SUFFA RADIO OBSERVATORY IN UZBEKISTAN: RADIOMETRIC RESEARCH IN THE RADIO RANGE

Raupov Dilshod Almasovich[1] ***Hotamov Jaxongir Abdumalikovich***[2]

[1]*Ulughbeg Astronomical Institute, Uzbek Academy of Sciences, Tashkent, Uzbekistan,*[2] *Jizzakh State pedagogical institute, Jizzakh,Uzbekistan*

e-mail: dilshod@astrin.uz

Annotatsiya. *Suffa radioastronomik rasadxonasi va atmosfera radiosini bashorat qilish uchun radioastroklimatik (ko'rish) tadqiqotlar bo'yicha yangi takliflar tasvirlangan.*

Kalit so'zlar. *O'zbekistonda radio astronomiya, radio teleskoplar, asboblar: adaptiv optika, radiometr, chiziqlar: umumiy, millimetr, submillimetr, joyida sinovlar, atmosfera effektlari*

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Аннотация.*Описываются радиоастрономическая обсерватория Суффы и новые предложения по радиоастроклиматическим (видящим) исследованиям для прогнозирования атмосферного радио.*

Ключевые слова. *Радиоастрономия в Узбекистане, радиотелескопы, приборы: адаптивная оптика, радиометр, линии: общие, миллиметровые, субмиллиметровые, натурные испытания, атмосферные эффекты.*

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Abstract. *Radio Astronomical Observatory of Suffa, and new proposals for radioastroclimatic (seeing) studies for atmospheric radio prediction are described.*

Keywords. *Radio astronomy in Uzbekistan, radio telescopes, devices: adaptive optics, radiometer, lines: general, millimeter, submillimeter, on-site tests, atmospheric effects.*

Introduction

One of the large-scale radio-astronomy facilities is the complex of the International Radio Astronomy Observatory being created on the Suffa plateau (Uzbekistan) in close collaboration with Russia. It should be a basic part of the Earth-Space VLBI system. With the main instrument similar to the GBT at NRAO it will be one of the main basic elements of the global radio interferometry network as well. The Suffa project has been mentioned as one of the most prominent for the new century astronomy in the millennium overview paper.
Suffa radio observatory is located on the northern spurs of the Turkestan ridge at an altitude of 2500 m above sea level. At present, a unique scientific object, the RT-70 radio astronomy telescope, is under construction on the Suffa plateau. The staff of the observatory and the Astronomical Institute of the Academy of Sciences of the Republic of Uzbekistan have been conducting astroclimatic studies on the Suffa plateau for a long period. (1 fig) Information about the main parameter of the

atmosphere - image quality, as well as meteorological parameters, such as the amount of clear time, wind speed and direction, are presented in [1].

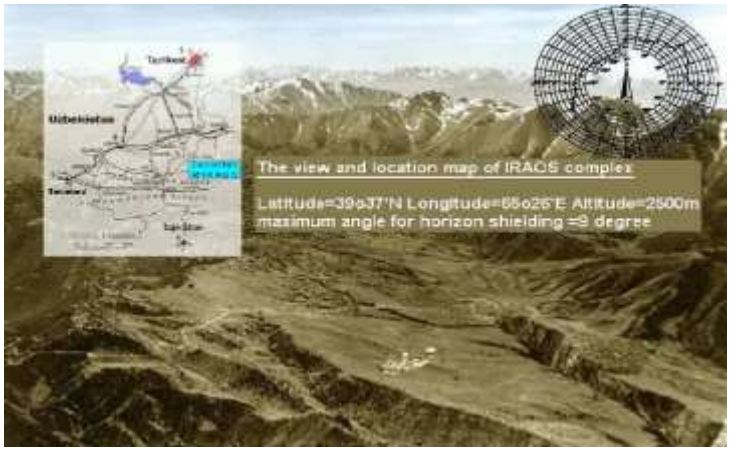

Figure 1. A mountain view of observatory on Suffa plateau. The location map and the telescope horizon shielding diagram are inserted in the left and top right, respectively

At the end of 2014 on the Suffa plateau to study atmospheric distortion, a millimeter atmospheric absorption radiometer - MIAP-2 was put into operation. The meter consists of two independent channels for recording atmospheric absorption in the so-called radio transparency windows of the earth's atmosphere - 84-99 GHz (λav = 3mm) and 132-148 GHz (λav = 2mm). A detailed description of the radiometer, its functional diagram, basic principles of measurements and calculations, estimates of permissible errors are given in [2].

In the period from January 2015 to December 2020, a significant array of atmospheric absorption measurements in the 2 mm and 3 mm ranges has been accumulated on the Suffa plateau. During this period, more than 265,000 atmospheric absorption values were obtained for both channels. Figure 2 shows the daily averaged atmospheric absorptions in Napers (1 dB = 4.343 Np) during the above period. Average value of atmospheric absorption for the whole the observation period was 0.1262 ± 0.0097 and 0.1064 ± 0.0052 Nep for 2 mm and 3 mm channels, respectively. A fairly low level of absorption, less than 0.10 Nep, is observed during the winter months. In the period from October to December, the radio absorption level is 0.10 Nep. Between March and May, the atmosphere becomes unstable due to atmospheric intrusions.

In fig. 3. presents the daily mean values of the integral moisture content for the 2 mm and 3 mm channel in the atmosphere of the Suffa plateau during the above period. The average values of water content for the entire observation period were 4.66 ± 0.1430 and 9.10 ± 0.1952 mm for 2 mm and 3 mm channels, respectively. A low value of water vapor is observed in the winter months (less than 2.6 mm).

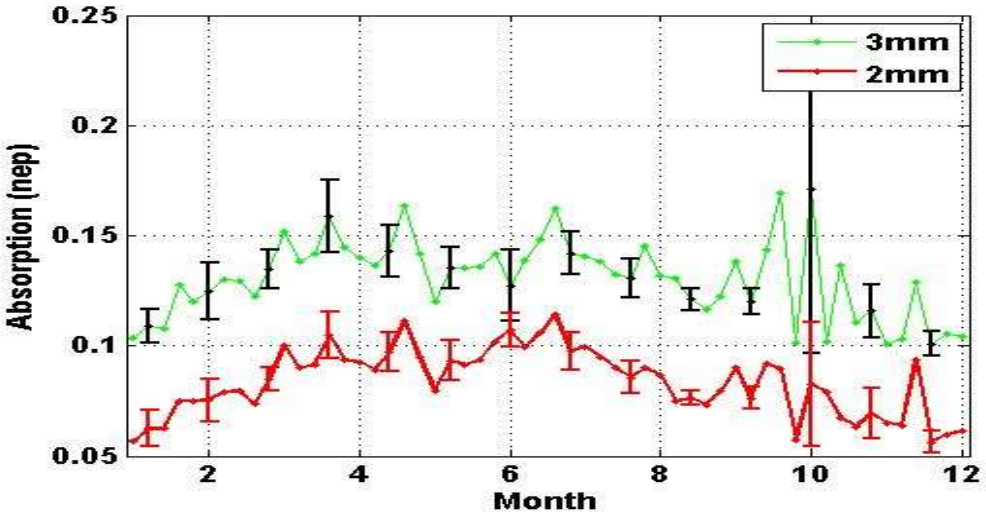

Fig. 2. Daily mean values of atmospheric absorption during the period from 2015-2019 on 2 mm and 3 mm wavelength ranges

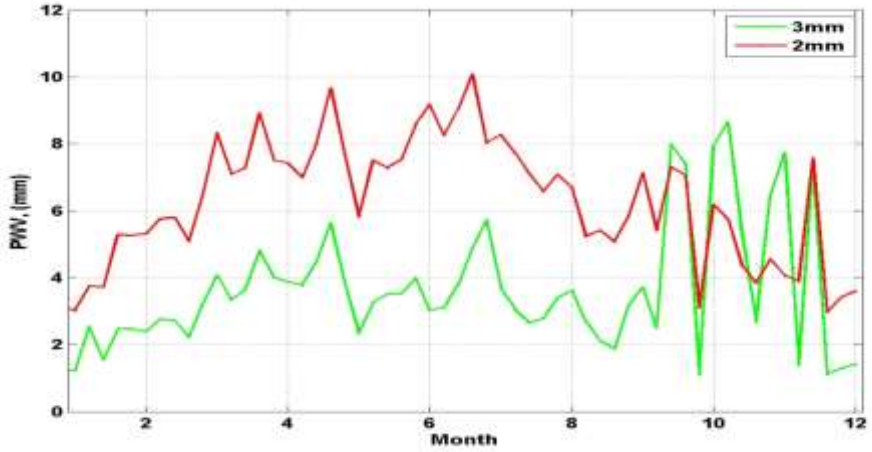

Fig. 3. Daily mean values of the integral amount of precipitated water from January 2015 to December 2020 for 2 mm and 3 mm ranges

As can be seen from the figure, the lowest value of the water vapor content (2.5 mm) is observed in January and February, in the period from October to December, a relatively low level is also observed (about 3.2 mm).

Table 1.presents monthly averaged values atmospheric absorption and the integral amount of precipitated water in the 2 and 3 mm ranges from January 2015 to December 2020.

Obtained results of observations of atmospheric parameters are used in the development of methods for predicting the main parameters of the atmosphere on the Suffa plateau in the millimeter range.

Table 1

Monthly averaged values of atmospheric absorption and integral amount of precipitated water for the period from January 2015 to December 2019.

Months	Abcorption 3mm	Abcorption 2mm	PWV 3mm	PWV 2mm
January	0,0822	0,0746	6,15	2,41
February	0,0848	0,0767	6,47	2,51
March	0,1156	0,1323	10,22	4,92
April	0,1156	0,1628	10,22	6,25
May	0,1397	0,1833	13,16	7,14
June	0,1102	0,1281	9,56	4,74
July	0,1284	0,1734	11,78	6,71
August	0,1181	0,1521	10,53	5,78
September	0,1195	0,1542	10,71	5,87
October	0,0768	0,0923	5,49	3,19
November	0,0979	0,1029	8,06	3,64
December	0,0959	0,0859	7,51	2,91

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