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Comparison of several databases of downward solar radiation data at ocean surface with PIRATA measurements

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Measurements of the downwelling shortwave irradiance at the surface (SSI) at the Atlantic ocean surface are very limited in space and time. Re-analyses offers high quality and high resolution data of SSI. They can be used in addition to in-situ measurements in order to increase the knowledge of the relationship between the SSI and atmospheric circulation. However, the accuracy of such re-analyses over the Atlantic ocean remains to assess. To answer this question, measurements of the SSI were collected from the Prediction and Research Moored Array in the Tropical Atlantic (PIRATA) network of buoys located in the equatorial Atlantic ocean. The SSI from several re-analyses were compared to these measurements. Quality-control was performed onto the measurements from the 17 buoys using recognized procedures. SSI from the ERA-Interim and MERRA-2 re-analyses were collected for the coincident period: 2011-2016 for the locations of the buoys. In addition, SSI were collected from three satellite-derived databases: CAMS Radiation, HelioClim-3v4 and v5.
Work is underway and exact results are unknown at the moment of submission. From preliminary results, the following is expected. The re-analyses exhibit a tendency to underestimate the SSI in the equatorial Atlantic ocean with a noticeable influence of the sky conditions on the bias. The re-analyses tend to predict cloud-free conditions while actual conditions are cloudy. The correlation coefficients are weak, showing that a large part of the temporal variability is not captured.
In contrast, the three satellite-derived databases offer a fair agreement with PIRATA measurements. Though the bias may be large at times, the standard deviations of the errors are small, meaning a limited scattering of errors. The correlation coefficients are great, meaning that the satellite-derived databases capture a great part of the variability in time.
It is concluded that efforts must be made on the re-analyses for a better modelling of the clouds. Meanwhile, satellite-derived data sets offer less uncertainties and should be preferred.