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Validating CM-SAF's Surface Incoming Radiation Products based on Ship Observations

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The present work investigated the quality of the downward shortwave (DSR) and longwave (DLR) radiation retrieved by Meteosat Second Generation (MSG) algorithms for the Atlantic sea surface.
The datasets of two transatlantic research cruises were chosen as an ideal basis to be compared with the MSG products for incoming surface radiation fluxes of Meteosat-8 and Meteosat-9. Onboard the research vessels Ioffe and Polarstern high quality in situ measurements for DSR and DLR fluxes were performed. Additionally the cloudy sky has been monitored permanently by means of an automated full sky imager, and meteorological standard measurements were performed. This allowed a comprehensive evaluation of the skills of MSG radiative retrievals in different climate zones and under various cloud and weather conditions.
The incoming DSR was retrieved by MSG with a positive bias of $2.77\,Wm^{-2}$ to $22.23\,Wm^{-2}$ depending on the cruise. The bias for the DLR was $-1.73\,Wm^{-2}$ to $2.76\,Wm^{-2}$. The differences between the two cruises were influenced by its distribution of typical weather scenarios. Significant differences of Meteosat-8 and Meteosat-9 were shown for the same in situ dataset.
In general DSR and DLR for clear sky conditions are captured with a high accuracy. Largest errors occur for retrieved insolation of fast fluctating broken cloud conditions, though in average the MSG algorithms matched well. Semitransparent cirrus was found to cause a negative bias for the retrieved DSR. In tropics and subtropics the errors for DLR are reduced compared to higher latitudes. A significant dependency of errors of both the DSR and the DLR on the solar elevation, the humidity near the surface, SST and the shift of day and night was not found.