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Preliminary 4-band colour photometry of the Earth, using Earthshine observations.

Peter Thejll (1), Chris Flynn (4), Hans Gleisner (1), Torben Andersen (2), and Ahmed Darudi (3)

(1) Danish Meteorological Institute, Danish Climate Centre, Copenhagen, Denmark (pth@dmi.dk), (4) Centre for Astrophysics and Supercomputing, Swinburne University, Hawthorn VIC, Australia., (2) Lund Observatory, Lund University, Sweden, (3) School of Astronomy, Institute for Research in Fundamental Sciences, Tehran, Iran

The terrestrial radiation budget determines, and depends on, climate and is therefore valuable to study empirically, as it gives insights into the state of the climate system as well as our own theoretical understanding of climate processes and modelling skills. The long-wave and shortwave components of the budget are typically observed with quite different technologies. From space, shortwave outgoing fluxes are commonly derived from satellite image data. The long term stability of these is known to limit the accuracy to about 1%. Precision can be much higher at a given moment, but the lack of high accuracy in the long terms limits the insights that can be had from satellite-based studies of the net shortwave flux.

Better long term accuracy is promised by methods based on using the Earthshine intensity as a proxy for terrestrial shortwave outgoing fluxes. We have designed and built an Earthshine observation system, and operated it for 1 year at the Mauna Loa Observatory on Hawaii. We present preliminary results from this observing period. The data were obtained in 4 broad photometric bands and we can present the Johnson B-V colors of the Earthshine, along with a color index similar to the NDVI index commonly used to investigate the presence of vegetation on Earth in satellite images.

Scattered light has to be removed from the data before analysis, and we show results following two independent paths for coping with this.

While Earthshine observing methods may be precise at any given moment, and more accurate in the long run - since it is a self-calibrating method - the overall signal to noise ratio is dominated by the natural variability of Earth's reflectivity, and data must be gathered, just as with satellites, for a long period before the potential benefits of Earthshine observations are felt. The Earthshine technique remains much less expensive than satellite technologies and can be a valuable independent means of complementary data.