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Near-equatorial magnetic field of the photosphere

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The heliolatitude distribution of magnetic field groups of different strength was studied on the basis of the synoptic maps of NSO Kitt Peak (1976-2003). The analysis of the synoptic maps averaged over 3 solar cycles allowed to distinguish four typical groups of magnetic fields: B = 0 - 5 G; B = 5 - 15 G; B = 15 - 50 G and B > 50 G. It is shown that there exists a definite relation between the strength of the magnetic field and its latitudinal localization. The time-dependence is studied for different groups of magnetic fields. The fields of different polarity are considered separately for the North and the South solar hemispheres.

A special attention is given to the weakest magnetic fields (B = 0 - 5 G) which are localized near the equator (latitudes $\pm$ 5°) and in the interval 40° – 60° in each of the hemispheres. For the near-equatorial region the weakest fields in the North and the South hemispheres change synchronously and are approximately in anti-phase with the Wolf numbers. On the contrary the stronger fields (B = 5 - 10 G and higher) change in the phase with the solar cycle. Thus the magnetic field strength of the 5 G value represents the threshold below which the time-course of the magnetic field is in anti-phase with the solar cycle, while above 5 G it changes in the phase with the solar cycle.

It should be noted that in the near-equatorial region the fields of the same sign in the North and the South hemispheres change almost synchronously, while the relation between the fields of the opposite signs in one hemisphere is much less pronounced. This relation differs sharply from the case of strong magnetic fields in the sunspot zone where a strong correlation is observed for the magnetic fields of opposite sign within the same hemisphere. The obtained results allow to conclude that the weak magnetic fields of the near-equatorial region of the Sun are not just the “wings” of the magnetic field distribution of the sunspot zone, but represent a separate phenomenon.