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11-year and 22-year periodicities in the photospheric magnetic field changes

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We study changes of the photospheric magnetic field using synoptic maps for 1976 - 2003 (NSO Kitt Peak). The positive and negative magnetic fluxes were considered for the Northern and the Southern hemispheres separately. The presence of either 11-year or 22-year solar cycles was found for different magnitudes of the photospheric magnetic fields. For weak magnetic fields ($|B| < 10$ G) 22-year cycle only exists for all considered parameters: fields of positive polarity in the Northern hemisphere, fields of negative polarity in the Northern hemisphere, and for their sum. The extrema of 22-year changes occur in the minimum of 11-year solar cycle, but in anti-phase for positive and negative polarities. For strong magnetic fields ($|B| > 100$ G) 11-year solar cycle only was observed in all considered parameters. The following phenomenon (observed for the fields with $|B| > 10$ G) is of special interest: for each polarity in the Northern heliosphere the changes with 11-year solar cycle are seen, yet the sum of fields of positive and negative polarities shows only 22-year cycle. The same results were obtained for the Southern hemisphere.

We have also considered the longitudinal distribution of photospheric magnetic fields for positive and negative polarities. For strong equatorial magnetic fields we observe different longitudinal distributions for the ascending and the descending periods of the solar cycle: the maxima of the distribution are situated around 180° and 0°/360°, respectively. According to the phase of the solar cycle, dominating longitude changes by 180° twice during the 11-year solar cycle.