

Cooling the atmosphere may be our only hope

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The release of some 910 billion tonnes of carbon dioxide since the onset of the industrial age is leading human society to an existential impasse. Reports from the Madrid COP-25 climate conference suggest negotiations were almost exclusively focused on reduction of carbon emissions. This avoids the evidence that the high atmospheric concentration of CO₂, at 410 parts per million (or 500 ppm when combined with methane and nitrous oxide) has created amplifying feedbacks. These include the release of methane from permafrost, desiccated vegetation, extensive fires, a reduced capacity of warming oceans to absorb CO₂, and the melting of ice sheets, which opens ocean and land tracts that absorb infrared radiation, pushing global temperatures further upwards.



Cutting emissions is absolutely necessary - but is it even enough? Picture: Shutterstock

Due to these amplifying feedbacks and the long-term residence of greenhouse gases in the atmosphere, attempts to limit further temperature rises to 1.5 degrees, or a maximum of 2 degrees, by emissions reduction alone may not be possible. Indeed, whereas abrupt reduction in CO₂ emissions is absolutely essential, no one knows how to prevent further warming, for the following reasons:

- An increase in evaporation due to warming of the land and oceans leads to further heating due to the greenhouse effect of water vapour. This factor, significant in the tropics, is less important in the dry subtropical zones and relatively minor in the polar regions.
- The release of methane from melting permafrost and bubbling of methane hydrates from the oceans has already raised atmospheric methane levels from about 800 to 1863 parts per billion - which, given the radiative effects of methane being 25 times that of CO₂, is significant.
- As the oceans warm they become less capable of taking up carbon dioxide.

Encroachment of tropical and subtropical climate zones into temperate Mediterranean-type climate zones leads to extensive fires, constituting a factor in the current bushfires raging across eastern Australia, which have already released 250 million tonnes of CO₂ - almost half of country's annual emissions in 2018.

Stabilisation and cooling of the climate would include two principle approaches: solar shielding and CO₂ sequestration. However, solar shielding by injected aerosols is bound to be transient, requiring constant reinjection. According to Professor James Hansen, carbon sequestration in soil using the biochar method (oxygen-free combustion using residues of crops, forestry and animal waste) would sequester large amounts of CO₂ from the atmosphere. The biochar method helps soil retain nutrients and fertilisers, reducing the release of greenhouse gases such as nitrous oxide.

Other methods of carbon sequestration, if applied on a large scale, include the streaming of air through basaltic rocks, where the CO₂ is incorporated with calcium and magnesium as carbonates.

The big question is how effective these methods are in reducing CO₂ levels on a global scale - at the very least in being able to balance emissions, currently at 36.8 billion tonnes of CO₂ per year. Whereas each of the methods I've mentioned have advantages and disadvantages, it is hard to see an alternative way of cooling the atmosphere. Budgets on a scale of military spending (\$1.7 trillion in 2017) would be required for any attempt to slow down the current trend across climate tipping points to have a chance of working. The choice humanity is facing is whether to spend its dwindling resources on wars or on defence of life from the climate calamity.

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