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Counteracting global warming by using a locally variable Solar Radiation Management

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Solar Radiation Management (SRM) is regarded as a tool which could potentially mitigate or completely offset global warming by increasing planetary albedo. However, this approach could potentially reduce precipitation as well, as shown in the latest Intergovernmental Panel on Climate Change (ICPP) 5th report. Thus, although SRM might weaken global climate risks, it may enhance those in some regions. Here, using the Globally Resolved Energy Balance (GREB) model, we present experiments designed to completely offset the temperature and precipitation response due to a CO_2-doubling experiment (abrupt2×CO2). The main idea around which our study is built upon is to employ a localized and seasonally varying SRM, as opposed to the most recent Geo-Engineering experiments which just apply a global and homogeneous one. In order to achieve such condition, we carry out the computation by using an "artificial cloud cover". The usage of this localized approach allows us to globally cut down temperature warming in the abrupt2×CO2 scenario by 99.8% (which corresponds to an increase of 0.07 °C on a global average basis), while at the same time only having minor changes in precipitation (0.003 mm/day on a global average basis). To achieve this the cloud cover is increased by about 8% on a global average. Moreover, neither temperature nor precipitation response are exacerbated when averaged over any IPCC Special Report on Extremes (SREX) region. Indeed, for temperatures, 90% of SREX regions averages fall within 0.3 °C change, with all regional mean anomalies being under 0.38 °C. Whereas, as far as precipitation is concerned, changes go up to 0.01 mm/day for 90% of SREX regions, with all of them changing by less than 0.02 mm/day. Similar results are achieved for seasonal variations, with Seasonal Cycle (DJF-JJA) having no major changes in both surface temperature and precipitation.