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Variations of magnetic field structure and solar eruptive events occurrence

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Solar magnetic field structure changes are supposed to be associated with many solar activity phenomena like flares, prominence eruptions, and coronal mass ejections. The cluster structure has been reveled in the time-space organization of active regions. Clustering properties were also revealed for the unipolar photospheric magnetic fields, traced by coronal holes. Dimensions and life-time of the clusters depend on the solar cycle phase. It is found that the evolution of the structure of the photospheric magnetic field clusters during solar cycles is not characterized by continuous transition, but by relatively sudden rearrangements. This reflects the large-scale solar magnetic field distribution changes. Distribution of solar flares is not random but shows evidence for active zones where flares concentrate. The longitudinal dependence for coronal mass ejections has also been revealed. Filament eruptions trace the coronal magnetic field reconfigurations. It is found that periods of the cluster structure rearrangements are characterized by the higher occurrence rate and parameter changes of flares, prominence eruptions, and coronal mass ejections. High spatial and temporal resolution observations obtained with SOHO instruments combined with data from other space and ground-based observatories are used to study the photospheric magnetic fields and coronal changes associated with different types of eruptive events at different phases of solar cycles. Comparison of geo-effectiveness of eruptive events during the cluster structure changes and “quiet” periods is made. The possibility of space weather forecast is discussed.