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Feasibility study of high precision measurement of Earth Albedo in space

Thorben Löffler¹, Jona Petri², René Fléron³, Peter Thejll⁴, and Sabine Klinkner⁵

¹University of Stuttgart, Institute of Space Systems, Stuttgart, Germany (loeffler@irs.uni-stuttgart.de)

²University of Stuttgart, Institute of Space Systems, Stuttgart, Germany (petri@irs.uni-stuttgart.de)

³DTU Space, Lyngby, Denmark (rwf@space.dtu.dk)

⁴Danish Meteorological Institute, Copenhagen, Denmark (pth@dmi.dk)

⁵University of Stuttgart, Institute of Space Systems, Stuttgart, Germany (klinkner@irs.uni-stuttgart.de)

The Earth Albedo is one of the important parameters in the study of climate change. In this work, the scientific background and mission analysis of a space based earthshine-telescope to observe Earth Albedo using relative photometry on the Moon with an accuracy of 0.1% is presented. The earthshine, which is the sunlight reflected from Earth on the Moon, is proportional in intensity to the surface-averaged Earth Albedo. This gives an advantage over LEO observations of Earth's surface in that a global average can only be constructed from such data by overcoming difficult and well-known issues in surface reflectance studies. A measurement with ground-based telescopes is limited by atmospheric variability, even at the best high-altitude sites; thus, a spaceborne instrument is proposed, which provides an increase in scientific performance. ROMEO, a satellite for research in Low and Medium Earth Orbit developed by IRS, serves as a test platform for the JULIET instrument. The JULIET instrument is the first space-based earthshine-telescope, developed by the DTU. A preliminary analysis is done to verify the feasibility of carrying JULIET on ROMEO. The orbit simulation software ASTOS is used to gather realistic observability time of the moon in different orbits. Furthermore, an optical analysis shows that the scientific performance of JULIET can exceed that of current ground-based Earth Albedo measurements. This mission is seen as the precursor of further decades-long observations of Earth Albedo using a space-based earthshine-telescope. The data will raise the accuracy of current Earth Albedo measurements by one order of magnitude and thus contribute towards increasing the overall accuracy of climate data.