Title: Interventions that May Prevent or Mollify Supervolcanic Eruptions

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Interventions that May Prevent or Mollify Supervolcanic Eruptions

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Highlights:

- Supervolcanic eruptions could destroy civilization or worse.
- Little work has been done on preventing super volcanic eruptions.
- We propose 49 new interventions to prevent or mollify supervolcanic eruptions.
- Adding dams or soil could delay eruption 100 years with 1 to 15 years of effort.
- Cost-effectiveness and reducing scientific uncertainty are important future work.

Abstract:

A supervolcanic eruption of 10^{15} kg could block the sun for years, causing mass starvation or even extinction of some species, including humans. Despite awareness of this problem for several decades, only three interventions have been proposed. In this paper, we increase the number of total possible interventions by more than an order of magnitude. The 52 total interventions involve changing magma characteristics, venting magma, strengthening the cap (rock above the magma), putting more pressure on the magma, stopping an eruption in progress, containing the erupted material, disrupting the plume, or provoking a less intense eruption. We provide qualitative evaluations of the feasibility and risk of 37 of the more promising interventions. The two most promising interventions involve putting more pressure on the magma and delaying the eruption with water dams or soil over the magma chamber. We perform a technical analysis, accurate to within an order of magnitude, and find that water dams and soil and could statistically delay the eruption for a century with 1 and 15 years of effort, respectively. All actions require essentially untested geoengineering challenges along with economic, political and general public acceptance. Further work is required to refine the science, provide cost estimates, and compare cost effectiveness with interventions focusing on adapting to a supereruption.

Key index words/phrases: Global catastrophic risk; supervolcano; existential risk; geothermal energy; geoengineering; Yellowstone

1. Introduction