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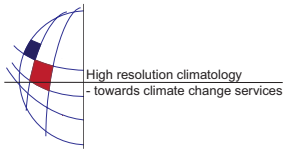

New parameterization of surface short wave radiation based on highly accurate in-situ measurements in the Atlantic Ocean

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The major source of uncertainties in the existing parameterizations of solar radiation at sea surface is associated with the large scatter of the atmospheric transmission factor under different cloud types, even under the same total cloud cover. In order to resolve this problem and to discriminate between different cloud type conditions we performed 4-year (2004-2007) in-situ measurements of surface short wave radiation and associated meteorological characteristics on board research vessels traveling along meridional sections in the Atlantic Ocean from 60N to 60S under different cloud conditions. Surface short wave was measured by the Kipp&Zonen net radiometer CNR-1 with temporal resolution of 10 seconds. The compiled data base of in-situ measurements consisted of about 130 daily time series of short wave radiation measurements. For all measurements an accurate analysis of the impact of platform rolling on the accuracy of radiative measurements was provided. Collected data were used for the development of new parameterization of short wave radiation at sea surface. Contrasting to the traditional ones, our parameterization employs different approximations of the dependencies of the atmospheric transmission factor on the cloud cover for different cloud types. Furthermore, for the clear sky conditions we account for the non-linearity of the transmission factor dependency on the solar altitude. New parameterization also provides a special approximation for the eastern North Atlantic tropics and subtropics, influenced by the advection of Saharan aerosols. New parameterization demonstrates a clear improvement of the accuracy of computation of short wave radiation fluxes compared to the traditional schemes based exclusively on the total cloud cover. New approach is especially effective under high cloud cover and conditions close to the complete overcast, when its accuracy may be 20% than that for the traditional schemes. Comparison for the other cloud conditions demonstrates although smaller, but statistically significant improvement of the accuracy. Newly developed parameterization represents likely the upper limit of complexity that can be achieved with bulk parameterizations employing total/low cloud cover and cloud type information along with standard meteorological observations.