Documentation of MeteoSwiss Grid-Data Products

Daily, monthly and yearly satellite-based Cloud Fractional Cover

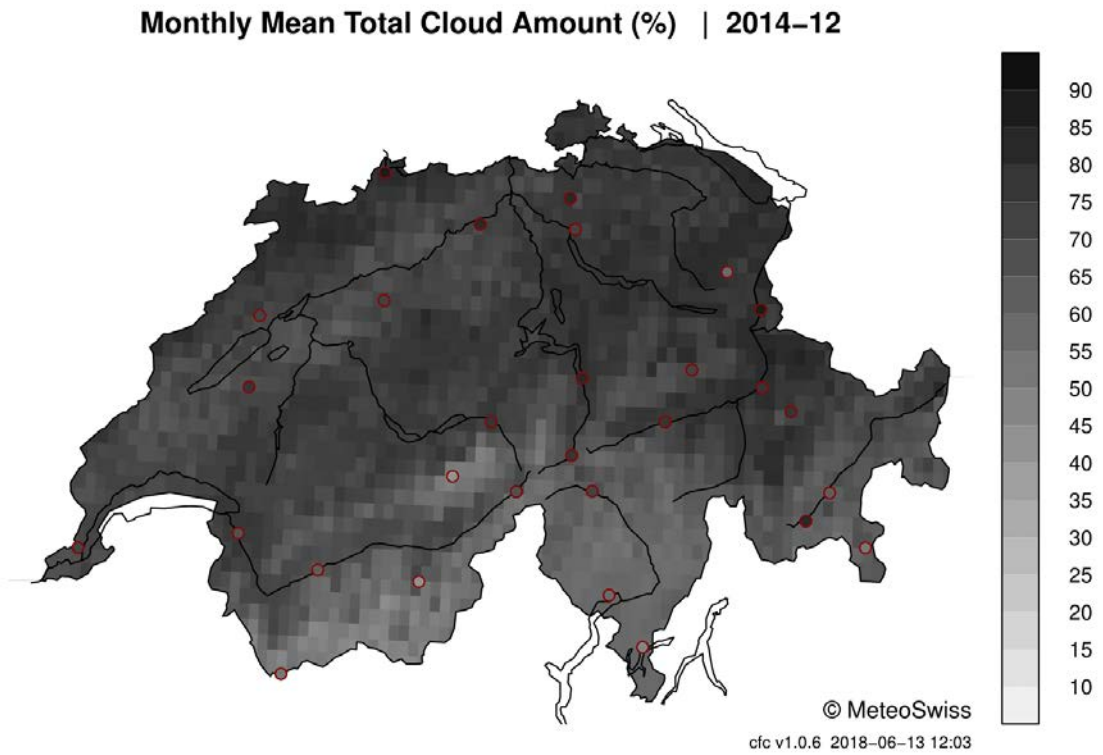

Figure 1: Monthly Mean Cloud Cover over Switzerland from December 2014.

Variable Cloud Fractional Cover in % (0-100%) corresponding to 0-8 okta synoptic cloud amount according to the WMO specification. Cloud Fractional Cover = 0% reflects a synoptic cloud amount of <= 1 okta (completely cloud free). Cloud Fractional Cover = 100% reflects a synoptic cloud amount >= 7 okta (completely cloud covered). In the range of 2–6 okta cloud amount is linearly related to the Meteosat Cloud Fraction. Mean daily, monthly and yearly quantities since 1991.

Application Climate Analysis, Weather- and Climate Model validation, Cloud observations (complements synoptic cloud observations), Tourism.

Satellite-based Cloud Cover

Overview

The dataset provides cloud fraction on a high resolution grid with validated accuracy back to 1991. The dataset is entirely derived from Meteosat satellite measurements by use of an advanced Bayesian retrieval algorithm. The method has been calibrated and validated using synoptic cloud observations over Switzerland, Europe and Africa.

The Meteosat Cloud Fractional Cover is characterized by comparability to synoptic cloud observations. The Meteosat Cloud Fraction is therefore useful to supplement ground-based cloud estimates in areas with high spatio-temporal cloud variability such as the Alps.

This data set is linked to our international collaboration with the EUMETSAT sponsored Satellite Application Facility on Climate Monitoring (CM SAF) where we derive cloud cover for the full Meteosat disk for the whole range of Meteosat satellite sensors since 1991.

Data base

The MVIRI (Visible and InfraRed Imager) and SEVIRI (Spinning Enhanced Visible and Infrared Imager) sensor on board the EUMETSAT Meteosat First and Second Generation satellite serves as the foundation for this data set.

The Cloud Fractional Cover data is derived from two Meteosat heritage channels. MVIRI data are carefully inter-calibrated using daily calibration coefficients provided by EUMETSAT to ensure climate quality. For the processing Level 1.5 data are used. The data is processed at 15 minutes intervals at the native satellite resolution. Data gaps might occur during satellite calibration, satellite maneuvers or technical failures in the transmission or EUMETSAT processing facilities. To ensure consistency between medium resolution MVIRI and high resolution SEVIRI data, the data are resampled to a 0.05° latitude and longitude grid after the processing.

Method

The Cloud Fractional Cover data is based on only two heritage channels from MFG MVIRI and MSG SEVIRI. The calibrated visible and inter-calibrated infrared radiances firstly serve as input to a daily recurring parametric estimation of clear sky background fields with diurnal cycle models of brightness temperature and reflectance. These clear sky inversions are constrained by previously cloud masked reflectances and brightness temperatures. The resulting clear sky background fields together with the all sky instantaneous reflectances and brightness temperatures yield continuous cloud mask scores of pixel wise state and spatio-temporal variability. Cloud Fractional Cover is retrieved from these scores by use of a Bayesian classifier. It is based on the conditional occurrence probability of scores and two dimensional score combinations given SYNOP observed cloud fraction classes. The use of such two dimensional score combinations featuring both the state and variability of specific reflectance or brightness temperature features is a substantial and useful addition to the commonly used naïve Bayesian classifier. The use of a Bayesian classifier has the benefit of instantaneous and pixelwise cloud fraction estimates.

The algorithm is fully described in Stöckli et al. (2017).

Target users

Climate Modelers, Climate Researchers, Tourist Resorts.

Accuracy and interpretation

The accuracy of the dataset is characterized in Bojanowski et al. (2018). Monthly data reveal a mean bias of −0.1%, a root mean square error of 7.0% and a trend in bias of −0.9% per decade compared to synoptic observations over Africa and Europe. Shortcomings are a

larger negative bias during winter and a lower precision for high sun zenith angles.

Related products Synoptic ground-based cloud observations from WMO stations (SYNOP).

Grid structures The dataset is available in the following grid structures:

ch05.lonlat: A grid in regular longitude and latitude increments covering the territory of Switzerland (5.5-11.0 deg E, 45.5-48.0 deg N). The grid spacing is 0.05° in longitude and latitude, corresponding to approximately 5.6 km (3.9 km) in the North-South direction (West-East direction).

Versions Current version: 1.0

Previous versions: none

Update cycle The daily, monthly and yearly dataset is updated every year. Please note that this is not a real-time dataset.

Data format NetCDF (CF standard v1.6)

Contact point Data service at MeteoSwiss (dataservice[at]meteoswiss.ch)

References

Bojanowski, J.S., Stöckli, R., Duguay-Tetzlaff, A., Finkensieper, S., Hollmann, R., 2018: Performance Assessment of the COMET Cloud Fractional Cover Climatology across Meteosat Generations, Remote Sensing 2018 10(5) 804. doi:10.3390/rs10050804

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