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12.085 Assignment 2

Teller et al. (1997) argues that it is much cheaper to combat global warming through geoengineering (specifically, scattering incoming solar radiation by injecting particles into the atmosphere or Earth's orbit) than through limiting greenhouse gas emissions.

The paper discusses in detail the efficiency of various ways of deflecting sunlight from Earth. In particular, the focus is on the estimated cost for each method and the estimated mass of scatterers needed. One idea is to inject alumina particles into the stratosphere. The effects will be similar to injecting sulfates, but without the associated problems of acid rain and air pollution. It's interesting that the estimated amounts of alumina (and SO_2) needed are insignificant compared to the annual output from natural and anthropogenic activities. One disadvantage to this solution is the particles' short residence time of 5 years in the stratosphere. The alumina would have to be re-injected many times to achieve a long-term effect. This increases the cost associated with such a solution, but it also offers opportunities for improvements over time. Other solutions such as placing reflective shields seem more risky in this aspect, due to the high initial cost and the difficulty in adjusting them if something goes wrong.

I was surprised at the ambitious, almost arrogant tone of the paper. The authors state in the abstract that their plans may be used to "reduce or eliminate all climate failures." We could have complete control over the climate. The most ambitious solution, called "fine-grained insolation modulation," has the potential to warm or cool the surface at different latitudes, allowing for climate control on a regional scale. It could be used for

stopping both global warming and future ice ages. Overall, I think the authors are too optimistic. Even if it becomes technically and economically feasible to control climate on local scales, the politics of the process will be messy. Everyone will have different ideas of what is the "best" climate for each region, and it will be nearly impossible to agree on a plan.

References:

Teller et al., (1997), Global Warming and Ice Ages: Prospects for Physics-Based Modulation of Global Change, *Report for the 22nd International Seminar on Planetary Emergencies*, Erice (Sicily), Italy, 20-23 August 1997.