MeteoSwiss Grid-Data Products: Documentation for Users

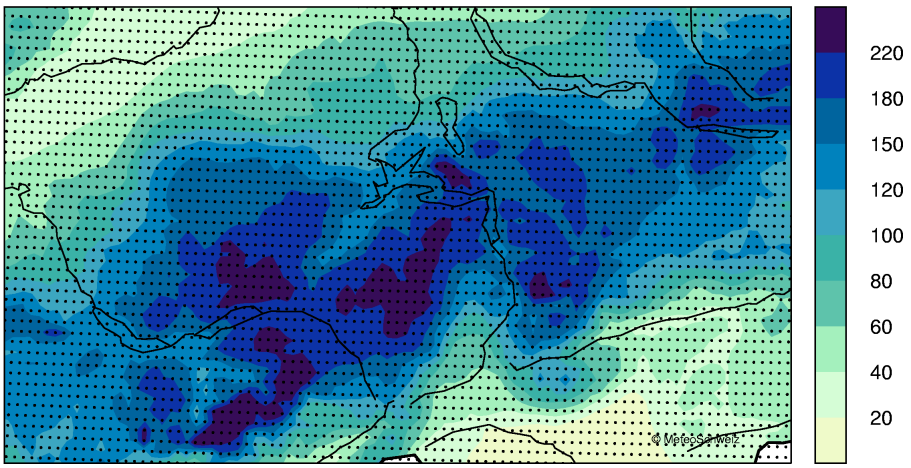

Figure 1: Distribution of the 48-hour precipitation (in mm) of 21-22 August 2005 in central Switzerland. Points indicate the underlying grid of the analysis.

Overview

Grid data provides estimates of the spatial distribution of weather and climate at the earth surface. While instrumental measurements are taken at irregularly distributed stations, grid data represents meteorological parameters on a predefined lattice (grid) with a regular spacing. “Gridding” integrates measurements, knowledge of their representativity and physical understanding into quantitative statistical procedures that estimate climate at locations without measurements.

Grid data is of strong benefit in disciplines applying distributed quantitative models to examine the influence of weather and climate. For example, models to forecast river flow, to understand glacier retreat or to map crop suitability, they all depend on grid data. Moreover, beeing a refinement of instrumental measurements, grid data also serves native meteorological applications, such as climate monitoring and the evaluation of weather forecasts.

MeteoSwiss has established a suite of ready-made grid datasets for the territory of Switzerland. These encompass several parameters, are regularly updated and can be distributed to customers in one-time or repeated deliveries. The present documentations describe, for each product, the procedures and underlying data used, indicate potential areas of application and pinpoint to uncertainties and limitations of the datasets.

Products

The suite of grid-data products encompasses datasets for several parameters, currently precipitation, temperature and sunshine duration. Products are usually available for several time aggregations (hourly, daily, monthly, yearly or climate norm values). Moreover, for some parameters and aggregations, several products are provided, which were constructed with different procedures in order to meet the variable requirements of different user groups. For example, daily precipitation is available as a preliminary real-time estimate, based on a smaller set of automatic measurements, and a final analysis, integrating all available (also non real-time) measurements.

Each product is denoted with an acronym indicating the parameter, time aggregation and, if relevant, specific characteristics of the dataset. Table 1 lists currently available grid data products. At present, detailed documentations are available for most of the precipitation grid-data products. Documentations for the remaining products are in preparation.

Table 1: Currently available grid-data products

Acronym	Description	Current Version
	Precipitation	
RprelimD	Daily precipitation (preliminary analysis)	v2.0
RhiresD	Daily precipitation (final analysis)	v1.0
RdisaggH	Hourly precipitation (experimental)	v1.0
RhiresM	Monthly precipitation	v1.0
RhiresY	Yearly precipitation	v1.0
RnormM6190	Mean monthly precipitation (norm, 1961-1990)	v1.0
RnormY6190	Mean yearly precipitation (norm, 1961-1990)	v1.0
RanomM	Monthly precipitation anomaly	v1.0
RanomY	Yearly precipitation anomaly	v1.0
	Temperature	
TabsD	Daily mean temperature	v1.2
TminD	Daily minimum temperature	v1.2
TmaxD	Daily maximum temperature	v1.2
TabsM	Monthly mean temperature	v1.2
TminM	Monthly mean of daily minimum temperature	v1.2
TmaxM	Monthly mean of daily maximum temperature	v1.2
TabsY	Yearly mean temperature	v1.2
TminY	Yearly mean of daily minimum temperature	v1.2
TmaxY	Yearly mean of daily maximum temperature	v1.2
TnormD6190	Mean calendar day temperature (norm, 1961-1990)	v1.2
TnormM6190	Mean monthly mean temperature (norm, 1961-1990)	v1.2
TnormY6190	Mean yearly mean temperature (norm, 1961-1990)	v1.2
TanomD	Daily mean temperature anomaly	v1.2
TanomM	Monthly mean temperature anomaly	v1.2
TanomY	Yearly mean temperature anomaly	v1.2

Table 1 (continued)

Acronym	Description	Current Version
	Sunshine duration	
SrelD	Daily relative sunshine duration	v1.0
SrelM	Monthly relative sunshine duration	v1.2
SrelY	Yearly relative sunshine duration	v1.2
SnormM6190	Mean monthly relative sunshine duration (norm, 1961-1990)	v1.2
SnormY6190	Mean yearly relative sunshine duration (norm, 1961-1990)	v1.2
SanomM	Monthly sunshine duration anomaly	v1.2
SanomY	Yearly sunshine duration anomaly	v1.2

Accuracy and interpretation

MeteoSwiss has adopted advanced techniques for the generation of its grid data products, and it is active in national and international research collaborations for the ongoing development of methodologies. Spatial interpolation is, however, always associated with limitations and uncertainties. Notably the topography of the Alps and the attendant small-scale variations of the climate in Switzerland are a major challenge to interpolation. The nature of uncertainties and the magnitude of errors differ markedly between parameters, aggregation times, regions of interest, seasons and time periods.

For each data product a detailed analysis was carried out of the characteristics and magnitude of interpolation uncertainties. The most important results and their implications for practical applications are discussed in section “accuracy and interpretation” of the individual documentations. We recommend that users seek an understanding of the relevance of uncertainties prior to the application.

Two types of error are worth mentioning in general: Firstly, the underlying station networks are much coarser than the spacing of the target grid. The fine-scale structures evident in the grid datasets rely mostly on relationships of the parameter in question to geo-topographical factors and, hence, the ability to recover fine-scale structures depends on the strength of these relationships. As a result, the effective spatial resolution in a gridded analysis may be coarser than the grid spacing. The user should therefore be careful in relying on data at single or few gridpoints.

Secondly, several of the grid datasets are affected by temporal variations of the station network, changes in instrumentation and position of stations. These can result in unreal temporal variations. Users requiring high climatological homogeneity should use datasets, which were explicitly derived for long-term monitoring (see individual documentations), and, eventually, contact MeteoSwiss to investigate options for a dedicated dataset.

Versions

A versioning system is adopted individually for each dataset. The “version”, a number similar to standard software versioning, allows users to track changes in the procedures or settings used for constructing the datasets. Moreover each dataset is associated with a “production date”, reflecting the status of the MeteoSwiss station database at calculation time. Grid datasets are re-calculated periodically to yield updated products, which translate improvements in the quality of the station data with time. For example, grid data calculated close to real

time may be affected by gross errors in station data. Updates, typically calculated one month later, incorporate amendments from late data quality procedures.

Grid structures

Grid data products are available usually in several different grid structures to accommodate users with their traditional modeling coordinates. A list of the grids with pertinent descriptions is given in Table 2. Not all the products are produced on all these grids. Available grid structures for each product are listed in the documentations for the products. In most cases, the datasets for each grid structure were calculated directly from the original station data to avoid unnecessary smoothing by re-interpolation. It is recommended to use the data on the provided grid. A re-interpolation can substantially degrade the quality of the data.

“ch02.lonlat” is the common grid structure for which all products have been processed. At present, several of the products are available on this grid only. It is foreseen to expand the gridding procedures systematically to process the fields on grid “ch01r.swisscors”, i.e. in the traditional CH1903 Swiss coordinate system.

Table 2: Grid structures used for the grid data products

ch02.lonlat	A grid in regular longitude and latitude increments covering the territory of Switzerland (5.75-10.75 deg E, 45.75-47.875 deg N). Gridpoints outside Switzerland are flagged. The grid spacing is 1.25 deg minutes (0.02083 deg) in longitude and latitude, corresponding to approximately 2.3 km (1.6 km) in the West-East direction (South-North direction).
ch01r.swisscors	A 1 km grid in the Swiss coordinate system CH1903. Grid points are located on the 500 m nodes. The grid window (474’500 – 843’500, 64’500 – 303’500) covers entire Switzerland. Gridpoints outside the country are flagged.
ch.cosmo2.rotpol	A 0.02 degree grid in rotated pole longitude/latitude coordinates, including all of Switzerland (resolution approx 2.2 km). This is the grid of the MeteoSwiss NWP model COSMO-2.
ch.cosmo6.rotpol	A 0.06 degree grid in rotated pole longitude/latitude coordinates, including all of Switzerland (resolution approx 6.6 km). This is the grid of the MeteoSwiss NWP model COSMO-7.

Data format

Grid data is available in the following data formats: NetCDF (CF standard), ASCII, GeoTIFF.

Contact point

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

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