# INTRODUCTION OF METEOROLOGICAL WORKSTATIONS AT THE ROYAL NETHERLANDS METEOROLOGICAL INSTITUTE (KNMI).

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## 1. INTRODUCTION

The operational department of the Royal Netherlands Meteorological Institute (KNMI) is organized in three main branches : general services (national meteorological centre), airport services and marine forecasting services. The production of forecasts at each of these centres is based on:

- plotted observations in hard copy.
- decoded observations displayed in alphanumeric format at a standard terminal.
- hard copies of plotted output of several numerical models.
- limited set of plotted output of several numerical models on colour screens
- loops of weather radar pictures at dedicated colour screens.
- satellite images presented by a dedicated system (the forecaster can choose from a limited set of loops).
- interactive tools at main frames and personal computers.

## 2. CURRENT SITUATION

In random order at least the following bottlenecks can be mentioned:

### 2.1 Numerical model output.

Only a (small) part of the output from the numerical models of the European Center for Medium Range Weather Forecasts (ECMWF) and United Kingdom Meteorological Office (UKMO) is presently available to the forecasters, plotted on paper. As result of the introduction of new numeric models at KNMI (HIgh Resolution Limited Area Model,

HIRLAM) the amount of available information will grow with a factor five or more. A full use of all this information is not possible with hard copies. Some output of these models is presented on a screen, however only predefined and produced as graphical files which can be displayed.

Some additional tools are available, e.g. Model Output Statistics (MOS) applied on the ECMWF model, presented as tables and plotted on a map, air trajectories, prognostic profile diagrams et cetera.

## 2.2 Observations.

The traditional surface and upper air observations are plotted as station model plots on preprinted maps (size about 60 times 70 centimeter) in two colours, the upper air observations also as profile diagram.

The time between observation time and graphical presentation on paper is one hour or more.

## 2.3 Satellite.

Satellite images of geostationairy satellites and of the polar orbitters are received and processed with a dedicated system at KNMI. At the three main centers a decicated display system is available.

## 2.4 Radar.

KNMI has currently two radar sites in use, one at De Bilt and one at Amsterdam airport. Because these sites are not far from each other the Amsterdam airport radar will be moved to the North-west of the Netherlands to obtain a better coverage of the North Sea. The images of both radars are combined and displayed on PC-s.

## 2.6 Lightning.

Lightning is displayed with a low resolution on the image of the radar.

## 2.7 Facsimile.

Facsimile charts are available as hard copies only.

## 2.8 Other systems.

Beside above mentioned systems the forecasters also have available some additional tools: alphanumeric presentation of decoded observations, flight information, small interactive computer programs, a dedicated system for text processing and distribution, a system to correct graphically time series of computer output for a number of locations in the Netherlands et cetera.

## 2.9 Multiplicity of non integrated systems.

All these tools have their own screen and keyboards and their own user interfaces. Combinations (overlays) of the graphical products is not or only limited (hardcopies at the same scale) possible.

## 2.10 The interactive production.

The process of analysis and diagnosis is mainly performed manually with hard copies as input. Only standard meteorological parameters are used. Introduction of new ones is difficult with the present tools. Some tools are available on PC-s and as main frame application.

## 2.11 The distribution of products.

The distribution of alphanumeric products has been modernized recently. However, clients prefer more and more graphical presentation of weather forecasts or a mixture of text and graphics. With our present outfit this is not possible.

## 3. METEOROLOGICAL WORKSTATIONS

Because the above described bottlenecks limit the efficiency and the possibilities to expand the service to customers KNMI started in January 1991 a project to redesign the present meteorological production process through the introduction of Meteorological WorkStations (MWS). The general requirement was to obtain as soon as possible a user friendly system that easily performs the complex task of integrating information and creating final products, based on most up to date techniques. The chosen solution was the procurement of a commercial available MWS.

## 3.1 Basic Requirements.

KNMI likes to standardize as much as possible and buy systems at the commercial market if possible. The basic requirements therefore are:
- Proven technology (in use elsewere)
- off-the-shelf (+/- 80 %)
- standard hardware
- UNIX/OSF operating system
- X-WINDOWS (OSF/MOTIF) user interface

## 3.2 Time schedule.

In January 1991 KNMI started a study to define all the requirements for an MWS. In August 1991 it was decided to fasten the process. Early December 1991 the specifications

were plublished in accordance with the rules for the EC/GATT. In February 1992 six bids were received mainly from US companies. After a thouroughful evaluation of the bids the contract was granted to RMS Technologies, INC., Marlton NJ, USA, at the end of June 1992. At that time the development of the software for the not standard available items started. The first MWS with limited functionality (observations and model output) has been delivered in December 1992 at NMC De Bilt. Medio 1993 a MWS has been installed at the marine forecasting service and at the airport service. More workstations will be installed in 1994. The training of the forecasters (80) is planned between November 1993 and May 1994 followed by operational use of all the MWS systems in the summer of 1994.

## 3.3 Hardware.

As hardware originally has been selected a DIGITAL 5000/240 ULTRIX system. Each display system has three 19" colour screens which can be operated by one mouse and one keyboard!. For data ingest a similar system with one screen is used. All the systems have currently 1 Gb disk capacity and 64 Mb memory. The datacommunication is performed by means of a local and a wide area network (Ethernet).

In 1994 an upgrading to DIGITAL ALPHA SYSTEMS 3000/300 and 3000/400 will be performed. These systems will have 96 MB memory and 1.4 GB disk space.

## 3.4 Functions.

The following functions will be available in the MWS:

- PROJECTIONS
    - polar stereographic
    - satellite view
    - mercator (optional)
    - lambert conformal (optional)
    - cylindrical equidistant (optional)

- plate-carre (optional)
- PAN AND ZOOM FACILITIES
- OBSERVATIONS
  - surface and upper air station plot
    (SYNOPS,METARS,SHIPS,SFLOCS,SATOBS,AIREPS,TEMPS,PILOTS,
    DRIFTERS, derived parameters)
  - conditional presentations of observations
  - click and display nearest observation in decoded format
  - sounding diagrams (TEMPS,PILOTS)
  - stability indices
  - cross sections
- NUMERICAL MODEL OUTPUT
  - contours of GRIB-coded fields ( regular LAT/LON, LAT/LON with bitmap,
    shifted pole and stereographic)
  - output of ECMWF atmospheric and wave model, UKMO model, KNMI high
    resolution limited area model and wave model)
  - graphical display of time series for a number of selected locations (atmospheric,
    wave and tide model), combined with observed values as a menu selection.
  - air trajectories.

- SATELLITE
  - visible and infrared channels of the polar orbitters (NOAA11 and NOAA12)
  - visible, infrared and water vapor channels of METEOSAT
- RADAR
  - combined image of two KNMI-radars.
- LIGHTNING
  postponed to 1994 (waiting on the procurement of a new lightning detection system).
- DIGITAL FACSIMILE (T4-code)

- DRAW FACILITIES
  - . lines (6 types, 20 thicknesses, 12 colours)
  - . fronts (cold, warm, occluded, et cetera)
  - . symbols (present weather, clouds, special, KNMI defined).
  - . filled areas ( 6 types, 12 colours)
  - . text ( 5 fonts, 6 sizes, 12 colours)
  - . merge model output contours
- EDIT FACILITIES
  - . change shape,colour,type,size, font,..
  - . move
  - . delete
- DISTRIBUTION FACILITIES
  - . send maps to other systems at the same location or at other sites.
- HARDCOPIES ON LASER PRINTER.
- IMAGES in PC-FORMAT
  - . X-window screen dump converted to PC-format (GIF).
- KNMI-tools:
  - . windows to existing UNIX or VAX/VMS systems
  - . Soft PC (MS-DOS emulation)
  - . KNMI applications on the MWS system
- ANIMATION
  - . of all types of products
- OVERLAY
  - . of all types of products
- FOLDERS
  - . of all types of products

All these functions can be used indepentdently at each of the three screens.

## 4.    NEW INTERACTIVE  PROCESSES

Beside the introduction of the Meteorological  Workstations  KNMI has started developments  to improve the meteorological  production  process with interactive  modules for fog forecasting,  short range precipitation,  short range cloudiness,  et cetera.

## 5.    FUTURE

The available amount of data will grow more and more in the future. The hardware and the display software on the desk of the forecaster  is not the limiting factor anymore, the problem  will be the selection  of useful data. The MWS of the future should "advise" the forecaster  which data contain  important  information.  This will be the challenging  task for the MWS developpers  the coming years.