THE ASSOCIATION OF TYPE III BURSTS AND CORONAL TRANSIENT ACTIVITY

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Metric Type III radio bursts are nearly always associated with solar active regions. In particular, the occurrence of Type III bursts within a few minutes of the onset of the solar flares (Wild et al. 1954) is well known. During the Skylab period, a broad peak in the number of isolated Type III bursts occurred about 5 h prior to large Hα solar flares (Jackson and Sheridan 1979).

Here we follow up on a report by Jackson et al. (1978) that a peak in the number of isolated Type III bursts occurs prior to mass ejection transients observed from Skylab. Histograms show a broad peak approximately 8 hours prior to the time that the most massive portions of the transients reach 3 $R_{\odot}$. Further, those Type III bursts whose positions were measured with the Culgoora heliograph generally emanated from the vicinity of the eventual mass ejections. Figure 1 shows the temporal distribution of the bursts observed to lie within 20° of the solar position angle of the eventual transient; there is a pronounced peak in the number of bursts some hours prior to the transient.

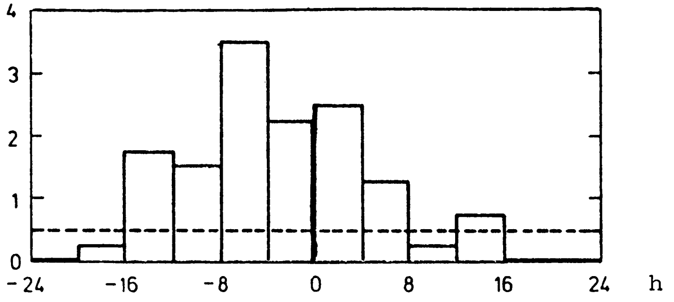

FIGURE 1. Number of isolated Type III bursts or burst groups per hour prior to and after mass ejection transients. The dashed line gives the mean number of Type III bursts per hour over ±126 h, excluding the interval of the histogram. 17 transients are represented.

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The lead time of the Type III bursts is not the same from one event to another, but depends on the speed of the eventual transient: the slower transients lag the Type III bursts much more than do the faster transients. Most of the Type III bursts of individual events occur near the time of initial motion of the outermost material of the mass ejections, i.e., the onset of motion of the transient forerunners described by Jackson and Hildner (1978).

From Hα, X-ray, and magnetogram data, there is no evidence for an extraordinary input of energy into the corona at the time of the peak in Type III activity prior to the transients. However, there is evidence that the transients arise from active regions in which the areas of strong magnetic field gradually increase in size over a period of days. Thus, the data indicate that the corona slowly stores the energy that is quickly released at the time of the mass ejection. We suggest that the increase and subsequent decrease in Type III activity indicates a new phase in the coronal adjustment to the long-term addition of energy, with some of the energy going into lifting the plasma and perhaps some into the kinetic energy of moving plasma. If this is correct, the peak in Type III activity indicates the beginning of outward coronal plasma motion and can be studied for clues to the energy input mechanism(s) responsible for mass ejection transients.

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DISCUSSION

Webb: Did you observe the distribution of Type IIIs on the disc, and if so, do they give the same type of peak in Type III number prior to solar flares as is observed prior to limb transients?

Jackson: During the Skylab period a peak in Type III burst number was found approximately 5 h prior to solar flares of importance 1 or greater. The Type III bursts of this peak are generally associated with the active region where the flare occurs. The often-reported peak in Type III activity at the onset of flares and subflares is well observed for approximately 11% of the ∿ 1300 Type III bursts observed during Skylab. However, there is no increase in the number of observed subflares 5 hr prior to the flares during Skylab.