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Inter- and intra-annual variability of Namibian stratocumulus clouds from 8 years of METEOSAT SEVIRI observations

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In this study, we utilize the full 8-year record of METEOSAT SEVIRI observations available at present to analyse the properties of marine stratocumulus cloud decks observed over the subtropical eastern Atlantic off the Namibian coast. Mean daylight and annual cycles of cloud fraction, optical thickness and effective droplet radius are derived over the entire record. For this purpose, a novell method based on multi-dimensional distribution functions and Copula theory is applied to the satellite radiances and ancillary datasets. This technique allows us to capture the statistical interdepencies between different quantities, in particular between the conservative and weakly absorbing solar channels used as basis for Nakajima and King-style retrievals. We can thereby avoid the explicit inversion of pixel-level radiances and significantly reduce the computational costs. The homogeneity of the resulting time series are assessed with special attention to changes of satellite sensor between METEOSAT 8 and 9, differences in the sub-satellite longitude as well as uncertainties caused by sensor calibration. Inter-annual variations in cloud properties are derived and discussed with regard to potential physical forcing mechanisms as well as resulting changes in cloud radiative effects.