A review of Sporadic E in 2002

The “amount” of sporadic E present in any period can be assessed in a number of ways. One method is the estimation of the E-layer “MUF” (in this context thought of as the highest frequency at which the E-layer returns signals to earth), either by direct observation (the maximum observable frequency) or by calculation using the skip distances of open paths and an inferred layer height. (Note that neither of these is “MUF” in the sense used in propagation predictions). Another method seeks to count the number of hours or minutes per day that a path is open at a particular frequency. Both these methods allow quantification of “amount” but suffer the limitation of not taking into direct account how widespread the “amount” is. Given that the usable frequency is above “x” MHz for “y” hours, does this relate to a layer area the size of Europe or to a single point on the layer?

The rationale used in the *Six and Ten Report* is to measure the “amount” of Es by counting the number of different geographically distinct areas that can be heard by a UK observer during an opening. On 28 MHz “areas” comprise the number of unique beacons heard and on 50 MHz the number of countries heard or worked. (For historical continuity, 6m country areas include entities such as “former Yugoslavia” and small counties like T7 and 3A are included with their larger neighbours). The different measures used on the 2 bands reflect the availability of usable data. Even under “dead band” conditions some 6m operators will be listening for, and will report, the most fleeting of openings while on 10m there is a useful group of people who systematically monitor beacon activity. The reverse cases are not true! A useful consequence of this approach is two completely independent views of the “amount” of sporadic E as seen from the UK. A limitation is that the maximum number of available areas is not constant from year to year so year-on-year trends are difficult to assess.

Some frequency control for the “areas” measure is gained from looking at two different frequencies (28 and 50 MHz), but maximum frequency is a secondary consideration for the bands we are concerned with - during the summer months the E “MUF” exceeds 50 MHz on some path on virtually every day. Time control is obtained by counting areas within 3-hourly time bands but in the analysis that follows the time bands are amalgamated into a single daily value, more appropriate when looking at trends over an entire year. So, what do the data for 2002 look like?

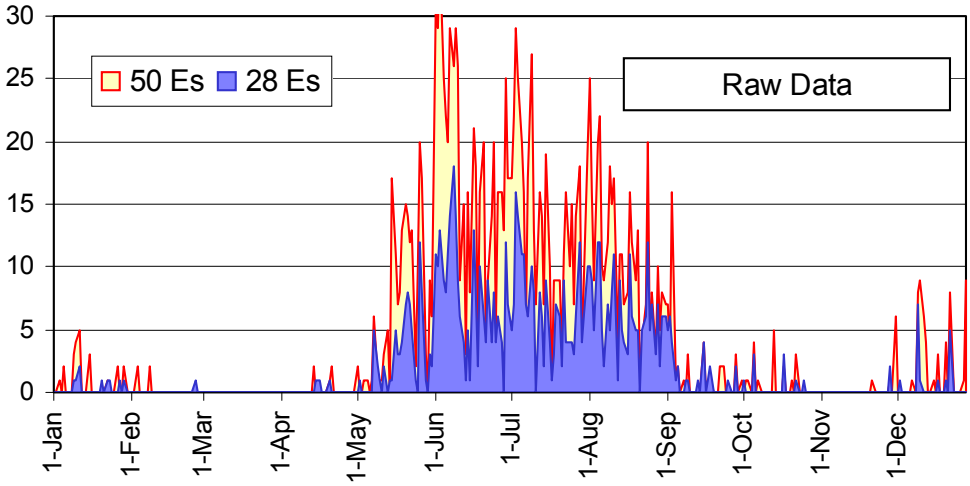

Fig 1. Daily area counts

Figure 1 is a graph showing the counts of areas reported for Es on 50 and 28 MHz for every day in 2002. The “spiky” nature of the graph is a consequence of the variability of the “amount” of Es from day to day. The gross seasonal distribution is clear in this graph: it follows the normal and expected pattern of a dominant summer season (lasting from early May to the start of September) with a much weaker mid-winter season. This year there is no discrete weak autumnal “season”, rather there is a tail of minor Es activity extending from the end of the summer season through to the end of October

Notice the strong correlation between the independent 28 and 50 MHz measures: the 50 MHz counts and higher than those for 28 MHz because of the greater number of country areas compared to the number of 10m beacons within sporadic E range.

Although large-scale seasonal distributions can be seen in the raw daily data it is difficult to discern trends on shorter time scales. Figure 2 presents the same data but as 7-day moving averages. A whole series of graphs with moving averages ranging from 3 to 31 days were produced, but those for 5 and 7 days most clearly illustrate shorter time scale trends. The 7-day average shown below is preferred over the 5-day average because all the averages include week and weekend days, avoiding possible bias due to higher activity levels and more frequent reporting during weekend days.

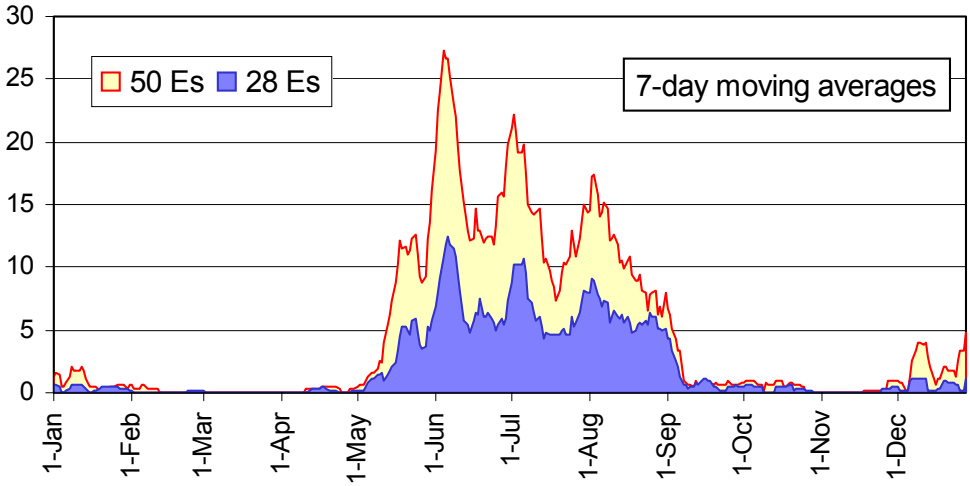

Fig 2. 7-day moving average daily area counts

The summer season is seen in figure 2 to comprise 3 main peaks, the largest of which occurred in early June. Subsequent peaks are in early July and early August. The immediate impression is that this represents a monthly repetition of "good" conditions with a periodicity redolent of the solar rotation period. Unfortunately I can find no evidence for a correlation of these peaks with any sun-derived factor – but perhaps this is not surprisingly as correlation between solar activity and Es has been looked for many times and found wanting.

Between the main peaks there are hints of subsidiary peaks. The positions and dates of the peaks (some of which are not at all well defined) are shown in figure 3. The periodicity of the labelled peaks is close to 2 weeks. No amount of re-working of the data can generate periods of the order of 5 to 7 days that are sometimes quoted as a feature of the repetitive element of sporadic E events.

The results presented here have been compared to a range of solar and geomagnetic indices but it has not been possible to detect any unambiguous correlation between them and no controls on the apparent periodicity of sporadic E events are indicated

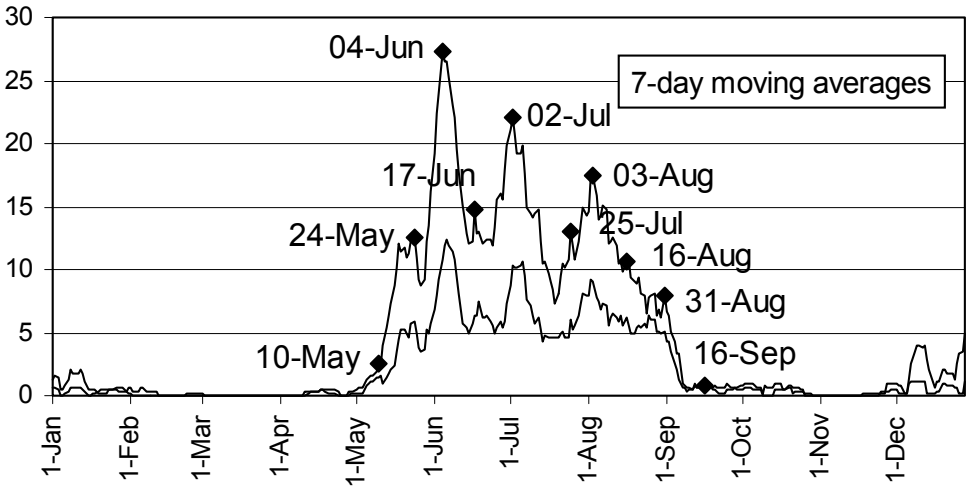

Fig 3. Dates of peaks in Es activity as portrayed in the 7-day moving avergae data
Dates are marked on the 50 MHz line: equivalent peraks are present at 28 MHz.

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