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Cloud Climatology and Surface Radiative Forcing over Switzerland

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Understanding the effects of clouds on the surface radiation budget is essential because clouds and especially cloud feedbacks are the largest source of uncertainty concerning global change simulations (Randall et al., 2007). Moreover, in order to interpret long term trends of downward longwave and shortwave radiation, which are also thought to be associated with changes in greenhouse gases and aerosol loads respectively, a precise estimate of cloud cover and cloud radiative forcings of different cloud types is needed. The Project Cloud Climatology and Surface Radiative Forcing over Switzerland (CLASS) aims at quantifying the effect of clouds on the surface radiation budget by developing an algorithm to determine cloud fraction and cloud type from measurements of longwave and shortwave radiation since 1995 at five selected sites in Switzerland. The algorithm will be validated through various instruments such as cloud cameras (fractional cloud cover), Ceilometer measurements (cloud base height) and thermal infrared cameras (cloud brightness temperature). Particular attention will be paid to the radiative effect of cirrus clouds since their effect on the surface radiation budget is still largely unknown (Dupont and Haeffelin, 2008). In this respect the high altitude station Jungfraujoch (3580 m a.s.l) is thought to give valuable insights into the radiative effect of cirrus clouds.
In order to determine fractional cloud cover from the cloud cameras installed at five selected sites in Switzerland, an algorithm has been developed which compares the red to blue ratio of the RGB image to a reference value, which is dependent on the elevation of the sun. This reference value is typically set to 0.8-1.0, whereas above this threshold the pixels are interpreted as cloudy. The error between observed and estimated fractional cloud cover is between 5-10 %. Therefore, the strong advantages of such automatic systems will be shown as well as their limitations and problems. In addition, first estimates of longwave cloud radiative forcings over Davos for cirrus cloud types (stratiform and broken) will be presented.

References:

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