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Improving the satellite retrieval of surface solar irradiance during an eclipse

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Solar eclipse causes high magnitude fluctuations in the Surface Solar Irradiance (SSI) for a short duration and consequently reduces the output of solar PV systems. Grid operators try to estimate the impending loss in PV power generation prior to the occurrence of an eclipse in order to schedule conventional generators for compensating the loss. The worldwide installed capacity of grid connected solar PV systems is expected to steeply rise in the coming decade as a result of the various policy initiatives aimed to tackle the climate change. In future electric supply networks with a high penetration of solar PV systems, such large ramps in generation could impact the stability of the network. Although a solar eclipse is a purely deterministic phenomenon, it's impact on the satellite retrieval of Surface Solar Irradiance (SSI) is complicated due to the possibility of cloud presence in the regions affected by the eclipse. The extraterrestrial solar irradiance is reduced by the moon during an eclipse. On the one hand this causes clouds to appear darker and they get assigned lower reflectance values than they should have in reality. This leads to predicting higher values for the solar irradiance under these clouds than expected. On the other hand, the eclipse also reduces the clear sky irradiance reaching the earth surface. We developed a method to make corrections for both of these effects on the High Resolution Visible (HRV) channel images from Meteosat-11 The results are validated against ground measurements of irradiance provided by BSRN, IEA-PVPS, DTN and the National Weather Services networks. The validation is performed for sites with locations across Europe and for the last two eclipses.