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Shortwave flux at the surface of the Atlantic Ocean: in-situ measurements, satellite data and parametrization.

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Shortwave radiation is one of the key air-sea flux components playing an important role in on the ocean heat balance. The most accurate method to obtaining estimates of shortwave fluxes are the field measurements at various locations at the globe. However, these data are very sparse. Different satellite missions and re-analyses provide alternative source of short-wave radiation data, however they need are source for uncertainties and need to be validated. An alternative way to produce long-term time series of shortwave radiation is to apply bulk parameterizations of shortwave radiation to the observations of Voluntary Observing Ship (VOS) cloud data or to the cloud measurements from CM-SAF. In our work, we compare three sources of shortwave flux estimates. In-situ measurements were obtained during 12 cruises (320 day of measurements) of research cruises in different regions of the Atlantic Ocean from 2004 to 2014. Shortwave radiation was measured by the Kipp&Zonen net radiometer CNR-1. Also during the cruise, standard meteorological observations were carried out. Satellite data were the hourly and daily time series of the incoming shortwave radiation with spatial resolution 0.05x0.05 degree (METEOSAT MSG coverage Europe, Africa, Atlantic Ocean), and were obtained by the MVIRI/SEVIRI instrument from METEOSAT. SEVIRI cloud properties were taken from CLAAS-2 data record from CM-SAF. Parameterizations of shortwave fluxes used consisted of three different schemes based upon consideration of only total as well as total and low cloud cover. The incoming shortwave radiation retrieved by satellite had a positive bias of 3 $Wm-2$ and RMS of 69 $Wm-2$ compared to in-situ measurements. For different Octa categories the bias was from 1 to 5 $Wm-2$ and RMS from 41 to 71 $Wm-2$. The incoming shortwave radiation computed by bulk parameterization indicated a bias of -10 $Wm-2$ to 60 $Wm-2$ depending on the scheme and the region of the Atlantic Ocean. The results of the comparison suggest that satellite data is an excellent ground for testing bulk parameterizations of incoming shortwave radiation. Among the bulk paramterizations, the IORAS/SAIL scheme is the least biased algorithm for computing shortwave radiation from cloud observations.