

THE MAGNETIC FIELDS AT DIFFERENT LEVELS IN THE ACTIVE REGIONS OF THE SOLAR ATMOSPHERE

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Abstract. The strengths of the longitudinal magnetic fields recorded at different depths of active regions with a double magnetograph of the Crimean Astrophysical Observatory are compared.

The recordings of the magnetic fields were made in the lines Fe I $\lambda 5250 \text{ \AA}$, Ca I $\lambda 6103 \text{ \AA}$, Na I D₁, Ba II $\lambda 4554 \text{ \AA}$, Mg I $\lambda 5184 \text{ \AA}$, H α , H γ , H δ .

It is shown, that there is a close correlation between the longitudinal magnetic field at different levels.

The double solar magnetograph of the Crimean Astrophysical Observatory permits one to observe magnetic fields simultaneously in any two spectral lines (Severny, 1966). A number of magnetographic records of active regions have been obtained for the period from 1965 to 1969 simultaneously in different lines. The following lines were chosen for these records Ca I $\lambda 6103$ –Fe I $\lambda 5250$, Ca I $\lambda 6103$ –Na I D₁, Ca I $\lambda 6103$ –Ba II $\lambda 4554$, Ca I $\lambda 6103$ –Mg I $\lambda 5184$, Ca I $\lambda 6103$ –H δ , Ca I $\lambda 6103$ –H γ , $\lambda 5250$ –H α . The resolution of these records is $3'' \times 9''$.

A magnetic field calibration was carried out by means of the signals of radial velocity (E - W).

The comparison of the longitudinal magnetic fields of active regions, recorded in the above mentioned lines, shows very good agreement between the distributions of magnetic fields at different levels. All magnetic features seen at some level can be seen at any other level in the majority of the cases (see examples in Figures 1–4). There were observed a few cases when magnetic fields were observed only at one level, or when magnetic fields at the different levels for the same point of the solar surface showed opposite polarities. This is in accordance with the data of Severny (1966). The examples of the correlation between the strengths of the longitudinal magnetic fields in lines $\lambda 6103$ – $\lambda 5184$, $\lambda 6103$ – $\lambda 4554$, and $\lambda 5250$ –H α are shown in Figures 5–7. A close correlation between the magnetic field strengths at different depths in the active region can be seen in Figures 5–7. The values of the correlation coefficient are 0.8–0.9. But the ratio of magnetic field strengths at different levels can vary from point to point in different ways.

The field strength at the same points of active regions on the upper level appears to be larger than on the lower (see Figures 1–4 and 5–7). Probably this can be connected with the change of the line of force direction at different depths relative to the line of sight.

Reference

Severny, A. B.: 1966, *Astron. Zh.* **43**, 465.

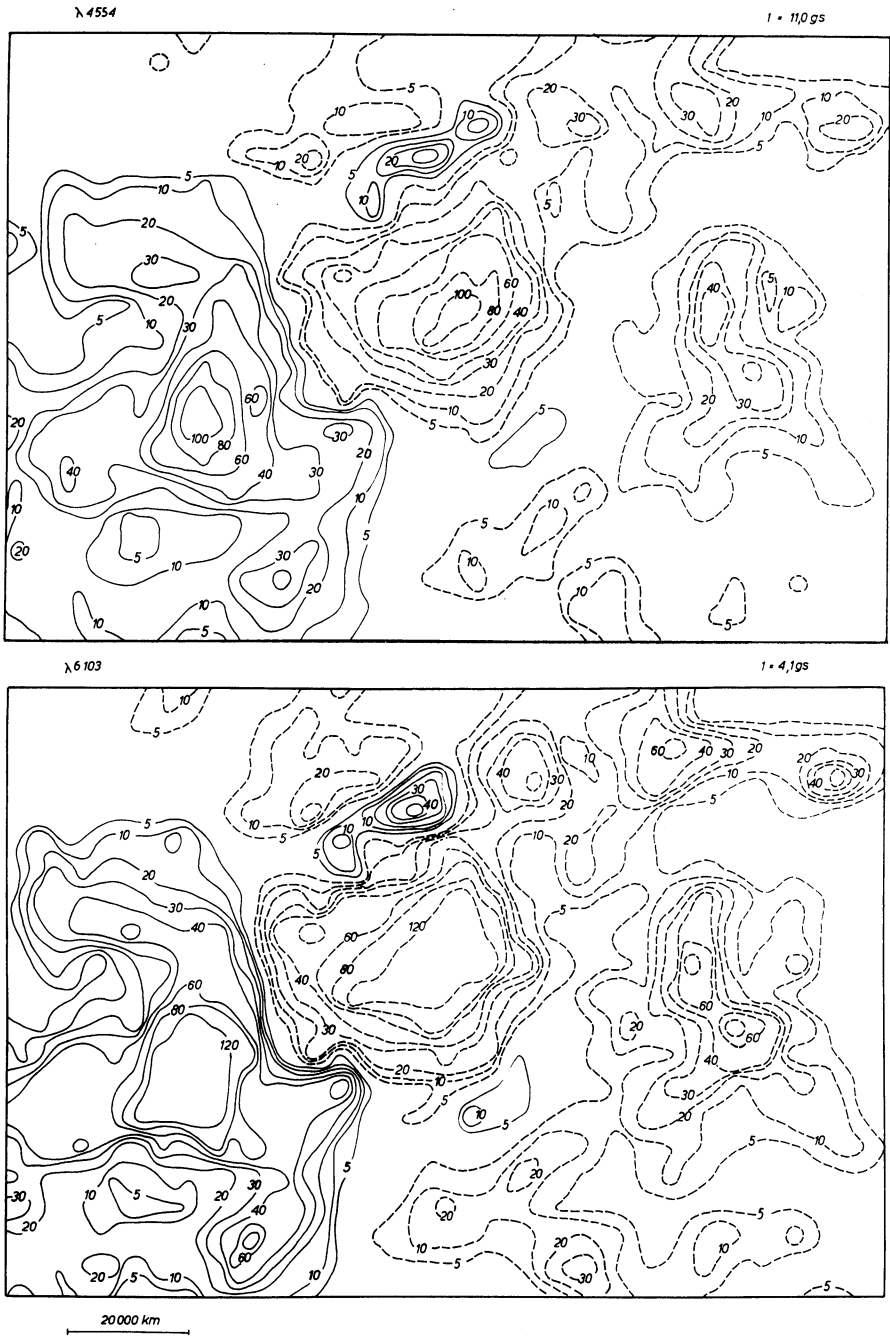


Fig. 1. The comparison of longitudinal magnetic fields recorded in the lines Ca I $\lambda 6103$ –Ba II $\lambda 4554$.

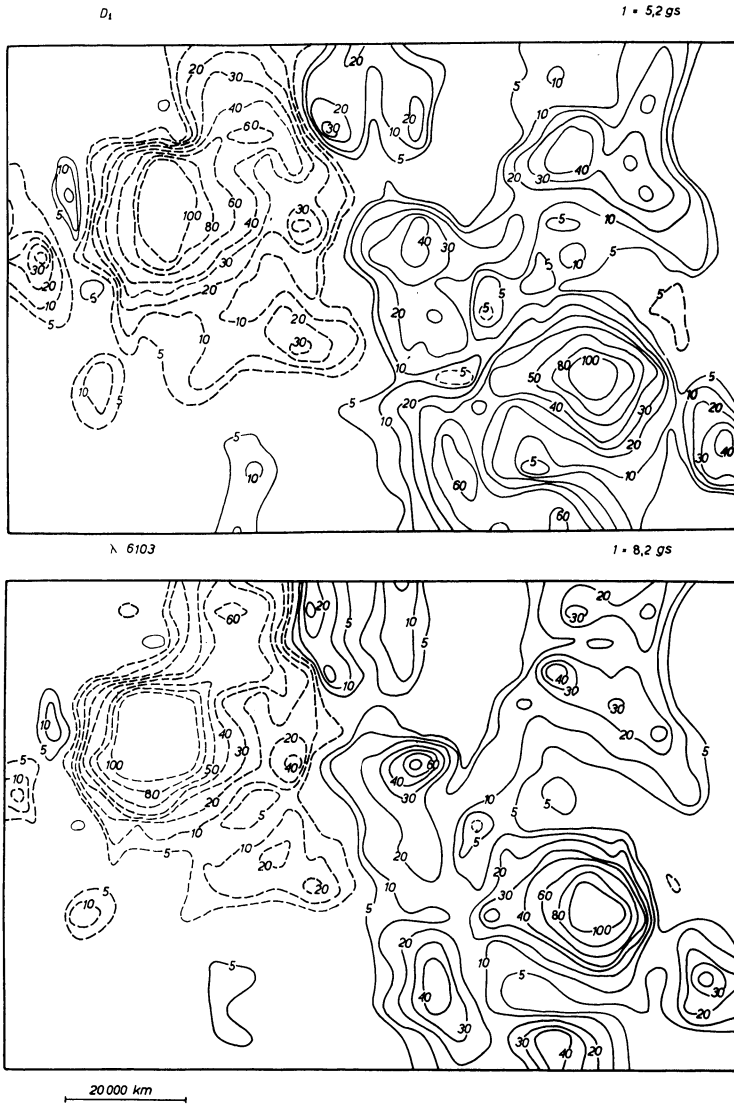


Fig. 2. The comparison of longitudinal magnetic fields recorded in the lines Ca $\lambda 6103$ -NaI D1.

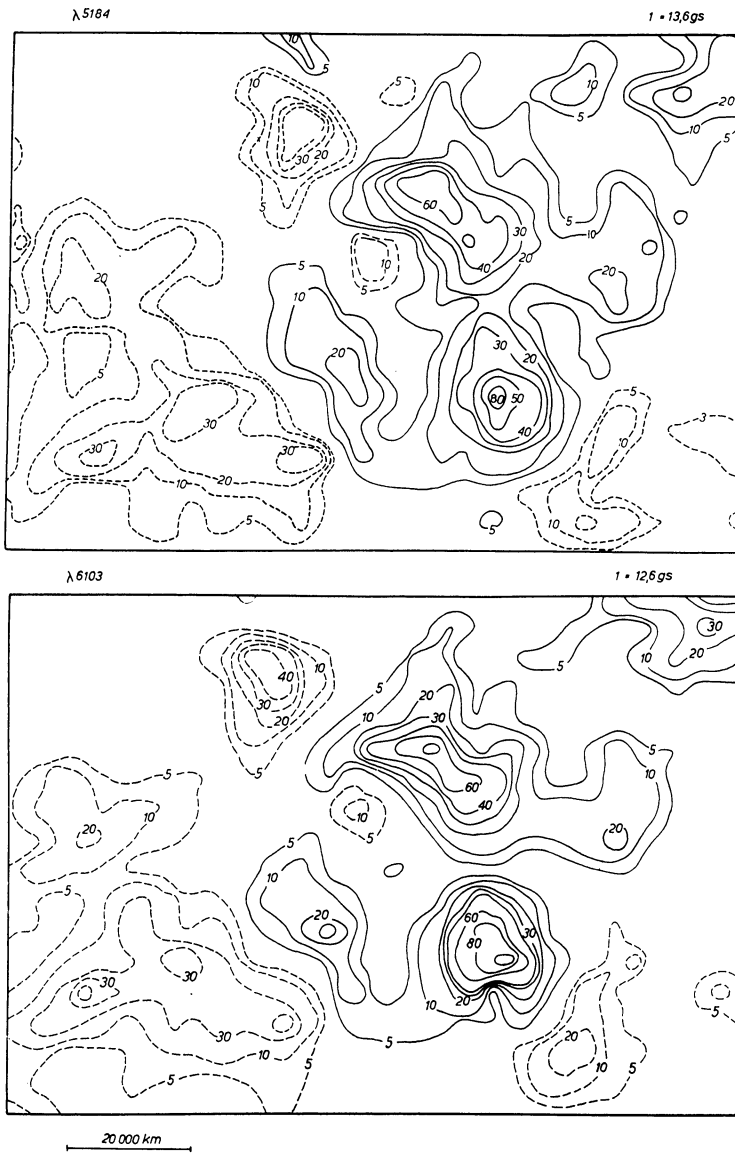


Fig. 3. The comparison of longitudinal magnetic fields recorded in the lines Ca I $\lambda 6103$ –Mg I $\lambda 5184$.

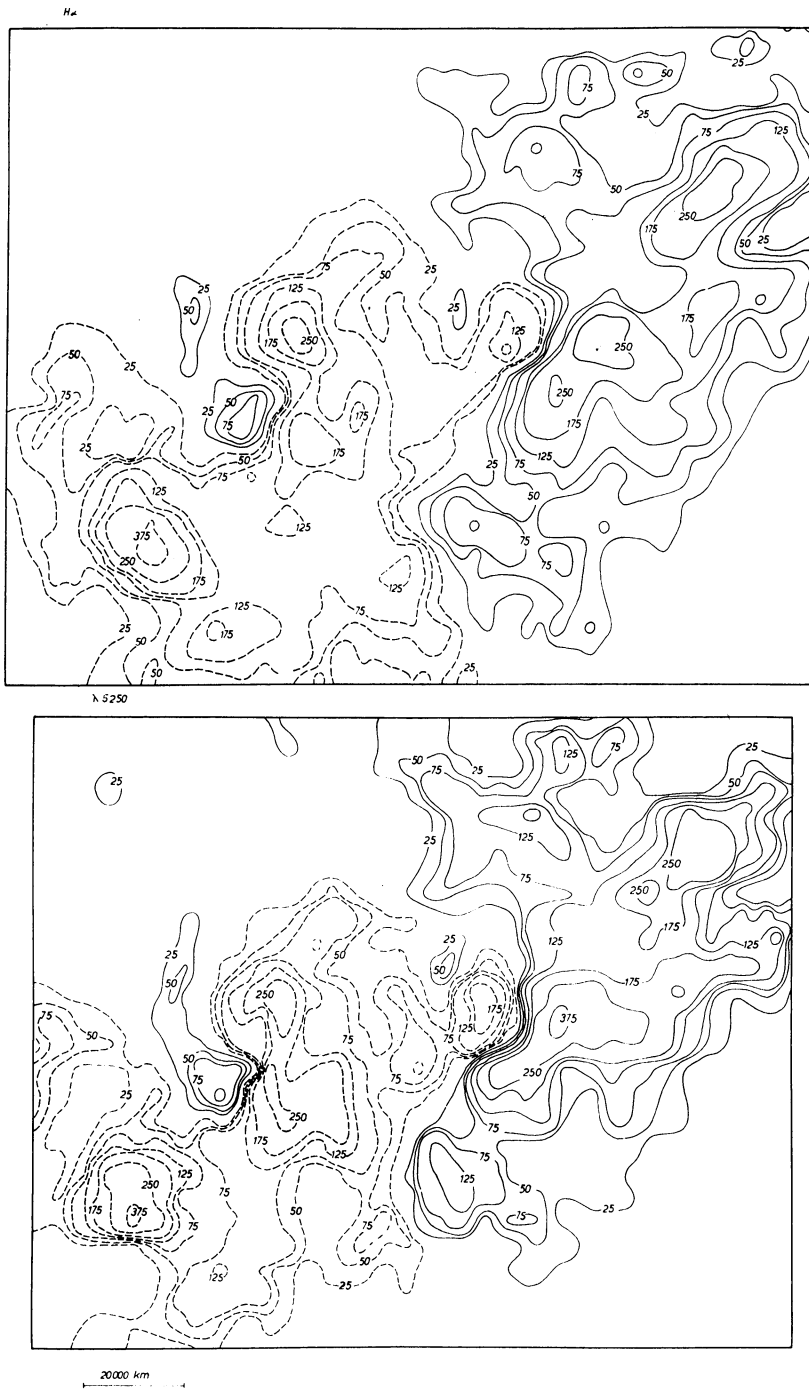


Fig. 4. The comparison of longitudinal magnetic fields recorded in the lines Fe λ 5250 and H α . Gauss levels are shown on the figure. Solid lines indicate south polarity.

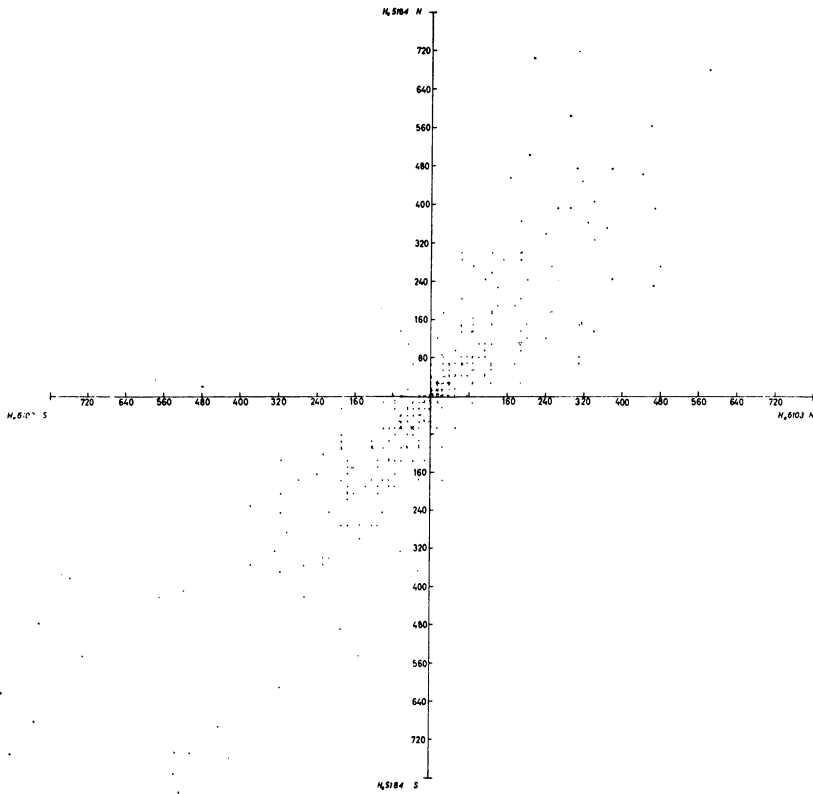


Fig. 5. The correlation between magnetic field strengths in the lines $\lambda\lambda 6103-5184$.

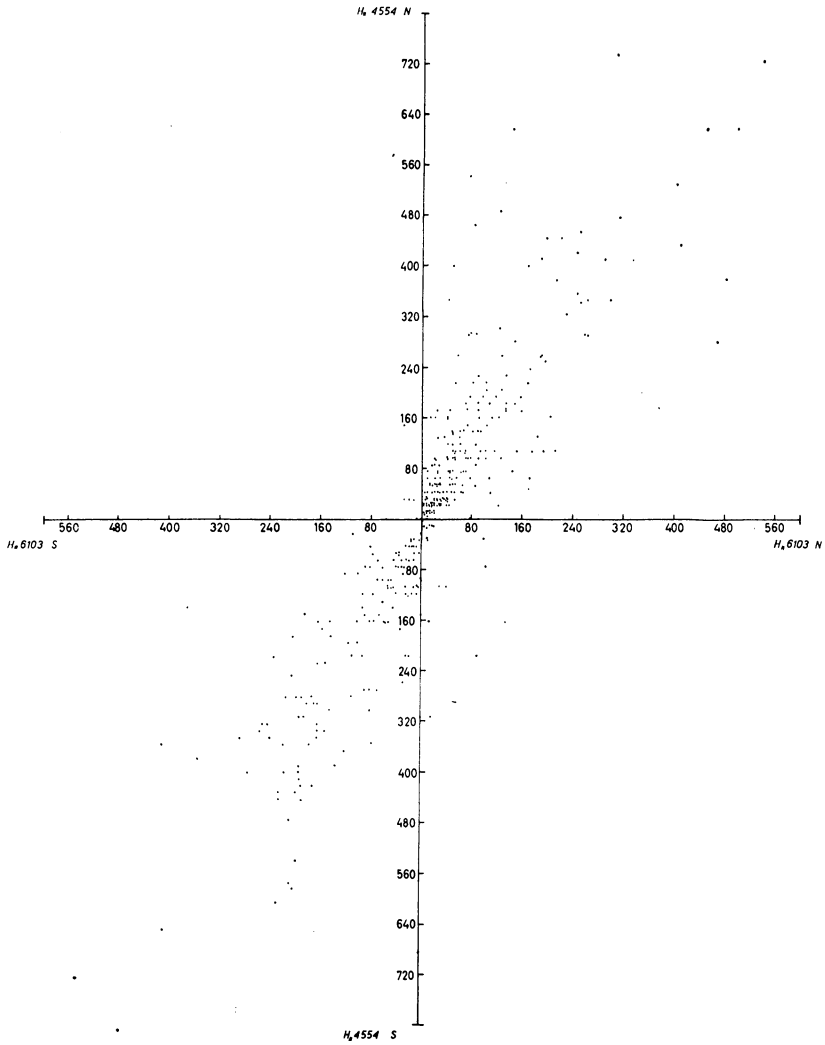


Fig. 6. The correlation between magnetic field strengths in the lines $\lambda\lambda 6103-4554$.

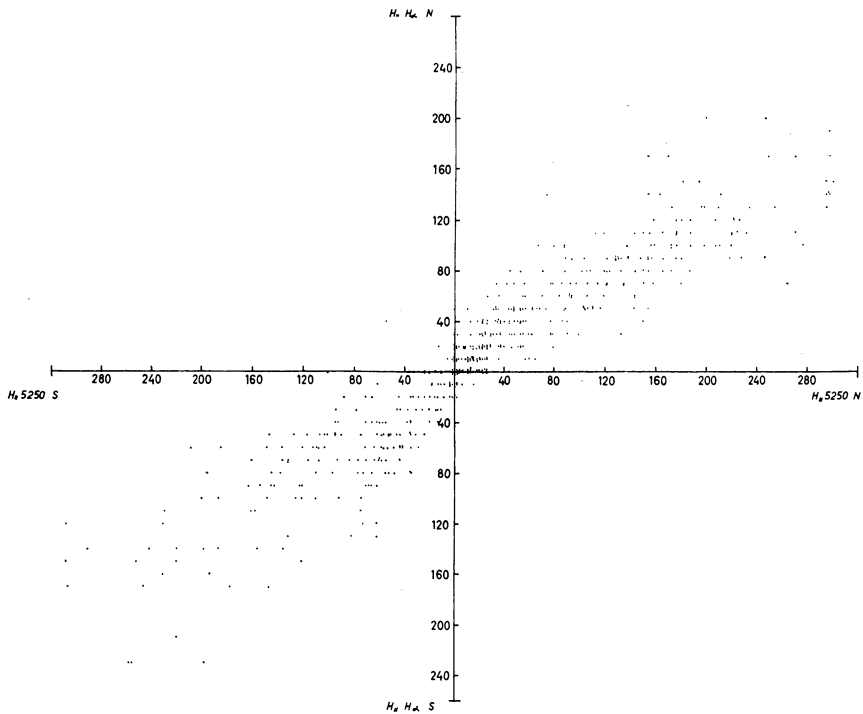


Fig. 7. The correlation between magnetic field strengths in the lines $\lambda 5250$ – H_{α} .