

Compendium of Good National Practices for Public-Private Engagement

SWITZERLAND: MeteoSwiss public-private partnership with MeteoGroup

Switzerland's National Weather Service MeteoSwiss has a long history of using partner data within their own operations. Collaborations with public partners started in early 2000. In those early days, MeteoSwiss did see private weather companies as competitors and conflicts about where and how to measure or about the accuracy of forecasts transpired through the media. The situation changed in 2011 when MeteoSwiss decided to start a cooperation with the private weather company MeteoGroup, the largest operator of a network of private weather stations in Switzerland.

After some devastating storms and floodings in 2005, which have raised the understanding of the importance of forecasting the impacts of natural hazards, the Swiss government commissioned MeteoSwiss to increase the density of their network of automatic weather stations. In 2009, a warning concept, which divided Switzerland into around 140 warning regions, was operationally put in place with the goal to ensure at least one automatic weather station in each warning region measuring on a near-real-time basis (10 minutes frequency). Prior to that, in 2007, MeteoSwiss started an analysis to compare the existing automatic weather station network with the requirements of the new warning concept. The warning regions colored in green in Figure 1 were already covered by at least one MeteoSwiss weather stations. In contrast, the red areas show the gaps (lack of weather station) present at that time. In parallel, MeteoSwiss created an inventory of all existing, both public and private, partner stations in Switzerland. The inventory consisted of around 1000 partner stations. They are shown in both Figure 1 and Figure 2 using different symbols for the different types of partners such as hydrology departments, snow and avalanche research centers, etc.

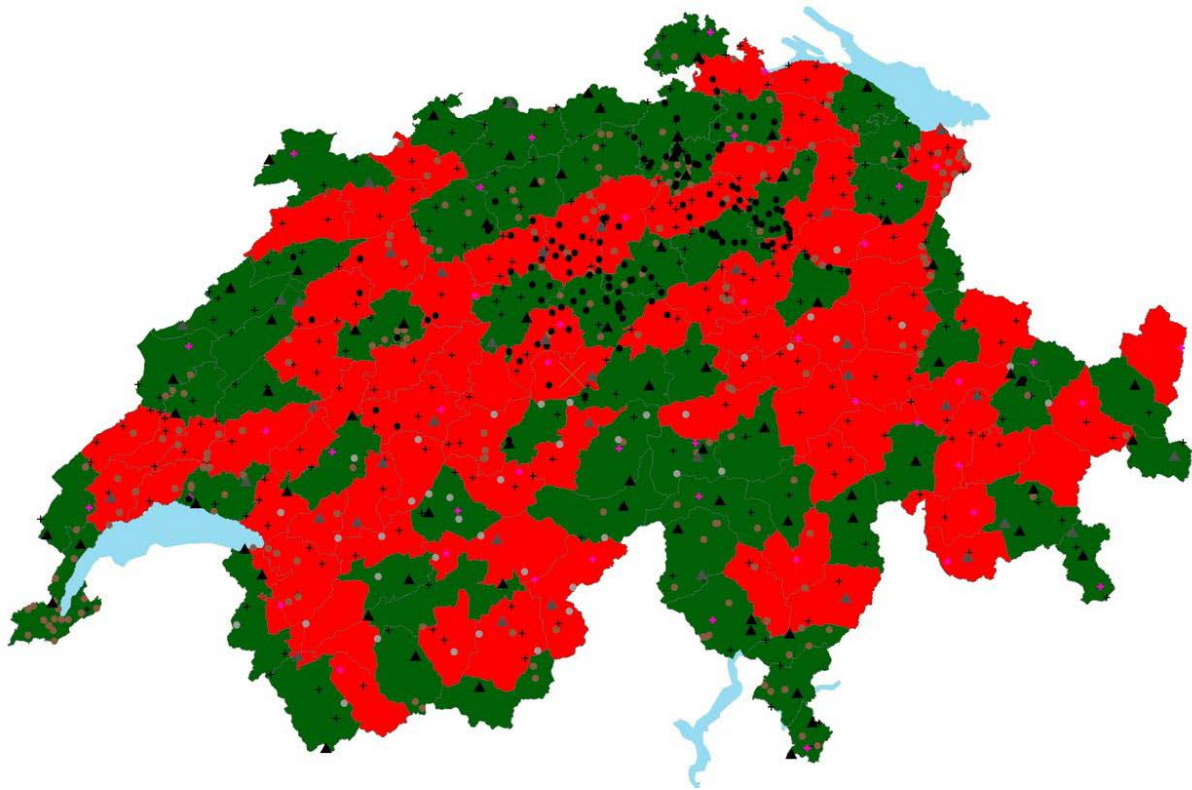


Figure 1: Overlay of the existing automatic weather stations network of MeteoSwiss with the new warning regions. In green the areas, which were covered by a MeteoSwiss weather station in 2008, in red the areas, which were not yet covered at that time. The different forms of symbols show different kinds of existing partner weather stations.

Can private partner stations fill the measurement gaps in Switzerland?

Based on this analysis it was shown that the existing gaps could be filled either by expanding the MeteoSwiss automatic weather stations network or by integrating existing partner stations. Considering the financial implications, MeteoSwiss decided that using partner stations, wherever possible, would be an effective way to save taxpayers money without compromising the quality of its weather forecasts and warnings. It was shown that existing partner networks could fill around half of the observational gaps in the warning regions without MeteoSwiss measurements. Partner weather stations, which delivered the needed measurement data in the required temporal resolution and quality, were considered. Figure 2 illustrates in light green the warning regions, which in 2008 could be covered by partner stations. The remaining red areas represent the warning regions where MeteoSwiss had to build their own weather stations due to the lack of alternative from the partners.

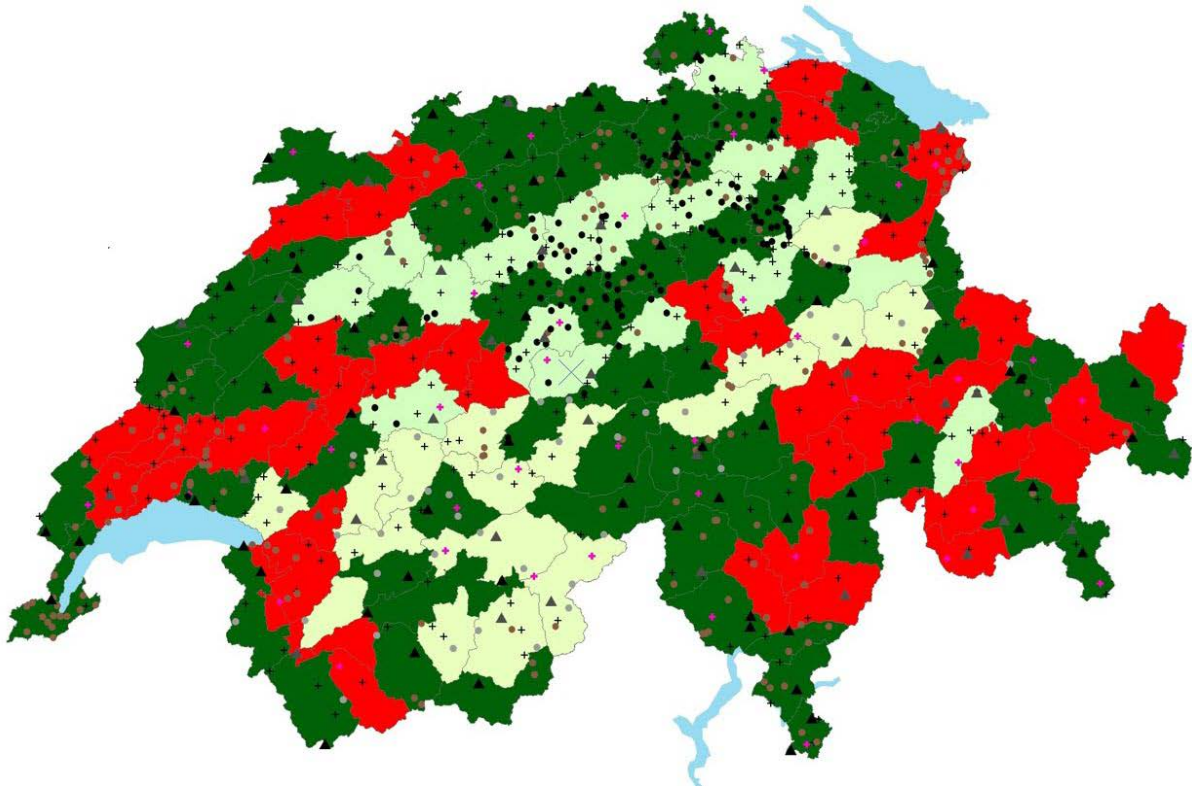


Figure 2: Overlay of the gaps with existing private or public measurement networks (symbols show existing partner weather stations). Light green shows the areas where partner data could fill the gaps, red areas highlight locations where MeteoSwiss had to build new automatic weather stations.

In addition to the already existing data exchange with public partners like the National Air Pollution Monitoring Network (NABEL), the Institute for Snow and Avalanche Research (SLF) or the exchange of hydrological monitoring data with the Swiss Cantons, in 2010 MeteoSwiss decided to also start cooperation with private data providers. With over 300 weather stations, the largest private weather company in Switzerland was (and still is) MeteoGroup, which at that time was still known under its former name Meteomedia. Analyzing their weather station network, MeteoSwiss experts from different fields like nowcasting, climatology, numerical weather modelling, radar or satellite technology, determined in 2011 a set of 50 stations, which would add great value to MeteoSwiss official duty tasks such as forecasts, warnings or verification. Since 2012, these 50 MeteoGroup stations, together with a number of stations operated by governmental agencies, have been integrated into the central data platform of MeteoSwiss. These observational data have been assimilated in the working environment of the forecasters (e.g. NinJo) and other data extraction tools. Recognizing the importance of these 50 stations for the quality of the warning products, a special contract has been signed between MeteoSwiss and MeteoGroup in order to ensure data quality, availability, timeliness etc. The Swiss law does not allow barter agreements between governmental agencies and private companies. Thus with MeteoGroup being a private company, a regular customers contract clarifying terms and conditions of use was signed. Besides these 50 stations, there are currently more stations from public partners integrated in our systems (see Figure 3).

However, these additional collaborations are based on barter agreement (no money involved). They are valuable additional information but not part of the set of data being essential in critical weather situations.

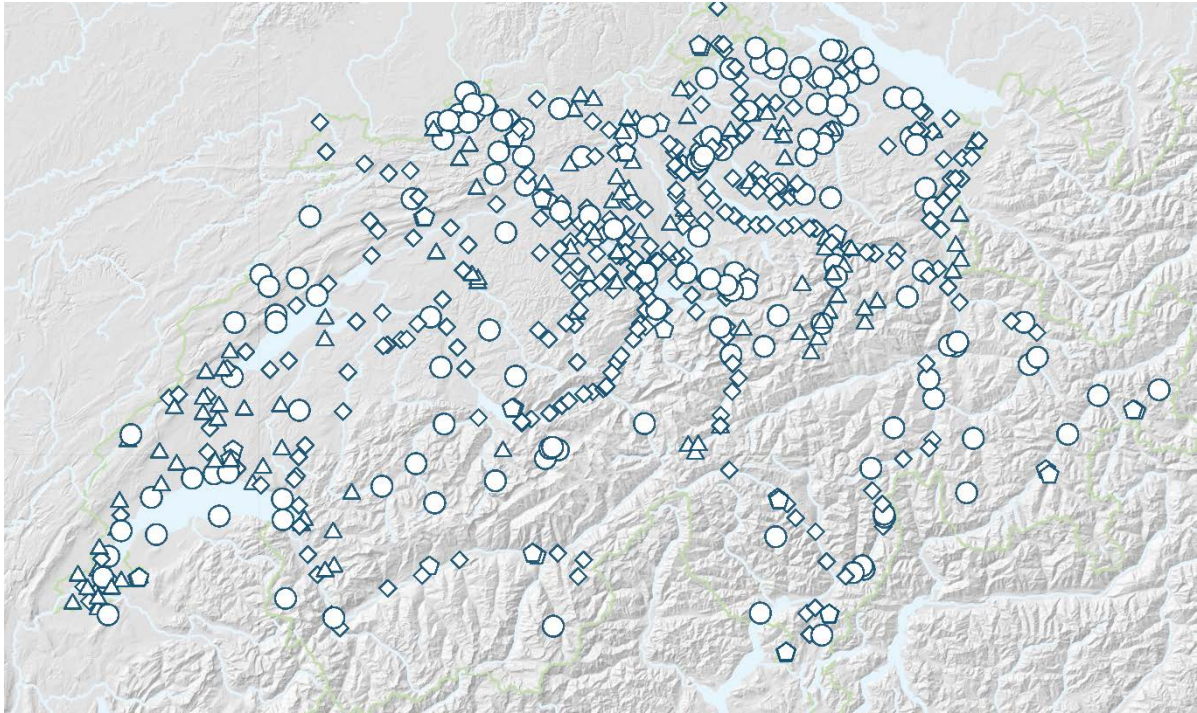


Figure 3: Current map of private and public partner stations integrated in the MeteoSwiss systems (screenshot taken: 4.4.2020). The different symbols stand for different types of partner stations. A current map with detailed information about each partner station can be found [on the MeteoSwiss website](https://www.meteoswiss.admin.ch/home/measurement-and-forecasting-systems/land-based-stations/automatisches-messnetz/partnernetze.html) [Source: <https://www.meteoswiss.admin.ch/home/measurement-and-forecasting-systems/land-based-stations/automatisches-messnetz/partnernetze.html>]

What is the quality of private partner stations?

Since MeteoGroup is mainly using low-cost all-in-one Davis-Stations, questions about quality and comparability with MeteoSwiss-Stations were risen. In order to address this issue, MeteoSwiss has developed a procedure to evaluate a station's quality - the so-called [MeteoSwiss Classification Procedure for Automatic Weather Stations "METEO-Cert"](https://www.meteoswiss.admin.ch/home/measurement-and-forecasting-systems/land-based-stations/automatisches-messnetz/certification-of-monitoring-stations.html) [Source: <https://www.meteoswiss.admin.ch/home/measurement-and-forecasting-systems/land-based-stations/automatisches-messnetz/certification-of-monitoring-stations.html>]. It was developed and implemented between 2010 and 2013 and was put into operation in 2014. METEO-Cert evaluation includes about a hundred criteria covering uncertainty of the instruments, measurement location and siting (based on the WMO CIMO Siting Classification), maintenance and calibration procedures of the operator, as well as metrics such as timeliness (transmission speed) and data availability. The evaluation results are determined by analyzing one year of data (see example in Figure 4). To ensure an unbiased result, the inspections and application of the METEO-Cert is carried out by a third party institution – in our case, the Swiss Institute of Metrology (METAS). METAS experts inspect both MeteoSwiss own stations and the

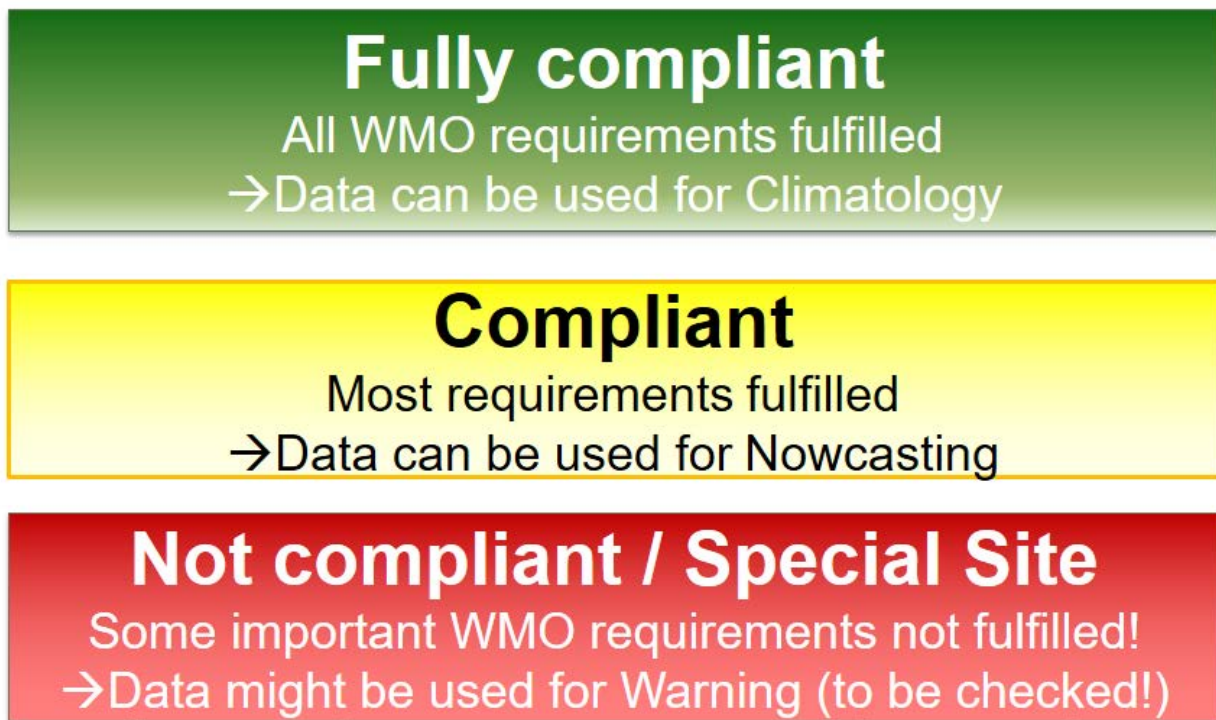


Figure 5: The three METEO-Cert quality labels. In future versions of METEO-Cert there will be two separate labels for “Not Compliant” and “Special Site”.

Can station inspections improve data quality?

The inspections and METEO-Cert results were used not only to assess the compliance of automatic weather station but also to find quality issues and to try to fix them. This applies to both partner stations as well as MeteoSwiss stations. Based on the METEO-Cert results, MeteoSwiss had to remove some trees, which were influencing the measurements by either shading instruments or acting as an obstacle for precipitation or wind measurements (an example is illustrated on the MeteoSwiss METEO-Cert page [Source: <https://www.meteoswiss.admin.ch/home/measurement-and-forecasting-systems/land-based-stations/automatisches-messnetz/certification-of-monitoring-stations.html>]). Quality issues findings have been discussed with the respective partner at regular annual meetings and possible solutions to existing problems have been found together. In some cases, such solutions included: relocations of stations (see examples in Figure 6); correction of measurement heights on wind masts or of temperature sensors (as required by the WMO CIMO Guide); and the installation of dynamic heating units in Davis precipitation sensors. In summary, it can be concluded that the quality of measurement of both MeteoSwiss and partner stations has been improved thank to the METEO-Cert inspections carried out in the last years.



Figure 6: The MeteoGroup stations of Zernez (too close to the forest) and Brissago (station not measuring above grass) are two examples where the stations were relocated to a more representative location due to the results of the METEO-Cert inspections.

The future of public-private partnerships

MeteoSwiss has started its partnerships with partners from the public sector already in the early 2000's, while the first collaboration with a private partner started in 2011 with the signing of the contract with MeteoGroup. During the last ten years, the significance of partner data has increased and this is seen in the increased number of partner stations in the MeteoSwiss data warehouse. Figure 7 shows that, as of 2014, the number of partner stations in the data warehouse exceeds those of the MeteoSwiss stations (a map of these stations is shown in Figure 3). The launch of the METEO-Cert certification procedure for automatic weather station was another milestone in the MeteoSwiss partner network strategy. This procedure helps to find possible problems with weather stations and it is also a tool for determining possible applications of the measurements. The procedure is applied to all MeteoSwiss automatic weather stations as well as to the described set of 50 MeteoGroup stations. An assessment of all third-party stations would be ideal but is not possible at present due to its high cost.

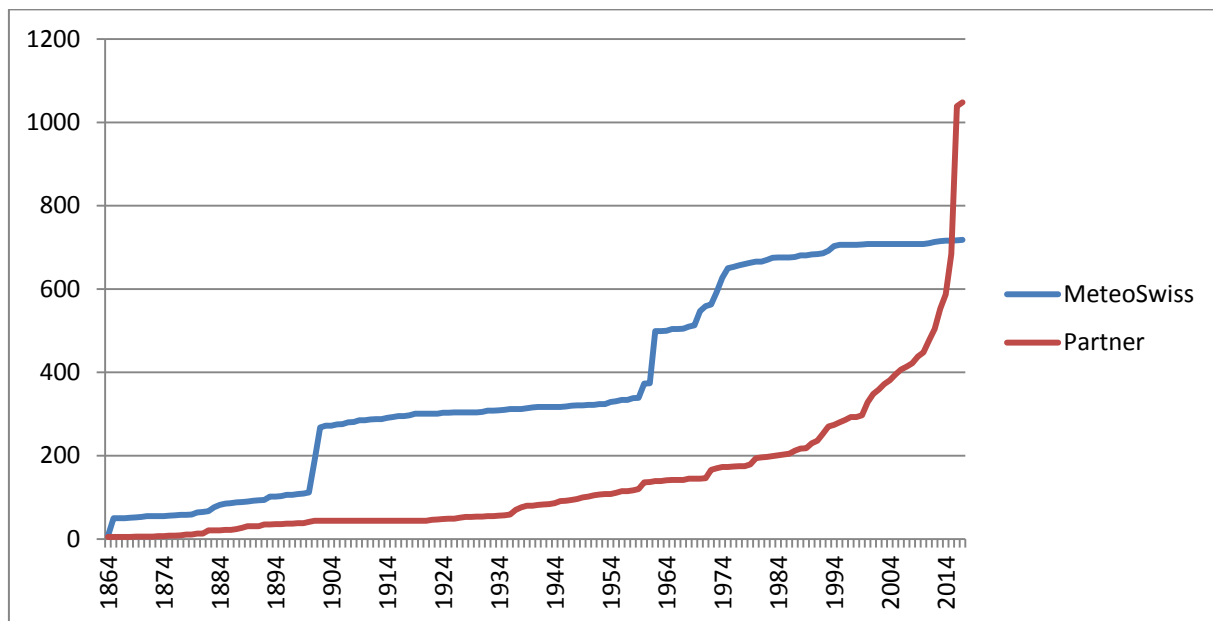


Figure 7: The amount of MeteoSwiss (blue) and partner (red) weather stations in the MeteoSwiss data warehouse. Most partner stations integrated before 1970 belong to the National Weather Services of the neighboring countries like France, Germany or Austria. First private partner stations appeared in 2011. Since 2014 there are more partner stations than MeteoSwiss stations in the MeteoSwiss.data warehouse – its central data platform.

As a next step, MeteoSwiss is currently working on applying quality checks on the partner data itself. In 2018, MeteoSwiss started a project to renew its data quality assessment procedure and tools. This includes an update or creation of hundreds of plausibility tests applying “hard” or “soft” limits, based on regional or temporal comparisons or on comparisons with other instruments (e.g., parallel measurements, etc.). These quality assessment procedures are also applied to all the data of meteorological partner stations. As a first step, partner data is tested against hard limits (e.g., “physically impossible”). The next step, planned for late 2020, is to check partner stations data with the same set of tests as for MeteoSwiss’ own stations. Currently, load tests are being carried out on all MeteoGroup stations in our testing environment and the first results look promising. Once this testing infrastructure is in production, the possible applications of partner data will increase. At the moment, some users are reluctant to use partner data or use them only very conservatively due to lack of quality assurance. Once the full set of plausibility tests is applied and outliers are flagged accordingly, this will not be an issue anymore. We are therefore looking into a future where partner data become even more important and their use by MeteoSwiss as well as by other governmental agencies (with whom we share the data) will increase. As one of our partners, Dennis Schulze (Chief Meteorology Officer at MeteoGroup), said recently: “The public-private partnership has been successfully established but there is always room for improvements”, and this is well illustrated in Figure 8.



Figure 8: Two public and a private party measuring at the same location. This scenario will soon be a thing of the past. MeteoSwiss and MeteoGroup have been successfully cooperating and coordinating their network expansions since 2011. Meanwhile there is also a cooperation with the Swiss