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Solar Radiation Modification: a multi-century commitment

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A growing body of literature investigates the effects of Solar Radiation Modification (SRM) on global and regional climates. Previous studies on SRM have mainly focused on potentials and side effects of deployment without addressing plausible avenues of a subsequent phase-out. This would require large-scale carbon dioxide removal (CDR). Here, we look at SRM deployment lengths to keep global temperature increase to 1.5°C under three emissions scenarios that follow current climate policies until 2100 and are continued with varying assumptions about the magnitude of net-negative CDR (-11.5, -10 and -5 GtCO₂yr⁻¹). Our results show that there would be a lock-in of around 245 - 315 years of continuous SRM engagement. During peak deployment in 2125 around 2.80 Wm⁻² would have to be compensated by SRM, a number at the upper end of currently estimated maximum SRM potential in climate model environments. In total, around 976 - 1344 GtCO₂ would need to be removed from the atmosphere via CDR. We find only minor effects of SRM on carbon fluxes a few decades after cessation. Our study shows that even if SRM is combined with high CDR, SRM would come with very long legacies of deployment, implying centuries of costs, cumulative risks and all negative side effects of SRM and CDR combined.