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Inter-comparison of cloud detection and cloud top height retrievals using the CREW data base

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About 70% of the earth's surface is covered with clouds. They strongly influence the radiation balance and the water cycle of the earth. Hence the detailed monitoring of cloud properties - such as cloud fraction, cloud top temperature, cloud particle size, and cloud water path – is important to understand the role of clouds in the weather and the climate system. The remote sensing with passive sensors is an essential mean for the global observation of the cloud parameters, but is nevertheless challenging. The three dimensional structure of the clouds, the mixtures of ice crystals, and the reflection characteristics of the surface are known only with a limited accuracy and causing uncertainties in the retrieved cloud products. Unfavorable viewing geometries, like high solar and viewing zenith angles, sun glint, have to be accurately taken into account. Further uncertainties originate from calibration and degradation of the satellite sensor, the use of auxiliary data and assumptions in the radiative transfer simulations. To understand the uncertainty characteristics an in depth analysis and validation of the data sets is required.

This talk focuses on the inter-comparison and validation of cloud detection and cloud top properties retrievals from the Spinning Enhanced Visible and InfraRed Imager (SEVIRI) onboard METEOSAT. For this study we use retrievals from 12 state-of-art algorithms that are made available through the common database of the CREW (Cloud Retrieval Evaluation Working) group. This database contains four days, when the satellite constellations are especially suited for validation studies. The accuracy of the cloud retrievals is determined by comparisons with CLOUDSAT and CALIPSO measurements. The ability of the different algorithms to detect clouds and to determine the cloud height under different viewing, sunlight, cloud, aerosol, and surface conditions is evaluated. The first part of the talk concentrates on cloud detection. The general global cloud distribution is perceived by each algorithm. Deviations are noticed for clouds with a small optical depth, broken cloud conditions, and for clouds over snow and ice. Differences arise from the distinction between clouds and aerosols, too. This influences the instantaneously retrieved cloud properties and in consequence cloud climatologies in aerosol loaded areas. In the second part of the talk the retrieval of the cloud top temperature and height is analyzed. For optically thick clouds the retrieved cloud tops heights generally agree very well. For thin cirrus - especially in the inter-tropical convergence zone - and frontal systems the disagreement is higher. In multilayer cloud situations some algorithms tend to retrieve a cloud top height in between the cloud layers. Methods to catch the uppermost cloud top are reviewed.

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