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METEOSAT Observations of the Daily Variation of Cirrus

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Cirrus clouds have a substantial impact on net radiation and therefore also on climate, but the physical processes involved in cirrus formation and decay are not very well represented in climate and weather prediction models. In-situ formation of natural cirrus clouds is initiated when cooling moist air parcels reach a substantial super-saturation with respect to ice. This happens either due to dynamic lifting of the air or due to radiative cooling. But once ice crystals are formed, they grow until the ambient air becomes sub-saturated either by subsidence of the whole air-mass or sedimentation of the particles into drier air. Thus the pure diagnostic description of clouds, as it is still used in current climate and weather prediction models has to be tuned to match observations at least until a prognostic description of cirrus clouds will be introduced into these models.

The decay of cirrus clouds is a process with a typical timescale of hours. Therefore geostationary satellites with their high temporal resolution are an ideal platform for cirrus observations. The data from these satellites offer the possibility to observe the life cycle either by tracking cirrus clouds or by observation of the typical daily and seasonal variation of cirrus coverage. In particular the infrared channels of the METEOSAT satellites, which are independent from day-light and not affected by the different scattering properties of the various ice particle habits are suitable for such observations.

For the analysis we use a novel scheme to derive cirrus optical depth and height from the SEVIRI infrared channels. It is based on an artificial neural network trained with the data provided by CALIOP, the lidar system aboard of the CALIPSO satellite.