

# Ground based meteor radar of Kazan Federal University

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## Kazan Federal University

The sources of meteoroid particles entering the upper layers of the atmosphere when the Earth moves in its orbit are being actively investigated. For this phenomena, the radiometric method is very actively used. This method is based on the radar of meteor trails that appear as a result of air ionization in the mesosphere – lower thermosphere (75-110km) during the combustion of meteors.

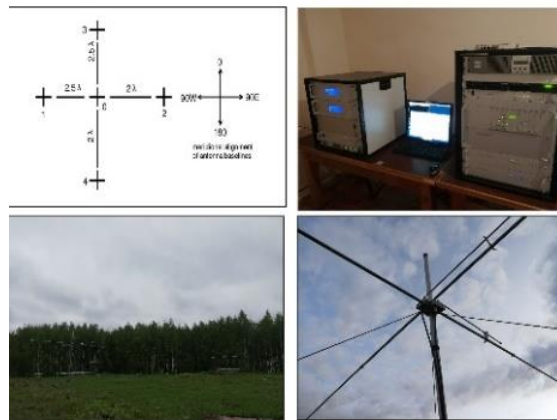
Radiometric observations of meteor showers are actively conducted at Kazan Federal University. Regular observations began in 1978, and the first data with measurement of meteor combustion heights - in 1985. In 2015, a Skymet type meteor radar of joint Canadian and Australian production was installed.

The KFU meteor radar consists of a phase interferometer (five two-element crossed receiving antennas of the Yagi-Udo type) with bases of 2 and 2.5 wavelengths, a transmitting antenna (crossed three-element antennas), as well as a transmitter with a power of 15 kW per pulse (average power of about 1 kW) with a carrier frequency of 29.75MHz and a pulse repetition frequency of 1594 Hz.

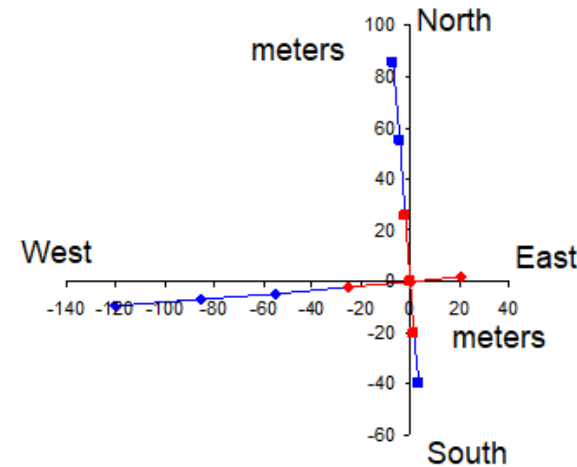
The meteor radar of Kazan Federal University (56N, 49E) has been upgraded. The results of modernization are presented: a significant increase in the number of meteors and the accuracy of the estimation of angular coordinates and heights.

### Meteor radar of KFU

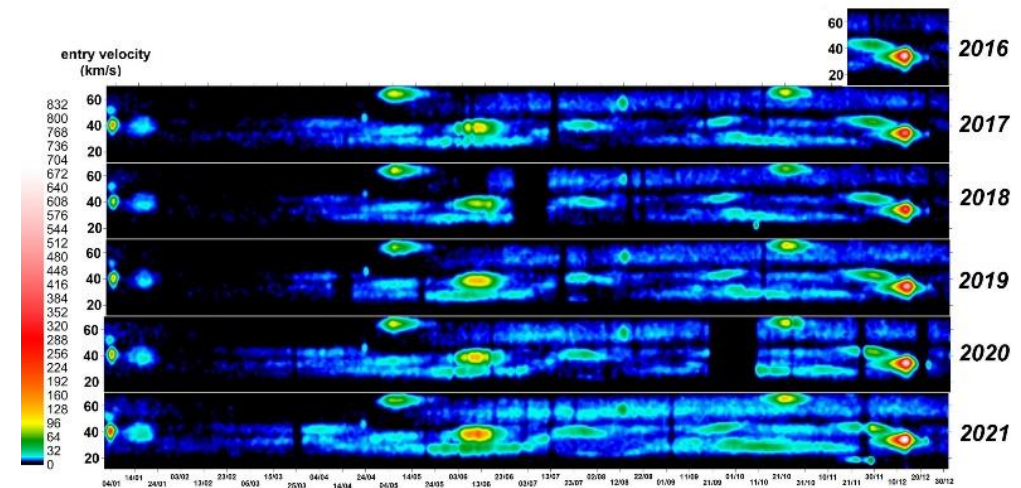
Transmitter & Receiver and Antenna's configuration



### Upgrading of antenna receiving system additional 6 antennas



### Distribution of meteor streams in 2017-2021



An increase in the lengths of the bases, as well as the number of receiving antennas, made it possible to improve the accuracy of estimating the angles of arrival, height, Doppler shift, and other parameters.

To work with 11 receiving antennas, super-heterodyne resonant low-noise receivers with intermediate frequencies of 10.7 MHz and 450 kHz and a gain of about 80 dB at a carrier frequency of 29.75 MHz with an output signal bandwidth of 150 kHz were developed, manufactured and installed.

Analog-to-digital conversion of signals is carried out using L-Card E20-10 collection boards. The sensitivity of receivers at the carrier frequency in the 100 kHz band to weak signals was -110 dBm. To work with 11 channels, it was also necessary to refine the software for detecting, registering and processing radio meteor reflections.

## Conclusion

The KFU meteor radar has been modernized: the number of receiving channels has been increased from 5 to 11 pcs. At the same time, the length of the antenna bases has been increased from 45 meters to 130 and 140 meters. The meteor data processing software has been improved, a reliable and fast method for restoring full phases on antenna bases on a line with an arbitrary number of antennas has been developed. Radio meteor observations were carried out from 10/10/2020 to 04/15/2021 with a new antenna configuration.

The results of processing and numerical modeling showed a significant increase in the number of registrations and the accuracy of estimates of angular coordinates, heights and Doppler frequency shifts (in fact, wind speeds). The modernization made it possible to increase the interval of meteor observations: 75-110 km. An increase in the number and improvement of the accuracy of meteor measurements make it possible to detect weak and strong meteor showers all round the year, to measure their velocities and coordinates of meteor radiant.