

WORLD METEOROLOGICAL ORGANIZATION

CIMO/OPAG-UPPER-AIR/
ET-RSUAT&T-1/Doc.6.1(4)

**COMMISSION FOR INSTRUMENT AND
METHODS OF OBSERVATION**
OPAG-UPPER AIR

(3.III.2005)

**EXPERT TEAM ON REMOTE SENSING UPPER-AIR
TECHNOLOGY AND TECHNIQUES**
First Session

ITEM: 6.1

Geneva, Switzerland, 14-17 March 2005

Original: ENGLISH ONLY

INTEGRATED PROFILING SYSTEMS AND OTHER UPPER-AIR MEASUREMENT TECHNIQUES

Summary Report on National and Regional Projects set-up in Russian Federation to integrate different Ground-based Observing Systems

(Submitted by E. Kadygrov, CAO, Russian Federation)

Summary and purpose of document

This document provides information on projects in Russian Federation to integrate different ground-based observing systems to provide improved sensing of vertical profiles of temperature, humidity, wind and cloud structure

Action proposed

The meeting is invited to take information provided in the document in discussing projects for integration of different ground-based observing systems.

**SUMMARY REPORT ON NATIONAL AND REGIONAL PROJECT SET-UP IN
RUSSIAN FEDERATION TO INTEGRATE DIFFERENT GROUND BASED
OBSERVING TOGETHER TO PROVIDE IMPROVED SENSING OF VERTICAL
PROFILES OF TEMPERATURE, HUMIDITY, WIND AND CLOUD STRUCTURE**

Evgeny Kadygrov,
Central Aerological Observatory
Dolgoprudny, Moscow region, 141700, Russia

The main objective of the European Action COST 720 “Integrated ground-based remote sensing stations for atmospheric profiling” is development of integrated ground-based stations for atmospheric profiling and the assessment of their use for meteorological analysis and forecast as well as climate research and climate monitoring. Formally Russian Federation is not participated in European COST-720 Action, but as a member of WMO provided several national projects for development of advanced remote sensing instruments, modernization of observing stations and integration of data from different ground-based remote sensing profilers. This summary report consist three parts: brief information about Russian remote sensing instruments which can be useful for integration system; short description of some Russian observing systems, and short information about national and regional projects for integrated systems.

1. Remote sensing instruments in Russia

1.1. Microwave temperature profilers MTP-5

MTP-5 is a single-channel an angular scanning microwave radiometer for atmospheric boundary layer temperature profiling. Developed at the Central Aerological Observatory (CAO) and manufacturing by Russian scientific – production company ATTEX. There are several modifications of the instrument:

MTP-5H – with the altitude range 0÷600 m, accuracy 0,2⁰-0,5⁰C, vertical resolution 50-200 m, it can operate in unattended mode practically in all weather conditions. There is currently a network of 8 stations with MTP-5H profilers.

MTP-5HE – with the altitude range 0÷1000 m.

MTP-5P – for polar region, can operate up to –70⁰C, and with vertical resolution 10 m at the first 100 m.

MTP-5M – mobile version (with installation to the car or train).

1.2. DHS (Dangerous Height Sensor) – dual-channel passive microwave system for retrieval of cloud parameters: liquid water path and the average temperature of liquid water layer in clouds (CAO, ATTEX). The main part of the system: two microwave radiometers with the central frequencies 85 GHz and 37 GHz.

1.3. “Volga” – dual-channel differential – microwave radiometer for water vapor total concentration measurements (Radiophysical Institute, Nygny-Novgorod). The channels frequencies are 22,2 GHz and 20,7 GHz. Can measure water vapor path even in cloudy atmosphere.

1.4. “Volna-3” – 3 component SODAR (developed by Institute of Atmospheric Optics, Russian Academy of Science, Syberian Branch, Tomsk). The main parameters of this SODAR are:

- height range – 25 – 750 m
- height resolution – 12 – 25 m.

Measured range:

wind speed $0,3 \div 30$ m/c with the accuracy $\pm 0,2$ m/c for wind speed and ± 3 degree in wind direction.

Antennas dimensions: $2 \times 2 \times 3$ m.

1.5. “LATAN-3” – 3 component SODAR (developed by Institute of Atmospheric Physics, Russian Academy of Science, Moscow). The main parameters of this SODAR are:

- altitude range: $30 \div 500$ m;
- height resolution: 8-17 m.

Measured ranges:

- horizontal wind speed $0,2 \div 30$ m/s;
- vertical wind speed $\div 2$ m/c

Measured accuracy:

- vertical wind speed: $\pm 0,1$ m/c;
- horizontal wind speed: $\pm 0,5$ m/c.

1.6. Mini-Radar wind profiler (developed by Moscow State Academy of Instrument Engineering and Information). The main parameters are:

- altitude range: $10 \div 3000$ m;
- altitude resolution: 50 m;

- accuracy of wind velocity measurement: 0,5 m/s;
- accuracy of wind direction measurement: 8 degree.

1.7. Lidar for temperature profile measurement (developed by Institute of Atmospheric Optics, Russian Academy of science, Tomsk). Dual-channel system with the wavelength 532 nm and 607 nm:

- altitude range: 10÷75 km;
- altitude resolution: 0,5÷1,5 km;
- accuracy: 2-5 K.

1.8. Lidar for water vapor mixing ratio measurement (developed by Institute of Atmospheric Optics, Russian Academy of Science, Tomsk). Main parameters:

- maximum altitude: – 10 km;
- receive wavelength: 347 nm and 332 nm;
- transmitter wavelength: 308 nm;
- vertical resolution: 50 m;
- time resolution: 15÷30 min.

2. Observing stations with possibility of integration

There is currently in Russia a network of 8 temperature profilers that covers mostly some part of the European territory of Russia and partly Syberia (Moscow, Zvenigorod, Dolgoprudny, Nigny Novgorod, Orenburg, Ufa, Krasnojarsk, Tomsk). At a three stations (Moscow, Nigny Novgorod and Orenburg) in addition to the stationary temperature profilers are using mobile instruments also. Several stations had different remote sensing instruments, for instants: Zvenigorod (temperature profiler, SODAR), Dolgoprudny (temperature profiler, mini-radar wind profiler, cloud radar); Tomsk (temperature profiler, SODAR, lidar for temperature profiling, lidar for water vapor mixing ratio measurements, aerosol lidar).

3. National and regional projects

Currently in Russia there is no special project for integration of the data from different ground based remote sensing profiling system. Some regional project partly connected with this problem (for instants, improving of atmospheric boundary layer parameters monitoring for short-time local weather forecast – in Orenburg and in Nigny Novgorod). One of National project of Russian Federal Service of Hydrometeorology and Environmental Monitoring is development of

a network of temperature profilers and this network can be combined in future with the radar wind profilers or with SODAR.

Conclusion

Currently there are different modern remote sensing ground based instruments developed in Russian Federation. There are also a network of 8 temperature profilers which can be sufficiently improved by installation of wind profilers also in case of additional financial support. But real work with integration of the data from different remote sensing instruments is in a very beginning only.