

# *Documentation on Quality Assurance and Representativity of Meteorological Observations*

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## *Abstract*

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Appropriate quality management and assurance of the representativity of meteorological observations require an up to date view on the functional specifications of the variabls to be observed. The Royal Netherlands Meteorological Institute KNMI has published a guide-document on in situ measurements, data reduction, quality control and data presentation. The content of the guide and the chapters of the guide is in accordance with the style and contents of the WMO Guide to Meteorological Instruments and Methods of Observation and gives details on:

- definitions, units, coding, derived variabls;
- requirements on range, resolution, accuracy, frequency of measurements, etc.
- instruments and technical specifications, calibration procedures;
- procedures in case of missing data, methods on datavalidation, procedures on site inspection;
- calculating derived parameters: used formula to transform data;
- siting conditions and –requirements.

The guide is as a loose leave booklet, so it remains up-to-date with new revisions. The book consists of 20 chapters. The first chapter gives a general overview of the conditions, rules, etc. with respect to observation sites in general. Like the CIMO Guide, the other chapters describe the special rules per variable. An important element of the quality system is document management. A number of tasks are highlighted: mangement issues, maintenance, procedures and know-how. An electronic version will published on the world wide web in 2005.

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## **1. Introduction**

For the departments in the Royal Netherlands Meteorological Institute (KNMI), which frequently use data of meteorological measurements, it is of high importance to have a good view on the specifications of the measurements. Interested departments are in the fields of weather forecasting, climate research, development of high resolution models and other applications, statistical research, inspection of observation sites, validation of data, etc. However, most of the above mentioned information is spread out over a lot of special documents or is even only in the heads of the specialists. In the framework of quality assurance, to provide better view on those specifications and to realize a central information source, a couple of years ago the KNMI has started the project Guide on Observations. This project mainly focuses on the publication of a guide containing descriptions of all relevant matters concerning the operational meteorological and climate variables, especially with respect to the situation in The Netherlands:

- definitions, units, coding, derived variables;
- requirements on range, resolution, accuracy, frequency of measurements, etc.
- instruments and technical specifications, calibration procedures;
- procedures in case of missing data, methods for data validation, procedures on site inspection;
- calculating other parameters: used formulae to transform data;
- site conditions and requirements with respect to the surroundings.

The guide is provided as a booklet consisting of removable pages. A system like this makes it relatively simple to delete, change or add parts of the document and to quickly generate up-to-date versions of the guide. The book has been divided in 20 chapters, for the main part in accordance with the content of the WMO-guide to Meteorological Instruments and Methods of Observation, Part I (ref.1).

The first chapter gives a general overview of the conditions, rules, etc. with respect to observation sites in general. The next 19 chapters describe the special rules per weather variable. One variable per chapter and every chapter in a standard format. Part of the guide has been published: the chapters concerning the observation stations and the variables temperature, atmospheric pressure, humidity, wind and precipitation have been finished. The chapters about radiation, sunshine duration, visibility, evaporation, soil temperature, present weather, clouds, sea waves and lightning are in preparation.



*Fig. 1. Front page of the guide*

A draft version of those chapters is available on the KNMI- intranet site. It is foreseen that the whole document will be completed before the end of 2005. It is also the intention to publish the document on Internet. A translation of the chapters 1 -6 into has been produced under the supervision of Dr. Günter Olbrück of EUMETNET. The word-document of the English version is available on <http://www.dwd.de/EUMETNET/> see "NEW!! Meteorological Handbook".

A main functional element of the system is the document management. The following tasks have been distinguished:

- a) the management of the maintenance, for instance being alert to changes in methods, requirements or procedures, and realizing up-date versions;
- b) management with respect to administrative procedures, up-dating distribution lists, taking care of sending new paragraphs, etc.
- c) the appointment in the institute of experts per variable.

These important functions and tasks have been given a fixed place in the organisation, especially in the KNMI-department for Observations and Models.

The distribution list of the guide includes about 200 persons and departments in the institute and about 80 extern relations in the Netherlands.

## **2. Content of the guide**

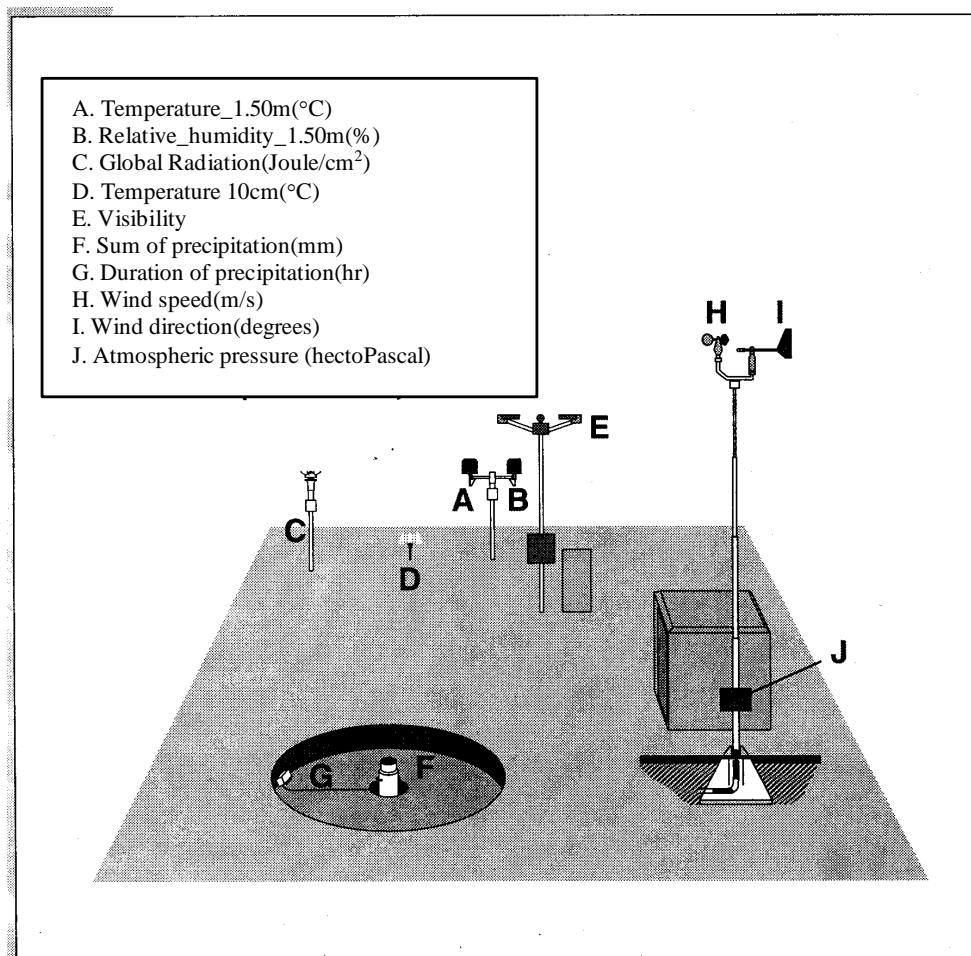
The guide contains 20 chapters. The first 17 concern subjects and variables that are in line with the contents of the WMO-guide to Meteorological Instruments and Methods of Observation, Part I (ref.1). Three subjects have been added as extra chapters, i.e. sea water temperature, sea waves and lightning. Chapter 11 in the KNMI-guide concerns the measurements of soil temperature. This differs from the philosophy of the WMO regarding this variable. In the WMO-guide soil temperature has been described in the framework of chapter 2, temperature. The KNMI considers soil temperature a parameter requiring specific attention and procedures, so it has been given a special chapter. The corresponding chapter number 11 in the WMO-guide concerns soil moisture. However, the variable soil moisture is (still) not measured operationally by KNMI, therefore this parameter is not included in the KNMI-guide.

The content of the KNMI-guide is as follows:

- |                        |  |
|------------------------|--|
| 1.General              | 12. Upper air pressure, temperature, humidity          |
| 2.Temperature          | 13. Upper air wind                                     |
| 3.Atmospheric pressure | 14. Present weather, past weather, state of the ground |
| 4.Humiity              | 15. Observation of clouds                              |
| 5.Wind                 | 16. Ozone measurements                                 |
| 6.Precipitation        | 17. Atmospheric composition                            |
| 7.Radiation            | 18. Seawater temperature                               |
| 8. Sunshine duration   | 19. Ocean waves  |
| 9. Visibility          | 20. Lightning  |
| 10. Evaporation        |  |
| 11. Soil temperature   |  |

Chapter 1, “observation station general” gives an overview of the different types of observation stations in The Netherlands, the composition of an (automatic) weather station, the repartitioning of the various weather stations around the country, the scales, general rules and procedures with respect to inspection, control and management with respect to weather stations, general information about the site conditions, etcetera.

Added to this chapter are appendices with a scheme of the site of an automatic station, a map of The Netherlands with the locations of all kind of stations (automatic stations, wind palls, specific precipitation stations, etc.), tables with the names of the stations, the positions of the stations, the measured variables, etcetera.



*Fig.2 Automatic weather station*



Fig.3. Meteorological observation network

In the chapters 2 – 20, a standard lay out of the paragraphs has been, c.q. will be followed:

1. Description

- 1.1 name of variable (e.g. wind, precipitation)
- 1.2 definitions
- 1.3 units: standard cf. SI (e.g. m/s), or non-standard (e.g. kts.)
- 1.4 derived variables (e.g. wind speed, -direction) + definition
- 1.5 codes and explanations (synop, metar)

2. Operational requirements

- 2.1 range, e.g. 0 - 50 m/s
- 2.2 resolution, e.g. 0.1 ° C
- 2.3 required accuracy, e.g.  $\pm 0.5$  hPa
- 2.4 required frequency of observations, e.g. every 12 seconds
- 2.5 required availability per specific period, e.g. 50 % per hour

3. Instruments and techniques

- 3.1 technical specifications of the instruments
- 3.2 management- and calibration procedures

4. Procedures

- 4.1 procedures in case of missing data
- 4.2 procedures for data validation
- 4.3 procedures for inspection and control of observation sites

5. Calculation of other parameters

- e.g. formula for calculating atmospheric pressure from measured value of pressure, or formula for calculating relative humidity out of dew point temperature and air temperature

6. Site conditions, requirements with respect to surroundings

- 6.1 Specific conditions per instrument
- 6.2 Conditions with respect to the surroundings of the site

**LITERATURE**

1. World Meteorological Organization, WMO, Geneva, 1996; Guide to meteorological instruments and methods of observation, WMO-No. 8, 6<sup>th</sup> edition, 1996;