A QUALITY MANAGEMENT SYSTEM FOR THE PROCESS OF COLLECTING METEOROLOGICAL DATA

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Abstract

Quality Management has been discussed widely within WMO Commissions meetings and it has been understood that the certification of NMHSs and its processes will become a future necessary activitiy. The German Meteorological Service (Deutscher Wetterdienst) implemented a quality management system and received its certificate following the ISO 9001 standards in July 2004.

It will be presented how the implementation of a quality management systems has been practically solved in the German NHMS. The presentation will introduce the main elements of a quality management system especially for meteological data generation and data management, that is, the documentation of the individual processes which are responsible for collecting meteorological data, performance indicators and mechanisms to integrate user requirements.

Quality Management System (QMS) and ISO Standards

A Quality Management System (QMS) is a business management system to direct and control an organization with regard to quality, i.e., to achieve its objectives. It is not a simple set of documents but a dynamic process, based usually upon ISO Standards that bring resources, activities and behaviours together and focus on the achievement of objectives. A QMS embraces all business processes of a NMS and is build on Technical Standards. The ISO 9001:2000 is nothing else than the international standard that specifies the fundamental concepts and vocabulary with quality management systems.

The up-dated standard ISO 9001:2000 is based on a model of a process-based QMS. This new standard is focussing on four major processes of which interactions establish a comprehensive QMS. The major processes are:

I Management Responsibility,
II Resource Management,
III Measurement, Analysis and Improvement,
IV Product Realisation.

These four major processes can be broken down into several sub-processes. Each of those sub-processes needs to be described and documented with regard to the specific framework of laws, guidelines and organisational peculiarities.

The ISO 9001 standard defines a "process" as a set of interrelated or interacting activities which transforms inputs into outputs. Processes are generally carried out under controlled conditions to add value. A process of a NMS can be, e.g., forecasting, warning, consultancy or collecting meteorological data.

The introduction of a QMS can be divided into five phases. The model of introducing the QMS in phases has been practised more or less in the same manner in most of the private and public sectors and is described in the respective literature. The phases are as follows:

Phase 1 Definition of the quality policy and the quality objectives.
Phase 2 Education and Training of the staff.
Phase 3 Analysis of the Processes Analysis.
Phase 4 Realisation and Implementation of the Processes.
Phase 5 Evaluation and Process Control.

Every 3 years the certificate expires and the process of registration has to be repeated.

The QMS of Deutscher Wetterdienst (DWD) obtained a certificate following the standard ISO 9001:2000 in July 2004.

The Processes of DWD

One major QM principle is the “process approach”. This principle expresses the following:

“**A desired result is achieved more efficiently when activities and related resources are managed in process**.”

For product realization you need a defined purpose and goal or objective. The process will need inputs in the form of product, people, information, equipment, materials and money. There should be a pool of resources available in the form of tools, equipment, machinery, money, people and knowledge to support the process development. The activities of a process have a sequence from start to finish.

The output of a process, which is in the form of a product, information, people or decision, needs to be controlled by standards, measurements and feedback loops. The process is characterized by results as a measure of achievement, efficiency and effectiveness.

Figure 1 shows the main processes (vertical columns) of the DWD and its supporting processes (horizontal columns).

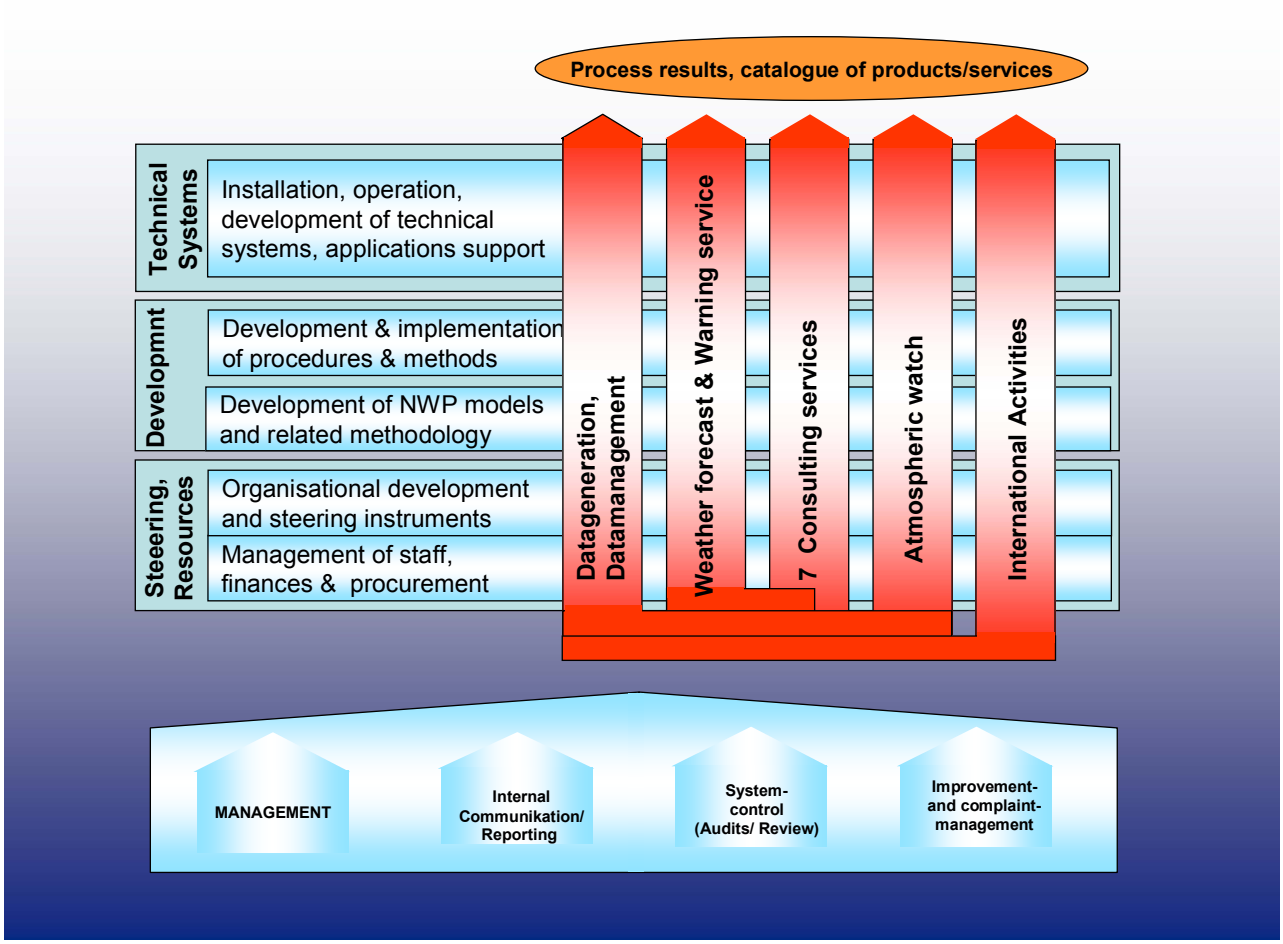


Figure 1: Major DWD processes and its supporting processes.

The major process of data generation and data management underwent again a process analyses and is divided again into main (vertical columns) and supporting processes (horizontal columns)(Figure 2).

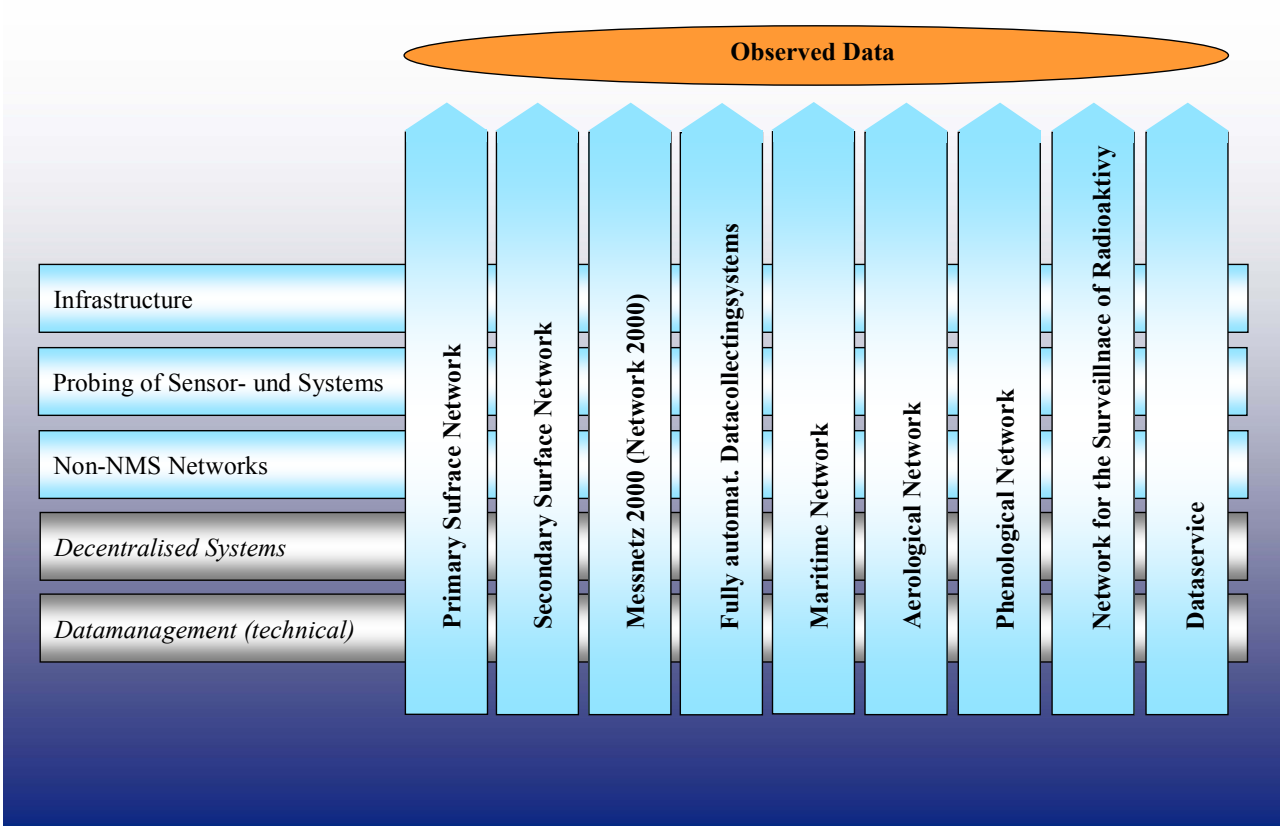


Figure 2: Process of Data Generation and Data Management as defined by DWD.

Documentation

The documentation of a QMS is a hierarchy of documents as demonstrated in Figure 3. At the top level there is a QM manual which contains the specifics of a QMS of an organisation. It contains the policies and objectives of the organisation. It is a means of showing how the systems has been designed, who carries the responsibilities for which process and how to improve the systems. The documentation of processes is at Level 2.

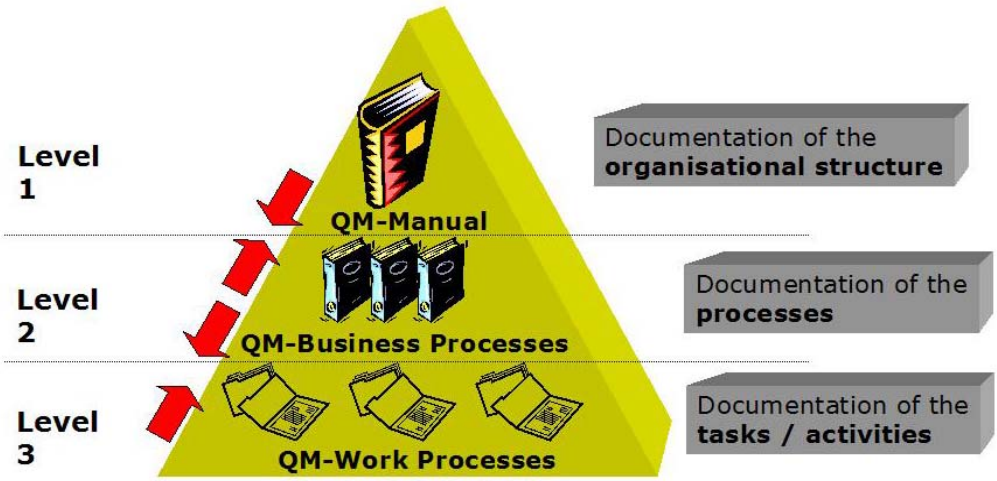


Figure 3: The three levels of Quality Management Documentation.

Performance Indicators of the Data Generation and Data Management Process

Performance indicators are an important tool to control processes. The process will only work successfully if the staff is appropriately qualified and performs satisfactorily, if hardware and software are reliable and if in particularly the cooperation with the major DWD process “Technical Infrastructure” works smoothly.

DWD determined the following indicators to monitor its Data Generation and Data Management Process:

- Completeness of data (E.g., Did all the stations reported in time ?).
- Timeliness of data (E.g., Did all data arrived in time ?).
- Percentage of corrected or complemented data.
- Number of user-help-desk tickets.
- Downtime of individual meteorological sensors.

The following examples show indicators from the secondary ground based observing network of DWD. Figure 4 gives the completeness of data during 2004. Figure 5 indicates in percentage how many of the data have been flagged in the quality control run and Figure 6 gives the result of the man-machine interactive quality control procedure. The results are shown for the different Regional Network Group of DWD which are responsible for the data control.

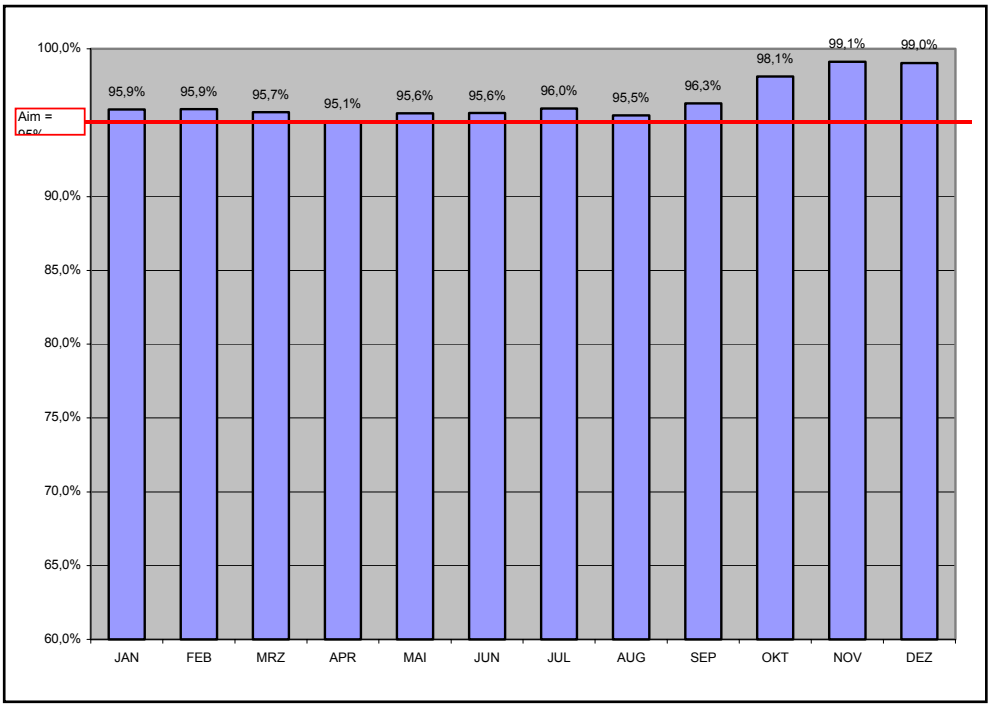


Figure 4: Data completeness for the secondary ground based observing network of DWD during 2004.

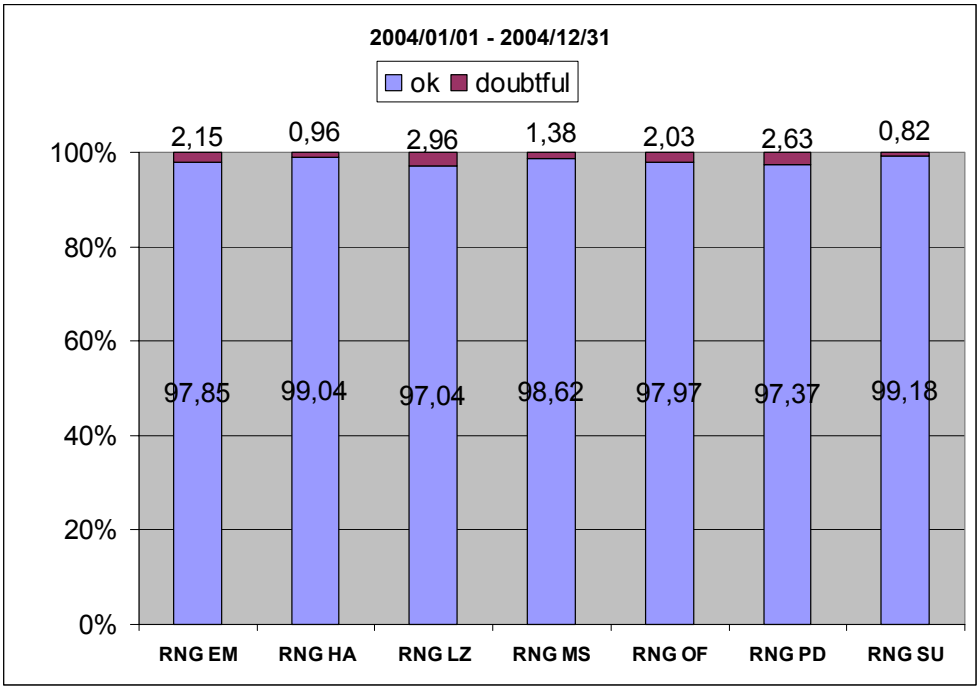
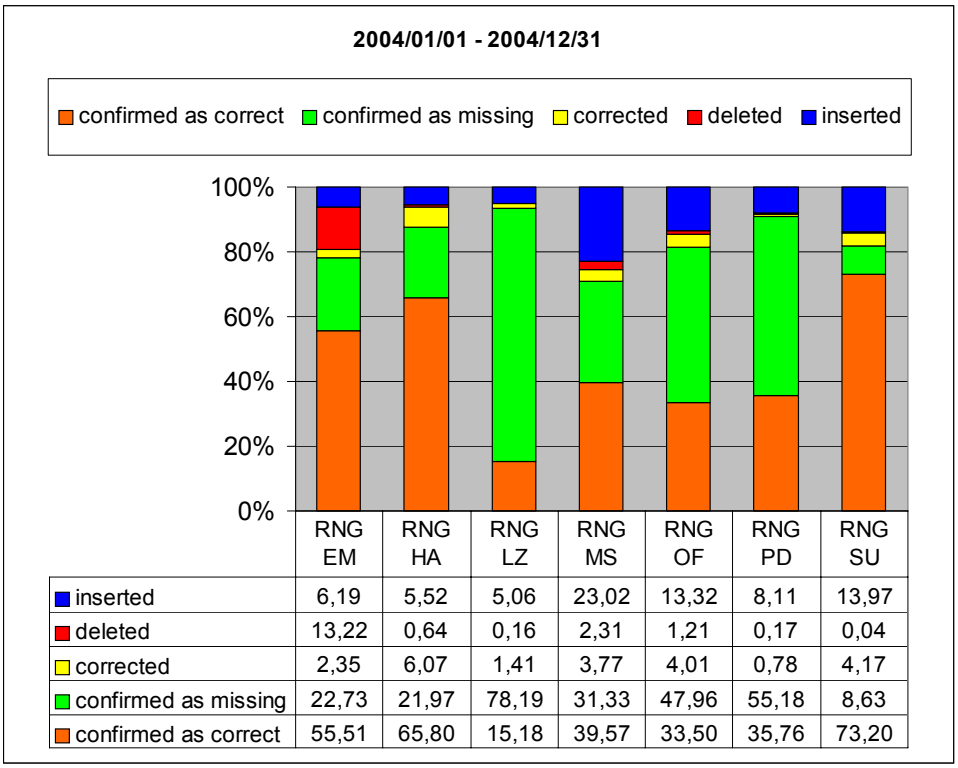


Figure 5: Percentage of data which have been flagged during the control run; results for the different Regional Network Groups of DWD.



	RNG EM	RNG HA	RNG LZ	RNG MS	RNG OF	RNG PD	RNG SU
inserted	6,19	5,52	5,06	23,02	13,32	8,11	13,97
deleted	13,22	0,64	0,16	2,31	1,21	0,17	0,04
corrected	2,35	6,07	1,41	3,77	4,01	0,78	4,17
confirmed as missing	22,73	21,97	78,19	31,33	47,96	55,18	8,63
confirmed as correct	55,51	65,80	15,18	39,57	33,50	35,76	73,20

Figure 6: Results of the man-machine interactive quality control procedure. The number of flagged data have been set to 100%. The results are shown for the different Regional Network Group of DWD which are responsible for the data control.

References

(1) World Meteorological Organization, 2003: *Congress*. Fourteenth Session, 5-24 May 2003. Abridged Final Report with Resolutions. Role and Operation of National Meteorological and Hydrological Services; Quality Management; Report to plenary on item 7.2; 23.V.2003, Cg-XIV/PINK 7.2(2). WMO-No. 960, Geneva.

(2) World Meteorological Organization, 2003: *Executive Council.* Fifty-Fifth Session, 26-28 May 2003. Abridged Final Report with Resolutions. WMO-No. 961, Geneva.

(3) Hoyle, David, 2003: ISO 9000:2000. An A-Z Guide. First edition. Butterworth-Heinemann. Elsevier Science, Oxford.

(4) International Standard Organisation, 2000: Quality management systems – Requirements (ISO 9001); EN ISO 9001:2000.

(5) International Standard Organisation, 2000: Quality management systems – Guidelines for performance improvements (ISO 9004), EN ISO 9004:2000.

(6) International Standard Organisation, 2000: Quality management systems – Fundamentals and vocabulary (ISO 9000), EN ISO 9000:2000.

(7) Richter, C.: Study of Quality Management Implications on the Instrumentation Sector, World Meteorological Organization, Study. March 2004, Geneva.