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Cloud Radiative Effect in dependence on Cloud Type

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Radiative transfer of energy in the atmosphere and the influence of clouds on the radiation budget remain the greatest sources of uncertainty in the simulation of climate change. Small changes in cloudiness and radiation can have large impacts on the Earth's climate. In order to assess the opposing effects of clouds on the radiation budget and the corresponding changes, frequent and more precise radiation and cloud observations are necessary.

The role of clouds on the surface radiation budget is studied in order to quantify the longwave, shortwave and the total cloud radiative forcing in dependence on the atmospheric composition and cloud type. The study is performed for three different sites in Switzerland at three different altitude levels: Payerne (490 m asl), Davos (1'560 m asl) and Jungfraujoch (3'580 m asl).

On the basis of data of visible all-sky camera systems at the three aforementioned stations in Switzerland, up to six different cloud types are distinguished (Cirrus-Cirrostratus, Cirrocumulus-Altocumulus, Stratus-Altostratus, Cumulus, Stratocumulus and Cumulonimbus-Nimbostratus). These cloud types are classified with a modified algorithm of Heinle et al. (2010). This cloud type classifying algorithm is based on a set of statistical features describing the color (spectral features) and the texture of an image (textural features) (Wacker et al. (2015)). The calculation of the fractional cloud cover information is based on spectral information of the all-sky camera data. The radiation data are taken from measurements with pyranometers and pyrgeometers at the different stations.

A climatology of a whole year of the shortwave, longwave and total cloud radiative effect and its sensitivity to integrated water vapor, cloud cover and cloud type will be calculated for the three above-mentioned stations in Switzerland. For the calculation of the shortwave and longwave cloud radiative effect the corresponding cloud-free reference models developed at PMOD/WRC will be used (Wacker et al. (2013)).

References:

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