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Mitigating the Climate Crisis from Space (6)

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THE INTERNATIONAL PLANETARY SUNSHADE - AN UMBRELLA PROJECT TO FOSTER INTERNATIONAL COLLABORATION TO MITIGATE GLOBAL WARMING

Abstract

The dramatic climate changes indicate that our existing actions against climate change are not sufficient to prevent critical tipping points from being reached. In addition to various terrestrial geoengineering methods, there are currently efforts to investigate new ways of integrating space-based geoengineering into the short-term construction of a buffer solution - the International Planetary Sunshade (IPSS). This poses new logistical and technological challenges that can only be mastered through the collaboration of space agencies, private companies, and the support of society. Therefore, the integration into international roadmaps is essential to exploit synergies, shorten development timeframes and promote international cooperation against climate change. To achieve this goal, a sustainable technology concept using lunar resources has been designed within this work to achieve stepwise Earth independence. In this context, the momentum in lunar exploration and the current efforts for space-based energy supply shall be used to integrate planned technology developments for sustainable lunar operations as well as for space based solar power. This can significantly reduce the cost of constructing a sunshade constellation and the deployment time. As a first step, an evolutionary sunshade concept was designed within the framework of a sunshade design study, which, based on a purely terrestrial sunshade design and the relevant technologies, should enable a step-by-step approach to a sustainable sunshade design based on lunar resources, incorporating current international technology trends. The parameterized modular sunshade concept shall allow a time- and cost-variant adaptation of the technologies to enable a continuous optimization of the sunshade design by embedding current knowledge and also enabling the evaluation of potentials for extended applications, such as a solar power satellite for terrestrial and lunar applications. Consequently, the IPSS system can promote the social and technological exchange of nations with the goal of protecting the survival of humankind. The designed sunshade model enables an estimation of the feasibility and the potential extension of existing climate actions, however, for this purpose further analyses on additional IPSS subsystems are planned. In order to be able to evaluate the potential effects of the IPSS concept, the development of a predictive model is intended by coupling technological and climatic submodels, which should enable a holistic simulation of the IPSS development phases. The approach of a digital IPSS model could enable a further use for the construction of new mega constellations, which can enable a cooperative exploration of further planets and beyond.