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Cloud parameters from reanalysis datasets – a comparison with satellite data

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Clouds are a key component of the hydrological cycle and play an important role in weather and climate. Feedbacks between clouds and climate have important implications for climate sensitivity and thus on amplitude and pace of future climate change. In this study, as part of the SPARC Reanalysis Intercomparison Project (S-RIP) phase 2, we compare the cloud parameters from different reanalysis datasets, including the most widely used reanalyses ERA5, MERRA2 and JRA-55, with satellite observations. The study focuses on tropospheric clouds on monthly to seasonal and multi-year time scales. Means and variability of cloud parameters from the reanalyses such as cloud fraction, cloud liquid and ice water content as well as cloud radiative effects are compared to satellite observations for specific cloud regimes and regions. In addition to evaluating the performance of the different reanalysis products, we investigate whether the multi-reanalysis mean is in closer agreement with the observations than the individual reanalyses.

The analyses are performed with the Earth System Model Evaluation Tool (ESMValTool), a community developed open-source software tool. The tool provides common operations such as interpolating data on the same grid, calculating multi-reanalysis means, common data masking, area extraction, and basic statistics such as seasonal means, annual means, area means, etc. which facilitates a fair comparison with observations. Uncertainties are estimated using multi-product observational reference datasets.