MF-19 SOLAR RADIOMETRY INSTRUMENT IN THE FRAME OF THE MODERNIZATION OF ROSHYDROMET OBSERVATION NETWORK

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The last stage of Russian solar observation network technical re-equipment is a newly designed MF-19 solar radiometry instrument.

MF-19 has been designed in the frame of Russia and Belarus cooperation program. MF-19 and software for solar radiometry based on Main Geophysical Observatory theory and algorithms has been designed by Research and Production Association "Typhoon".

MF-19 series production will provide Russian observation network with full sets of up-to-date automatic instruments of higher accuracy and on-line data processing.

MF-19 is a new automatic solar radiometry station intended for measuring direct, global, diffuse, reflected solar radiation and solar radiation balance. The principles of operation are based the transforming of the sensors signals into digital code and calculating the values of physical quantities using individual calibration characteristics.

MF-19 is intended to carry out any of basic ROSHYDROMET observation program:

- short program for measuring daily global radiation;
- continuous registration of direct, diffuse, global, reflected radiation and radiation balance;
- observatory program with increased or customary set of sensors.

MF-19 solar radiometry station consists of central measuring unit (logger) (fig.1), PC and power supply and data transfer unit, solar sensors (fig.2-4), sun tracker (fig.5), shadow ring (fig.6) and arm rack (fig.7).

Logger (fig.1) is intended for data retrieving, processing and presenting information in the form of tables and graphs on a PC.

Communication between the logger and the user's computer is provided by special software intended for:

- data import, transfer into daily files, comparative presentation in graphs and tables;
- setting current time of the logger, measuring range and time;
- setting factors for data converting into physical magnitudes for each measuring time.

In 2011 logger was certified and put into the State Register of measuring instruments (pattern approval certificate of measuring instruments RU.C.34.001.A № 45135).

Fig.1 Central measuring unit (logger) in a weatherproof box

MF-19 is fully compatible with various commercially available sensors. The basic solar sensors are “Peleng SF-06” pyranometer, “Peleng SF-08” balance meter and “Peleng SF-12” actinometer. All this sensors have been certified for the State Register of measuring instruments and recommended for ROSHYDROMET observation network.

“Peleng SF-06” and “Peleng SF-12” measure solar energy in 0.3 - 2.4 um range. “Peleng SF-08” measures solar radiation balance of the Earth surface within 0.3 - 10 um range.

Table 1 shows how the type of radiation correlates with the type of the sensor.

Table 1. Solar sensors for different kinds of radiation

Type of radiation measured	**Type of solar sensor**
Global solar radiation	“Peleng SF-06” pyranometer
Diffuse solar radiation	“Peleng SF-06” pyranometer
Reflected solar radiation	“Peleng SF-06” pyranometer
Radiation balance	“Peleng SF-08” balance meter
Direct solar radiation	“Peleng SF-12” actinometer

The solar sensors are shown at fig. 3-5.

Fig. 2 “Peleng SF-06” pyranometer

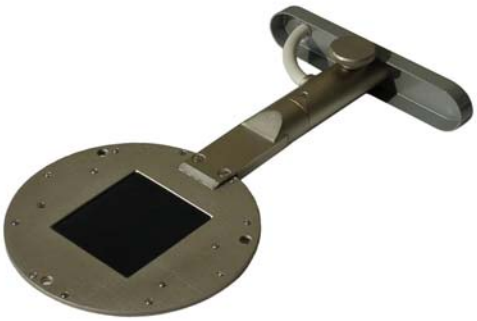

Fig. 3 “Peleng SF-08” balance meter

Fig. 4 “Peleng SF-12” actinometer

To carry out solar observations, all the above solar sensors should be duly placed on observation sites using certain facilities for their mounting and shadowing.

The PSS-1 sun tracker (fig.6) tracks the sun trajectory. It works without PC.

Direct and diffuse radiation sensors are placed on the sun tracker. Functions of the PSS-1 are both to aim the actinometer to the sun automatically and to shadow the pyranometer.

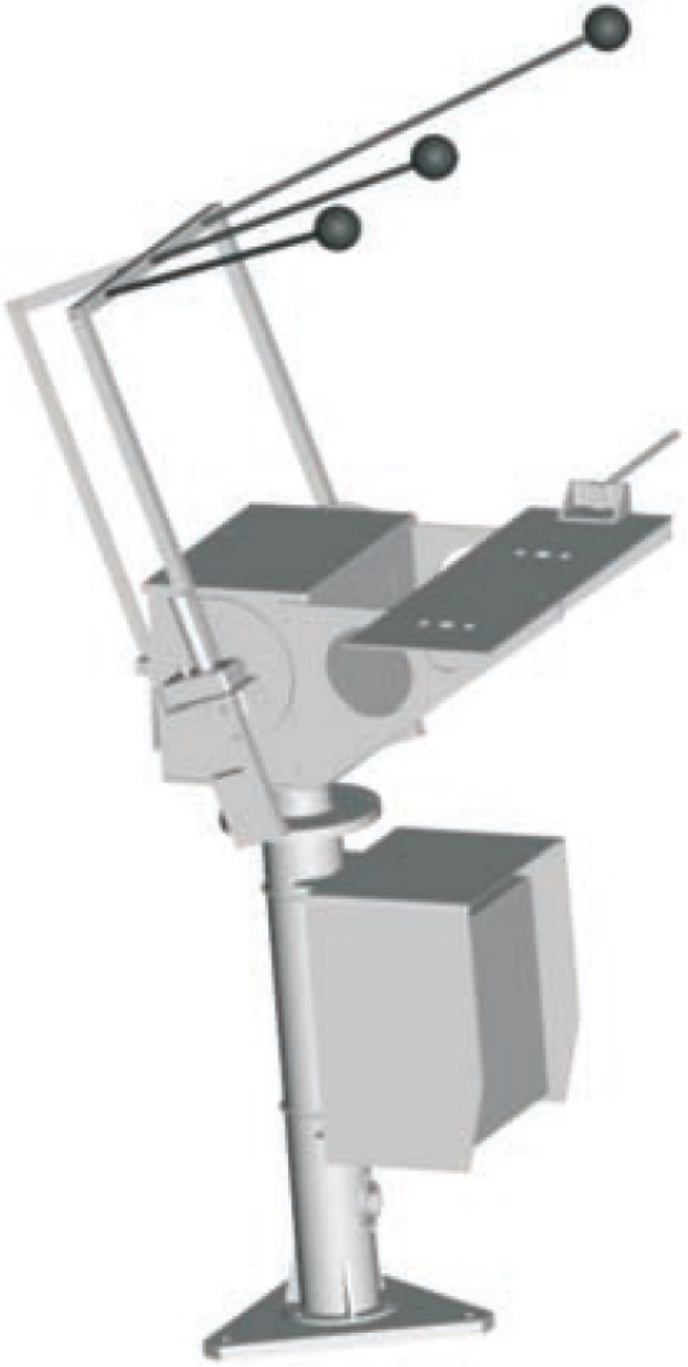

Fig. 5 PSS-1 sun tracker

M-41-3M shadow ring (fig.7) is intended for permanent shadowing (during the daylight time) of the balance meter from direct solar radiation. Balance meter is placed on the shadow ring for measuring solar radiation balance.

Fig.6 M-41-3M shadow ring

Retractable PI-21-M arm rack (fig.8) can bear different solar sensors. On the ROSHYDROMET network pyranometeres are placed on the PI-21-M at a height of 1,5 m. Global

radiation pyranometer is mounted above the base of the arm rack and reflected radiation pyranometer - at the end of the arm rack.

Arm rack is acceptable for heavy snow regions thanks to its expandability.

Fig.7 PI-21-M arm rack

Modernization of the ROSHYDROMET network is the most important step in increasing the number of solar radiometry stations and data receiving from them. MF-19 solar radiometry station is important point of realization this problem.