Ageing models for Meteosat First Generation visible band and the normalization to Meteosat-7

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Since February 2004, the Geostationary Earth Radiation Budget (GERB) instruments on board of the Meteosat Second Generation (MSG) satellites allow the production of a radiation budget database for the Meteosat field of view (FOV). There is however a strong interest from the climatological community to extend this database back to 1982, making use of the Meteosat First Generation (MFG) satellites. The production of this GERB-like data would be based on more than 2 years of overlap between Meteosat-7 (MFG) and Meteosat-8 (MSG) using empirical narrow band to broad band regressions. It is known though that satellites are plagued by sensitivity changes during their lifetime. We will show that all MFG satellites are affected by a degradation in time with a strong spectral dependence. For this, a mathematical and physical ageing model has been developed to correct for the temporal change of the spectral response curves. A normalisation method will also be proposed for the time series. Due to the difference in shape in the spectral response curves of the MFG satellites individually, this process will make the reflectance time series of Meteosat-2 until Meteosat-6 comparable with those of Meteosat-7. This is necessary to incorporate the empirical narrow band to broad band regressions, developed through the overlap between Meteosat-7 and Meteosat-8, to the whole Meteosat First Generation database. The resulting normalised reflectance time series have been validated using different stable Earth and cloud targets and will be presented for all MFG satellites. They will be useful to derive accurate climatology of surface radiation (e.g. for the Heliosat method) and surface albedo. In the future, these stable time series will expand the current GERB database with 24 years of GERB-like data.