Foreword

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Preface

The Commission for Instruments and Methods of Observation (CIMO) considers it to be an important task to make updated information on instrument development known to the Members. For nearly twenty years CIMO has been dealing with questionnaires on instrument development. As a result of these activities three editions of "Instrument Development Inquiry" were subsequently published in 1968, 1976 and 1980. The publications contained new information on 497 instruments under development.

Following the decision of the eighth session of CIMO, the Working Group on Instruments and Methods of Observation for Surface Data produced in close co-operation with the WMO Secretariat a revised text which is now published as the "Instrument Development Inquiry", fourth edition in the Instruments and Observing Methods report series. The format has been streamlined. Taking into account that some of the development activities reported are not applicable to operational use and that others are quickly outdated the issue now contains information on both instruments under development and instruments put into operational use. A total of 22 Members have provided new information on 120 items.
Introduction

The information included in this edition is divided into two chapters, namely, "Instruments under Development", and "Instruments put into Operational Use".

For ease of use, a fold-out page at the rear of the publication provides a key to the format. The categories of development are listed in the table of contents, while Table 1 provides a tabulation of the development categories for which information was received from the Members who responded positively to the inquiry.
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(WWW 1772)
Chapter 1 - INSTRUMENTS UNDER DEVELOPMENT

Category Number 1

GENERAL (Pertaining to general requirements of meteorological stations)

The following countries* have reported developments concerning instruments in this category.

None

* For key, use fold-out page at rear of book
Category Number 2
WEATHER OBSERVATIONS (techniques of observation)

The following countries* have reported developments concerning instruments in this category:

Germany, Federal Republic of

1 - Federal Republic of Germany
2 - Plastic instrument shelter (thermometer screen)
3 - Final design based on the operational experiences of selected stations supplied with prototypes
4 - Naturally ventilated meteorological screens to shield thermometers, recorders, sensors for temperature and humidity, etc. from direct radiation and precipitation

5.1 - Instrument shelter for observing stations

5.2 -
5.3 -
5.4 -
5.5 -
5.6 -
5.7 -
5.8 -
5.9 -
5.10 - The doubled louvered walls are made of injection cast plastic modules. The mechanical stiffness is achieved by a framework of aluminium profiles. The supporting stand is composed of stainless steel tubes.

6 - The temperature error is smaller compared with wooden white painted screens. Considering the characteristics of the material, long periods without maintenance are expected.

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* For key, use fold-out page at rear of book
7.1 - 700 approximately

8 - H. Brust, Deutscher Wetterdienst, Instrumentenamt München, August Schmauss Strasse 1, D-8042 Oberschleissheim

9 - Patented, DP No. 3034781
MEASUREMENT OF ATMOSPHERIC PRESSURE

The following countries* have reported developments concerning instruments in this category:

Canada

1 - Canada
2 Station Pressure - "HUMDINGER"
3 under test
4 Force balance between aneroid bellows and vibrating wire, frequency of vibration of wire is measure of atmospheric pressure applied to bellows

5.1 - station pressure
5.2 - 700 to 1100 mb
5.3 - short term 0.1 mb, drift 0.05 mb/year
5.4 - 5 seconds
5.5 - 100 seconds
5.6 - high
5.7 - Output frequency near 400 Hz. Microprocessor and display to convert to pressure and display 4 1/2 digits.
5.8 - sensor alone 100 mW
5.9 - recalibration 2 to 5 years
5.10 - Stationary application only. Will require calibration check after shipment.

6 - Tests over 7 year period against dead-weight pressure source. Can calibrate to about 2 pascals.

7.1 - Estimate 1000

7.2 -

* For key, use fold-out page at rear of book
1 - Canada
2 - Vapour Balance Barometer
3 - 10 production prototypes nearing completion
4 - Measurement of the boiling point of Freon and relating that to the atmospheric pressure.
   5.1 - Station barometer and Autostations.
   5.2 - 700 to 1100 mb
   5.3 - error less than 0.3 mb for 1 year
   5.4 - approximately 10 seconds
   5.5 - none
   5.6 - unknown as yet
   5.7 - not applicable - analogue voltage output 0 - 5 volts for 800 - 1100 mb.
   5.8 - 12 volts at 50 mA max.
   5.9 - unknown
   5.10 - Small and light; dimensions approximately 5 x 15 x 25 cm. Weight approximately 300 grams.
6 - Good experience with first prototypes, some difficulty in production so far. Now on third iteration of the design.
7.1 - 700
7.2 - unknown
9 - Original design held by the National Research Council, Canada.
Category Number 4

MEASUREMENT OF TEMPERATURE

The following countries* have reported developments concerning instruments in this category:

Germany, Federal Republic of
(see Category 2)

Sweden
Switzerland
Tunisia
United Kingdom
Canada
Philippines

1 - Sweden
2 - Microwave Radiometer
3 - Prototype field tested
4 - Multi-spectral measurement, possibility to utilize different elevation angles
5.1 - Temperature and humidity profiling, cloud liquid content
5.2 - 10 km
5.3 - Absolute accuracy of the radiometer 0.5 K
5.4 - Temperature and humidity profiles every 10 minutes
5.5 -
5.6 -
5.7 - V24 interface
5.8 - 220V or 380V
5.9 - 3 months

* For key, use fold-out page at rear of book.
5.10 - Accuracy of the retrieved profiles are better than 1.5 K below 6 km and better than 3 K below 10 km if the radiometer is used as an S-band alone instrument. The accuracy can be improved if the radiometer is used together with other sensors (SODAR or VHF-radar). A very high accuracy is obtained at low altitudes (2 km) if the elevation scan mode is used.

6 - Good agreement with radio soundings

7.1 - 100,000 - 200,000


9 -

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1 - Switzerland

2 - Thermo-hygrometer: temperature and humidity

3 - Under test since 1983, expected to become operational in spring 1985.

4 - Measure the air temperature and dewpoint with thermocouples, measure humidity with a mirror hygrometer.

5.1 - Swiss automatic meteorological station network.

5.2 - Temperature -40, +45°C, dewpoint -65, +40°C.

5.3 - 0,1°C (temperature) and 0,1% for RH

5.4 - ultrafast

5.5 -

5.6 - very big

5.7 - Sensor is commanded by an adequate microprocessor and is part of an automatic station.

5.8 - 50V AC and +6V DC

5.9 - one year
5.10 - Measure humidity with a mirror hygrometer
- thermocouples CuKonst of 0.3 mm diameter
- new absolute reference instrument for thermocouples
- the instrument is planned for use in extreme climatic conditions
- radiation error is less than 0.1°C for the flux of 1500 W/m² for temperature and dewpoint measurements
- sensor is protected from lighting

6 - Comparative tests of 7 instruments for 2 years with conventional reference instruments have shown excellent temperature measurement accuracy (THYGAN) and considerable improvement in humidity measurements.

7.1 - 4000

7.2 - Not yet available

8 - Dr. B. Hoegger, Chef du Service des Instruments, Institute Suisse de Meteorologie, Station aerologique, CH-1530, Payerne, Suisse

9 - B.A. Hoegger, et al. THYGAN a new rugged microprocessor based thermometer and dewpoint hygrometer, TECIMO III, Ottawa, 1985, to be published
1 - United Kingdom

2 - Thermometer for severe icing conditions

3 - Testing of field prototypes

4 - Very small openly exposed bead thermistor mounted at the tip of a flexible support rod which maintains essentially free of ice due to natural vibration in the wind.

5.1 - Severe icing environments

5.2 - at least -40 to +70°C

5.3 - ±0.5°C

5.4 - -

5.5 - -

5.6 - -

5.7 - DC potentiometric divider

5.8 - -

5.9 - 6 months

5.10 - -

6 - -

7.1 - 20

7.2 - very small


1 - Canada

2 - Remote Reading Thermometer

3 - Prototype

4 - At the remote site the temperature is measured and converted to a serial digital (ASCII) message and transmitted to the display at the observer's site. The display unit monitors the sensor and maintains a display of current maximum and minimum temperatures.

5.1 - Remote reading temperature

5.2 - -80°C to +60°C

5.3 - 0.2°C

5.4 - 2 minutes

5.5 - 2 minutes

5.6 - high

5.7 - Interface between sensor and display is a current loop transmitting an ASCII digital signal. Output is a digital display.

5.8 - Sensor 12V DC 100 mA. Display 12V DC 500mA.

5.9 - unknown

5.10 - Since the sensor contains a microcomputer it is able to carry out several diagnostic functions. A record of these diagnostic tests are transmitted with the temperature data and enhances the observer's confidence in the quality of the measurement. This development is a part of a family of sensors using similar remoting and display facilities.

6 - Accuracy and reliability are good

7.1 - Sensor 500 - Display 1500

7.2 - unknown

8 - David J. McKay, ACSL/M, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4.

9 -
1 - Canada

2 - Ground based six channel radiometer system. Measures total precipitable water (from 2 channels). Measures a temperature profile (from 4 channels).

3 - Completed prototype

4 - Dicke radiometers (i.e. a self-calibrating radio receiver operating at 20.65 GHz, 31.6 GHz, 52.85 GHz, 53.85 GHz, 55.85 GHz and 58.8 GHz).

5.1 - Aerological network

5.2 - 200 mb (arbitrarily terminated)

5.3 - H₂O vapour = 10%, Profiles 2°C - 4°C

5.4 - 1 second (i.e. systems are stable over 1.5 seconds)

5.5 - 1 minute and 10 minutes selectable

5.6 - Limited experience implies excellent

5.7 - IEEE-488 Buss with personal computers for control, data processing and data presentation.

5.8 - 115V, 60 Hz AC, 10 amp source

5.9 - not known

5.10 - Data is not reliable during rain

- 1 minute average of all data is archived (radiometric)
- 10 minutes averaged user data is archived (radiometric)
- All data may be remoted via two-way communications (modem)
- Archived data will include radiometric, surface data or "other data" that is interfaced to the IEEE Buss (other data is asynchronous, such as radiosonde)
- User data is be opacities from the 20.6 and 31.65 GHz channels, equivalent brightness temperatures from the remaining four channels, surface temperature, pressure, specific humidity as well as variances (based on one second averages) in the radiometric data
- How user data is further processed and presented will be selectable at the remoted terminal
- Radiometers must be in a controlled temperature environment
- Radiometer's field of view must be free of scattering sources, such as water towers, power lines, etc.

- This system is designed to operate without attendance for extended periods of time (more than 1 month)

6 - When compared against radiosondes - precipitable water consistently within 10%, temperature profiles are smoothed and have an error of approximately 2°C RMS in lower levels, much higher above 500 mb. Tropopause height within 50 mb.

7.1 - 400,000.00 including processing and display.

7.2 - unknown - should be under 10

8 - Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4, Attention: ACSL/M

9 -
Category Number 5

MEASUREMENT OF HUMIDITY

The following countries* have reported developments concerning instruments in this category:

Sweden (see Category 4)
Switzerland (see category 4)
Canada (see category 4)

* For key, use fold-out page at rear of book
Category Number 6

MEASUREMENT OF SURFACE WIND

The following countries* have reported developments concerning instruments in this category:

Bulgaria
Netherlands
Sweden
People's Republic of China
Philippines (see category 3)

1 - Bulgaria
2 - Wind speed gradient meter
3 - Instrument under field test
4 - Twin cup-wheel sensors with optoelectronic choppers and frequency meters. Difference of voltage outputs of frequency meters proportional to difference of wind speed at sensors' exposure levels
5.1 - Studies of sea breeze regime
5.2 - 0 to ±2.5 m/sec in wind speed difference
5.3 - 0.1 m/sec
5.4 - not yet measured
5.5 - not yet measured
5.6 - estimated MTBF not less than 24 months
5.7 - provision for analogue recording
5.8 - mains powered, 10VA
5.9 -
5.10 - Lightweight sensor cup-wheel, double ball bearing movement, dustproof, IR optoelectronic perforated disc chopper, pulse shaping circuits, analogue meters.

* For key, use fold-out page at rear of book
6 - Six months summer season testing in the field. Satisfactory performance. Necessity of ball bearing protection against salt pollution erosion.

7.1 - not applicable

7.2 - negligible, but not estimated practically

8 - D.A. Simidchiev, Experimental Meteorology Laboratory, Institute of Hydrology and Meteorology, 1113 Sofia, Blvd. Lenin 66.


1 - Netherlands

2 - Pressure Anemometer

3 - in use for research purposes

4 - The wind vector is measured by three orthogonal sensor systems. Each system measures the wind pressure in one direction. The sensors are protected from spray, rain, etc. by a continuous flow of clean pressurized air through the instrument.

5.1 - research

5.2 - 8 m/s and higher (will be extended to 4 m/s and higher)

5.3 - 0.2 m/s, 2° (azimuth and elevation)

5.4 - 0.03 seconds

5.5 - depending on peripherals

5.6 - not intended for long time unattended operation

5.7 - Three analogue signals (+ 5V) which must be computer processed to obtain wind speed and direction.

5.8 - 30W (excl. an eventual compressor)

5.9 - hourly zero point calibration

5.10 - not sensitive to mechanical vibrations; no moving parts; 360° azimuth angle; air consumption: 9 l/min (flow increases to 13 l/min during emergency situations, e.g., when the instrument is submerged).

6 - Compares well to Kayo Denki DAT-300 sonic anemometer, but has superior high frequency response.
7.1 - up till now not commercial
7.2 - arrangements for production
8 - Oost, KNMI, De Bilt, The Netherlands

1 - Sweden
2 - Sensitron Mini Doppler Sodar MDS 500 for measurement of wind and turbulent structure from 15 m up to max 500 m
3 -
4 - Remote sensing technique using acoustic sound pulses
5.1 - aviation, air-pollution, wind energy, research, met, observ.
5.2 - 0 to 30 m/s, height range 25 to max 500 m
5.3 - speed \( \pm 0.2 \) m/s, dir. \( \pm 5^\circ \)
5.4 -
5.5 - 15 seconds - 60 minutes (selectable)
5.6 - measured height 95% of the time 150 m (normal operation)
5.7 - Interface to most common computers RS 232 output, remote control
5.8 - 110 or 220VAC, 500W
5.9 - 2 time per year
5.10 - mobile
- can be integrated to order meteorological sensors
- software available for:
  - air pollution studies
  - windshear detection and warning
  - fog prediction
  - mixing height and inversion detection routine
  - statistics with windspeed and direction average and graphs like windroses etc.
Test made against Met. tower shows same accuracy as Doppler Sodar System 325

- 25,000 - 50,000

- 1,000 - 2,000 including spare parts

Mr. Claes Brodén, Sensiton AB, Nordmarksvägen 3, S-123 51, Farsta, Sweden

People's Republic of China

Automatic telemetering wind system

Prototype under field tests at six stations in 1985

Propeller and wind vane are used. Transmission is automatic every three hours by radio transmitter.

for island use

- 2 - 60 m/s

Wind speed $\pm(1+0.05V)$, direction $\pm22.5^\circ$

- 2 minutes

- 

Battery

- 

Ambient temperature range $-20-50^\circ C$ (sensor-transducer).
Ambient humidity, maximum 95% ($35^\circ C$) (sensor-transducer).
Transmission distance up to 200 km
Category Number 7

MEASUREMENT OF PRECIPITATION

The following countries* have reported developments concerning instruments in this category:

German Democratic Republic
Tunisia
United Kingdom
United States of America
Canada
People's Republic of China

1 - German Democratic Republic
2 - Precipitation sensor for automatic meteorological station, type NG 200, A = 200 cm²
3 - Under field test since 1982
4 - Amount of precipitation: counting of filling and emptying of a fixed quantity. Duration of rainfall: electric contact closed by water

5.1 - Measurement of precipitation amount and duration for solid and liquid precipitation
5.2 - 0 to 5 mm/min in steps of 0.1 mm
5.3 - 2% or ±0.1 mm
5.4 - -
5.5 - -
5.6 - -
5.7 - output suitable for IC's
5.8 - 220 VAC

* for key, use fold-out page at rear of book
5.9 - 2 weeks

5.10 - 

5.11 - 

6 - meets WMO requirements

7.1 - 

7.2 - 

8 - Akademie der Wissenschaften der DDR, Zentrum für wissenschaftlichen Gerätebau, DDR-1199 Berlin-Aldershof, Rudower Chaussee 6

9 - 

1 - United Kingdom

2 - Weighing Tipping Bucket Raingauge for total and rate of rainfall measurements.

3 - trials of field prototypes

4 - A conventional tipping bucket assembly supported on flexure pivots is continually weighed by means of a vibrating wire strain gauge and monitored using a microprocessor.

5.1 - Operational and specific trials requiring integrated and rate of rainfall.

5.2 - .1 mm/hr

5.3 - +./mm/hr
5.4 - 

5.5 - 2 minutes (currently)

5.6 - not yet determined

5.7 - low power microprocessor

5.8 - not yet ascertained

5.9 - not yet ascertained

5.10 - 

6 - 

7.1 - Not yet determined

7.2 - 


1 - U.S.A.

2 - Light Emitting Diode Weather Identifier precipitation (snow and rain from light to heavy intensities

3 - Prototype installed, data collection underway

4 - Scintillation techniques

5.1 - Present Weather Identifier

5.2 - Light to heavy precipitation

5.3 - to be determined

5.4 - to be determined

5.5 - to be determined
5.6 - to be determined
5.7 - -
5.8 - -
5.9 - -
5.10 - -

6 - Data collection from prototype underway

7.1 - 8000
7.2 - -

8 - Richard Ahlberg, W/OTS13, National Weather Service, Silver Spring, MD 20910, U.S.A.

9 - -

1 - Canada

2 - FOSS - Precipitation Occurrence Sensor System

3 - Feasibility

4 - A microwave doppler radar is used to measure the fall speed of precipitation particles. The fall speed denotes the type of precipitation. If all particles falling through the volume are measured we can determine the rate and quantity of precipitation.

5.1 - Identification of occurrence, type and amount of precipitation.

5.2 - -

5.3 - not established

5.4 - N/A

5.5 - About 1 minute

5.6 - unknown
5.7 - not finally established
5.8 - currently 110 VAC 500 W
5.9 - unknown
5.10 - Early feasibility work was done using a police speed trap radar unit.
       - Current version uses a separate transmit and receive head.
       - The output doppler signal is monitored using fast fourier analysis to obtain the velocity (frequency) of each drop passing through the measuring volume.
       - If the particles are falling at terminal velocity the drop size (therefore the volume) is known and rates and amounts of (at least) rain can be determined.

6 - promising
7.1 - unknown
7.2 - unknown
8 - B.E. Sheppard, ACSL/M, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4

1 - People's Republic of China
2 - Electroconductive rainfall recorder
3 - Field tests at eight stations completed in 1982 will be put into operational use in 1985
4 - There are 25 electroconductive pins with different length above the water level in the chamber. Each pin indicates one level with the difference of 0.1 mm rainfall. When rainfall attains 2.5 mm, the valve opens automatically and the chamber is empty in less than one second.

5.1 - 
5.2 - 
5.3 - +0.4 mm (10 mm), 4% (10 mm)
5.4 - 

---
5.5 -
5.6 -
5.7 -
5.8 - AC 180-240V or DC 10-12V
5.9 -
5.10 -
6 -
7.1 -
7.2 -
8 -
9 -
Category Number 8

MEASUREMENT OF EVAPORATION

The following countries* have reported developments concerning instruments in this category:

None

* For key, use fold-out page at rear of book.
Category Number 9

MEASUREMENT OF RADIATION

The following countries* have reported developments concerning instruments in this category:

BELGIUM

1 - Belgium

2 - Automatic calibration of pyranometer and pyrradiometer in short wavelength with sun eclipse technique

3 -

4 - Measure during 3 equal time intervals (in the 1st and 3rd interval the sun being eclipsed, in the 2nd interval the instrument is isolated). The radiometer signal is integrated digitally during these 3 intervals.

5.1 - Radiometers calibration, measure diffuse radiation

5.2 - Programmable

5.3 - Better than 0.1%

5.4 -

5.5 -

5.6 -

5.7 - Analogue

5.8 - 220V, 50 Hz

5.9 - no

5.10 - Destined exclusively for the calibration centres

6 -

7.1 - about 4000

7.2 -

8 - Koninklijk Meteorologisch Institute, 3, Ringlaan, 1180 Brussels, Belgium

9 -

* For key, use fold-out page at rear of book.
Category number 10

MEASUREMENT OF VISIBILITY

The following countries* have reported developments concerning instruments in this category:

CANADA

1 - Canada
2 - Wright and Wright Fog 15 Visibility Meter Visibility (Meteorological Optical Range)
3 - Commercially available
4 - Forward Scatter Meter
5.1 - Automatic meteorological observing
5.2 - 0.03 to 10 km
5.3 - +30%
5.4 - about 1 minute
5.5 - about 1 minute
5.6 - good
5.7 - 0 to 10V DC
5.8 - 105-125V DC, 60 Hz, 300 Watts
5.9 - 6 months
5.10 - uses quartz halogen source. A mechanical chopper wheel to produce modulated signal
  - analogue output must be processed for visibility value
6 - +30% in meteorological optical range as measured by transmissometer
7.1 - 10 K
7.2 - 0.3 K
8 - B.E. Sheppard, ACSL/M, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4

* For key, use fold-out page at rear of book
Category Number 11

CLOUD OBSERVATIONS

The following countries* have reported developments concerning instruments in this category:

Finland

Netherlands

United States of America

1 - Finland

2 - Laser Ceilometer, type CT12K

3 - Starting serial production mid-1985

4 - Optical radar principle based on infra-red laser source
   The software included takes special care of performance in rainy and foggy conditions

5.1 - Airports, synoptic stations, offshore platforms

5.2 - 0 ... 12 000 FT

5.3 - ±100 ft or 5%

5.4 - maximum 30 seconds

5.5 -

5.6 - MTBF 12300 hours (MIL handbook 217 D)

5.7 - Two digital inputs (outputs are provided: RS 232 C and FSK
   according to bell 103

5.8 - 115/230 VAC.47 ... 63 Hz, 200 W (without options)

5.9 - 30 daus (cleaning)

5.10 - optional auxiliaries:
   - solar shutter
   - blower unit for preventing dust accumulation on windows

6 -

7.1 -

7.2 -

* For key, use fold-out page at rear of book.
Cloud height measurement with laser beam ceilometer

Measurement of travelling time of light pulse. In our application an Impulsphysik L-WHL is used.

- air fields
- 0-5000 ft
- 5-10%
- 15 seconds
- good

Laser beam ceilometers are much more sensitive to rain than rotating beam ceilometers. This ceilometer is not in a vertical position but tilted under an angle of about 25°. This eliminates the noise sensitivity. They are still experimenting to determine the optimum angle.

Comparison with a rotating beam have been made for half a year. In the tilted position the performance of the LBC approaches that of the RBC.

not applicable

S.H. Muller, Royal Netherlands Meteorological Institute, P.O.Box 201, 3730 AE De Bilt, The Netherlands.

1 - U.S.A.
2 - Cloud Height Indicator
3 - First delivery - July 1986
4 - single ended laser powered
5.1 - cloud height
5.2 - 12,000 ft
5.3 - ±100 ft or 5% whichever is greater
5.4 -
5.5 -
5.6 - MTBF 1 year
5.7 - Digital and analogue
5.8 - 120 volts
5.9 - 30 days
5.10 -
6 - in the development stage
7.1 - 13,500
7.2 - Unknown at this time
8 - Michael Salyards, W/OTS13, National Weather Service, 8060 13th Street, Silver Spring, MD 20910, U.S.A.
9 - 
MEASUREMENT OF UPPER WIND

The following countries* have reported developments concerning instruments in this category:

Finland

Sweden (see category 6)

Canada

1 - Finland

2 - Automatic Rawinsonde Set MW11

3 - Early production (exploitation beginning in 1985)

4 - Multi-frequency NAVAID Windfinding, Automatic Data Acquisition and Processing with Message Generation

5.1 - Upper-air observations

5.2 - Full ranges (0 to 35 km)

5.3 -

5.4 -

5.5 -

5.6 -

5.7 - RS 232 C (several), Telex (CCITT-2) WMO Standard Message Formats

5.8 -

5.9 - 2 years

5.10 - Special environmental protection for use on board ships and in the tropics, modular expansion capability

6 - CIMORSEX 1985 in Wallops Islands

7.1 -

7.2 -

* For key, use fold-out page at rear of book
1 - Finland
2 - Containerized Upper-air System for shipboard use
3 - Under development
4 - Complete integrated system, including balloon handling equipment, measurement system and data transmission system
5.1 - Shipboard aerological observations
5.2 - 0-24 altitudes
5.3 - 
5.4 - 
5.5 - 
5.6 - 
5.7 - Temp ship is transmitted over geosynchronous satellite channels
5.8 - 
5.9 - 
5.10 - Provides complete shiptemp format observations capability on board ships of opportunity. Single or part-time operator only required for synoptic use
6 - 
7.1 - 
7.2 -
8 - Vaisala Oy, PL 26, SF-00421 Helsinki, Finland
9 - 
1 - Canada
2 - Navaid (Loran) Windfinding System
3 - under test
4 - Using Loran C to derive upper winds
5.1 - Replacement of radio theodolite with automatic system
5.2 - same as standard rawinsonde system
5.3 - ±1 kt for wind
5.4 - not known
5.5 - 2 minutes
5.6 - undetermined
5.7 - Winds derived using minicomputer - all meteorological data computed automatically
5.8 - same as standard rawinsonde system
5.9 - N/A
5.10 - Sonde uses prebaselined sensors and requires no lock-in prior to launch. All computations are handled automatically in flight by a minicomputer thus releasing the upper-air technician for other duties.
6 - insufficient data
7.1 - about 80 US/sonde
7.2 - 2 sondes per day per station
8 - Vaisala Inc. and VIZ (Beukers) Manufacturing
9 - -
The following countries* have reported developments concerning instruments in this category:

Germany, Federal Republic of
France

1 - Federal Republic of Germany
2 - Automatic upper-air sounding system RSG 78C
3 - Final design for running production
4 - Radio telemetry of temperature, relative humidity and atmospheric pressure by balloon-borne radiosonde and data evaluation by a processor controlled ground station
5.1 - Soundings in the free atmosphere
5.2 - -80 to +40°C, 10 to 100%, 1060 to 8 hPa
5.3 - +0,2°C, +2,5%, +1,5 hPa (1060-800 hPa); +0,5 hPa (800-8 hPa)
5.4 -
5.5 -
5.6 -
5.7 - The evaluated data are displayed on the computer terminal in real-time. The computer supplies automatically the coded TEMP-message
5.8 -
5.9 -
5.10 - Radiosonde:
  Sensors temperature: white varnished bead thermistor
  humidity: Hygristor (VIZ, USA)
  pressure: capacitor inside aneroid capsule

Transmitter power: 350 mW
- frequency: 40 kHz-channel within 402-406 MHz

* For key, use fold-out page at rear of book
- bandwidth: ± 15 kHz
- stability: ± 30.10^{-6} (crystal controlled)

Weight (with batteries) 8 N (800 gr), water activated cells
Ground equipment:
Antenna: dipole array, remote controlled in azimuth angle manual or by radar

Preamplifier: 400-410 MHz, 30 dB, low noise
Receiver: sensitivity - 120 dBm
Data acquisition: frequency counter (IEEE 488-interface)
Computer: Micro PDP 11
Data processing: automatic data processing, presentation and storing, complete evaluation of the coded TEMP-message

6 -

7.1 - Radiosonde: approximately 125
Ground equipment: approximately 30,000

7.2 -

8 - A.Kölbl, Deutscher Wetterdienst, Instrumentenamt München., August Schmauss Str. 1, D-8042 Oberschleissheim

9 - Capacitive pressure sensor: BGM-Nr.7710381, Patent No. 271539

1 - France

2 - Radiosonde system type ASAP

3 - Two systems planned for 1986

4 - Reception equipment, data processor and transmitter in separate containers. All operations are performed automatically except the balloon launch

5.1 - radiosounding

5.2 - 0 - 22000 m

5.3 -

5.4 -

5.5 -

5.6 -

5.7 - Transmission TEMP A and TEMP B through Meteosat

5.9 -
5.10 - container (dimensions 6.1 x 2.4 x 2.4 m) holds:
- inflation system
- power supply and conditioning system
- Omega receiver and wind calculator
- 400 MHz receiver
- data processing computer
- satellite emission beacon
- radiosonde MESURAL (under development)

6 - Two experimental trials Havres-Antilles (May and November 1984)

7.1 - 100,000

7.2 - 36,000

8 - M. Leroy, Météorologie Nationale (SETIM/DEV), Météorologie Nationale, B.P. 202, 78195 Trappes Cedex, France

9 -

1 - France

2 - Radiosounding PTU, Omega possible

3 - Preserial production in 1986

4 - sequencial, electronic

5.1 - application PTU, Omega possible

5.2 - 1050 - 5 hPa

5.3 - pressure 0.5 hPa, temperature 0.2°C, humidity 3%

5.4 -

5.5 -

5.6 -

5.7 - transmitter 400 MHz

5.8 -

5.9 -

5.10 -

6 - on trial
7.1 - not fixed, 50 planned

7.2 -

8 - M. Leroy (SETIM/T/DEV) Météorologie Nationale, BP 202, 78195 Trappes Cedex, France

9 -
Category Number 14

METEOROLOGICAL BALLOON TECHNIQUES

The following countries* have reported developments concerning instruments in this category:

Philippines

1 - Philippines

2 - Fabrication of assorted devices used in the manufacture of meteorological balloons

3 - Some minor innovations on previously fabricated equipment are still undertaken

4 - Small grooved wooden moulds are dipped into a coagulant then into a latex compound; the deposited latex is then stripped, inflated to its unstretched diameter and vulcanized at 120°

5.1 - for radiosonde operation

5.2 - N/A

5.3 - to be verified

5.4 - N/A

5.5 - N/A

5.6 - to be assessed

5.7 - Improved elasticity was observed on the latest experimental production

5.8 - 5 kW/100 gram balloon (approximate)

5.9 - 5 times per year for electrical systems

5.10 - 

6 - 

7.1 - 12,000 (approximate cost of materials and equipment)

7.2 - to be established upon actual mass production

* For key, use fold-out page at rear of book
8 - Instruments Development and Research Division, National Institute of Atmospheric Sciences, PAGASA, Q.C., Philippines

9 - 1. Natural Rubber by G. Martin
2. Practical Compounding by J.W. Denson
4. Chemical Formulary by Bennet, Volume 2
5. Darex Meteorological Balloons Bulletin, Copyright 1952
6. Polymer Products Information Bulletin
7. Rubber Ageing Fundamental Studies by J.F. Smith
8. Practical Vulcanization by L.R. Mernagh
9. Chemical Process Industries by R.M. Shreve
Category Number 15

OBSERVATION OF ATMOSPHERICS

The following countries* have reported developments concerning instruments in this category:

Belgium

1 - Belgium

2 - Lightning counter CIGRE, installation and operation in 1985

3 - 

4 - Detection of electrical field variations produced by lightning with a vertical antenna

5.1 - 

5.2 - 

5.3 - 

5.4 - 

5.5 - 

5.6 - 

5.7 - output pulses of 30 ms

5.8 - 25μA, 9 V

5.9 - 

5.10 See CIGRE

- temperature band -25°C, -70°C

- encapsulated in silicon

6 - 

7.1 - 400

7.2 - 

8 - K.M.I. - I.R.M.

9 - Technical description being prepared

* For key, use fold-out page at rear of book
The following countries* have reported developments concerning instruments in this category:

Sweden (see Category Number 6)

United Kingdom

United States of America (see Category Number 11)

1 - United Kingdom

2 - Automated SFERICS system, location of lightning flashes

3 - to go operational in approximately 12 months

4 - A network of outstations monitors the 10 kHz. Radiowave emitted by a lightning flash. This data is forwarded to a control station which fixes the flash by an arrival-time-difference technique, analogous to Loran-C radio navigation

5.1 -

5.2 - 40° W-40°E, 30° N-30°N, or greater

5.3 - 2-50 km

5.4 -

5.5 -

5.6 -

5.7 - U.K. Meteorological Office autocom to WMO channels

5.8 - 7 kW Maximum

5.9 - 3 months (operator driven)

5.10 -

6 - Considerably more accurate than the CRDF it will replace

7.1 -

7.2 -

8 - Dr. A.C.L. Lee, Room B 101, Meteorological Office (Met O 16f), Beaufort Park, Easthampstead, Wokingham, Berkshire RG11 3DM, U.K.

9 - Paper offered to Q.J. Royal Meteorology Society; Not yet accepted

* for key, use fold out page at rear of book
Category Number 17

MARINE OBSERVATIONS

The following countries* have reported developments concerning instruments in this category:

Netherlands (see Category Number 6)

* For key, use fold-out page at rear of book
METEOROLOGICAL OBSERVATIONS FROM AIRCRAFT

The following countries* have reported developments concerning instruments in this category:

Canada

1 - Canada
2 - ASDAR: Wind, temperature, height, geographic co-ordinates, time, turbulence
3 - Prototype operational equipment being processed
4 - Data available in Boeing 747 aircraft is assessed, processed, formatted and transmitted via Geostationary Meteorological Satellite for insertion to GTS
5.1 - to assess upper-air data from aircraft sensors
5.2 - Temp: +99.9°C - Wind: to 4095 knots
5.3 -
5.4 - determined by averaging algorithm
5.5 - determined by averaging algorithm
5.6 - unknown but predicted high
5.7 - designed to interface with standard aircraft data systems and transmit via IDCS
5.8 -
5.9 -
5.10 - Developed by GEC-McMichael under contract from the Consortium for ASDAR Development, which operated under the aegis of WMO.
- Design and averaging algorithm proprietary
- Time constant varies with variable measured and phase of flight (cruise or ascent/descent).

6 - ASDAR was judged effected on the basis of the experience as part of FGGE and continued evaluation of prototypes.

* For key, use fold-out page at rear of book.
7.1 - 50,000
7.2 -
8 - ASDAR operating organization, c/o WMO
9 -

1 - Canada
2 - equipment to transmit wind, temperature, height, geographical co-ordinates, time and turbulence from Boeing 767 aircraft via VHF radio.
3 - Proposal based on ASDAR equipment requested from the manufacturer
4 - data available in Boeing 767 aircraft is assessed, processed, formulated and transmitted via VHF for other radio link from aircraft in flight to terrestrial users.

5.1 - to assess upper-air data from aircraft
5.2 - temp: +99.9°C, wind to 4095 knots
5.3 -
5.4 - determined by averaging algorithm
5.5 -
5.6 - unknown but expected to be high
5.7 - designed to interface with B-767 avionics and to transmit via ACARS - compatible air-ground communications.
5.8 -
5.9 -

5.10 Based on equipment developed by GEC-McMichael under contract from the Consortium in ASDAR Development, which operated under the aegis of WMO.
Design and averaging algorithms proprietary
Time constant varies with variable measured and phase of flight (cruise or ascent/descent)

6 - Provides capabilities as ASDAR and ACARS, which were judged effective on the basis of the experience as part of FGGE and continued evaluation of prototypes

7.1 -
7.2 -
8 - GEC-McMichael
9 -
Category Number 19

METEOROLOGICAL ROCKET SENSING

The following countries* have reported developments concerning instruments in this category:

None

*for key, use fold-out page at rear of book
The following countries* have reported developments concerning instruments in this category:

Sweden (see also Category Number 4)

1 - Sweden

2 - Lidar (Laser Radar) for remote sensing of slant visibility and humidity (using Raman scattering). Temperature and wind sounding experiments are planned.

3 - Research instrument

4 - Laser radiation is emitted into the atmosphere and scattered, radiation from aerosol particles or molecules is detected, digitized and stored. Profiles of met. parameters are obtained.

5.1 - Tropospheric research

5.2 - Depends on visibility - 3km common

5.3 - Variable

5.4 - Laser pulse length: 15 ns, PRF 10 Hz

5.5 - Flexible; example: 10 minutes for humidity

5.6 -

5.7 - Results displayed on graphic screen or plotted

5.8 - 220 VAC. 3 phase, 15 Amps

5.9 - not defined

5.10 UV-radiation at 355 nm is used, which means that eye safety problems are minimized. Maximum range of profiles is limited by attenuation in haze, fog, rain, snow and clouds. A range interval of 0-3 km is commonly used.

Cloud sounding can be performed.

Data are stored on magnetic discs (floopy disc unit). The laser is an Nd-YAG-laser. The third harmonic at 355 nm is generated and used for sounding. The range

*For key, use fold-out page at rear of book

(WWW 1772)
resolution can be 2.5 meters as the pulse length is 15 ns. Pulse repetition frequency is 10 Hz.

6 -

7.1 - Not for sale

7.2 -

8 - Arne Hagard, FOA 3, Box 1165, S-581 11 Linköping, Sweden

9 -
MEASUREMENT OF SUNSHINE DURATION

The following countries* have reported developments concerning instruments in this category:

Japan
France

1 - Japan

2 - Rotating Mirror Sunshine Recorder

3 - Expected to become operational in 1986

4 - A rotating mirror reflects sky radiation to a pyroelectric sensor. The sensor generates a pulse voltage proportional to the intensity of direct solar radiation, triggered by jumping-up of radiation intensity upon encountering the solar beam.

5.1 - 

5.2 - 

5.3 - Better than +20% at 120 \text{ Wm}^{-2} of threshold

5.4 - 

5.5 - 

5.6 - 

5.7 - A relay contact is made each time the radiation exceeds the threshold.

5.8 - 10 VA, AC 100 V

5.9 - 

5.10 -
(i) The mirror rotates once in 30 seconds
(ii) Sensitivity is independent of wavelength
(iii) Accuracy:

- Better than +5% in ambient temperature range of -20 to +40°C
- Better than +10% in the solar declination range of +23.5°

* For key, use fold-out page at rear of book

(WWW 1772)
6 - The relevant WMO standards have been met
Countermeasures for snow and frost are being tested

7.1 - About 1,800

8 -

9 -

1 - France

2 - Heliograph with fibre optics for measurements of sunshine duration

3 - Finishing up laboratory and field tests

4 - Fibre optics sensor rotated with a step motor. Thermal sensor outputs is a pulsed signal with an amplitude proportional to direct energetic insolation. The interface is used to compare this signal with a reference value of insolation threshold (120 Wm$^{-2}$) and outputs the pulsed signal corresponding to 1/100 hour of insolation.

5.1 - meteorological stations

5.2 - direct energetic illumination 0 - 1100 Wm$^{-2}$

5.3 - see par. 6

5.4 - detector, several hundredths of a second

5.5 -

5.6 -

5.7 - Interface with a registering device (compatible with pulsed signal) through electronic coupler or relay.

5.8 - see below

5.9 - 2 years (verification of thermal detector)

5.10 - Sensor:
- power supply, DC tension 2 V (2 mA)
- working temperature -20, +50°C
- for use in latitudes 0° - 90°
- detector sensitivity, about 1 mV/10 Wm$^{-2}$ (adjustable with potentiometer)
- heating system can be used

(WWW 1772)
Interface:

- monitoring of sensor motor power supply voltage
- insolation threshold comparison, pulsed output signal
- galvanic isolation between power supply and registering device
- sealed container
- AC power supply 24 V (other voltage possible)

6 - comparison for 1 year of daily insolation values measured by heliometer with a threshold of 120 Wm\(^{-2}\) and by fibre optics heliometer gives for 90% of cases insolation duration errors less than 3% or 20/100 of hour of insolation

7.1 - about 1100

7.2 - practically zero (change of desiccant)

8 - Service des Equipements et des Techniques Instrumentales S.E.T.I.M./T/CIG - Météorologie - BP 202, 78195 Trappes Cedex, France

9 - Technical document can be obtained from the Service (see above).
Category Number 22

AUTOMATIC METEOROLOGICAL STATIONS

The following countries* have reported developments concerning instruments in this category:

- German Democratic Republic
- Sweden (see Category 6)
- Switzerland (see Category 4)
- United Kingdom
- United States of America
- Canada
- France

1 - German Democratic Republic

2 - Automatic meteorological station, microprocessor controlled, read out on standard WMO format (FM 12).

3 - Prototype under laboratory tests (1984)

4 - A microprocessor interrogates the sensors at fixed intervals and registers the reading in a memory. Calculation of averages, maximum, minimum, etc. Formatting in FM 12 Code. Transmission to collecting centres by using TELEX-network. Storage of data on cassettes which are read into the computer centrally.

5.1 - meteorological stations

5.2 - temperature -40° to +60°
    dewpoint - temperature -30° to +30°
    wind speed 0 to 50 m/s
    wind direction 0 to 360°
    ice deposit 0 to 4 kp

5.3 - temperature, dewpoint - temperature ±0.1 K
    wind speed ±(0.5 + 0.05 v) m/s
    wind direction ±10°
    ice deposit ±50 p

5.4 -

* For key, use fold-out page at rear of book
5.5 - 10 minutes (wind speed and direction)

5.6 -

5.7 - input; a) analogue: resistances, voltages
b) frequency, impulses

5.8 - 220 V AC

5.9 - one week

6 -

7.1 -

7.2 -

8 - Akademie der Wissenschaften der DDR, Zentrum für wissenschaftlichen Gerätebau, DDR-1199 Berlin-Aldershof, Rudower Chaussee 6

9 -

1 - United Kingdom

2 - Automatic Weather Station for use in severe icing conditions, measures wind speed, wind direction, gust, temperature and relative humidity

3 - field trials

4 - Wind measurements utilize a heated orthogonal pressure tube, anemometer temperatures are taken from a small bead thermistor, and humidity from a heated humicap hygrometer

5.1 - Severe icing environments

5.2 - 0-130 kts - 30 to +40°C, 0 - 100% RH

5.3 - 4% wind speed, 7° wind direction, .5° temp. 4% RH

5.4 - not specified

5.5 - depends on requirements

5.6 - good

5.7 -

5.8 - 400 watts

5.9 - 6 months
5.10 - The AWS is also provided with a Platinum Resistor thermometer in a temperature screen for more accurate temperature readings in non-icing conditions.

6 - Comparisons with conventional instrumentation when conditions allow show good agreement.

7.1 - 12,000 (estimated)

7.2 - 500 (estimated)


1 - Canada

2 - READAC automatic weather station. Measures temperature, dewpoint, pressure, wind direction, wind speed and visibility. Other instruments can be added.

3 - Field test in progress

4 - Readings of individual sensors are processed and made available to an output processor that codes a message for transmission over various communication links

5.1 - remote stand-alone operation or airport observer assistance

5.2 - as determined by sensor

5.3 - varies with sensor

5.4 - varies with sensor and processing algorithm

5.5 - according to WMO standards

5.6 - 6 months MTBF (estimated) excluding sensors

5.7 - teletype landline, VHF radio and GOES DCP

5.8 - 325 watts

5.9 - generally determined by needs of sensors

5.10 - 1. EMI and voltage surge protection
        2. Remote diagnostics
        3. Standard or observer modified messages
        4. Surface observations in support of aviation
        5. Test set under development
        6. Sensor simulators for fault location
        7. Modules removable without having to disconnect power
        8. Battery operation during power failures
        9. Raw and processed data available
        10. Modular. New sensors easily accommodated

6 - The long-term errors are as determined from field test:
    Temperature (+ 0.3°C), Dewpoint (+0.5°C)
    Wind speed (+ 1 knot), wind direction (+ 3°)
    Pressure (+ 0.6 mb)

7.2 - 10,000

8 - Atmospheric Environment Service, Environment Canada, 4905 Dufferin Street, Toronto, Canada M3H 5T4

9 - Papers have been presented at recent TECIMO and AMS conferences

1 - France

2 - Miriad automatic station

3 - prototype is planned at the end of April 1985

4 - microprocessor controlled equipment: sensor power supply, sensor control, data processing, interrogation and response sequence control

5.1 - telemetric network or uninhabited areas

5.2 - -

5.3 - -

5.4 - -

5.5 - -

5.6 - -

5.7 - -

5.8 - 12 V +2 V, type A 2 W, type B 4 W

5.9 - -

5.10 - Stations for uninhabited areas
   - real-time data transmission (type A), transmitter frequency 400 MHz
   - on site registration for subsequent transmission (type B) by commutated telephone lines
   - Miriad can handle up to 16 sensors
   - visualization of measured parameters
   - information is memorized (48 hours of autonomous work)
   - data is visualized and memorized by the central computer

6 - -

7.1 - 4000

7.2 - -

8 - M.Bettan (SETIM/T/SII) Météorologie Nationale, BP 202, 73195 Trappes Cedex, France.

(WWW 1772)
Category Number 23

SOIL MOISTURE MEASUREMENT

The following countries* have reported developments concerning instruments in this category:

Belgium

1 - Belgium
2 - in situ measurements of soil resistivity at 1590 Hz
3 -
4 - based on relations between the independent variables (nature of the soil, mass volume, temperature, water content, structure) and electric resistance
5.1 - measure of the soil water content (agriculture and ecology) values important for the plant growth
5.2 -
5.3 -
5.4 - to be determined
5.5 - instantaneous and continuous measurements
5.6 -
5.7 - direct tension
5.8 - alternative tension source
5.9 -
5.10 -
6 -
7.1 -
7.2 -
8 - Paul Lelouchier, Institut Royal Météorologique de Belgique
9 -

* For key, use fold-out page at rear of book

(WWW 1772)
The following countries* have reported developments concerning instruments in this category:

Philippines

1 - Philippines

2 - Barometer Filling Device, used in filling barometer tubes under vacuum

3 - The condensor components of the device are undersized, hence plans to make proper innovations are considered

4 - Mercury under vacuum is vaporized, condensed, then made to trickle down size barometer glass tubes

5.1 - used to fill barometer glass tubes

5.2 - N/A

5.3 -

5.4 -

5.5 -

5.6 - 90%

5.7 - Mercury with which to fill barometer is devoid of impurities and air

5.8 - 3 kW/operation (approx)

5.9 - 2 to 3 times per year

5.10 - The condensor component of the device is of the triple-effect type thus clean pure mercury is produced

6 - N/A

7.1 - 850.00 (cost of materials and accessories)

8 - Instruments Development and Research Division, National Institute of Atmospheric Sciences, PAGASA, Q.C., Philippines

9 - Meteorological Instruments by W.E. Knowles, Middleton

* For key, use fold-out page at rear of book
Chapter II - INSTRUMENTS PUT INTO OPERATIONAL USE

Category Number 1

GENERAL

The following countries* have reported instruments related to this category put into operational use:

None

* For key, use fold-out page at rear of book
WEATHER OBSERVATIONS

The following countries* have reported instruments related to this category put into operational use:

Germany, Federal Republic

Sweden

1 - Federal Republic of Germany

2 - Model MIRIAM-TDH, temperature, dew point, relative humidity

3 - 2 years in operational use

4 - Microprocessor controlled system for acquisition, monitoring, recording and storage of meteorological data. The model MIRIAM-TDH is designed to observe temperature, dew point and relative humidity

5.1 - Remote measurements on observing stations

5.2 - -50 to +50°C, -30 to +40°C (dew point), 5 to 96% relative humidity

5.3 - +0.05 K, 0.8 K (dew point), ±2% relative humidity

5.4 -

5.5 -

5.6 -

5.7 - Data are monitored on a LED-display, dc-output for multipoint recorder, RS 232 interface for data storage on digital cassette recorder

5.8 - 220 V 50 Hz

5.9 -

5.10 - Sensors:

Temperature: platinum resistance thermometers (PRT 100)

Dew point: Lithiumchloride dew cell

Relative humidity: potentiometric hair hygrometer

Electronic components:

Transducers for temperature, dew point and relative humidity

* For key, use fold-out page at rear of book

(WWW 1952)
Multiplexer for 8 platinum thermometers
Cable distribution box with power supply (transducers, dew cell)
Central unit containing microprocessor, multiplexer, analogue/digital converter, LED-display, control panel, digital/analogue converter, interfaces and power supply

Peripherals:
12-channel multipoint recorder
digital cassette recorder

6 -

7.1 - approximately 5,000

7.2 -

8 - A. Kölbl, Deutscher Wetterdienst, Instrumentenamt München, August Schmauss Str. 1, D-8042 Oberschleissheim

9 -

1 - Sweden

2 - Observers terminal for automatic data acquisition. ManDAT

3 - 1982-1984

4 - Manual data entry device for synoptical and climatological observations. Communication via the switched telephone network

5.1 - Synoptic and climatological data acquisition

5.2 -

5.3 -

5.4 -

5.5 -

5.6 -

5.7 - Normally connected to the switched telephone network via built-in modem. Also available with V24/RS232 communication interface for connection to AWS

5.8 - 5 VDC alt. 220 VAC

5.9 - 1 year
5.10 - ManDAT is a small table terminal with keyboard, display, micro computer and power back-up, connected to the switched telephone network. The observer can use it for input of SYNOP data - coded or in parameter form - or climatological information. In SYNOP mode, an automatic error check is performed. Functions for calculations of air dew point and reduced air pressure are included in the software. ManDAT is an integrated part of the existing Automatic Data Acquisition System, ADAS. The terminal is automatically interrogated by ADAS via the switched telephone network.

6 - 37 ManDAT terminals are in operation. The observers have found them easy to handle, they eliminate boring work and improve the results.

7.1 - 1,500

7.2 -

8 - Swedish Meteorological and Hydrological Institute, S-601 76 Norrköping, Sweden


(www 1952)
Category Number 3

MEASUREMENT OF ATMOSPHERIC PRESSURE

The following countries* have reported instruments related to this category put into operational use:

Finland
Japan
United Kingdom
France

1 - Finland

2 - Triple aneroid barometer, type PA 11

3 - In production since later 1984

4 - Measurement with three microprocessors controlled independently operating temperature compensated sensors. Averaged pressure and three hours' trend are displayed in LCD-display

5.1 - Airports, ships, synoptic stations, offshore platforms

5.2 - 600 ... 1050 HPa

5.3 - ±0,3 HPa over one year

5.4 -

5.5 - 20 seconds

5.6 - MTBF 35 000 hours 9MIL handbook 217 D

5.7 - Serial I/O 300 baud, full duplex

5.8 - 10 ... 28 V 350 mA DC

5.9 - once a year

5.10 - Table top instrument with fixtures for panel mounting
Size: 72 (h) x 144 (w) x 250 (d) mm
Weight: 1,7 kg
Battery: 4,8 V 1,2 Ah NiCD

6 -

7.1 -

* For key, use fold-out page at rear of book

(WWW 1952)
7.2 -

5.1 - At weather stations anywhere
5.2 - 870 to 970 mb/950 to 1050 mb
5.3 - ±0.1 mb

5.7 - Digital output under the General Purpose Interface Bus specifications is possible
5.8 - 40 VA, AC 100 V/DC 12 V
5.9 -

5.10 (i) It is possible to manufacture the instrument which can measure down to zero mb
(ii) It is possible to make measurement increment 0.01 mb
(iii) Offset adjustment is available
(iv) Automatic temperature correction is made, with temperature measurements of vibrating cylinder
(v) Reduction to sea level pressure, using the input of ambient temperature

6 - There is a secular change of 0.1 mb/year in early stage of use

7.1 - About 3,800

7.2 - Utility (electricity) cost only

(WWN 1952)
1 - United Kingdom
2 - No moving parts, static pressure head for atmospheric pressure measurements
3 - 6 years
4 - Shielded orifice resulting in a null point in dynamic pressure effects

5.1 - Automatic Weather Stations and overpressured observing offices
5.2 - 60 kts wind speed
5.3 - +0.2 hP at 60 kts
5.4 - negligible (not measured)
5.5 - not measured but small
5.6 - very high
5.7 - not applicable
5.8 - nil
5.9 - at least six months

7.2 - negligible

8 - D.W. Jones, Met O 16a, Meteorological Office, Beaufort Park, Easthampstead, Wokingham, Berkshire, England RG11 3DN

9 - A. Osmond, D.J. Painting, Static Pressure Heads for Meteorological Use, WMO Instruments and Observing Methods, Report No.15, TECMO 1984

1 - France
2 - Absolute pressure sensor for measurements of atmospheric pressure
3 - Functioning for 18 months in the French meteorological network

(WWW 1952)
4 - Aneroid capsule with a vibrating band sensor, the output frequency treated with microprocessor and results are displayed on a liquid crystal indicator, sensor can be used in an automatic station

5.1 - meteorological stations
5.2 - 800 - 950 hPa, 850 - 1000 hPa, 900 - 1050 hPa
5.3 - better than ±0.4 hPa
5.4 - several seconds
5.5 -
5.6 - excellent (no shocks)
5.7 - Pressure value is displayed on the liquid crystal indicator, pulsed output for interfacing with automatic station (through microprocessor)
5.8 - mains 220 V/20 mA
5.9 - periodic comparison with reference barometer
5.10 - resolution 0.1 hPa (for visualization and interfacing with automatic station)
   - possibility of correction from +3.8 hPa to -3.8 hPa (by steps 0.1 hPa)
   - possibility of visualization of primary transducer frequency (Hz)
   - sensor calibration by steps of 10 hPa; corresponding frequency values are stocked in microprocessor memory
   - dimensions: 49 x 26 x 11 cm
   - mass 4.5 kg
   - sensor can use 12 V DC when used in automatic station (sensor only)

6 - weak temporal shift
7.1 - about 1200
7.2 - almost none (desiccant change)

8 - Service des Equipement et de Techniques Instrumentales, SETIM/T/CIG - Météorologie, B.P. 202, 78195 Trappes Cedex, France

9 - Technical data can be obtained from the Service (see above)
Category Number 4

MEASUREMENT OF TEMPERATURE

The following countries* have reported instruments related to this category put into operational use:

German Democratic Republic

Germany, Federal Republic of (see Category Number 2)

Netherlands

United States of America

People's Republic of China

1 - German Democratic Republic

2 - Aspirated psychrometer for wet- and dry-bulb temperatures (WMO reference model)

3 - 4 years

4 - Forced ventilation by motor driven fan, Pt-100 resistors, siphon-type water supply

5.1 - Atmospheric humidity sensor for automatic stations

5.2 - Temperature -10°C to +45°C

5.3 - ±0.1 K

5.4 - 40 s at 3.5 m/s

5.5 -

5.6 -

5.7 -

5.8 - 12 V DC

5.9 - 1 week

5.10 -

6 - The instrument meets the WMO requirements

7.1 -

* for key, use fold-out page at rear of book

(WW 1952)
7.2 - not estimated

8 - Akademie der Wissenschaften der DDR Zentrum für wissenschaftlichen Gerätebau, DDR-1199, Berlin-Aldershof, Rudower Chaussee 6

9 -

1 - Netherlands

2 - Wet- and dry-bulb thermometer, ventilated Kosmann type

3 - 4 years

4 - thermocouple sensor, ventilation rate about 7 m/s, a peristaltic pump provides a continuous non-superfluous water supply

5.1 - temperature profile measurements

5.2 - wet-bulb: 0-40°C dry-bulb: -30 - +40°C

5.3 - 0,3°C (including radiation error)

5.4 - 1 S

5.5 -

5.6 - failure rate about one percent

5.7 - output: 40 uV/°C

5.8 - power for ventilation

5.9 - wet bulb, weekly; dry bulb, monthly

5.10 -

6 - Dry bulb functions properly except during rain and fog; it will be tried to switch off the ventilation during these conditions to prevent inhalation of water droplets. In the wet bulb thermometer sometimes droplets are formed between shield and sensor; therefore the overall size of the instrument will be increased

7.1 - unknown

7.2 - unknown

8 - W.A.A. Monna, c/o Royal Netherlands Meteorological Institute, Post Box 201, 3730 Ae De Bilt, Netherlands


(WWV 1952)
1 - The Netherlands

2 - Fast responding psychrometer for determination of heat and moisture flux, used in combination with fast responding wind sensor

3 - 4 years, not continuously

4 - Thermocouple sensors with internal reference temperature (thermistor). Forced water supply

5.1 - Heat and moisture flux measurements

5.2 - 0-40°C

5.3 - 0,3°C, fluctuation sensitivity 0,01°C

5.4 - 0.3 s

5.6 - 200 hours for wet thermocouple, due to corrosion

5.7 - electronic circuit provides direct read out of temperatures

5.9 - daily

6 - satisfactory performance

7.1 - unknown

7.2 - unknown

8 - W.A.A. Monna, c/o Royal Netherlands Meteorological Institute, Post Box 201, 3730 Ae de Bilt, Netherlands

9 - Kohsiek, W. and W.A.A. Monna, 1980; A fast response psychrometer, K.N.M.I. Scientific report 80-4

1 - U.S.A.

2 - Hygrothermometer - temperature and dew point

3 - Installation began November 1984

4 Cooled mirror

5.1 - measure temperature and dew point

5.2 - temperatures -50°C to +50°C
5.3 - temperature $\pm 5^\circ C$

5.4 -

5.5 - 5 minutes

5.6 - MTBF 1 year

5.7 - digital

5.8 - 120 V 1 amp

5.9 - 30 days

5.10 - dew point accuracy ranges from 0.6$^\circ C$ upward depending on temperature, dew point, spread and dew point temperature

6 - More accurate than previous system

7.1 - 4500

7.2 -

8 - Michael Salyards, W/OTS13, National Weather Service, Silver Spring, MD 20910, U.S.A.

9 -

1 - People's Republic of China

2 - HMS aspirated screen psychrometer for measuring air temperature and humidity

3 - Put into operational use in 1985

4 -

5.1 -

5.2 - temperature $-36^\circ C$ - $50^\circ C$, relative humidity 1% - 100%

5.3 - temperature $\pm 0.1^\circ C$, RH $\pm 2\%$ (when RH 50%) $\pm 5\%$ (when RH 50%)

5.4 -

5.5 -

5.6 -

5.7 -

5.8 - D.C. 12 V

5.9 -

(WWW 1952)
5.10 Other characteristics
Ventilation rate 3.5 m/s
Psychrometer constant, \( A = 0.667 \times 10^{-3} \)
when wet bulb is coated with ice \( A + 0.588 \times 10^{-3} \)
MEASUREMENT OF HUMIDITY

The following countries* have reported instruments related to this category put into operational use:

German Democratic Republic (see Category Number 4)

Germany, Federal republic of (see Category Number 2)

Netherlands (see Category Number 4)

United Kingdom

United States of America (see Category Number 4)

France

People's Republic of China

1 - United Kingdom

2 - PCRC11 Humidity Sensor for Marine and other AWS use

3 - 6 years sensor, 3 years with current protective filter

4 - Resin based electrolytic conductance element with expanded PTFE filter (Goretex) for protection from marine contaminants

5.1 - Mainly marine or low power capability AWS

5.2 - 30% to 100% RH

5.3 - ±2.5% RH

5.4 - 3 - 5 minutes for RH 30% 80% at 10°C

5.5 -

5.6 - not determined

5.7 - AC potentiometric divider with linearisation

5.8 - ±12 V 12 mA (includes interface)

5.9 - 6 months

5.10 -

6 -

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* For key, use fold-out page at rear of book

(WWW 1952)
7.1 - 50

7.2 - small

8 - D.W. Jones, Met 0 16a, Meteorological Office, Beaufort Park, Easthampstead, Wokingham, Berkshire RGll 3DN, England


1 - France

2 - capacitive hygrometer for air relative humidity measurements

3 - functioning for 18 months in the French meteorological network

4 - sensor, capacitance of hygroscopic polymer dielectric transducer; sensor is used as capacitance in oscillatory circuit. The output frequency is linearized and converted to current 4-20 mA for the humidity between 0 and 100%

5.1 - meteorological stations

5.2 - 0 - 100% RH

5.3 - absolute error ±3% of RH (temperature -20, +50°C)

5.4 - about 20 seconds

5.5 -

5.6 - excellent (no saturation problems for long periods)

5.7 - output current 4-20 mA (2 wires), measurement signal is superimposed on transducer power supply (other types of output on demand - tension, frequency)

5.8 - 4 - 20 mA, 10 - 48 V DC

5.9 - sensor element changed every 6 months, transducer verified annually

5.10 - sensor (capacitive element): printed circuit, polymer protective coating, working temperature - 20, +50°C
preconditioner (oscillating circuit): protects the sensor, frequency regulation by potentiometer depending on RH, temperature stabilization
transducer: preconditioner power supply (5V, regulated), linearization of preconditioner signal, generation of measurement current 4 - 20 mA

(WWW 1952)
6 - excellent reliability (stable change with time)

7.1 - about 400 (sensor + preconditioner + transducer)

7.2 - sensor element changed every 6 months (about 15)

8 - Service des Equipments et des Techniques Instrumentales. SETIM/T/CIG, Météorologie, BP 202, 78195 Trappes Cedex, France

9 - Technical data can be obtained from the Service (see above)
Category Number 6

MEASUREMENT OF SURFACE WIND

The following countries* have reported instruments related to this category put into operational use:

Argentina
Finland
Germany, Federal Republic of
Sweden
United Kingdom
Canada

1 - Argentina

2 - Wind measurement system WA21. Measures surface wind direction and velocity

3 - 4 years

4 - Optoelectronics. Conversion of rotation parameters into proportional electrical units. Interpretation and display of these parameters

5.1 - Meteorology (aeronautical meteorology, agrometeorology, etc.)

5.2 - Velocity: 0-150 knots, direction: 0-360°

5.3 - ±0.2% (velocity); ±2.8° (direction)

5.4 - 4 seconds

5.5 - 2 minutes

5.6 - 90%

5.7 - can be interfaced to cassette tape recorders and chart recorders

5.8 - 35 W maximum

5.9 - twice a year

5.10 - Presentation on digital display of maximum velocity values every 10 minutes as well as mean and instantaneous velocity, mean and instantaneous direction. Alarm in case of failure. Thermal sensors.

* For key, use fold-out page at rear of book
(WWW 1952)
- 74 -

6 - no comparisons

7.1 - 4.200

7.2 - 12.000

8 - Vaisala S.A., Campichuelo 636, Buenos Aires, Argentina

9 -

1 - Finland

2 - Multichannel averaging surface wind monitoring system, type WA 21 M

3 - In serial production since 1982

4 - Up to four sets of wind sensors can be monitored over long distances via one cable pair by the averaging display unit. Different averaged values, wind variability and extremes are continuously available in the display unit.

5.1 - airports, ships, synoptic stations, towers

5.2 - 0 ... 150 knots, 0 ... 360°

5.3 - speed ±0,2 knots below 20 knots, ±2% over 20 knots, direction ±2,8°

5.4 -

5.5 - 2 and 10 minutes

5.6 -

5.7 - RS 232 and three 4-20 mA analogue outputs

5.8 - 115/230 VAC, 47 ... 63 Hz, 35 W

5.9 - once a year

5.10 - Data loop operates through a two wire cable in 300 Bd, ASCII coded. The display unit is able to display:
- instantaneous speed and direction
- 5 second min/max speed and direction
- 5 second direction variability
- two minute average speed and direction
- max/min speed over two minutes
- two minute direction variability
- 10 minute average speed and direction
- max/min speed over 10 minutes
- 10 minute direction variability

6 -

7.1 -
1 - Federal Republic of Germany
2 - Electrically heated wind measurement-system especially for severe weather conditions. Model designation: MIRIAM-W
3 - 2 years (2 prototypes in operational use)
4 - Cup anemometer and single blade wind vane with devices to heat surface areas of all fixed and moveable components

5.1 - Wind measurements on observing station
5.2 - 0.5 - 60 m/s, 0 - 360°
5.3 - ± 0.1 m/s; ± 3.6°
5.4 - Anemometer distance constant/vane damping ratio
\[ l = 7.9 \text{ m} \quad D 60° = 0.33 \]
5.5 - 1 to 10 minutes programmable
5.6 - 
5.7 - The signals of the sensors are converted and evaluated by a microprocessor controlled data unit. Display: 9"-monitor; Outputs: analogue and digital for recording
5.8 - 220 V AC/850 W
5.9 - 1 year
5.10 - The cup-anemometer and the wind vane are attached to a cross beam in a single position.

The heating power is supplied to the moveable surfaces of the anemometer by a mechanical contactless inductive transformer to the moveable surfaces of the vane by a low friction mercury rotary contact.

For the signal transducer an optical chopper is used for the anemometer, an optical shaft angle encoder is used for the vane.

By the processor operation of the data acquisition unit the instantaneous wind values are evaluated with a sample rate of 0.2 seconds. Then the statistical parameters (means, deviations and extremes) are calculated.
6 - During the period of exploitation the mechanical, thermal and electrical reliability could be demonstrated. By air temperatures to -22°C, air speeds to 220 km/h and ice accretion to 60 cm the sensors remained ice free.

7.1 - estimated 4,000

7.2 -

8 - H. Brust, Deutscher Wetterdienst, Instrumentenamt München, August Schmauss Strasse 1, D-8042 Oberschleissheim


1 - Federal Republic of Germany

2 - WIMEA, Windspeed and wind direction measuring system

3 - 4 years

4 - wind vane with potentiometer, cup anemometer with light barrier transducer

5.1 - Universal wind measuring system

5.2 - 0,3 ... 50 m/s, 0,6 ... 100 knt. 0 ... 360°

5.3 - ± 1%

5.4 - variable with wind speed

5.5 - 2 minutes or 10 minutes

5.6 - routine device

5.7 - potential 0 ... 5V, current 0 ... 5 mA, IEEE-bus, V24 (RS 232)

5.8 - 220 V AC

5.9 - 2 years

5.10 Digital display of momentary and averaged wind parameters, registration on a double curve drawing recorder

6 - reliable in routine work

7.1 - 5000

7.2 -
1 - Sweden

2 - Doppler Weather Radar, Ericsson UBS 10301

3 - Mid 1984

4 - 

5.1 - Precipitation intensity, radial wind speed

5.2 - 240 km and 120 km resp.

5.3 - 

5.4 - Full scanning volume every 10 minutes

5.5 - 

5.6 - excellent

5.7 - colour screen

5.8 - 3 x 380·V

5.9 - 3 months

5.10 - 

6 - 

7.1 - 200,000

7.2 - 

8 - Mr. Birger Ekengren, Ericsson Radio Systems, S-431 26 Moelndal, Sweden

9 - 

1 - United Kingdom

2 - Wind system Mk 5B

3 - 2 - 3 years

4 - Analogue outputs from sensors converted to digital signals for transmission by telemetry to distant reading sites.

5.1 - Developed to overcome limitation of earlier systems

(WWW 1952)
5.2 - 250 watts
5.9 - 
5.10 - 
6 - 
7.1 - 
7.2 - 

8 - Mr. N. Price, Met 0 16b, Beaufort Park, Easthampstead, Wokingham, Berkshire RG11 3DN
9 - 

1 - United Kingdom
2 - Digital Anemograph Logging Equipment (DALE)
3 - 4 years
4 - Analogue output sensors scaled and converted in digital signals stored on magnetic tapes. One month's data collected on tape

5.1 - Data logging system
5.2 - 
5.3 - 
5.4 - 
5.5 - 
5.6 - 
5.7 - 
5.8 - 50 watts
5.9 -

5.10 -

6 -

7.1 -

7.2 -

8 - Mr. N. Price, Met 0 16b, Beaufort Park, Easthampstead, Wokingham, Berkshire RG11 3DN

9 -

1 - Canada

2 - 78D Digital Anemometer

3 - 1 year

4 - Cup and vane anemometer. Remote link uses serial digital (ASCII) message. Vector averaging is used in sensor head (5 seconds) and processor/display unit (2 minutes and 10 minute averages)

5.1 - remote display (and averaging) of wind

5.2 - 1 - 150 knots

5.3 - 2 knots ±2%

5.4 - distance constant approximately 3 meters

5.5 - 2 minutes and 10 minutes

5.6 - high - works in condensing atmosphere

5.7 - interface between sensor and display is a current loop transmitting an ASCII digital signal. Output is a digital display

5.8 - sensor 12 V DC 60 mA Display 110 V AC 100 W

5.9 - bearing replacement in anemometer approximately 2 years

5.10 - This development is part of a family of sensors using similar remoting and display facilities

6 - accuracy, remotability and reliability all exceed current anemometers

7.1 - sensor 3000 - display 1500
7.2 - unknown

8 - David J. McKay, ACCL/M, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, Canada M3N 5T4

9 - D.J. McKay, "A Digital Anemometer System for Meteorological Wind Measurements", WMO Instruments and Observing Methods, Report No.1
MEASUREMENT OF PRECIPITATION

The following countries* have reported instruments related to this category put into operational use:

Hong Kong
Netherlands
Sweden (see Category Number 6)
United Kingdom

1 - Hong Kong
2 - Rainfall data acquisition system
3 - operational since November 1983
4 - rainfall measured by each tipping bucket rain gauge of the network is coded by a single chip microcomputer and transmitted via a telephone line to a Z80-based microcomputer which processes the data to give tabular display on a VDU and printer. The microcomputer is also linked to a Data General Eclipse SL40 minicomputer for data archiving.

5.1 - to measure depth of rainfall
5.2 - 0.5 mm/h to 900.0 mm/h
5.3 - 0.5 mm
5.4 - 0.5 mm in 2 seconds
5.5 - not applicable
5.6 - good
5.7 - Mostek MDX series circuit boards. Output to video terminal, line printer and 9-track magnetic tape recorder
5.8 - microcomputer and peripherals: 200 VAC, 500 W field unit: 200 VAC, 10 W
5.9 - twice a month
5.10 - On site storage capacity of 8 Kbyte (equivalent to 1200 mm of rainfall for 0.5 mm tipping bucket rain gauge) by EPROM

* For key, use fold-out page at rear of book

(WWW 1952)
During 1984, the real-time rainfall data were checked against data obtained from conventional rain gauges and found to be generally very reliable. The transmission of rainfall data was practically instantaneous and no undue delay was experienced.

7.1 - Microcomputer peripherals 17,500
     Transmitter unit  440
     Receiver unit    300

7.2 - excluding staff cost, electricity supply and telephone line rental 700

8 - Director of the Royal Observatory
     (Attention: Mr. Y.K. Chan), Royal Observatory, Nathan Road, Kowloon, Hong Kong


1 - Netherlands

2 - Electronic rain gauge

3 -

4 - Based on the measurement of the height of a floater with a potentiometer. If the reservoir is full it is automatically emptied in 15 seconds. Resolution 0.025 mm

5.1 - measurement of rain intensity and rain amounts

5.2 - 0-1000 mm/h

5.3 - In accordance with WMO requirements

5.4 -

5.5 -

5.6 - good

5.7 - voltage 0-10 V

5.8 - 75 W

5.9 - twice a year

5.10 - This rain gauge is not yet well suited for measurement of solid precipitation intensities. Some minor improvements are still in progress

6 - Far superior to tipping bucket system. Operates well over the whole range of 0.1 to 1000 mm/h, although corrections must be applied when the reservoir empties.
7.1 - 

7.2 - 

8 - S.H. Muller, Royal Netherlands Meteorological Institution, P.O. Box 201, 3730 Ae De Bilt, The Netherlands

9 - Scientific Report WR 83-16 (in Dutch)

1 - United Kingdom

2 - Weather Radar System (Plessey) for the measurement of precipitation to a range of 210 Kms

3 - Operational since January 1985 (Software corrections/calibrations and hardware improvements still being carried out)

4 - Measurement of precipitation using the digitizing of radar pulses and DEC computer processing

5.1 - Precipitation measurement

5.2 - 210 Kms

5.3 - various with range and time of year

5.4 - 

5.5 - 

5.6 - for the latest syptoms, very high MTBF 7 1000 hours

5.7 - Modems and telephone lines 3 bit and 8 bit data transmitted at 1200 and 2400 bit per second

5.8 - 10KVA 240 V mains AC single phrase monthly

5.9 - 

5.10 - 

6 - Performance very good for quantitative data (to 75 Km)

7.1 - plus site works and installation 810 K at 1.12 rate of exchange

7.2 - 39K

8 - AD Met.O (01), Meteorological Office, Beaufort Park, Easthampstead, Wokingham, Berkshire

9 - 

(WWW 1952)
Category Number 8

MEASUREMENT OF EVAPORATION

The following countries* have reported instruments related to this category put into operational use:

None

* For key, use fold-out page at rear of book
The following countries* have reported instruments related to this category put into operational use:

Belgium
German Democratic Republic
Germany, Federal Republic of
Sweden
Canada

1. Belgium
2. - direct solar radiation - net radiometer
3. -
4. automatic net radiometer used in different operation modes (see reference)
5.1 - radiometric reference corresponding to WRR
5.2 - 1 solar constant
5.3 - 0,1%
5.4 - 3 seconds at 10^{-3}
5.5 -
5.6 - excellent
5.7 - signal input to special electronics - commands and acquisition with HP 85
5.8 - 220 V AC
5.9 -
5.10 -
6. - excellent stability
7.1 - not available for sale
7.2 -

* For key, use fold-out page at rear of book

(WWW 1952)
8 - Dr. D. Grommelynck, Chef de Section, Institut Royal Météorologique de Belgique, Section Radiométrique, 3 Avenue Circulaire, 1180 Bruxelles


1 - German Democratic Republic

2 - Pyranometer with electro-plated thermopile measurement of atmospheric global radiation (solar and sky radiation) or sky radiation only (shadow-ring)

3 - 10 years

4 - Heating of a thermopile of 50 Cu-Const. elements with radiation sensitive surface of 10 x 10 mm$^2$ by solar and/or sky radiation

5.1 - radiation sensor for automatic meteorological stations

5.2 - 0.28 to 2.9 μm or 0.28 to 50 μm

5.3 - ±3%

5.4 - 6 seconds of 52 seconds (99% time)

5.5 - -

5.6 - -

5.7 - output approximately 7.5 μV/W/m$^2$

5.8 - 220 V AC (for ventilation only)

5.9 - 1 month

6 - -

7.1 - -

7.2 - -

8 - Akademie der Wissenschaften der DDR, Zentrum für wissenschaftlichen Gerätebau, DDR-1199, Berlin-Aldershof, Rudower Chaussee 6

9 - Abhandlungen des Met. Dienstes der DDR, Band XV, Nr.115 (1975), (Sonntag, D.)
1 - Federal Republic of Germany

2 - SONI, Sunshine duration sensor

3 - 1 year

4 - SONI senses the levels of radiation from narrow segments of the sky with a rotating slit diaphragm. The incoming light is guided by a rotating light guide to a fixed photo-cell. The photo-cell is zeroed every second revolution by a dark phase.

5.1 - Automatic sunshine duration recorder

5.2 - adjustable, 120 mW/cm², resolution 2 seconds

5.3 - threshold 3%

5.4 -

5.5 -

5.6 - rugged device

5.7 - yes - no output 4.5/0 V or 4.5/0 mA, analogue output 0 ... 10 V

5.8 - 24 V AC or DC

5.9 - 1 year

5.10 -

6 - Compared and tested with normal incidence pyrheliometer (Eppley)

7.1 - 1,000

7.2 -

8 - Dipl-Phys. Lindner, Deutscher Wetterdienst, Instrumentenamt Hamburg, Frahmreder 95, D-2000 Hamburg 65

9 - TECRMO 1984, Patents pending by Mr. Lindner

1 - Sweden

2 - Automatic suntracker

3 - since January 1983

4 - Passive operation. External control unit equipped with microprocessor which compares calculated direction with actual direction as measured with angle sensors.
5.1 - pointing pyrheliometers at the sun
5.2 - 
5.3 - ±0.5
5.4 - 
5.5 - 
5.6 - 
5.7 - 
5.8 - 24 volts DC, 40 W
5.9 - 2 years
5.10 Tracking accuracy depends on how well the axis is aligned to be parallel to the polar axis. Automatic remote control of alignment by telephone. Battery backup. The external control unit can easily be supplemented to serve as an automatic data acquisition terminal.

6 - The suntrackers at the 12 stations in Sweden that are supplied with these devices have been working satisfactorily since 1983 and are functioning at temperatures down to at least -40°C

7.1 - 10,000
7.2 - 100

8 - Swedish Meteorological and Hydrological Institute, S-601 76 Norrköping, Sweden


1 - Canada
2 - AES/SONOTEC SUNPHOTOMETER
3 - 2 years as research instrument
4 - Silicon photocell with interference filters
5.1 - determination of atmospheric turbidity
5.2 - N/A
5.3 - resolution 10 full scale - accuracy ±1% rms

(www 1952)
5.4 - peak hold/approximately 0.5 seconds
5.5 -
5.6 - satisfactory
5.7 - visual reading of LCD display. Also 0-5 V analogue output
5.8 -
5.9 - annual recalibration advised
5.10 - Has been used by AES on several aircraft surveys of stratospheric aerosol. Also on the Space Shuttle STS 41-9 (October 1984)
6 - satisfactory
7.1 - 2500
7.2 -

8 - Mr. Alex Kitson, President, Sonotec Ltd., 2410-5 Dunwin Drive, Mississauga, Ontario, L54 1J9. D.I. Wardle, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, M3H 9T4


1 - Canada
2 - AES/SCI-TEC COSMOS TRACKER
3 - 3 years
4 - Primary purpose: to provide a platform for pyrheliometer accurately following the sun. Method: computer control of two axis high reduction friction drives from Stepper Motors
5.1 - platform to point instruments
5.2 - N/A
5.3 - Resolution 0-0.2°; Accuracy 0.2°/month
5.4 -
5.5 - N/A
5.6 - depends on applications - 1-2 years for solar tracking
5.7 - 4 bit sensing and 4 bit control from microcomputer

5.8 - 50 watts

5.9 - 1-2 years

5.10 - the tracker is used for other payloads than pyrheliometers. In the radiation area it has been used at AES for tracking a shadow disc onto a pyranometer and when required operating this on a 10 minute intermittent schedule for pyranometer calibration. The tracker is programmed also to follow the moon and stars and can be operated as a heliostat. The tracker is also used with radar antennae in research applications.

6 - greatly improves quality of direct sun and diffuse radiation as well as reducing maintenance compared with previous methods

7.1 - 6500 (+500 computer)

7.2 -

8 - Mr. Neil Foulds, President, Sci-Tec Ltd., 1526 Fletcher Road, Saskatoon, Saskatchewan S7M 5M1. D.I. Wardle, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario M3H 5T4

9 - Canada Patent License to Sci-Tec Ltd., USA Patent applied

1 - Canada

2 - Ventilated pyranometer housing

3 - 1 year in AES radiation network

4 - Purpose: keep frost, condensation, snow and rain off the dome of Epply and Kipp and Zonen pyranometer. Method: Encloses main body of pyranometer and blows air over the dome

5.1 - Support system for pyranometers

5.2 - N/A

5.3 - N/A

5.4 - N/A

5.5 - N/A

5.6 - more than one year

5.7 - line power only
5.8 - 10 watts AC

5.9 - more than 3 years: Inspection weekly

5.10 -

6 - about 30 of these units have been operated for more than 4 years - no mechanical problems - almost complete elimination of frost, etc. Recently completed 1 year operational network test: data quality greatly improved - mechanical modifications made

7.1 - 250,000

7.2 -

8 - D. Wardle, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4

9 - none
Category Number 10

MEASUREMENT OF HUMIDITY

The following countries* have reported instruments related to this category put into operational use:

Germany, Federal Republic of
Netherlands
Sweden

1 - Federal Republic of Germany
2 - Background Luminescence Sensor
3 - 3 years
4 - A photo cell with appropriate filters and having an aperture of 10 degrees measures in the range of $3 \times 10^{-1}$ to $1 \times 10^{5} \text{ cd/m}^2$. The actual analogue current produced is proportional to the logarithm of background luminence

5.1 - in accordance with ICAO recommendations
5.2 -
5.3 -
5.4 -
5.5 -
5.6 -
5.7 - Output is fed into data processing system for the determination on RVR
5.8 - 220 V AC
5.9 -
5.10 -
6 - reliable
7.1 - 2000
7.2 -

* For key, use fold-out page at rear of book

(WAW 1952)
8 - Dr. Däke, Deutscher Wetterdienst, Instrumentenamt Hamburg, Frahmredder 95, D-2000 Hamburg 65

1 - Netherlands
2 - Luminance sensor
3 - 4 years
4 - A photocell is amplified
5.1 - Runway visual range
5.2 - 12,000
5.3 - 3%
5.4 - 
5.5 - 
5.6 - excellent
5.7 - Voltage to frequency conversion output pulses to a 800 Ohm impedance line
5.8 - 50 W
5.9 - once a year
5.10 - Viewing angle 20°

6 - Calibrated and controlled against an EG & G luminance meter
7.1 - 1000
7.2 - 
8 - M.P.D. Jansse, c/o Royal Netherlands Meteorological Institute, P.O.Box 201, 3730 Ae De Bilt

(www 1952)
1 - Sweden

2 - Transmissiometer QL 1250

4.1 - Measurement of transmission in the air using laser pulses.
     Calculation of RVR and MOR

5.3 - According to ICAO

5.4 -
Category Number 11

CLOUD OBSERVATIONS

The following countries* have reported instruments related to this category put into operational use:

Sweden

Canada

1 - Sweden

2 - Cloud ceilometer QL 1212

3 - 

4 - Measurement of cloud base level using laser pulses

5.1 - airports, automatic weather stations

5.2 - 0-3,000 meters

5.3 - 

5.4 - 

5.5 - 

5.6 - 

5.7 - 

5.8 - 110/220 VAC

5.9 - 

5.10 - This ceilometer is developed with experience from installations of earlier generations of ASEA ceilometers all over the world during 17 years

6 - Tested and approved by the US FAA

7.1 - 

7.2 - 

8 - ASEA Tractyion Dept. TFF, S-721 83 Väsreras, Sweden

9 - 

* For key, use fold-out page at rear of book

(www 1952)
1 - Canada

2 - ASEA QL1212 laser ceilometer

3 - 1 year operational use as an observer aid

4 - laser range-finding for cloud height

5.1 - measuring cloud height

5.2 - 3000 meters (10,000 feet)

5.3 - approximately 5 meters (detected height)

5.4 - N/A

5.5 - 1 scan per minute

5.6 - high

5.7 - 2 wire communication cables. Digital display

5.8 - 110 V AC 1600 W

5.9 - cleaning of windows about each month, depending on area

5.10 - Using the non-processed output of the ceilometer we are developing a more reliable method of determining the presence of cloud. As well we are using a time series of cloud presence and developing a clustering algorithm to determine cloud amount so that cloud cover can be estimated. The output of this algorithm will be a coded cloud message similar in format to that from a human observer

6 - laser ceilometer is usually superior to other types of observer aids and is particularly low in maintenance

7.1 - 38,000

7.2 - approximately 2000

8 - David J. McKay, ACSL/M, Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4

9 -
Category Number 12

MEASUREMENT OF UPPER WIND

The following countries* have reported instruments related to this category put into operational use:

Italy

Sweden

1 - Italy

2 - Sodar Doppler: vertical profile of wind in the boundary layer

3 - 12 months

4 - acoustic sounding (monostatic)

5.1 - wind measurements

5.2 - 0-50 kts

5.3 - 0.3 m/s

5.4 -

5.5 - variable

5.6 - to verify

5.7 - RS 232

5.8 - 1 kw

5.9 - once a week

5.10 -

6 -

7.1 - 60,000

7.2 -

8 - O.S.S.M.A. Vimna di Valle, I-00062 Bracciano, Roma, Italy

9 - Bertin, now Remtech, Paris, France

* For key, use fold-out page at rear of book

(WWW 1952)
1 - Sweden

2 - Sensitron Doppler Sodar System 325 for measurement of wind and turbulent structure from 25 m up to maximum 1000 m

3 - 1978

4 - Remote sensing technique using acoustic sound pulses

5.1 - aviation, air pollution, wind energy, research, met. observations

5.2 - 0.1 to 30 m/s, height range 25 to maximum 1000 m

5.3 - speed + 0.2 m/s, dir. + 5°

5.4 -

5.5 - 2 - 90 minutes (selectable)

5.6 - measured height 95% of the time 220 m (normal operation)

5.7 - interface to most common computers. RS 232 output, remote control

5.8 - 110 or 220 VAC, 500 W

5.9 - 2 times per year

5.10 - mobile

- can be integrated to order meteorological sensors
- software available for:
  - air pollution studies
  - windshear detection and warning
  - fog prediction
  - mixing height and inversion detection routine
  - statistics with windspeed and direction average and graphs like wind roses, etc.

6 - Test made by SMHI, Civil Aviation, University of Uppsala, Swedish Military Weather Service comprising meteorological tower and Sensitron Doppler Sodar showed very good agreement (Swedish Space Report FL 8-2, December 1982)

7.1 - 44.000 - 66.000

7.2 - 1.000 - 2.000 including spare parts

8 - Mr. Claes Broden Sensitron AB, Nordmarksvägen 3, S-123 51 Farsta, Sweden

Category Number 13

RADIOSONDE TECHNIQUES

The following countries* have reported instruments related to this category put into operational use:

Argentina
Finland
Japan

1 - Argentina

2 - radiosonde RS80, pressure, temperature, humidity and wind

3 - 2 years

4 - pressure: aneroid, capacitive capsule, temperature, capacitive sensor, humidity: capacitative film sensor; wind: Omega phase shift system

5.1 - radiosonde

5.2 - P: 1060 ± 3 mb; T: 60°C, -90°C; U: 0 - 100% RH

5.3 - P: ± 0,5 mb, T: ± 0,2°C; U: ± 2% RH

5.4 - 8 measurements in 10 s for each parameter

5.5 - 0 - 5 minutes every 10 s
   6 min every 30 s

5.6 - 90%

5.7 - capacitive and digital for RS 232C

5.8 - 18 V, 70 mA

5.9 - used one time only

5.10 - transmitter 403 MHz, maximum deviation 1 MHz power output 250 mW (18V), modulation FM, range 200 km, mass (battery and antenna not included) 90 gr

6 - comparisons with WMO standards

7.1 - 87,50 FOB of Finland

* For key, use fold-out page at rear of book
7.2 - 170,000,-

8 - Vaisala S.A. Campichuelo 630, Buenos Aires, Argentina

9 -

1 - Finland

2 - Rawinsonde RS 80 (pressure, temperature, humidity, wind speed, and direction)

3 - Since 1981

4 - PTU - radiosonde, NAVAID - based as option (OMEGA, LORAN C)

5.1 - Upper air observations

5.2 - 1060 to 3 hPa, +60°C to -90°C, 0 to 100% RH

5.3 - ±0,5 hPa, ±0,2°C, ±2% RH

5.4 - at 1000 hPa; T: 2,3 s, U: 1 s

5.5 -

5.6 -

5.7 - Compatible, e.g. with Automatic Rawinsonde SET MW11 (see category 12) and with most other existing ground equipment (403 and 1680 MHz)

5.8 -

5.9 -

5.10 - The radiosonde RS 80 is available both with 1680 MHz transmitter (type RS 80-16) and 403 MHz transmitter with NAVAID wind capability (types RS 80-15 N for OMEGA and RS 80-15 L for LORAN C windfinding). Type RS 80-15 is with 403 MHz transmitter without NAVAID wind capability. Some other models also available. Weight of the sonde is less than 200 g with water activated battery. Dimensions 55 mm x 147 mm x 90 mm. Sampling rate 8 samples/10 seconds for each parameter. All sensors solid state without moving parts.

6 - CIMORSEX 1984 in Bracknell and 1985 in Wallops Islands

7.1 -

7.2 -

8 - Vaisala Oy, Pl 26, SF-00421 Helsinki, Finland.

9 -

(WWW 1952)
1 - Japan
2 - Type RS II-80 Rawinsonde. Pressure, temperature, humidity and wind direction/speed
3 - about four years

5.1 - Aerological observation
5.2 - P: 5 to 1040 mb; T: -90 to +45°C; U: 0 to 100%
5.3 - P: +1 mb; T: +0.3°C; U: +7%
5.4 - For temperature: 3.5 seconds (under 6 m/s wind at ground)
5.5 -
5.6 -
5.7 -
5.8 - Above 0.4 W
5.9 - About 24 seconds per one cycle of P-T-P-U-P-T-P-Ref

5.10 - Sensors: for pressure; constant elastic modulus alloy
        for temperature; thermistor
        for humidity; carbon hygrometer

Carrier frequency: 1,680 MHz
Modulation frequency: 0 to about 2,300 Hz
Power requirement: 20V, 150 mA
Weight: about 580 g including a battery

6 - The results of comparison with RS II-56 Rawinsonde and with Japanese temperature reference sonde are satisfactory

7.1 - About 90
7.2 - Unavailable

8 - a part of the circuitry patented

9 -
Category Number 14

METEOROLOGICAL BALLOON TECHNIQUES

The following countries* have reported instruments related to this category put into operational use:

None

* For key, use fold-out page at rear of book

(WWW 1952)
Category Number 15

OBSERVATION OF ATMOSPHERICS

The following countries* have reported instruments related to this category put into operational use:

Bulgaria

1 - Bulgaria
2 - Lightning Flash Counter
3 - One year and a half (field test)
4 - VLF Radio Receiver with Counter and Pulse rate
5.1 - in Weather Modification
5.2 - selectable, test model set to 50 km
5.3 - WMO requirements compatible
5.4 - 500 msec
5.5 - not applicable
5.6 - Opamp and TTL logic used dependent
5.7 - Indicator: electromechanical counter
   Recorder, weekly strip chart pulse recorder
   Provisions for magnetic/cassette/recording
5.8 - Mains, storage battery buffer powered
5.9 - Strip chart exchange weekly
5.10 - Omnidirectional antenna 1,0 m long, input filters active
       based on use of opampfilter, frequency response set with
       precision, special 500 millisees blocking device for
       precision setting of time constant, pulse generator
       calibrating device with LEO range calibration indication
6 - Field comparisons with the WMO recommended Sullivan-Wells
    Lightning Flash Counter in favour of newly developed
    instrument
7.1 - not applicable, laboratory models available

* For key, use fold-out page at rear of book
7.2 - not yet evaluated


Category Number 16

INSTRUMENTS AND OBSERVATIONS AT AERONAUTICAL METEOROLOGICAL STATIONS

The following countries* have reported instruments related to this category put into operational use:

Belgium
Germany, Federal Republic of
Hong Kong
Sweden (see also categories 10, 11, 12)

1 - Belgium
2 - Automatic videometer, RVR
3 - Exploitation is to start after final modifications
4 - As for the manned videometer the signal lights at the side of a runway are observed and the last visible light is determined automatically. The RVR is displayed remotely
5.1 - measure RVR
5.2 - 30 - 1200 m (can be adapted as required)
5.3 - depends on the distance between the lights, in our case 30 - 50 m up to 600 m and 100 m after
5.4 - 12 s between the measurements
5.5 -
5.6 - not determined for the lack of experience
5.7 - microprocessor produces the digital value. This data is fed into the central computer and videosynthesizer
5.8 - 220 V, 2 kW
5.9 - probably 6 months
5.10 - RVR is measured directly, no conversion or extrapolation is necessary. The measuring procedure is identical to that with a human observer. Correlator associated with a microprocessor also computes background luminance (automatically).

* For key, use fold-out page at rear of book

(WWW 1952)
6 - In the first trials the comparison with the observer determining the last visible light gave perfect results

7.1 - 54,000

7.2 - probably a little high

8 - Mme De Swert or Mr. Etienne (Régie de voix aériennes); Service Météorologique, Aeroport de Bruxelles National, 1930 Zaventem

9 - TECEMO, Toronto, European and American patents purchased by Airvideo (Monisuer Rouet)

1 - Federal Republic of Germany

2 - ASDUV; Electronic data processing system

3 - 1 year

4 - Automatic collecting, checking, data handling, displaying, distributing and storing of meteorological parameters in real-time at aerodromes

5.1 - in accordance with relevant ICAO, WMO recommendations

5.2 -

5.3 -

5.4 -

5.5 -

5.6 -

5.7 - display terminals for users. Different communication lines to weather service centre and air traffic control service

5.8 - 220 V AC

5.9 - monthly

5.10 - 2 synchronised minicomputers (back-up system). Ability of manual input of manmade observations and selected information. Data display by a video colour graphic system

6 - No comparisons with other systems up to now. Reliable

7.1 - 400,000

7.2 -
1 - Hong Kong

2 - Wind analyser system which measures aerodrome surface wind and low level wind shear along the slide paths to the Hong Kong International Airport

3 - Development completed in 1983. Installed and became operational in January 1984

4 - A microcomputer accepts wind data from 5 mast mounted anemometers, computes and displays a number of surface wind parameters and also the vertical wind shear for the lowest 70 m along the glide paths to the runway

5.1 - wind and wind shear monitoring

5.2 - Wind direction: 0 to 360 degrees from N
Wind speed: 0 to 200 knots

5.3 - Wind direction: 2 degrees; Wind speed: 1 knot

5.4 - sampling time 1 second

5.5 - 5 seconds, 2 minutes and 10 minutes

5.6 - very good

5.7 - Analogue outputs of anemometers are digitized and transmitted to the microcomputer via FSK modems and private telephone lines. Wind and wind shear information is displayed on a video magnetic tape drive

5.8 - 200 VAC, less than 1 KW

5.9 - Once a month

5.10 - The surface wind parameters computed include:

(a) The highest speed and associated direction in each 5 second update interval;

(b) 2 minute average wind vector expressed in direction and speed, update interval being 5 seconds;

(c) 10 minute average wind vector expressed in direction and speed, update interval being 2 minutes;
(d) Significant deviation in direction - the two extreme directions, clockwise from one to the other, between which the wind has varied during the preceding 10 minutes, if the total variation is 60 degrees or more, update interval being 2 minutes;

(e) Significant deviation in speed - the minimum and maximum speed during the preceding 10 minutes, if the variation from the 10 minute average is 10 knots or more, update interval being 2 minutes;

(f) Maximum trackwind and crosswind components recorded in the preceding 10 minutes

6 - The wind shear information has been verified against reports from airline pilots

7.1 - 30,000 (excluding anemometers which cost 1,500 each)

7.2 - 2,000

8 - Director of the Royal Observatory (Attention: K.H.Yeung), Royal Observatory, Nathan Road, Kowloon, Hong Kong.


1 - Sweden

2 - TAFS 8003 Automatic Weather Data Acquisition Terminal

3 - Test of first series

4 - Microprocessor based terminal for weather data collection, processing and transmission

5.1 - Automatic weather stations, airports

5.2 -  

5.3 -  

5.4 -  

5.5 -  

5.6 -  

5.7 - Output: V24/V28/rs232/V21

5.8 - 12 VDC or 110/220 VAC
5.9

5.10 - Can be connected to a great number of weather sensors

6 - Good experience from primal tests

7.1 -

7.2 -

8 - ASEA Traction, Dept. TFF, S-721 83 VÄSTERAS, Sweden

9 -

1 - Sweden

2 - SAWO, Semi Automatic Weather Observation System,

3 -

4 - Weather data collection, processing and presentation. METAR and SYNOP reports transmission on AFTN network

5.1 - Airports

5.2 -

5.3 -

5.4 -

5.5 -

5.6 -

5.7 -

5.8 - 110/220 VAC

5.9 -

5.10 -

6 - Operational on ten airports

7.1 -

7.2 -

8 - ASEA TRACTION, Dept. TFF, S-721 83 VÄSTERAS, Sweden

9 -

(WWW 1952)
Category Number 17

MARINE OBSERVATIONS

The following countries* have reported instruments related to this category put into operational use:

United Kingdom

United States of America

1 - United Kingdom

2 - Meteorological Office System for Ships (MOSS)

3 - 1 year

4 - Meteorological data manually inserted via keyboard into data collecting platform automatically transmitted to geostationary satellite and relayed via ground receiving station to GTS

5.1 - Surface obs from ships

5.2 -

5.3 -

5.4 -

5.5 -

5.6 -

5.7 -

5.8 - 0.25 KVA

5.9 - Variable

5.10 -

6 - DCP reliable. New VDU under test

7.1 -

7.2 -

8 - J.E. Wright, Met 0 16b, Beaufort Park, Easthampstead, Wokingham, Berkshire

9 -

* For key, use fold-out page at rear of book

(WWW 1952)
1 - USA

2 - Magnavox Data Acquisition Control and Telemetry (DACT) - measures wind speed and direction, maximum wind speed, air temperature, water temperature, water level and wave data

3 - 2 years (first station operational 11/82)

4 - Automated, self-timed data acquisition platform accepting digital and analogue inputs, capable of running off on A/C, solar cells, or batteries and using GOES and telephone communications

5.1 - Real-time marine meteorological observations from remote sites

5.2 - Wind (0-120 kts), Temperature -40°C to +50°C, pressure (27-31 in Hg), wave height (0-49 m), wave period (2.5 - 99.0 sec.)

5.3 - Wind (2 kts or 5%, 15° true), Temperature (1°C), Pressure (.03 in Hg), wave +(0.5 m and 1 sec.)

5.4 -

5.5 - Wind (2 to 8 min), temperature (1 min.), pressure (2 min.), wave (20 min)

5.6 - Designed for 18 months MTBF

5.7 - ASCII output in geophysical units modified FM 12 and 13, formats, GOES and telephone communications

5.8 - Of the order of 4 watts

5.9 - approximately 1 year

5.10 - Wave data now only available in buoy configuration. 46 stations (including 9 buoys, 7 platforms, 30 headland stations). Hourly observations.

Observations on Domestic and International Data Services (NWS Family of Services).

Data archived at NCDC, Asheville, NC.

The accuracies stated earlier were system accuracies, not instrument accuracies. Because of the need for a gyrocompass on the buoys and for rugged equipment, accuracies had to suffer a little.

6 - Instruments meet specifications. The few problems have been with the barometer (now fixed) and ring of the antenna (temporarily halting transmissions).
7.1 - 34,000 including sensors

7.2 - 11,000

8 - Michael Uhart, W/OTS 21x5, National Weather Service Hg., Silver Spring, MD

9 - No. Patents apply - property of the U.S. Government
METEOROLOGICAL OBSERVATIONS FROM AIRCRAFT

The following countries* have reported instruments related to this category put into operational use:

Bahrain

1 - Bahrain

2 - Inertial Navigation System on Board Aircraft

3 - Since 1.1.1985.

4 - Reports of Winds and Temperatures at 500' intervals from 3,000 ft received from landing aircraft equipped with INS

5.1 -

5.2 -

5.3 -

5.4 -

5.5 -

5.6 -

5.7 -

5.8 -

5.9 -

5.10 -

6 - Verification of 1 month's data forecast accuracy using criteria for forecasts for take-off give between 65 and 69% for wind speed and direction

7.1 -

7.2 -

8 - Director General of Civil Aviation, Post Box 586, Bahrain

9 -

* For key, use fold-out page at rear of book
Category Number 19

METEOROLOGICAL ROCKET SENSING

The following countries* have reported instruments related to this category put into operational use:

None

* For key, use fold-out page at rear of book

(WWW 1952)
LOWER TROPOSPHERIC SOUNDINGS

The following countries* have reported instruments, related to this category, put into operational use:

Germany, Federal Republic of

Canada

1 - Federal Republic of Germany

2 - Low level radiosonde system TDFS-82 for measurement of temperature, humidity and pressure in the free atmosphere

3 - 3 years (improved design of models TDFS 73, TDFS 76Q)

4 - Radio telemetry of dry and wet bulb temperatures and atmospheric pressure by balloon borne radiosonde and data evaluation by a processor controlled ground station

5.1 - Lower troposphere soundings

5.2 - 40°C to 40°C, 1050 hPa to 600 hPa

5.3 - T, +0.4°C, Td-Tw, +0.2°C, P, +2 hPa

5.4 - approximately 2 s

5.5 -

5.6 -

5.7 - monitoring and analogue recording of dry and wet bulb temperature, pressure steps and digital output for further processing

5.8 - radiosonde; 18 V, 50 mA; ground station; 220 V AC

5.9 -

5.10 - Radiosonde TDFS 82

Weight with batteries           30 N (300 g)
sensors (temperatures)          matched bead thermistors
sensor (pressure)               aneroid capsule
radio frequency                 20 kHz channel within 402-406 MHz
r.f. bandwidth                  ± 6 kHz

* For key, use fold-out page at rear of book

(WWW 1952)
r.f. deviation  ± 4 kHz
r.f. stability  ± 5 kHz (crystal controlled transmitter)

r.f. power  25 mW typ.
subcarrier frequency  400-1100 Hz
duration of operation  45 minutes (alkali-magnanese cells)

Ground equipment KS 75
(UHF-Receiver, data processing unit, strip chart recorder)

weight  400 N (40 kg)
line voltage  220 V 50 Hz 100 VA
calibration input  manual (4 co-efficients)
analogue recording  alternating dry and wet bulb temperatures, interrupted by pressure steps

6 -

7.1 - TDFS: approximately 85, KS75 approximately 13,000

7.2 -

8 - A.Kölbl, Deutscher Wetterdienst, Instrumentenamt München, August Schmauss Str. 1, D-8042 Oberschleissheim

9 - For model TDFS76Q; WMO-CIMO Report No.3 Low Level Intercomparison Experiment (BLIE)

1 - Canada

2 - Minisonde - Temperature only in lower troposphere

3 - 5 years

4 - Bead termistor on small 403 MHz transmitter

5.1 - augment raob for storm warning

5.2 - -35°C to 40°C

5.3 - +0.2°C

5.4 - 2 seconds

5.5 -

5.6 - high

5.7 - output is linearized and displayed on potentiometric recorder or fed directly to a microcomputer

5.8 - 9 V transistor battery

(www 1952)
5.9 - N/A

5.10 - Wind data obtained only from optical theodolite; height obtained by constant ascent rate or optical theodolite.

6 - temperature data very accurate, but height determination may be doubtful

7.1 - 15

7.2 -

8- MEP Company, 850 Magnetic Drive, Downsview, Ontario, Canada

9 -
Category Number 21

MEASUREMENT OF SUNSHINE DURATION

The following countries* have reported instruments related to this category put into operational use:

Sweden (see category 9)

Federal Republic of Germany

* For key, use fold-out page at rear of book
Category Number 22

AUTOMATIC METEOROLOGICAL STATIONS

The following countries* have reported instruments related to this category put into operational use:

Argentina
Austria
Finland
Germany, Federal Republic of (see category 16)
Hong Kong
Italy
Sweden (see categories 9, 11, 12, 16)
United Kingdom
United States of America (see category 17)
Canada
France

1 - Argentina

2 - Automatic meteorological station Milos 200. Measures atmospheric parameters (pressure, temperature, humidity, precipitation, wind, etc.)

3 - 4 years

4 - Automatic collection of data on physical parameters with sensors. Processing, indication and transmission of data in real-time with pre-determined time intervals

5.1 - meteorology, hydrology and nivology

5.2 - depends on the sensor type

5.3 - depends on the sensor type

5.4 - 5 minutes to 2 days (pre-determined)

5.5 - 90%

5.6 - serial interface RS 232C, cassette tape recorder, telemetry HF, UHF, UHL

* For key, use fold-out page at rear of book
(WWW 1952)
5.7 - depends on the transmission system type

5.8 - annual

5.9 - wind generator, automatic transmission, local operator interrogation or distant interrogation. Interface with direct connection to the computer. Telemetry output for different frequencies. Programmable

6 - no equivalent instruments of other firms

7.1 - 27,000

7.2 - 2,500

8 - Vaisala S.A. Campichuelo, 630 Buenos Aires, Argentina

9 -

1 - Austria

2 - Partial-automatic station.
Parameters measured: temperature (air, ground, water), relative humidity of air, wind speed, wind direction, pressure, precipitation, duration of sunshine, diffuse sky radiation, global radiation

3 - Since 1981

4 - Microprocessor controlled central unit with storage on a cassette tape and a printer. Maximum distance between sensors (up to 21) and central unit approximately 500 m

5.1 - Climatological measurements

5.2 - See Table 1

5.3 - See Table 1

5.4 -

5.5 - See Table 1

5.6 -

5.7 - The central data evaluation unit comprises the following functions:
Microprocessor (MC 6809)
Storage devices/RAM an UV-PROM, max. 56 k
Real-time clock with buffer and calendar
Interface to operation and display elements
Interface to built-in cassette station
Interface to external printer.
V 24 interface to telecommunication lines
Interface to analogue and digital measuring channels
<table>
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<tr>
<th>Measuring</th>
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<tr>
<td>Temperature</td>
<td>-40°C to +50°C</td>
<td>+0.1°C</td>
<td>10</td>
<td>Averaged/</td>
</tr>
<tr>
<td>Relative Humidity of Air</td>
<td>5% to 100%</td>
<td>+2%</td>
<td>10</td>
<td>Average</td>
</tr>
<tr>
<td>Pressure</td>
<td>650,0 mbar to 1050,0 mbar</td>
<td>+0.5</td>
<td>60</td>
<td>- Actual Value</td>
</tr>
<tr>
<td>Precipitation</td>
<td>-</td>
<td>0.1 mm</td>
<td>60</td>
<td>- Total/day in mm</td>
</tr>
<tr>
<td>Duration of sunshine</td>
<td>-</td>
<td>1 s</td>
<td>1</td>
<td>- Total/day in min</td>
</tr>
<tr>
<td>Global Radiation of the hourly total</td>
<td>-</td>
<td>+4.2/cm²</td>
<td>2</td>
<td>Average/ 30 min. Average</td>
</tr>
<tr>
<td>Sky Radiation</td>
<td>-</td>
<td>+4.2/cm²</td>
<td>2</td>
<td>Average/ 30 min. Average</td>
</tr>
<tr>
<td>Wind speed</td>
<td>-</td>
<td>+0.5 m/s</td>
<td>2</td>
<td>Average/ 10 min.</td>
</tr>
<tr>
<td>Wind</td>
<td>357°</td>
<td>+2°</td>
<td>2</td>
<td>Average/ 10 min.</td>
</tr>
</tbody>
</table>

(WWW 1952)
5.8 - 50 VA without sensor heating, 300 VA with sensor heating, supply voltage 220 V/50 Hz

5.9 - once a year

5.10 - An extension with additional feelers - up to 20 channels - is possible without changing the hardware. Some of the stations put in use are equipped with sensors for registration of the grass minimum temperature and soil and water temperatures at various depths. Stations in mountainous regions also measure snow depths with an ultrasonic sensor. The task of the observer of a partial automatic station is reduced to the recording of the elements not measured by the sensors but necessary for the climatological service, for example, cloudiness (amount and density), visibility, different between liquid and solid precipitation, atmospheric phenomena and, if not in mountainous regions, snow depths.

6 - Temperature: Drift within the accuracy of measurements from $\pm 0.1^\circ C$

Deviation in comparison with the mercury thermometer (aspirated) $\pm 0.5^\circ C$

No significant jumps in the series of data for previous years

Humidity: Deviation in comparison with the customary hygrometer by additional aspiration. During the day, on average 7% higher RH. On days with sunshine, on average 10% higher RH.

Sunshine duration: No significant differences compared with the registration of Campbell-Stokes autographs

Wind direction, Wind Speed: same as above

Global and diffuse sky radiation: the same as above

Pressure: Drift of 0.5 mb per year

Precipitation: Faulty measurings through false adjustment of the tipping bucket gauge: up to 30% strongly dependent on intensity. On average as against ombrometer, 5% diminished values.

7.1 - 20,000

7.2 - 400

8 - Austrian Research Centre, A-2444 Seibersdorf


5. Österreichisches Forschungszentrum Seibersdorf: Manual zur teilautomatischen Klimastation Meteodat S. 1982

1 - Finland

2 - Multichannel recording and reporting automatic weather station, type MILOS 200

3 - In serial production since 1983

4 - MILOS 200 is a modular construction being expandable up to 32 measurement channels. MILOS 200 is recording data on tape at station. It can be interfaced with a telephone network, Meteor Scatter Terminal, Satellite terminal or UHF/VHF radio link

5.1 - Climatological/hydrological/synoptic station

5.2 - up to 32 parameters

5.3 -

5.4 -

5.5 - adjustable

5.6 - MTBF 8000 hours (MIL handbook 217 D)

5.7 - Two RS 232 C output ports

5.8 - 115/230 VAC, 12 VDC (alternative)

5.9 - once a year

5.10 - vast variety of application software available
   - fixed and mobile masts
   - solar panel packages available
   - network configuration through Meteor Scatter Telemetry - System

6 -

7.1 -
Automatic weather station for measuring surface wind, air temperature, humidity, rainfall and atmospheric pressure.


Analogue signals from meteorological sensors at the field station are converted to digital signals and transmitted by microprocessor via modem/telephone line to the central station front-end microprocessor which collects the data and performs required computations. A multiplexing microprocessor controls up to 8 different front-end microprocessors and displays and transmits their data for archiving.

5.1 - Meteorological data collection and monitoring
5.2 - please see other characteristics
5.3 - please see other characteristics
5.4 - sampling time 1 second
5.5 - 1 minute, but for wind also every 10 minutes and every hour and for rainfall continuously.
5.6 - excellent
5.7 - Interface between field station and front-end microprocessor is via modem/telephone line. Interface between front-end and multiplexing microprocessors is via RS232C serial interface. Outputs from the multiplexing microprocessor are displayed on console and line printer, and transmitted serially to another minicomputer for archiving
5.8 - 200 VAC, less than 100 watts each for field station, front-end microprocessor and multiplexing microprocessor
5.9 - Once a month
5.10 - In addition to wind direction and speed, temperature, humidity, rainfall and pressure, other meteorological and oceanographic sensors can be connected to the field station, which can accommodate up to 16 different sensors.

Measuring range and accuracy of sensors:

(a) Setra Model 270 pressure transducer, range 800-1100 mbar, accuracy 0.3 mbar;

(b) Rosemount Series 78 platinum resistance temperature sensor, range -50 to 50 degrees C, accuracy 0.3 degrees C;

(c) Munro Mark 4B wind sensor, range 0-360 degrees from N, 0-200 knots, accuracy 3 degrees, 2 knots;

(d) Cassella Model W5698/1 Tilting Bucket Rain gauge, accuracy 0.5 mm

6 - Meteorological data collected from the automatic weather station compare very well with those collected by the human observer.

7.1 - field station 2,000 including sensors 20,000 front-end microprocessor 2,500. Multiplexing microprocessor 4,000

7.2 - field station 2,000, front-end and multiplexing microprocessors 1,000

8 - Director of the Royal Observatory (Attention: K.H. Yeung) Royal Observatory, Nathan Road, Kowloon, Hong Kong.


---

1 - Hong Kong

2 - Solar powered automatic weather station for measuring surface wind, air temperature, rainfall and atmospheric pressure

3 - Development completed in January 1985. The first station will be installed in May 1985

4 - Analogue signals from meteorological sensors at the field station are digitized and processed by a microprocessor. The meteorological parameters computed are transmitted via a UHF transmitter once every 30 minutes. A UHF relay station receives the data and retransmits them via private telephone lines to a fronted microprocessor at the central station. A
multiplexing microprocessor controls up to 8 different front-end microprocessors and displays and transmits their data for archiving.

5.1 - Meteorological data collection and monitoring

5.2 - Please see other characteristics

5.3 - Please see other characteristics

5.4 - sampling time 1 second

5.5 - 1 minute, but for wind also every 10 minutes and every hour, and for rainfall continuously

5.6 - Excellent in laboratory test

5.7 - Interface between field station and front-end microprocessor is via UHF transmitter/receiver and the modem/telephone lines. Interface between front-end and multiplexing microprocessors is via RS232C serial interface. Output from the multiplexing microprocessor are displayed on console and line printer, and transmitted serially to another minicomputer for archiving.

5.8 - Field station from 12 V batteries charged by solar panel, 2 watts, relay station 200 VAC, less than 10 watts, front-end and multiplexing microprocessors, 200 VAC, each less than 100 watts.

5.9 - 6 months

5.10 - The field station is powered by batteries charged by solar panels.

Measuring range and accuracy of sensors:

(a) Setra Model 270 pressure transducer, range 800-110 mbar, accuracy 0.3 mbar

(b) Rosemont Series 78 platinum resistance temperature sensor and Teledyne Geotech Model 21.32 temperature processor, range -50 to 50 degrees C, accuracy 0.3 degrees C

(c) Teledyne Geotech WS201 Wind System, range 0-360 degrees from N, 0-90 m/s accuracy 3 degrees, 0.5 m/s

(d) Cassella 400 cm² Tipping Bucket Rain gauge, accuracy 0.5mm

6 - Meteorological data collected from test runs of the field station compared well with those obtained by human observers

7.1 - field station including sensors 15,000, front-end microprocessors 2,500, multiplexing microprocessor 4,000
7.2 - field station 2,000; front-end and multiplexing microprocessors 1,000

8 - Director of the Royal Observatory (Attention: K.H. Yeung), Royal Observatory, Nathan Road, Kowloon, Hong Kong


1 - Hong Kong

2 - An automatic meteorological station which (i) measures horizontal and vertical winds, temperatures at two levels, dew point and solar radiation and (ii) computes a variety of parameters required for air pollution assessment and modelling. The Mostek series of Z-80 microprocessor boards are used in the data processing

3 - December 1982 - November 1983, August 1984 - present

4 - Measurements from the meteorological sensors are collected by a microprocessor at site. The microprocessor also calculates 10 minute and hourly averages of general and air pollution meteorological parameters, and relays them back to the headquarters via a pair of telephone wires.

5.1 - General and air pollution meteorological monitoring

5.2 - Please see "Other characteristics"

5.3 - Please see "Other characteristics"

5.4 - sampling time: 1 second

5.5 - every 10 minutes and every hour

5.6 - excellent

5.7 - Analogue outputs from sensors are converted to digital signals using factory-made translators which interface with a microprocessor. Outputs are displayed on a line printer and archived on a minicomputer at the headquarters.

5.8 - 200 VAC, 400 W

5.9 - about once a month

5.10 - In addition to the wind, temperature, dew point and solar radiation, the following parameters are also computed:

- Persistance in wind direction
- Fluctuations in the horizontal wind direction
- Fluctuations in the vertical wind speed
- Friction velocity
- Bulk Richardson number

Measuring range and accuracy of sensors:

<table>
<thead>
<tr>
<th>Sensor</th>
<th>Measuring Range</th>
<th>Accuracy</th>
<th>Accuracy of Translator</th>
</tr>
</thead>
<tbody>
<tr>
<td>(i) &quot;Climatronics&quot;</td>
<td>v: ±30 m/s,</td>
<td>0.5%</td>
<td>0.1% full scale</td>
</tr>
<tr>
<td>sensor</td>
<td>w: ±6 m/s</td>
<td>0.5%</td>
<td>0.1% full scale</td>
</tr>
<tr>
<td>(ii) &quot;Climatronics&quot;</td>
<td>-10°C - 40°C</td>
<td>+0.02°C</td>
<td>0.1% full scale</td>
</tr>
<tr>
<td>temperature and dew point sensors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(iii) &quot;Kipp and Zonen&quot;</td>
<td>0 - 1750 W/m²</td>
<td>0.1%</td>
<td></td>
</tr>
</tbody>
</table>

6 - Meteorological data from the station compares very well generally with those at a station 8 km away

7.1 - Microprocessor and peripherals 2,500, Sensors and translators 11,000

7.2 - 1,000 excluding electricity, telephone line rental and staff costs

8 - Director of the Royal Observatory, (Attention: B.Y. Lee), Royal Observatory, 134A Nathan Road, Kowloon, Hong Kong

9 - "User guide for an automatic weather station for air pollution meteorological monitoring, to be published by the Royal Observatory, Hong Kong

1 - Italy

2 - Meteosat Data Collection Platforms

3 - 6 months

4 - Measurements of 8 parameters; Transmission to Meteosat every hour; Emission into GTS through offenbach and acceptance in modified SDUS

5.1 -

5.2 -

5.3 -

5.4 -

5.5 -

5.6 -

5.7 -
5.8 - 

5.9 - 

5.10 - 1. Measured parameters:
   - pressure
   - wind speed
   - wind direction
   - air temperature
   - relative humidity
   - precipitation
   - solar and diffuse radiation
   - soil temperature

2. Reporting period: hourly
3. Message format: FM 12 VII SYNOP
4. Housekeeping data included in the message
5. Self-Government: 6 months

6 - Too short experience available

7.1 - 30,000

7.2 - 5,000

8 - Dr. B. Bizzarri, Italian Meteorological Service, Piazzale Degli Archivi 34, I-00144 Roma

9 - 

1 - United Kingdom
2 - Synoptic Automatic Weather Station (SAWS)
3 - 2 - 3 years
4 - A suite of meteorological sensors regularly sampled by data handling system which applies quality control and stores data. Interrogation is carried out on a regular basis by collecting centre polling unit

5.1 - Automatic sampling of weather conditions
5.2 - As for manned stations
5.3 - 
5.4 - 
5.5 - 
5.6 - MTBF 2000 hours with 90% confidence
5.7 - 

5.8 - 0.25 KVA
5.9 - 3 monthly

6 - Readings compare favourably with manned stations

7.1 -
7.2 -

8 - J.E. Wright, Met 0 16b Meteorological Office, Beaufort Park, Easthampstead, Wokingham, Berkshire RG11 3DN

9 -

1 - Canada
2 - Marine Automatic Weather Station (MAPS-II)
3 - 6 months

4 - Microprocessor based data acquisition
   - Local Power 12 volts DC, some use solar panels, some charge from line power, teletype or satellite (GOES) data communication hourly

5.1 - remote measurement and reporting (pressure, wind, humidity, precipitation, temperature, visibility)
5.2 - see "other"

5.3 - Sensors:
   - Temperature  - +0.2°C
   - Humidity     - +5% (+10% below 40% RH)
   - Rainfall     - +0.2 mm (error in high rates)
   - Wind speed   - +1 knot  - 10 min. averaged
   - Wind direction - +22.5° - 10 min. averaged
   - Pressure     - +0.8 mB
   - Visibility   - +20%

5.4 - see "other"
5.5 - see "other"
5.6 - see "other"

5.7 - teletype + GOES satellite data retransmission
5.8 - 12 volts DC, battery (200 AH)
5.9 - 3 months to 6 months
5.10 -

6 - Equipment performs within specification by engineering tests - calibration checks regular intervals

7.1 - System - 30,000 Sensors incl. (less visibility)

7.2 - 10% of purchase

8 - Atmospheric Environment Service, 4905 Dufferin Street, Downsview, Ontario, Canada M3H 5T4,

Attention: Jerry Musil, ACSL/M - technical
Mac MacLeod, AFON - operations

9 - Bristol Aerospace is licensed by Canada Patents and Developments Limited, to produce this product as its own

1 - France

2 - System in help to the observer - Mistral

3 - in service for two years

4 - Equipment controlled by microprocessor (8085 INTEL) with memory - 2 K octets RAM, 32 K octets PROM, 256 octets reserve, which performs the multiplexing of channels, analogue to digital conversion 12 bits, asynchronous input-output by 3 channels

5.1 - climatological observations, synoptic, aeronautic measurements

5.2 - corresponds to meteorological and aeronautical sensors

5.3 -

5.4 -

5.5 -

5.6 -

5.7 - 3 inputs-outputs of the current loop type (0-20 mA) or 24 V

5.8 - 220 V (50-60 Hz) 250 VA max

5.9 -

5.10 - acquisition and processing of data from 23 sensors is possible
- output of data on a printer every 6 minutes
- hourly edition of particular values of meteorological parameters
edition on Teleprinter SAGEM TX 35 of SYNOP messages (every hour) CLIMO-RAYON-PRECIP
edition every minute on alpha-numerical console of aeronautical parameters and local dissemination of data through video channels or telephone line

6 - very high operational reliability of the system

7.1 - 7,000 (without sensors and periphery)

8 - M. Bettan (SETIM/T/SII), Météorologie Nationale, BP 202, 78195 Trappes Cedex, France

9 -  

6 - very high operational reliability of the system

7.1 - 7,000 (without sensors and periphery)

8 - M. Bettan (SETIM/T/SII), Météorologie Nationale, BP 202, 78195 Trappes Cedex, France
SOIL MOISTURE MEASUREMENT

The following countries* have reported instruments related to this category put into operational use:

<table>
<thead>
<tr>
<th>Category</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Colombia</td>
<td>Evapotranspiration tank of reinforced plastic (fibreglass) to measure evapotranspiration</td>
</tr>
</tbody>
</table>

* for key, use fold-out page at rear of book
1 - Canada

2 - IRAMS (Instrument for Reflectometry, Analysis of Moisture in Soil)

3 - 3 months

4 - Time Domain Reflectometry - for a measurement of dielectric constant at 10-1000 MHz

5.1 - soil moisture

5.2 - 0 to 75% water content

5.3 - ±5% accuracy 1% precision

5.4 - about 5 secs to make reading

5.5 - about 5 secs to make reading

5.6 -

5.7 - visual display + RS232 port

5.8 - internal rechargeable battery

5.9 - charge batteries each day

5.10 - Inherent calibration
   - Portable - 4 Kgms
   - Uses direct contact probes
   - Detects presence of frost

6 - compared to gravimetric sampling - agreement to within 2% water content

7.1 - 4500

7.2 - nil

8 - Foundation Instruments Inc., 24 Colonnade Road, Nepean, Ontario K2E 7J6

Category Number 24

OTHER

The following countries* have reported instruments related to this category put into operational use:

Belgium
Colombia
Finland
Netherlands (see category 4)
Sweden (see also category 9)
United States of America
Philippines

1 - Belgium
2 - electrometer - air electric potential
3 - 4 years
4 - electrometer with an IC (FET) at the input. Input impedance is augmented by the gerdien technique
5.1 - measure the air potential
5.2 - -500 V, +500V
5.3 - +1%
5.4 - 3 ms (without antenna)
5.5 -
5.6 - very reliable electronics
5.7 - -1 V to +1 V. Two channels (corresponding to signals + or -) 0 m Ω to 1 m Ω
5.8 - 220 V, 200 mA
5.9 - 1 year
5.10 -

* for key, use fold-out page at rear of book
Solid state electrometers for measuring the electric potential of the air altimeter above the earth's surface; H. Malcorps et al. Translation 1217 Meteorological Office

1 - Belgium
2 - air conductivity (+ and -)
3 - one year
4 - measure the currents with varactor amplifier
5.1 -
5.2 - \(0 - 500 \times 10^{-16}\) Ohm\(^{-1}\) m\(^{-1}\)
5.3 - 5%
5.4 -
5.5 -
5.6 -
5.7 - 0 - 1 V, 0 - 1 mA
5.8 - 220 V, 250 mA
5.9 - 15 days
5.10 -
6 -
7.1 - 2200
7.2 -
8 - K.M.I. - I.R.M.
9 -

1 - Belgium
2 - vertical current
3 - 4 years

4 - horizontal plate electrometer - varactor amplifier

5.1 - 
5.2 - 
5.3 - 5%
5.4 - 
5.5 - 
5.6 - 
5.7 - 
5.8 - 220 V, 1 A
5.9 - 1 month
5.10 - 
6 - 
7.1 - 960
7.2 - 
8 - K.M.I. - I.R.M.
9 - 

1 - Belgium

2 - ion counter (+ and -), ions concentration, measure of currents with varactor amplifier

3 - 1 year

4 - measure of currents with varactor amplifier using gerdien technique

5.1 - 
5.2 - 0 - 50 000 ions/cm³
5.3 - 5%
5.4 - 40 s
5.5 - 
5.6 - 

5.7 - 0 - 1 V, 0 - 1 mA
5.8 - 220 V, 200 mA
5.9 - 15 days
5.10 -
6 -
7.1 - 2500
7.2 -
8 - K.M.I. - I.R.M.
9 -

1 - Colombia
2 - Evapotranspirometer Tipo HIMAT. Evapotranspiration potential.
3 - 2.5 years
4 - connected vessels
5.1 - measure the evapotranspiration potential for pastures
5.2 - from 0.00 mm to 25.00 mm
5.3 -
5.4 -
5.5 -
5.6 - good
5.7 - duct system, visual measurements by scales over the tank
5.8 - no
5.9 - recommended very 8 months
5.10 -
      - fibreglass tanks
      - freatic levels inside the evapotranspirometer tanks is calibrated so the instrument can be used in any climate and soil
      - system makes reliable measurements for the periods longer than those for which the maximum value is more than 5% higher than ETP
ETP = Ra + P + A -D (mm)
Ra - irrigation, P - precipitation, A - water applied, 
D - drainage and possible changes in water distribution
inside the 40 cm layer and in the tank

results are quite satisfactory, fine instruments installed
in different regions of the country and the system is now
fabricated in Peru

7.1 - 500
7.2 -

8 - HIMAT, carrera 10 No. 20-19-Division de Meteorologia

Mantenimiento del Evapotranspirometro de Compensacion Tipo
HIMAT. Instituto Colombiano de Hidrologia, Meteorologia y
Adecuacion de Tierras, HIMAT, Bogota, Colombia

1 - Finland
2 - Long distance (up to 2000 km) data transmission system, type
Meteor Scatter
3 - In serial production since late 1984
4 - Meteor Scatter utilizes the ionized trails of meteors as a
reflector for VHF radio signals
5.1 - Telemetry network for synoptic/hydrological stations
(automatic or manual)
5.2 - Telemetry range is 0 ... 2000 kilometers
5.3 -
5.4 -
5.5 -
5.6 -
5.7 - RS 232 C
5.8 - 28 VDC mains or battery
5.9 - once a year
5.10 - Frequency: 42.5 ... 45.5 MHz
Channels: 60 with 50 kHz spacing
Power output: 300 W
Modulation: FFSK (Fast Frequency Shift Keying)
Bit rate: 10 kbits/sec
Communication mode: simplex with T/R switch
Antennae: 6 element YAGI
The EBRA II Image Processing System is a compact low-cost microprocessor based digital system for image processing. It can operate as a stand-alone system, or it can be interfaced to a personal computer or a large host computer. EBRA II can be used to process and display any form of three-dimensional data such as digitized photographs, maps or sensor data. Combinations of images and other data bases is another obvious application. EBRA II can specially be used to display and analyse remote sensing satellite images.
1 - U.S.A.

2 - Automatic Radiotheodolite (ART)

3 - Implementing the hardware, hardware installation began in early 1985, continuing to develop ART software

4 - Upgrading of radiosonde ground equipment (GMD and WBRT) and automating the synoptic upper-air sounding observation

5.1 - at synoptic upper-air stations

5.2 -

5.3 -

5.4 -

5.5 -

5.6 - much higher than current GMD or WBRT

5.7 - Minicomputer or Microprocessor

5.8 - ART - 2000 W mini 1600 W

5.9 - as scheduled

5.10 -

6 -

7.1 - approximately 75 K (US)

7.2 - not yet established

8 - Leroy S, Nordahl, NOAA National Weather Service, 8060 13th Street, Silver Spring, MD 20910

9 -

1 - Philippines

2 - The pressure/vacuum chamber with a 1-inch thick clear glass top portion facilitates the taking of readings of surveying altimeters with dials in the horizontal position

3 - 1 year

4 - The airtight chamber is connected to a vacuum pump and a standard mercurial barometer. Altimeters for calibration are placed inside the chamber. Various levels below the tropopause are simulated.
5.1 - Standardization of surveying altimeter
5.2 - 300 meters below MSL, 3,000 meters above MSL
5.3 - 98% accurate
5.4 - N/A
5.5 - N/A
5.6 - 98%
5.7 - Corrections for errors of calibrated surveying altimeters are established
5.8 - minimal
5.9 - twice a year
5.10 - The effect of temperature variations on the instrument and its accessories is practically negligible since room temperature in the working space is maintained almost constant
6 - The error of every surveying altimeter so far calibrated was more accurately established
7.1 - 450,00 (cost of materials)
7.2 - Minimal
8 - Instruments Development and Research Division, National Institute of Atmospheric Sciences, PAGASA, Q.C. Philippines
9 - N/A
The information regarding each instrument is given in accordance with the following entry key numbers:

1 - Member country

2 - Identification of the device and parameter measured (or its function)

3 - State of developments; (for INSTRUMENTS UNDER DEVELOPMENT)
    Period of exploitation; (for INSTRUMENTS PUT INTO OPERATIONAL USE)

4 - Principle of operation

5 - Main technical characteristics

5.1 - application

5.2 - measuring range

5.3 - uncertainty (accuracy)

5.4 - time constant

5.5 - averaging time

5.6 - reliability

5.7 - interface and output details

5.8 - power requirements

5.9 - servicing interval

5.10 - other characteristics

6 - Experience from comparisons and tests performed

7.1 - unit cost at factory

7.2 - annual operating cost

8 - Name and address of person or organization responsible for further information

9 - Major bibliographic references, applicable patents, etc.