MICROWAVE OBSERVATIONS OF STRATOSPHERIC OZONE IN KIRUNA

Yu.Yu. Kulikov[1], *I.V. Kuznetsov*[1], *V.P. Pegeev*[1], *V.G. Ryskin*[1], *A. Steen*[2], *E.V. Suvorov*[1] and *G. Witt*[3].

[1] *Institute of Applied Physics, Russian Academy of Sciences, N.Novgorod, Russia.*

[2] *Institute of Space Physics, Kiruna, Sweden.*

[3] *Meteorology Department, Stockholm University, Stockholm, Sweden.*

We present here the results of the first experimental campaign on microwave sounding of stratospheric ozone over Kiruna ($68°N.$) which were performed within cooperation agreement on joint investigations of polar ozone between Meteorology Department of Stockholm University (MISU), Institute of Space Physics (IRF, Kiruna) and Institute of Applied Physics (IAP, N.Novgorod, Russia). The observations were performed in the line of rotational transition of ozone near 142 GHz with the superheterodyne receiver (SSB noise temperature about 3500 K) and 20 channel frequency analyzer with channel bandwidth 3 MHz covering total band of analysis about 100 MHz. This gives opportunity to measure stratospheric ozone at heights from 20 up to 50 km. The equipment and observation technique are described more in detail in [1,2] . The retrieval of vertical ozone distribution has been performed according to iteration procedure by Randegger [3] (see also [4]).

The observations in Kiruna took place in the period May 10-22, 1993 under wide variety of weather conditions from sunny and frosty up wet snowfall; measurements were performed with precipitated water varying from 4 to 20 mm. The weather conditions allowed to perform ozone observations during 110 hour from the whole observational period. The results are summarized in the Table I in which integral ozone over 25 km is presented together with ozone density at three heights (25, 35 and 45 km). Data are obtained by averaging over the day of all available data from two-hour observational series and the dispersion in the integral ozone presented characterizes the spread of this value over the day.

Ozone distribution at stratospheric heights according to the results of millimeter sounding demonstrated rather quite behavior without significant variations. Measured ozone content is by approximately 1.5 times lower than it follows from generally adopted model distribution for the season and latitude [5], corresponding to Kiruna in May. On 18-th of May millimeter observations were performed practically simultaneously with *in situ* measurements up to the height 35 km by ozonesonde launched from

Table 1

DATE	INTEGRAL OZONE ABOVE 25 km (D.U.)	OZONE DENSITY, cm^{-3}		
		25 km	35 km	45 km
10.05.93	82.3 ± 5.3	$2.2 \cdot 10^{12}$	$9.0 \cdot 10^{11}$	$1.1 \cdot 10^{11}$
12.05.93	70.7 ± 7.0	$9.8 \cdot 10^{11}$	$1.0 \cdot 10^{12}$	$1.0 \cdot 10^{11}$
13.05.93	75.6 ± 6.0	$1.8 \cdot 10^{12}$	$9.3 \cdot 10^{11}$	$1.1 \cdot 10^{11}$
14.05.93	86.0 ± 4.6	$2.0 \cdot 10^{12}$	$1.0 \cdot 10^{12}$	$1.2 \cdot 10^{11}$
15.05.93	85.4 ± 10.4	$1.7 \cdot 10^{12}$	$1.0 \cdot 10^{12}$	$1.4 \cdot 10^{11}$
17.05.93	85.0 ± 5.3	$1.4 \cdot 10^{12}$	$1.2 \cdot 10^{12}$	$9.0 \cdot 10^{10}$
18.05.93	87.1 ± 4.3	$1.4 \cdot 10^{12}$	$1.2 \cdot 10^{12}$	$1.0 \cdot 10^{11}$
20.05.93	74.5 ± 7.1	$1.7 \cdot 10^{12}$	$9.0 \cdot 10^{11}$	$1.1 \cdot 10^{11}$
22.05.93	78.4 ± 7.0	$3.3 \cdot 10^{12}$	$9.4 \cdot 10^{11}$	$1.2 \cdot 10^{11}$

ESRANGE (30 km from Kiruna). In spite of the bad weather conditions the fitting between the results from mm and ozonesonde measurements is rather good which is demonstrated in Fig.1. In the same Figure ozone profile from mm measurements are presented for two neighboring days. The correspodence seems to be rather good.

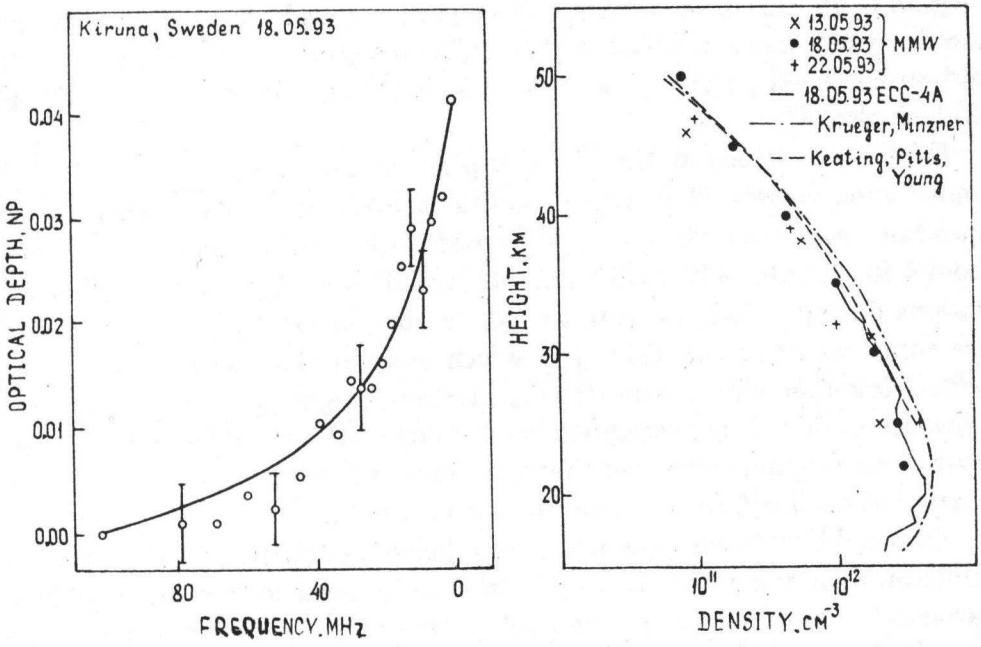

Fig.1

Simultaneously with Kiruna campaign similar measurements of stratospheric ozone were performed in N.Novgorod ($56^{o}N$) at the frequency 110 GHz corresponding to another ozone line in rotational transition spectrum.

The integral ozone over 25 km measured over N.Novgorod was corresponding to mid-latitude ozone model [6] and was approximately two times greater that the same quantity over Kiruna. For the same period the total integral ozone over N.Novgorod according to optical measurements was 335 DU and for Kiruna according to ozonesonde measurements it was 285 DU.

References

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