

7.4 THE SOVIET CONTRIBUTIONS TOWARDS MAP/WINE

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In the winter of 1983/1984, the research institutes of the Soviet Union took an active part in the accomplishment of the project "Winter in Northern Europe" (MAP/WINE) of the Middle Atmosphere Program. Different methods were used to measure temperature, direction and velocity of wind, turbulence, electron concentration in the lower ionosphere, and radio-wave absorption. The study of the stratospheric warmings and the related changes in the mesosphere and lower ionosphere was considered of special importance. The analysis of the obtained data has shown, in particular, that during the stratospheric warmings the western wind in winter time becomes weaker and even reverses. At the same time period the electron concentration and the radio-wave absorption in the lower ionosphere are often reduced. It is also observed that the high absorption zones move from west to east. These results confirm the concept about the role of the cyclonic circumpolar vortex in the transport of the auroral air to temperate latitudes and about the appearance of conditions for the winter anomalous radio-wave absorption.

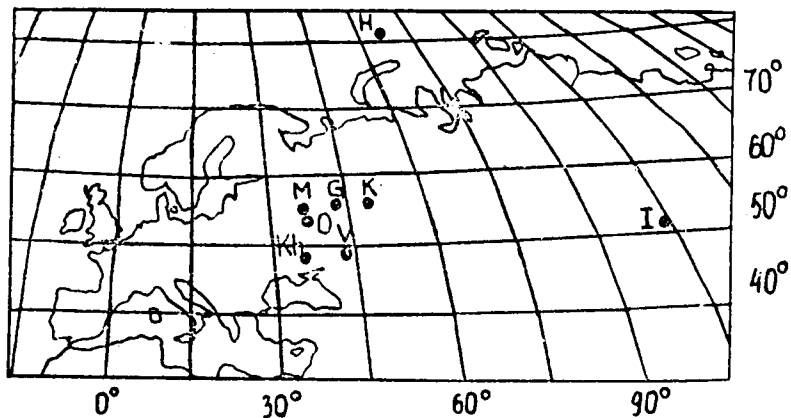


Figure 1. The location of observation sites according to MAP/WINE project. Rocket ranges of Heiss Island and Volgograd are shown, as well as location of Gorky (partial-reflection-method), Obninsk, Krarkov, Kazan and Irkutsk (ionospheric drift measurements by D2 and D1 methods).

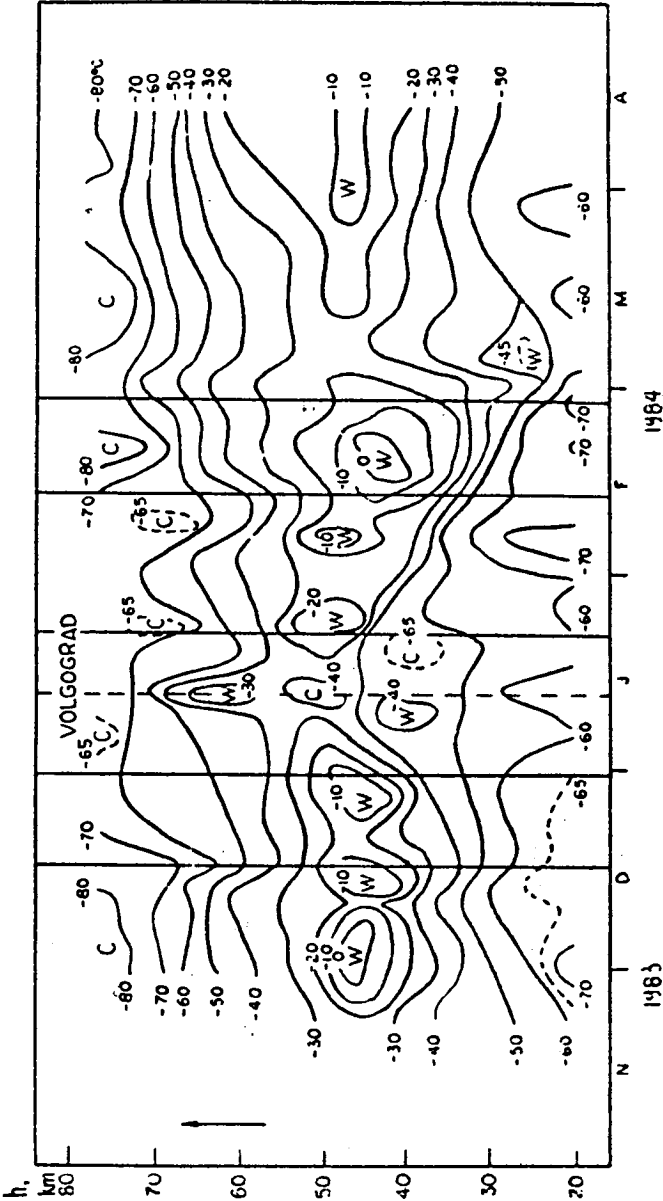


Figure 2. Height-temporal distribution of temperature above Volgograd in winter 1983-1984.

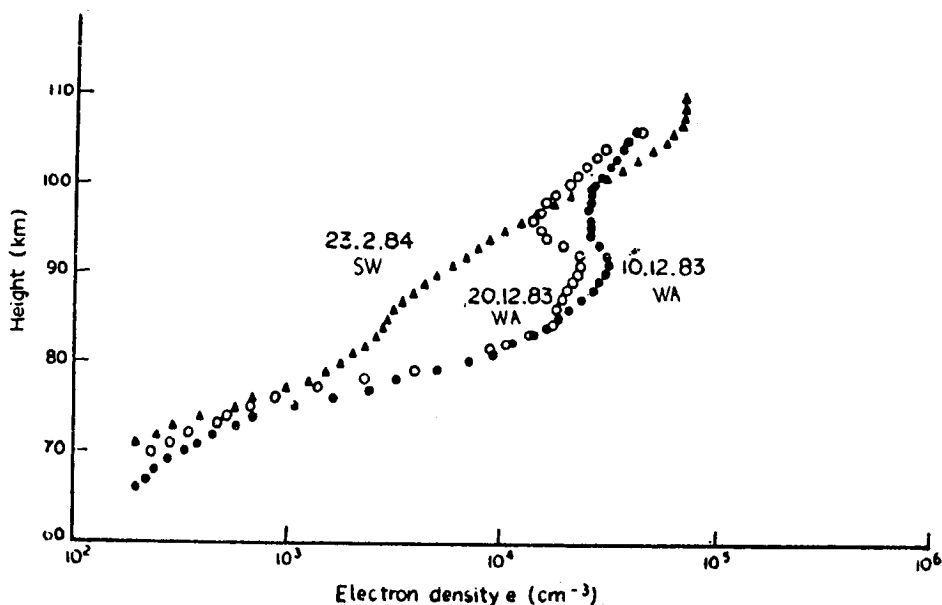


Figure 3. Electron density profiles obtained in Volgograd by the electrostatic probe and by the coherent frequencies technique (above 80 km) at the sun's zenith angle $\chi \approx 78^\circ$ on 10 and 20 December 1983 and 23 February 1984. On 23 February a stratospheric warming and the western wind reverse took place ($L_{2,2} = 33$ dB), on 10 and 20 December the dynamical state was characterized by a stable western wind ($L_{2,2} = 43$ and 50 dB correspondingly).

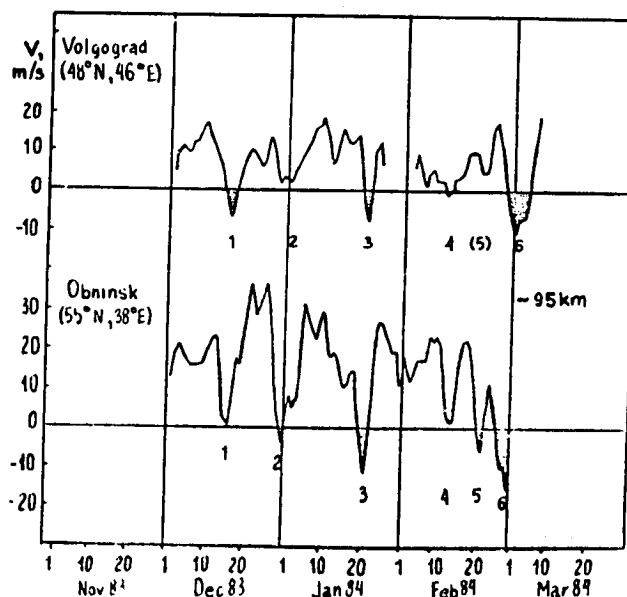


Figure 4. The wind zonal component according to measurements in Volgograd and Obninsk at the height of about 95 km (3 running means 1-2-1 weighting).

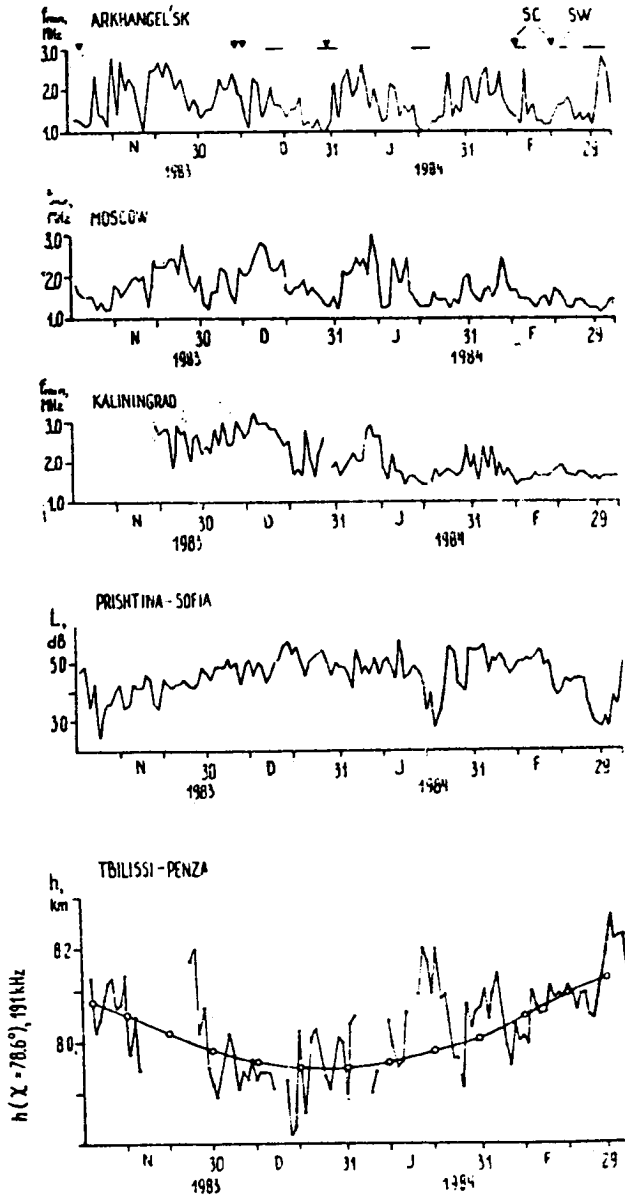


Figure 5. Triangles depict sudden commencements of geomagnetic storms (SC). The horizontal bars point out the periods of stratospheric warmings. Below values of $f_{min} (\cos \chi \approx 0.2)$ (averaged of fore and afternoon values) as indications of absorption for Arkhangelsk, Moscow, and Kaliningrad, the absorption data, obtained at Prishtina-Sofia circuit (A3 method, $f = 1412$ kHz, $d = 170$ km) and the phase height data obtained at Tbilissi-Penza circuit ($f \approx 191$ kHz, $d \approx 1278$ km) are shown.

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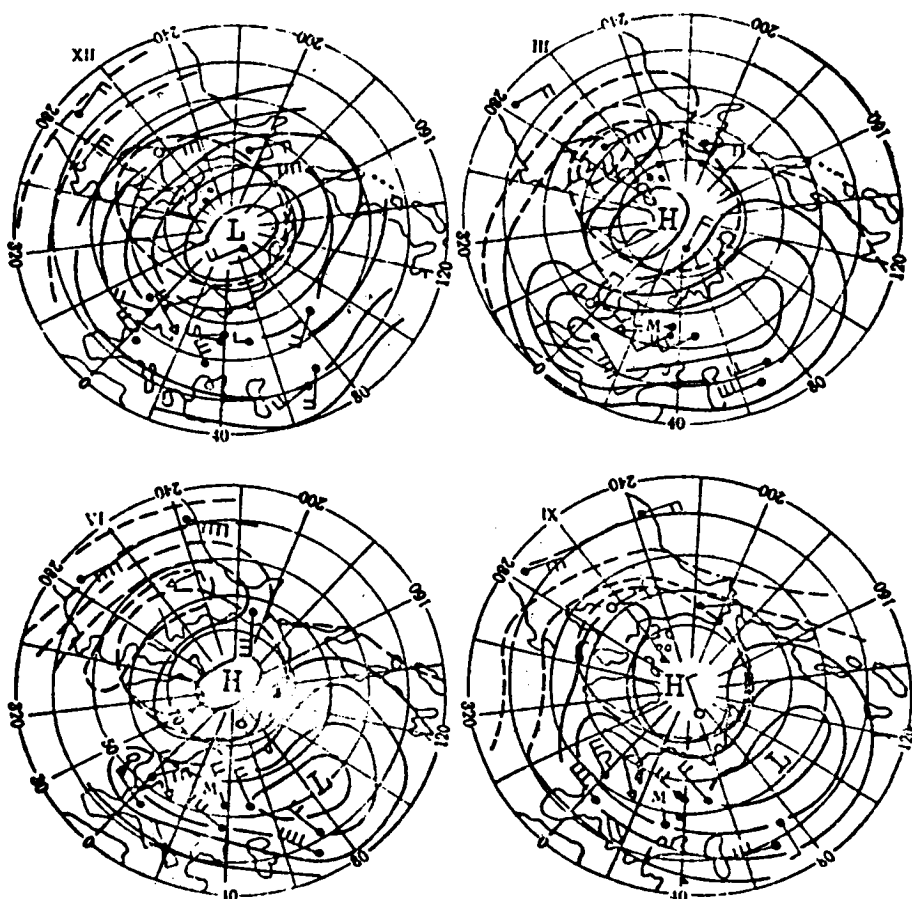


Figure 6. Scheming maps of atmospheric circulation in the Northern Hemisphere obtained by means of different techniques with the involvement of the data of many years for the height of ≈ 95 km for four months (December, March, June, September). An oval at $\Phi_c = 67^\circ$ is depicted on the map showing the location of the auroral zone. Letter M and the point show the location of Moscow, points and flags show the location of observation sites, wind direction and velocity.

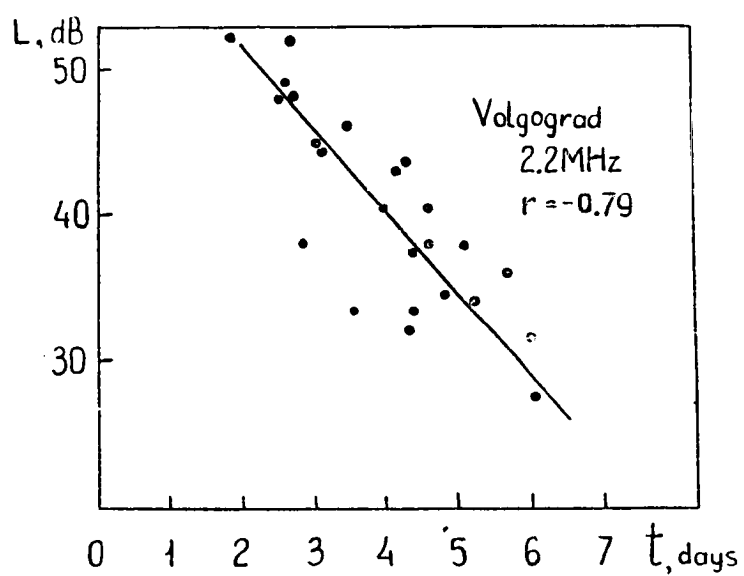


Figure 7. Relationship between absorption L , at 2.2 MHz in Volgograd and the time, t , of the air transport from the auroral zone to the observation site during MAP/WINE campaign. The correlation coefficient between L and t , $r = -0.79$.