Introduction:

Mitigating global warming is likely to require major upheavals to the way we live and produce energy. But could there be an easy and cheap alternative? Geoengineering refers to the manipulation of certain factors that control the climate system with a view to halting or reversing global warming. In this exercise, you'll run geoengineering tests on our virtual climate system.

Instructions and questions:

1. Select the 'Business as usual' RCP85 emission scenario.
2. Run the scenario to see how temperature and other climate variables change under this scenario (see tutorial for detailed instructions)
3. Re-edit the scenario, but this time turn off SO_2 aerosol emissions [i.e. SO_2 emissions is set to zero]
   - *Comparing the two above scenarios what effect does SO_2 have on global temperatures, sea level and pH?*
   - *Explain what effect SO_2 has on the energy balance (i.e. energy coming into and out of the climate system)*
4. Reset the scenario and select advanced mode. Scroll to SO_2 and select 5 nodes. Move the last two nodes so that instead of SO_2 emissions going down after the end of the 20th century, emissions keep rising.
   - *How does this affect future temperature?*
5. Repeat the above using more nodes and try to design a scenario that would stabilise temperatures at current levels or gradually bring temperatures back down to pre-industrial levels (i.e. so the temperature difference drops back to close to zero)
   - *Do you think this is a good solution to the problem of global warming?*
   - *Are here any potential side affects? (e.g. take a look at the other climate variables)*

Advanced

Proposed geoengineering technologies inject SO_2 aerosols into the upper atmosphere (where they last for a few years). However, so far, we have been changing the human SO_2 emissions. These only go into the lower atmosphere and are rapidly removed (over the course of a few days). Design a scenario that will simulate SO_2 emission into the upper atmosphere [you will need to export the RCP85 scenario, modify the input variables in excel and then re-import them as a new Carbonator scenario]

Discuss the pros and cons of geoengineering. Do you think this is something we should be considering to offset the effects of global warming? Can you think of other instances where we have tried to engineer environmental problems/ have these solutions been successful?

Resources:

https://en.wikipedia.org/wiki/Climate_engineering
https://www.theguardian.com/global-development/2018/apr/05/scientists-suggest-giant-sunshade-in-sky-could-solve-global-warming
https://www.technologyreview.com/s/540071/dont-count-on-geoengineering-the-oceans/