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Decadal changes in downward shortwave radiation from a satellite-derived CM SAF product and ground-based observations over Europe

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Trends of downward shortwave radiation (DSR) from high-spatial resolution satellite-derived data over Europe since 1983 are first presented based on a Satellite Application Facility on Climate Monitoring (CM SAF) surface radiation data set, which is derived from the Meteosat geostationary satellites. The results show a widespread brightening in the major part of Europe, especially since the mid-1990s and in springtime. There is a mean increase of SSR of around 2 Wm-2 per decade over the whole Europe, which, taking into account that the satellite-derived product lacks of aerosol variations, can be related to a decrease in the cloud radiative effects over Europe. The reported increase in SSR is slightly lower than the obtained using high-quality ground-based series over Europe. Secondly, residual series have been derived as the result of the difference between ground-based and satellite-derived all-sky SSR data. The residual mean series points to a significant increase during the period 1983-2010, with higher rates of around 2 Wm-2 per decade over central and eastern Europe. The spatial variation of these residual time series seem to be in line with observed clear-sky SSR and anthropogenic aerosol loading trends and are not just explained by inhomogeneities in the satellite-derived product. This increase in the residual series is mainly due to a strong increase from the mid-1980s to the late 1990s, thus possibly linked to a decrease in anthropogenic emissions and a recovery from the El Chichón and Pinatubo volcanic eruptions.