Eighth Workshop "Solar influences on the magnetosphere, ionosphere and atmosphere"

Basic results from the scanning spectrophotometer "EMO-5" on board "IC Bulgaria-1300"

V. Guineva, P. Stoeva

Space Research and Technology Institute (SRTI),
Bulgarian Academy of Sciences,
Stara Zagora Department

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Some hystory

Modern space research in Bulgaria started at the beginning of IGY 1957.

The organization of Bulgarian space research was closely connected with the establishment of INTERCOSMOS.

Bulgaria participated in the INTERCOSMOS program since 1967.

During the INTERCOSMOS era Bulgarian scientists participated in the development of experiments and equipment for INTERCOSMOS satellites 8,12,14,19, geophysical rockets VERTICAL –3,4,6,7,10, space missions Venus-Halley, Phobos-1/2, APEX, ACTIVNY, KORONAS-F, INTERBALL, Mars-96.

The scientific programs and equipment for two Bulgaria–1300 national space research projects and the flights of the first and second Bulgarian cosmonauts were created.

National space program Bulgaria-1300

One of the most impressive Bulgarian space projects in the 80-ies of the 20th century was named Bulgaria-1300 in honour of the 1300th anniversary of the Bulgarian state.

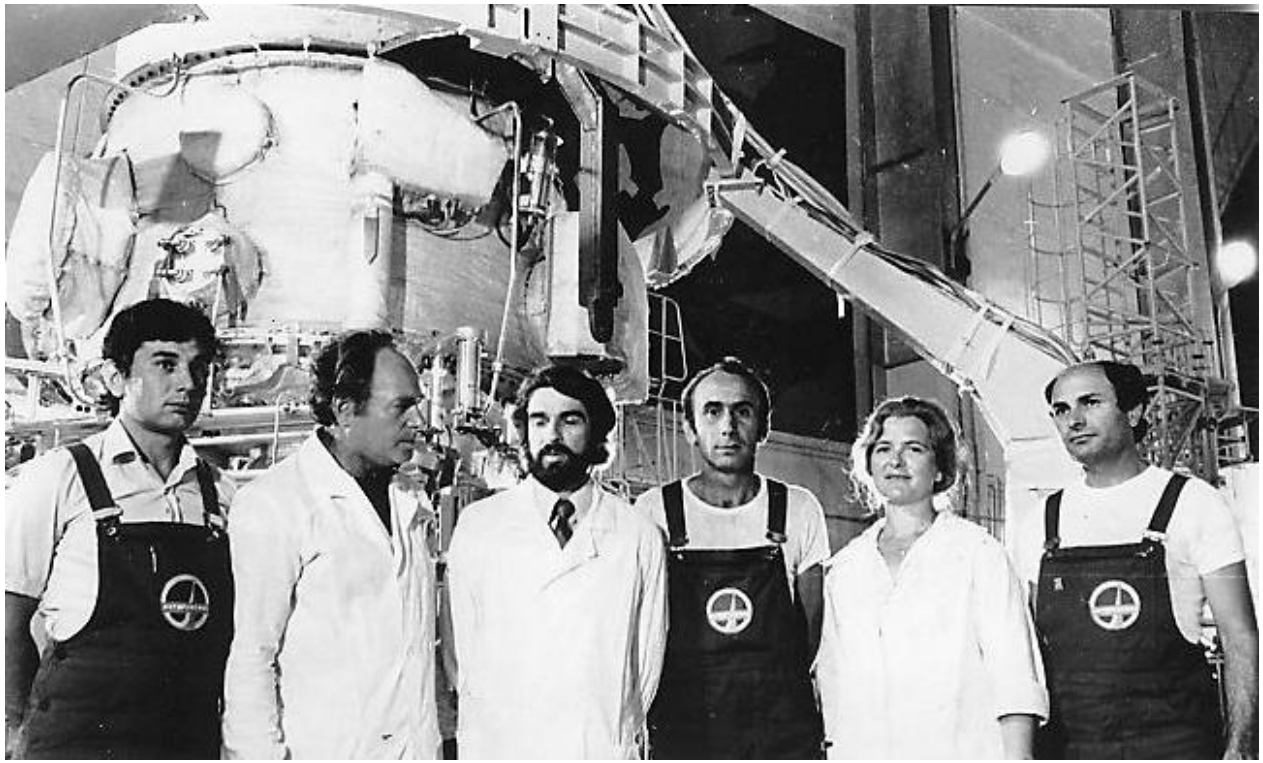
Signing of Bulgaria-1300 scientific program, 1979

National space program Bulgaria-1300

In the foreground (first row from left to right): Atanas Atanassov, V.Balebanov, K.Serafimov, N.Frolova, acad.Josifian, Adasko, K.Serafimova and I.Podgorni.

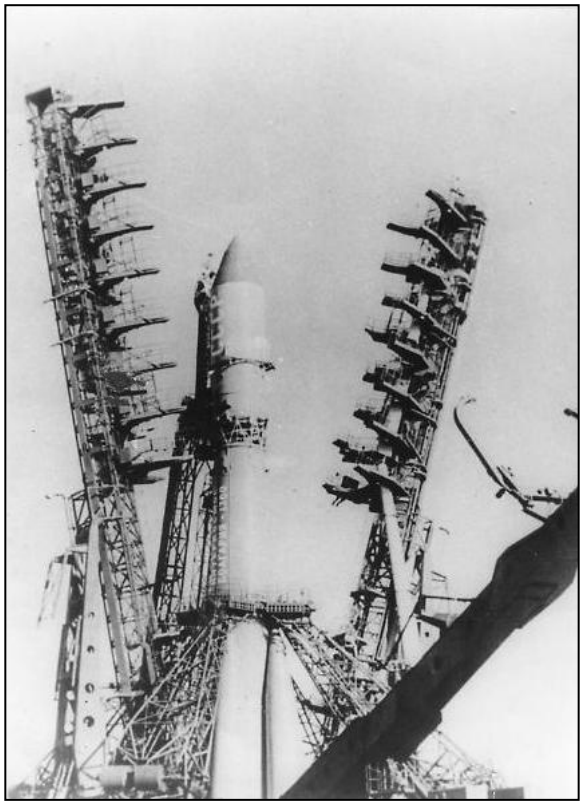
May 1979, Stara Zagora, Visit of the Interkosmos delegation to discuss the space project "Interkosmos – Bulgaria-1300"

Cosmodrome Plesetsk – preliminary tests, July 1981



Researchers from Base Observatory – Stara Zagora: I.Ivanov, G.L.Gdalevich (IKI – Moscow), S.Sargoichev, A.Dimitrov, Ts.Gogosheva, N.Petkov.

IC Bulgaria-1300



7 August 1981 – the launch of Intercosmos 22, called IC Bulgaria-1300 on a Meteor-type satellite

12 unique Bulgarian-Soviet scientific instruments on board (3 of them designed in St.Zagora) for plasma parameters, particle fluxes, electric and magnetic fields and optical measurements.

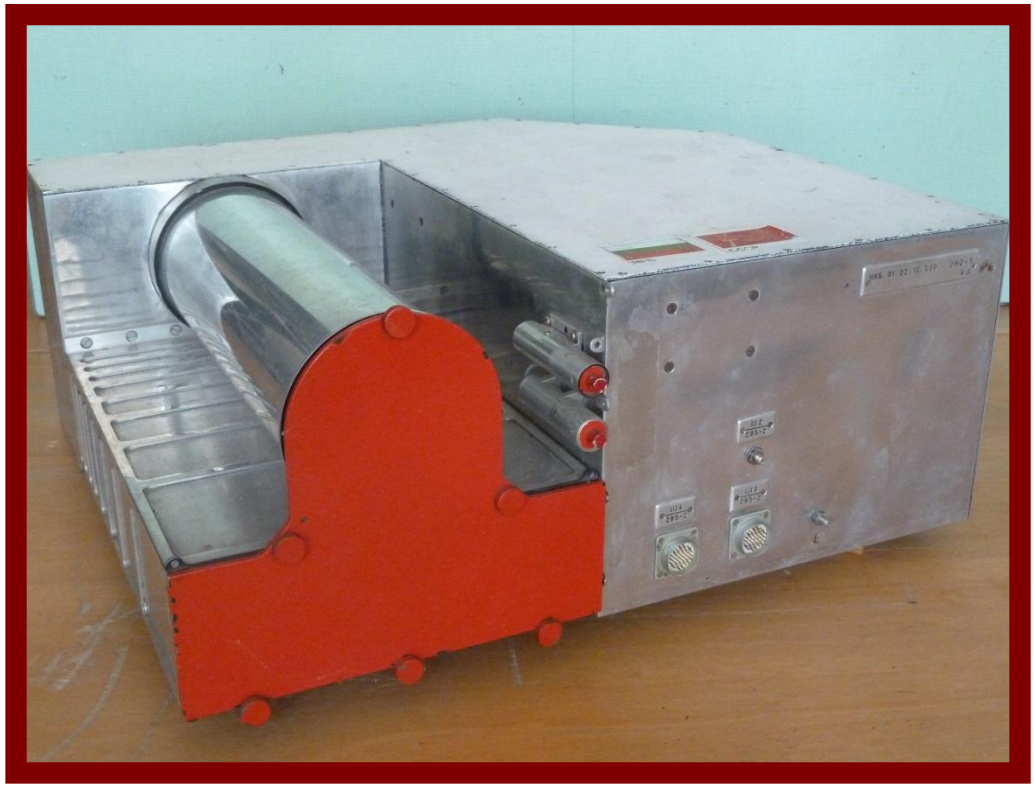
Goal: to study the magnetosphere-ionosphere interactions

IC Bulgaria-1300

One of the scientific instruments onboard IC Bulgaria 1300 was the scanning spectrophotometer EMO-5. It worked successfully during the whole period of satellite operation from August 1981 to May 1982.

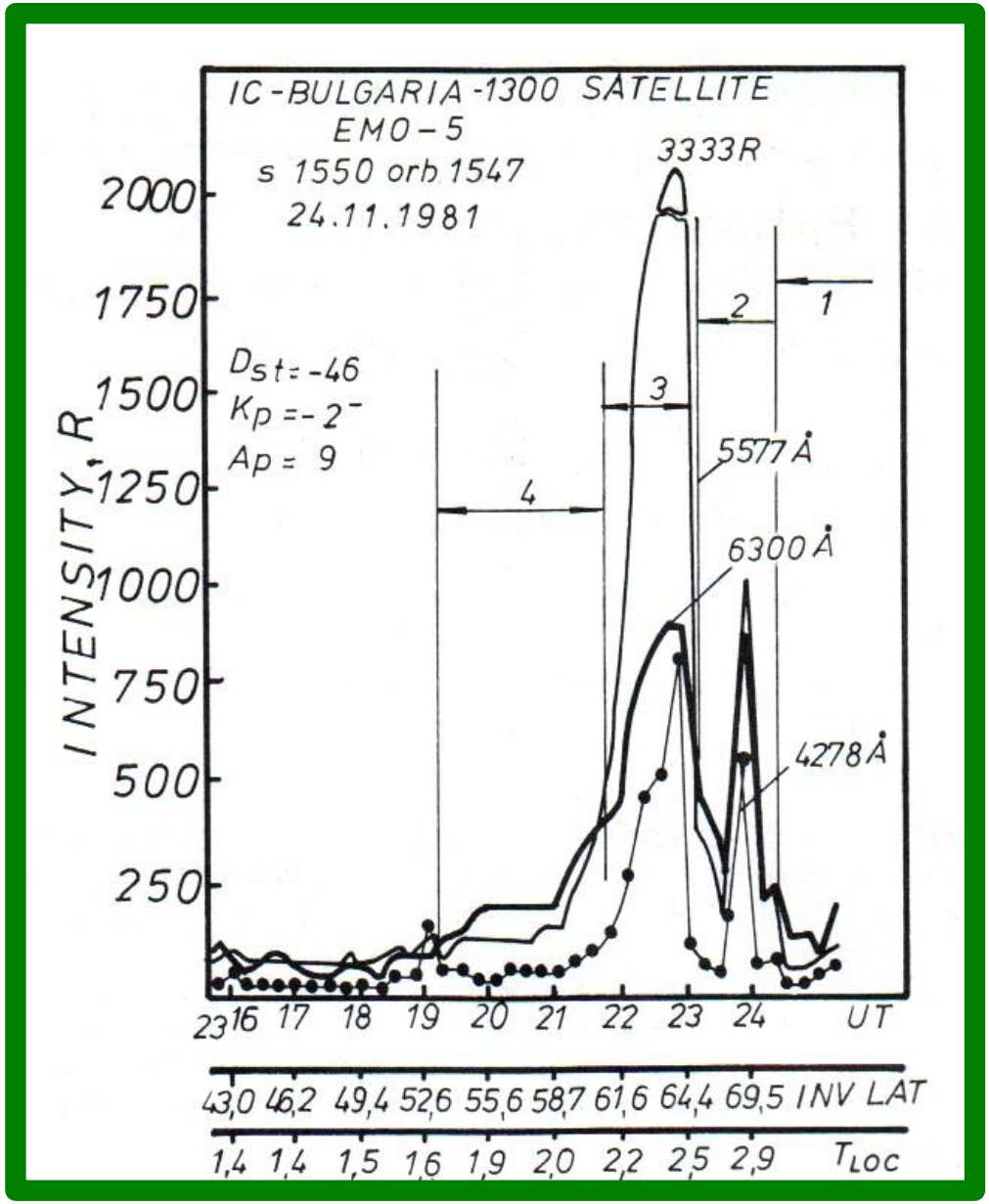
The satellite orbit was almost polar and covered all geographic latitudes which enabled the study of a variety of phenomena. Processes occuring in the equatorial region, at mid-latitudes, as well as at auroral and polar latitudes in the Earth upper atmosphere were investigated. Data from the whole period of measurements have been examined. The **purpose** of this presentation is to introduce some basic results of the studies.

Scanning spectrophotometer EMO-5



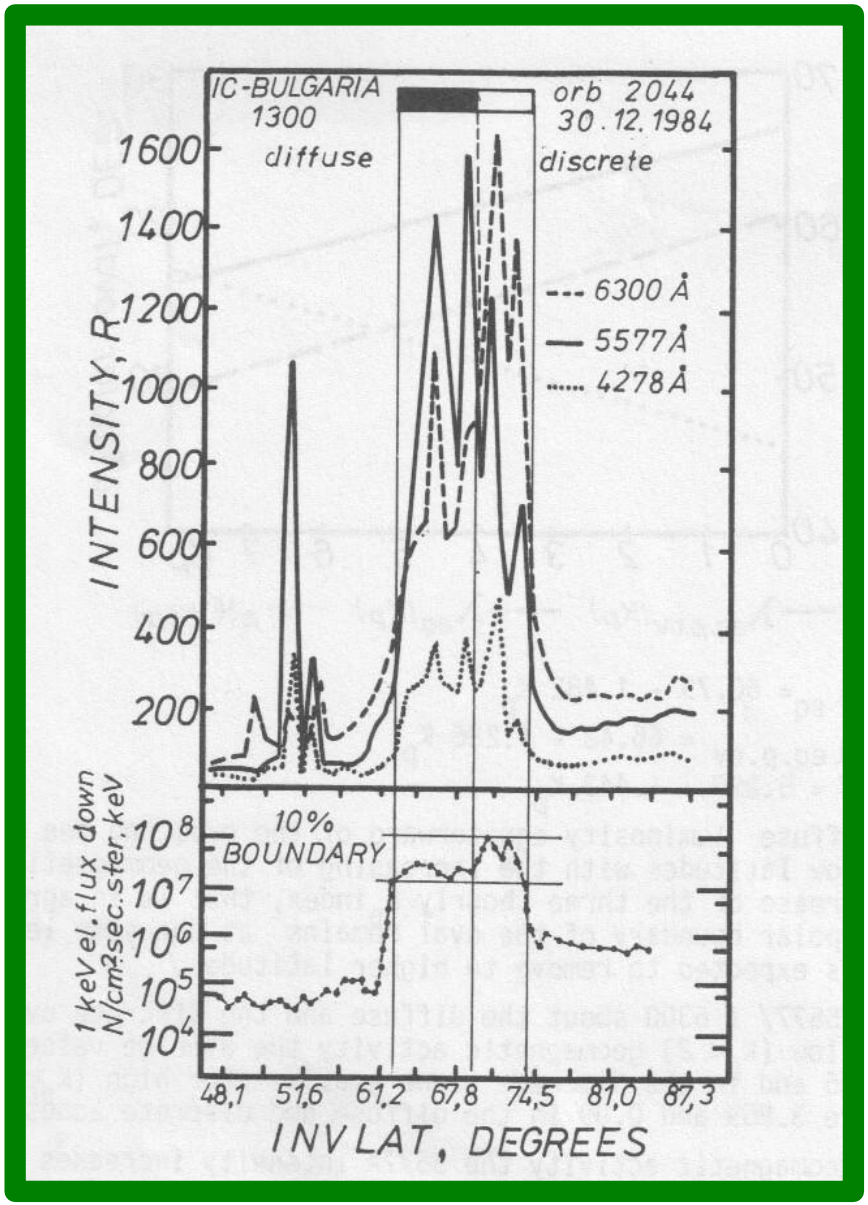
EMO-5 is a multi-filter optical scanning spectrophotometer manufactured in Stara Zagora. It was designed for the investigation of the temporal and spatial characteristics of the optical emissions. It consists of two photometric systems: filter system (SF) measuring the intensities of 5577Å, 6300 Å, 4278 Å, 4861 Å and 7320 Å emissions in the foot point every 16 s., and spatial scanning system (SS) registering the 6300 Å intensity in a band of about 270 km width along the satellite orbit projection.

Results: Auroral oval investigations



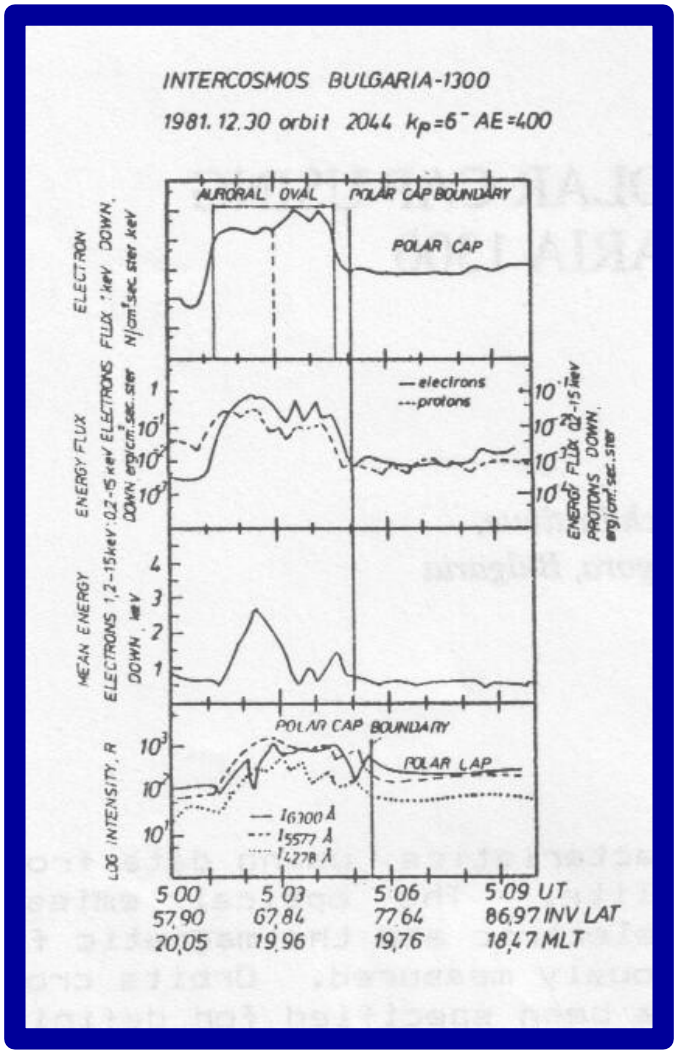
Zones of the nightside auroral zone: 1) soft zone poleward of the oval; 2) discrete component of the auroral oval; 3) diffuse component of the auroral oval; 4) diffuse luminescence equatorward of the oval.

Results: Auroral oval investigations



Auroral oval boundaries (the vertical lines) defined from optical and 1 keV electron flux data, for one case.

Results: Polar cap studies

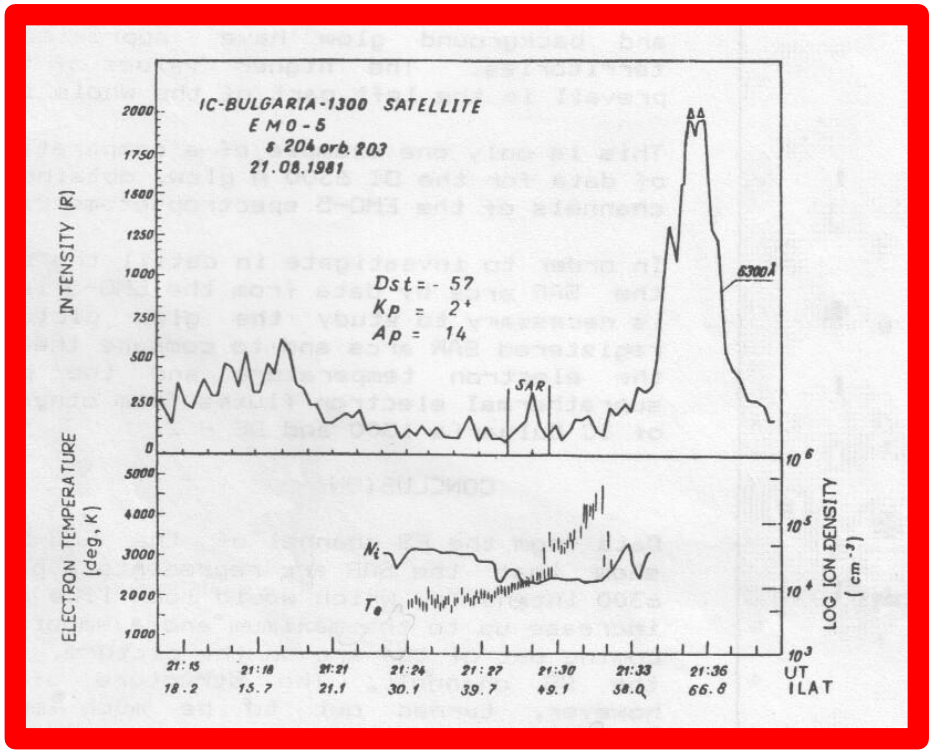


The zones boundaries were determined for 43 orbits by optical data and for 25 of them from 1keV e^- flux down. The boundaries defined by both ways coincided very well. The locations of the boundaries depending on the geomagnetic conditions have been studied.

The polar cap was examined by data from 39 orbits crossing it. Optical data were present for 21 of them.

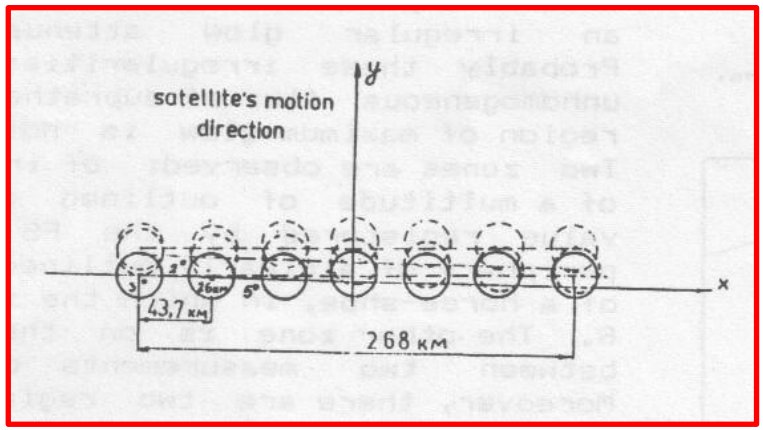
An example of the boundaries of the auroral oval and the polar cap by data of the luminosity and the particle and energy fluxes (orbit 2044).

Results: SAR arcs results

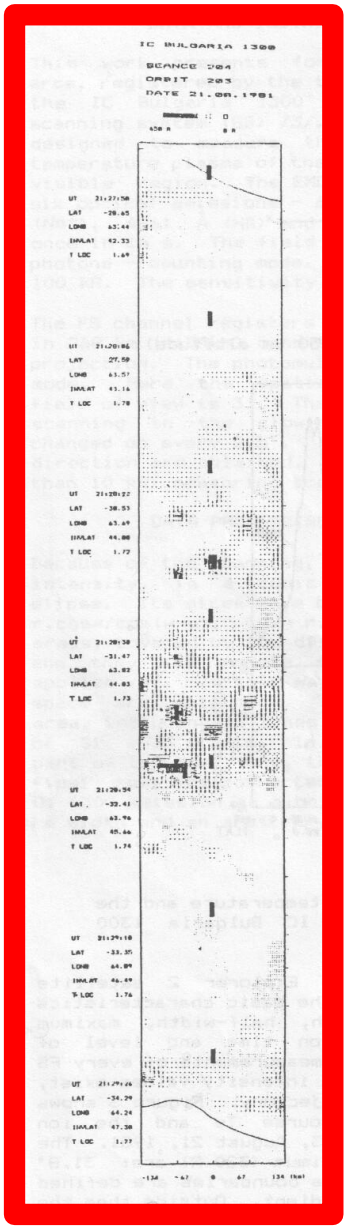


The red line intensity, the electron temperature and the ion density depending on UT for orbit 203 of IC Bulgaria-1300. The boundaries of the detected SAR arc are marked.

Results: SAR arcs results

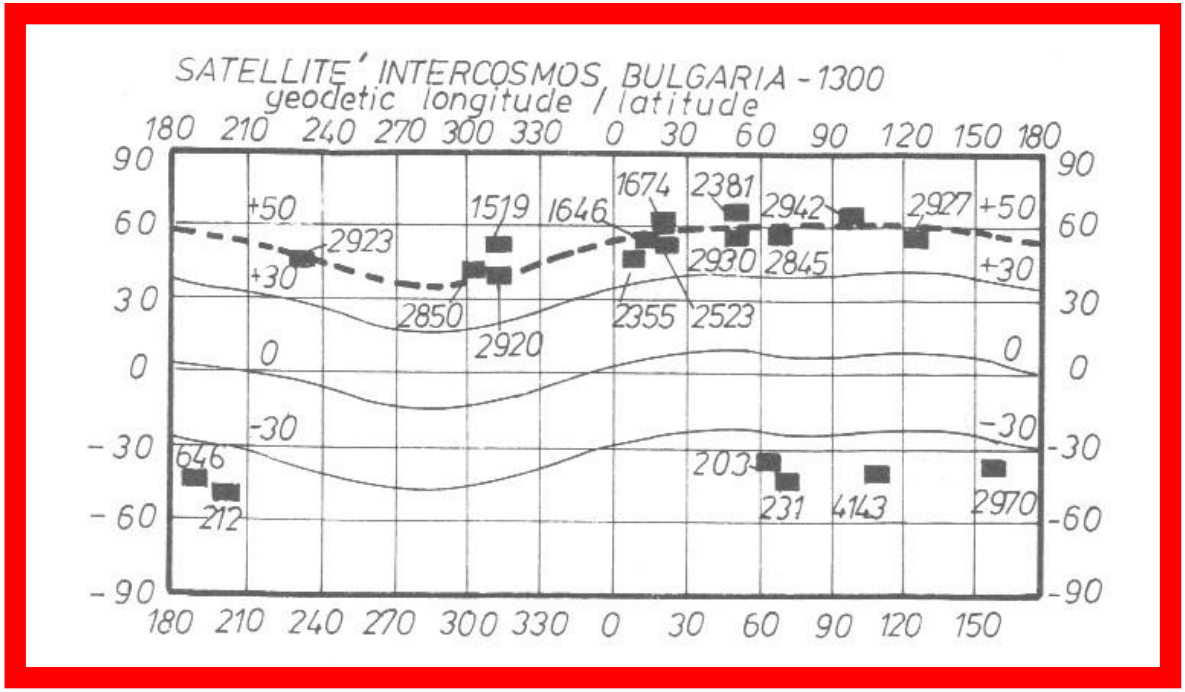


Scheme of the registration of $I_{6300Å}$ spatial distribution by the EMO-5 SS channel.



The spatial distribution of the same SAR arc obtained after the processing of the SS channel of EMO-5 data (orb.203, 21.08.1981).

Results: SAR arcs results



Geographical distribution of 19 SAR arcs detected in the measurements of EMO-5 and studied.

Summary

- By the intensities of the registered by EMO-5 optical emissions the processes in the upper atmosphere at different latitudes: from the equator through mid-latitudes up to the auroral and polar zones have been investigated.
- The zones of the nightside auroral region have been defined. The polar oval boundaries have been determined by simultaneous optical and particle precipitation observations. The intensity ratio I_{5577}/I_{6300} and the course of the electron flux in the polar oval zones, as well the positions and sizes of the zones under different geomagnetic conditions have been studied.
- The polar cap boundary was defined by optical data and by the 0.2 keV EEF.

Summary

- The average ratios I_{6300}/I_{5577} and I_{6300}/I_{4278} in the auroral oval zones and in the polar cap at different conditions have been analized.
- The conditions of appearance of SAR arcs, their situations, the dependence of their intensity, form and dimensions under different geomagnetic conditions have been studied.
- The seasonal and daily variations of I_{6300} emission in the equatorial F-region have been examined.

References

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Thank you for your attention!