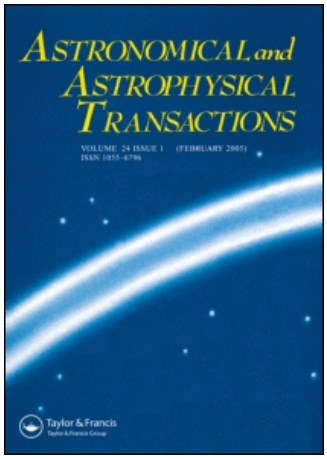

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ON THE SPACE-TIME DISTRIBUTION OF ACTIVE REGIONS ON THE SUN

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Space-time distribution of active regions (ARs)were obtained separately for the northern and southern hemisphere. ARs form two structures. The cell structure formed by powerful ARs in times of high activity and all ARs in times of low activity exist during a single 11-year cycle. Its origin is a consequence of many-layer solar convection. The second structure is formed by weak ARs, the magnetic fields of which are generated by photospheric streams.

KEY WORDS The Sun, active region

There are two conceptions about the formation of the magnetic field of active regions (ARs) in the solar photosphere: (1) the concentration of magnetic fields of ARs is conditioned by photospheric streams on the solar surface; (2) the magnetic field is carried outwards with convective movement on the surface, and the space-time organization of large-scale magnetic fields and various phenomena of solar activity depend on convective motions.

We have obtained space-time distributions separately for the northern and southern hemispheres of the total number of ARs (Figure 1(a)) and powerful ARs ($p > 2$, Figure 1(b)), as well as the distribution of recurrent ARs. The data for the ARs were taken from Solar Geophysical Data, 1976–1989.

During the time of high activity the distribution of powerful ARs has a spatial structure consisting of the cells apparently from the diagrams. The same spatial structure is observed for weak ARs during the time of low solar activity. These structures complement one another and form a single structure that exists during the 11-year cycle. Regarding the recurrent ARs the cell structure is clearer. The characteristic size of the cells is about 40–100 degrees in heliolongitude and 5–10 Carrington rotations in time. A north-south asymmetry is observed in the coming maximum of the activity and in the characteristic size of the cells. The other structure formed by a great number of weak ARs during the time of high activity is superimposed on the cell structure.

Obviously the cell structure formed by the powerful ARs is a consequence of many-layer solar convection and its interaction with the global magnetic field that falls in the base of the convective zone. The second structure formed of weak

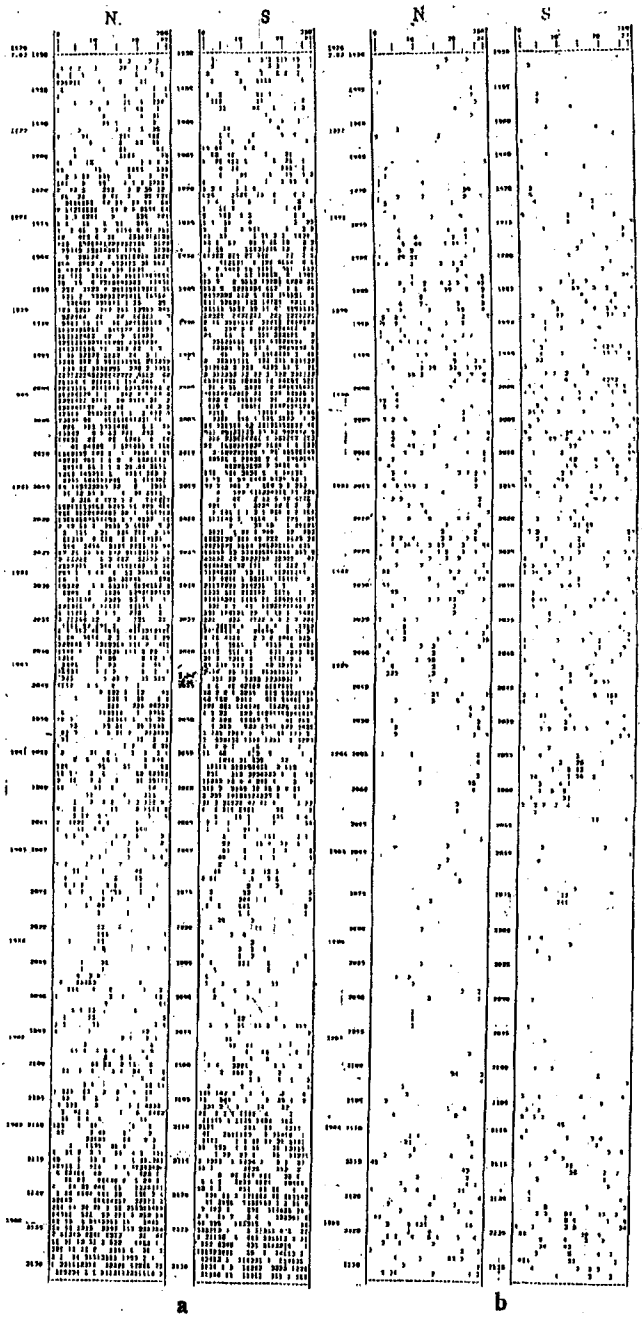

Figure 1 The space-time distribution of the total number of active regions (*a*) and powerful active regions ($p > 2$) (*b*). The first column on the ordinate is years, the second is Carrington rotation number, and the number of days in the Carrington rotation are plotted on the abscissa. The digits on the diagrams are the power of the active regions.

ARs is generated by photospheric streams. Therefore both conceptions about the formation of ARs is corroborated as well as the idea about the simultaneous existence and interaction of several longitudinal structures of the magnetic field on the Sun.