get serious about it. (It's really too late now.) As I see it, a
>>> logical "solution" to consider is to seek to recombine basic materials
>>> found in the mantle with the excess CO2 in the biosphere. Can that
>>> practically be done? To have a meaningful effect, a way must be found to
>>> release enough basic material to absorb 1x10^14 kg of CO2 per year. That
>>> is, about 5x10^12 kilogram equivalents of basic mineral per year.

>>> From here on, I am speculating. Could it be possible to
>>> stimulate enough eruptions of submarine volcanoes to discharge the
required
>>> amount of basic mineral into the deep ocean? What amount (chemical
>>> equivalents) of base can we expect the magma to contain and how much of
it
>>> might be exposed to react with the CO2-rich water? The heat from the

magma
>>> plus heat from the acid-base reaction will cause a large upwelling of deep
>>> (more basic) sea water to the surface. This basic water would then remove
>>> CO2 from the atmosphere on a short time scale. Note that deep ocean
water
>>> is already relatively basic because it has a much lower concentration of
>>> CO2 (and bicarbonate) than presently at the surface. That is because the
>>> deep water was put in place in earlier millennia when atmospheric CO2 was
>>> at about 280 ppm or less. Conceivably, a substantial reduction in
>>> atmospheric CO2 could occur even without the basic mineral.

>>>   Now, one more factor to consider—deep ocean water naturally
>>> contains an abundance of plant nutrients such as nitrogen and phosphorus.
>>> Mantle material can add other key "phytonutrients," in particular, iron and
>>> silicon. The result is the possibility that the upwelling flows will
>>> enrich the surface ocean water for an extended period, thus increasing
>>> biological production. Possible benefits are further absorption of CO2
>>> (from biological activity) plus some added food production in the oceans.

>>> Stating the Problem

>>>   The world is currently using 408 quadrillion BTUs of energy per
>>> year. Eighty percent of that energy is obtained by burning fossil fuels
>>> and releasing carbon dioxide into the atmosphere. Global emissions are
>>> estimated to be 3x10^13 kg of CO2 per year. While experts tell us we
>>> should cut emissions by 80% by 2050, so far there has been no slowing, but
>>> rather further increases. The CO2 level in the atmosphere continues to
>>> rise.

>>>   CO2 in the atmosphere is now at 390 ppm molar concentration at
>>> mountaintop level, or just a little less. This translates to about 3x10^15
>>> kg of CO2 in the global atmosphere.   Climatologists are telling us that the
>>> atmospheric concentration must be lowered to 350 ppm if we are to avoid
>>> catastrophic climate change.
>>> (http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf
>>> <http://www.columbia.edu/~jeh1/2008/TargetCO2_20080407.pdf>)

>>> That means the atmosphere must lose about 3x10^14 kg of CO2, a 10%
>>> reduction. The CO2 must be removed by some purposeful process since
just
>>> waiting for it to dissipate could take a thousand years.
>>> http://www.pnas.org/content/106/6/1704.full?sid=da072a3c-dc18-4132-b9...
>>> 5af65f74
>>> <http://www.pnas.org/content/106/6/1704.full?sid=da072a3c-dc18-4132-b9...
>>> 85af65f74>

>>>   At present, there is no obvious way to achieve even this modest
>>> goal—but that isn't enough. There is very nearly a chemical equilibrium
>>> between atmospheric CO2 and the CO2 dissolved in the top 200 meters of
the
>>> oceans, with a relaxation time believed to be less than one year. (Need a
>>> reference here.)   For every kilogram of CO2 removed from the atmosphere,
>>> another 1 to 1.5 kilograms of CO2 will have been given up and removed from
>>> the oceans (because of the equilibrium reaction).   With this added
>>> burden, the amount of CO2 to be removed is about 7x10^14 kg of CO2, and
it
>>> doesn't matter whether the CO2 is removed from the atmosphere or from the
>>> top layer of the oceans, the effect is the same.   Whatever the removal
>>> process is, to work in the near-term it will have to be rapid, of the order
>>> of 1x10^14 kg per year, or it will be overwhelmed by the rate of emissions,
>>> which will not drop significantly in the near term, more likely it will
>>> increase.

>>> Conclusion: We need a way to remove about 1x10^14 kg of CO2 from the
(air
>>> or ocean) every year for at least 10 years. Our lives may depend on it.
>>> It is proposed that we seek an engineering solution involving the
>>> purposeful release of basic materials (e.g., magma) into the deep ocean
>>> basins.

Forward