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Investigation of the cloud phase distribution and related parameters with datasets from a passive satellite sensor and reanalysis models

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In numerical weather prediction and climate models a particular challenge is represented by the simulation of mixed-phase clouds in the temperature range between 0 and -38°C, in which hydrometeors can either consist of supercooled water or of ice. The partitioning into liquid and ice in this regime depends on many factors (e.g. cloud dynamics, aerosols as ice nuclei, ice multiplication processes...) and varies therefore depending on different cloud types, regions and seasons. We use satellite data observations to analyse the cloud phase distribution under different conditions. To get a better understanding of cloud systems, different datasets are used to investigate the liquid and ice cloud distribution. The considered datasets are CLARA-A2, Cloud_cci v2.0, and Cloud_cci AVHRR-PMv3. They consist of data records derived from the AVHRR passive sensor, carried by the polar orbiting meteorological satellite NOAA-19. Special attention is paid to the geographical distribution of different cloud regimes, obtained using the k-means clustering method. The regimes taken into account are ISCCP-like regimes and mixed-phase regimes. For the first ones, bidimensional histograms are built using the cloud optical thickness and the cloud top pressure; for the mixed-phase regimes, bidimensional histograms are built using the mean liquid effective radius and the ice fraction as variables. We will present analyses about the occurrence of these regimes and their connections.
With the aim to evaluate NWP models, datasets derived from reanalysis models are analysed in a similar way. The models results are compared with the results of the observational study.