Catalogue of LDE-type flares (1994–1995)

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Abstract. The Catalogue of LDE-type flares covers 27 years of LDE-type flare data (1969 – 1995). The continuation of the list of long-lasting SXR flares (LDE-type) is given in Table 1. The latter contains the list of LDE flares observed from July 1994 to June 1995, and ties in timewise with the previous papers ; it is only available in a computer-file form.

Key words: the Sun – flares

1. Results

Analysis of temporal variations of the occurrence of the LDE–type flares, with SXR duration exceeding 2 hours, yields the following results:

- Periodicities of the LDE-type flare occurrence (1969 – 1992) in Antalová (1994 a, b).
- Cosmic-ray modulation and long-duration solar flare events, (on 15-day basis) in Kudela et al. (1994).
- The studies of cross–correlation functions between daily Calgary Galactic Cosmic Ray intensity (CNI) values and LDE–type flare index (FI) in Antalová et al. (1995a, b, c), Jakimiec et al. (1995) and Storini et al. (1995).
- E–W distribution of LDE–type flares and Galactic Cosmic ray modulation (1969–1972 and 1988–1989) in Antalová et al. (1994), Jakimiec et al. (1995), Storini et al. (1995) and Antalová et al. (1996).
- The magnetic reversal of Sun and sectorial distribution of LDE–type flares in Antalová (1994, 1996) as well as in Antalová and Jakimiec (1995).

There is an increasing consensus that LDE, i.e. soft X-ray post-flare component indicate the existence of the dense thermal plasma located in the corona, mainly in the summit of huge flare or post–flare arches, or arcades. Based on optical observations the generally adopted view was that eruptive prominences, sprays, disparition brusques (DBs) and eruptive flares are the most pronounced solar phenomena directed outward from the Sun to the corona and further to the heliosphere. However, recent space–borne observations changed this view revealing Coronal Mass Ejections (CMEs) to be the largest structures in question. It is well known that the modelling of the drivers of interplanetary disturbances suffers from large discrepancies. In spite of the fact that there is a relatively

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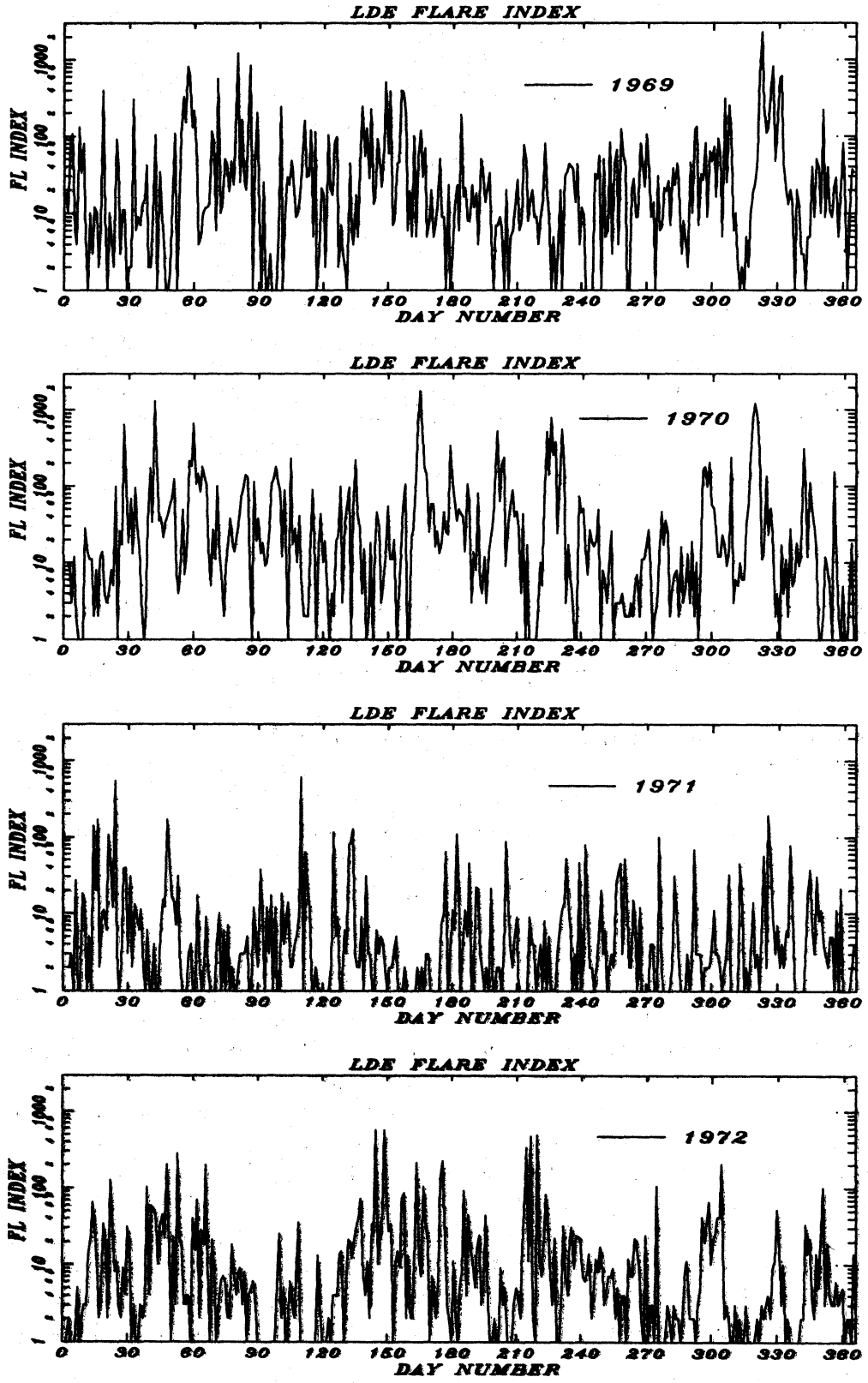

Figure 1. *Daily values of the LDE-type flare index for 1969 – 1972 years. The figure is taken from Antalová et al. (1995b).*

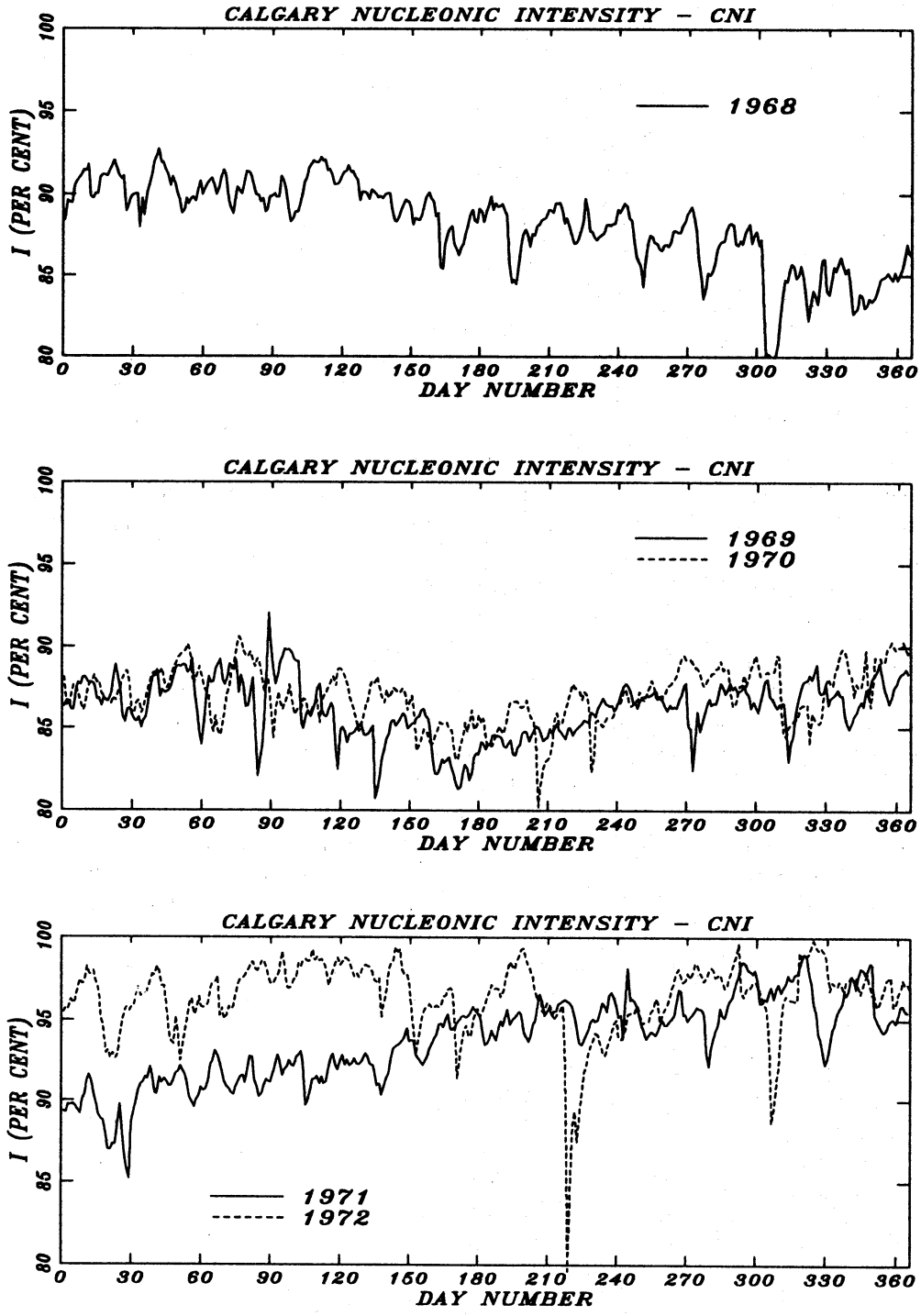

Figure 2. Daily 1968–1972 Calgary Cosmic Ray Intensity values (Venkatesan et al., 1989). In 1969 CNI dropped to the value 81% at the 180th day of the year; then began the relaxation to the value 85%. In 1971, steady relaxation of CNI to the values of about 96% is seen. The figure is taken from Antalová et al. (1995c).

good knowledge of solar eruptive phenomena on one hand and a fairly good understanding of interplanetary structures on the other, we cannot exactly say which solar sources are linked to CMEs. Reconsidering the data (Švestka 1995) emphasizes that eruptive flares are accompanied not only with primary particle acceleration, but also with large outward directed structures and huge flaring arches. The preferred CME sites are around coronal helmet streamers and near the boundaries of the large scale magnetic fields. On the other hand, CMEs are also associated with LDE–SXR emissions or bright SXR emissions (> M3). The 100% probability for a CME to be associated with an X-ray LDE was found for events lasting longer than 6 hours (Sheeley et al., 1983). HXR and gamma flare emissions clearly indicate the process of primary particle acceleration in flare structures (i.e. Solar Energetic Particles – SEP) and so one would expect that the largest heliospherical proton fluxes accompany gamma flares. As we know, this expectation is not approved. Measurements of solar particles from space have shown the existence of interplanetary shocks accompanying CMEs and Corotating Interaction Regions (CIRs). Interplanetary particles are in fact the products of secondary particle acceleration in both CME– and CIR–shocks.

References

Antalová, A.: 1994a, *Adv. Space Res.* **14**, (10)721

Antalová, A.: 1994b, in *1992 STEP Symposium/5th COSPAR Colloquium*, ed.: D. N. Baker, V. O. Papitashvili and M.J. Teague, Pergamon Press, Oxford, 113

Antalová, A.: 1994, *Contrib. Astron. Obs. Skalnaté Pleso* **24**, 19

Antalová, A.: 1996, *Adv. Space Res.* **17**, (4/5)213

Antalová, A. and Jakimiec, M.: 1995, *Contrib. Astron. Obs. Skalnaté Pleso* **25**, 19

Antalová, A., Jakimiec, M. and Storini, M.: 1994, in *8-th Internat. Symp. on Solar Terr. Phys., STEP, part I*, ed.: H. Oya and G. Rostoker, SCOSTEP, Sendai, 53

Antalová, A., Kudela, K., Venkatesan, D. and Rybák, J.: 1995a, *Adv. Space Res.* **16**, (9)233-(9)236

Antalová, A., Rybák, J., Kudela, K. and Venkatesan, D.: 1995b, in *24ICRC, Vol. 4*, ed.: N. Iucci, Intern. Union of Pure and Applied Physics, Roma, 530

Antalová, A., Rybák, J., Kudela, K. and Venkatesan, D.: 1995c, in *24ICRC, Vol. 4*, ed.: N. Iucci, Intern. Union of Pure and Applied Physics, Roma, 534

Antalová, A., Storini, M. and Jakimiec, M.: 1996, in *16th NSO/Sac Peak workshop*, ed.: S. L. Keil and K. S. Balasubramaniam, Astron. Soc. Pacific, Utah, in press

Jakimiec, M., Storini, M. and Antalová, A.: 1995, in *24ICRC, Vol.4*, ed.: N. Iucci, Intern. Union of Pure and Applied Physics, Roma, 852

Kudela, K., Antalová, A., Venkatesan D. and Rybák, J.: 1994, *Sol. Phys.* **154**, 371

Sheeley, N. R. Jr., Howard, R. A., Koomen, M. J. and Michels, D. J.: 1983, *Astrophys. J.* **272**, 349

Solar Geophysical Data : 1969 – 1994, Parts I and II.

Storini, M., Antalová, A. and Jakimiec, M.: 1995, *J. Geomagn. Geoelectr.* **47**, in press

Švestka, Z.: 1995, *Sol. Phys.* **160**, 53

Venkatesan, D., Mathews, T., Graumann, H. and Sharman, P.: 1989, *Calgary Cosmic Ray Intensity Records–Super Neutron Monitor*, The University, Calgary