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Regional Weights and Cost-Risk Trade-off of Solar Radiation Management and Mitigation

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While solar radiation management (SRM) offers an option to ameliorate anthropogenic temperature rise, it is not simultaneously expected to perfectly compensate for anthropogenic changes in further climate variables. Here, considering different regional weights in regional temperature and precipitation disparities, we ask to what extent a proponent of the 2°C-temperature target would apply SRM in conjunction with mitigation. We utilize cost-risk analysis in 'Giorgi'-regional-scale to evaluate the optimal mixture of SRM and mitigation under probabilistic information about climate sensitivity for regional temperature-risk-only, regional precipitation-risk-only, and equally-weighted both-risks scenarios. Our results indicate that in the temperature-risk-only scenario, SRM can reduce all regional temperature risks to zero with negligible cost in all weighting analyses. Although SRM can almost perfectly substitute for mitigation in temperature-risk-only scenarios, it matters how Giorgi regions are weighted in the regional precipitation-risk-only and both-risks scenarios. Giving the whole weight to only one region, SRM will be almost perfectly substituted for mitigation in all cases except for five regions in the precipitation-risk-only and thirteen regions in the both-risks scenario. When considering all regions with their own specific trade-off parameters, from previous evaluation, divided by the number of regions, regional population weights, and regional area weights, SRM saves only about 1/10 of mitigation costs in the precipitation-risk-only and both-risks scenario. In GDP weighted specific trade-off parameters, SRM can save 1/4 to 1/2 of mitigation costs, respectively in the precipitation-risk-only and both-risks scenario. By considering only critical regions in the analysis, SRM saves only about 1/20 to 1/5 of the mitigation costs, respectively in the precipitation-risk-only and both-risks scenario. In population and GDP weighted risks, SRM can save 3/4 to 4/5 of mitigation cost, respectively in the precipitation-risk-only and both-risks scenario. This substitution will be decreased to 2/3 and 3/4 of mitigation cost in the area weighted analysis.
To sum, in our study, we show the complexities of decision making on the optimal climate policies when regions have different weights. This has been ignored in the welfare-based economic studies so far. The optimal mix policies would widely differ depending on the social planner's choice of regional risks weighting.