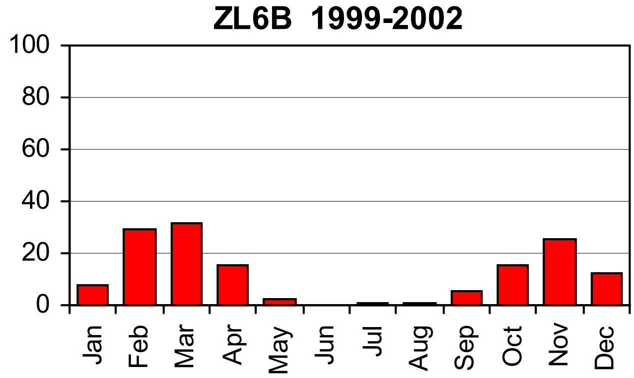
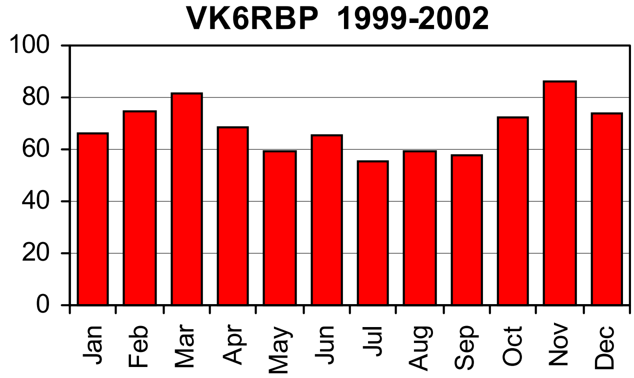
Analysis of IARU/NCDXF 28 MHz Beacons 1999-2002

Last month we looked at the performance of 6m paths in the period January 1999 to December 2002, the years that encompass the peaks in solar activity of cycle 23. This month it is the turn of 10m. Our 28MHz analysis is based on compilations of reports of the IARU/NCDXF beacons as heard in the UK and reported in the *Six and Ten Report*.

The following pages show charts of each beacon (in transmission time order) showing average daily beacon reliability for each month. Daily reliability here is defined as the percentage of days each month when the beacon was heard. The values for January, for example, are the average of the daily reliability for January 1999, 2000, 2001 and 2002.

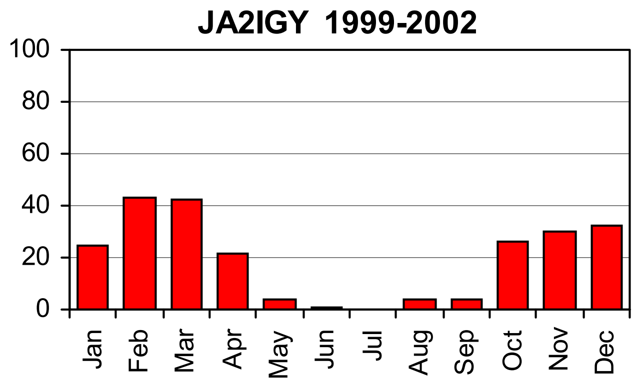
Nearly all the beacons suffered from breaks in transmissions at some time or other. Many of these outages were long enough to be obvious from the absence of reports (some were many months in duration), others were reported by NCDXF or beacon operators. Data for periods of known or strongly suspected outages have been excluded from the graphs and the analysis (as noted below for each beacon). Shorter breaks in transmission have not been tracked or taken into account

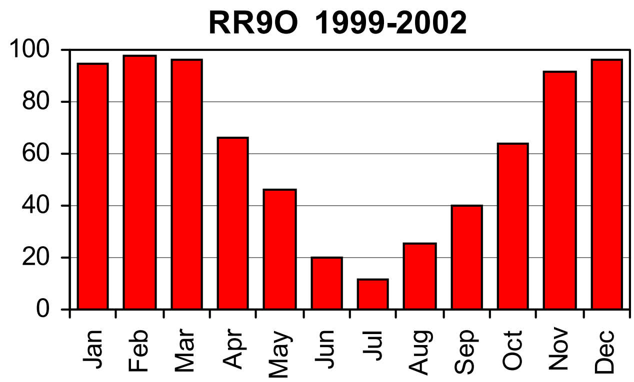




ZL6B: *(No significant outages known, but no data for January 1999).* The results include both long and short path openings, with winter openings predominantly short path and summer openings long path. The pattern is one of best propagation during the spring and summer equinoxes, skewed slightly towards the winter reflecting the efficacy of the north polar regions on the short path during the winter.

VK6RBP: *(The results suffer from outages and problems including low power output in November 1999 – January 2000, August-December 2001, and June-December 2002).* As befits a path that has a large north-south component, propagation is shown to be present all year, though with best opportunities at the equinoxes. Winter is slightly better than summer because more of the G-VK6 path lies in the Northern Hemisphere than the Southern.

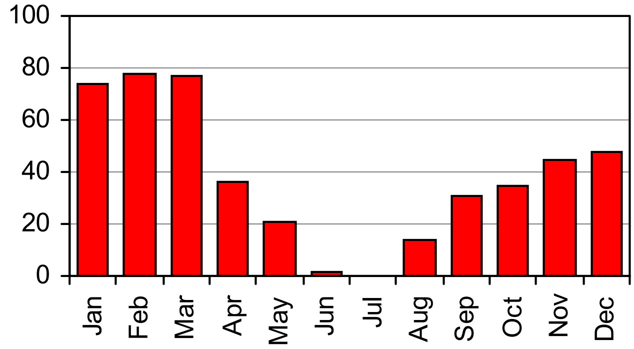




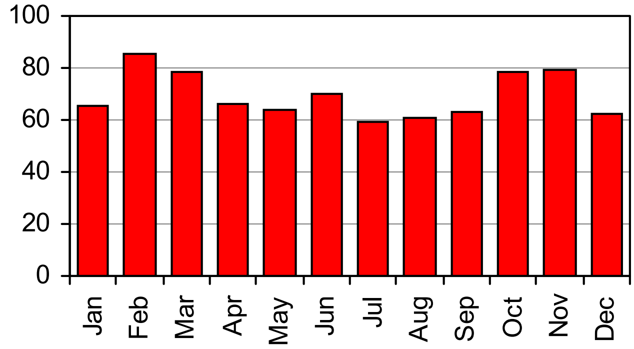
JA2IGY: *(No exclusions for outages. There were one or two odd variations in the data perhaps indicating outages we were unaware of).* The chart pattern is similar to that for ZL6B – the path orientations are similar (crossing polar latitudes). JA2IGY short path is predominant over long path at all times, and as fewer hops are required for JA short path, reliability is higher than for ZL6B.

RR9O: *(Graph is from December 1999, the first month of full service. Data for March 2001 is missing).* RR9O shows a strong pattern of winter (intra Northern Hemisphere) propagation with reliability close to 100% during the winter months. Recent problems with garbled signals have not affected reliability data.

VR2HK/VR2B 1999-2002



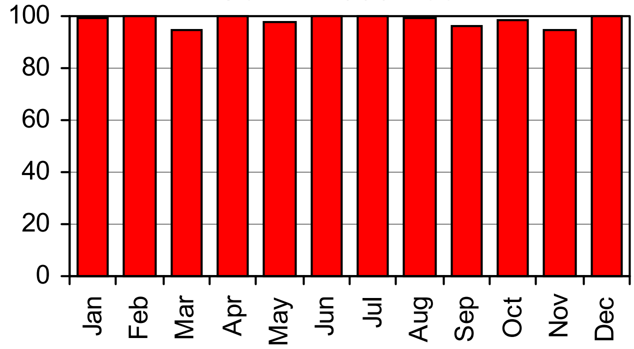
4S7B 1999-2002



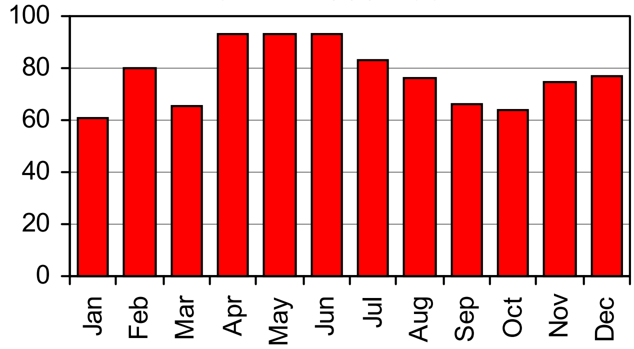
VR2B: (*VR2B started transmitting in March 2000 as VR2HK and there was a long outage for most of 2001. The data graphed are for April-December 2000 and January-December 2002)*. Data for this beacon is less reliable than some others because of extensive off-air periods and this seems to be the reason for the discrepancy between spring and autumn results. However the pattern, which is intermediate between that of RR9O and JA2IGY, is perhaps as one might expect.

4S7B. *(April 2000 appears to have been the first full month of operation. All of 2001 has also been excluded from the analysis).* The graph shows a similar, though slightly flatter, pattern to VK6RBP. Paths to 4S7 and VK6 lie further south than to VR2 and this is the reason for the difference seen in summer time propagation.

ZS6DN 1999-2002

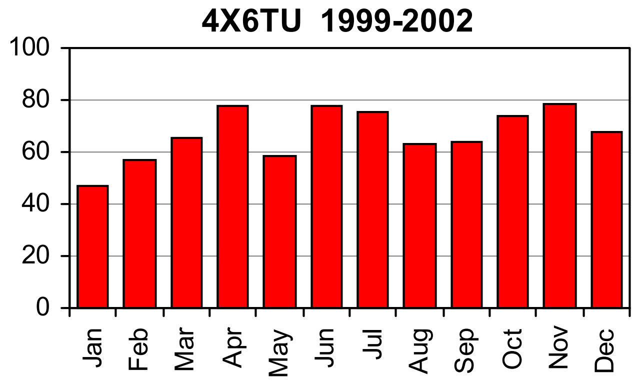


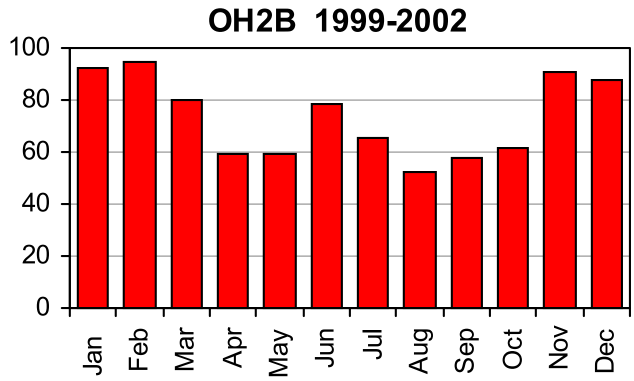
5Z4B 1999-2002



ZS6DN: *(Minor outages are known to have occurred and the graph excludes March-April 2000, October 2002 and December 2002)*. This beacon was heard on virtually every day throughout the period with no discernible seasonal variation. The circuit is effectively north-south. 50 MHz data show mid-winter to be the poorest month, but MUFs were high enough for this effect not to be detected in this analysis.

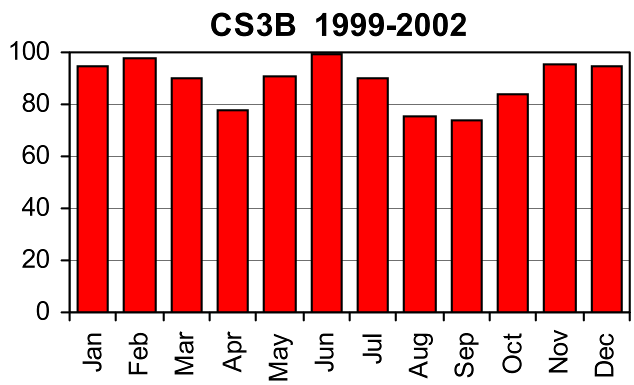
5Z4B: (*June 2000 to August 2001 and October 2001 to July 2002 had to be excluded from the graph because of outages and intermittent operation).* The somewhat irregular pattern of the chart bars reflects the relatively poor data available for this beacon. There is a suggestion that better propagation occurred during the summer than the winter but the reasons why this might be are unclear.

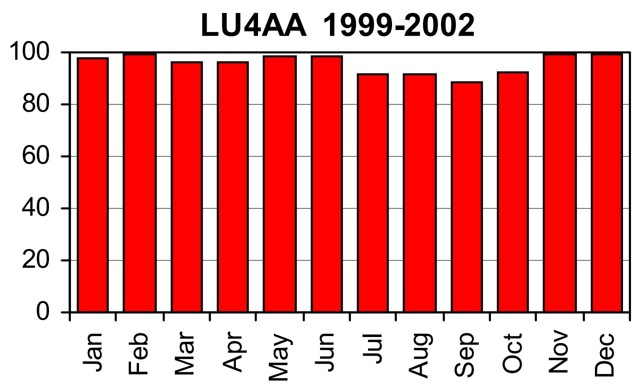




4X6TU: (*October 200m – April 2001 and December 2001 not included because of beacon outages).* The propagation pattern is unclear but may be indicating small enhancements at the equinoxes with the addition of a summertime sporadic E component (4X is one F layer hop from G but 2 E-layer hops)

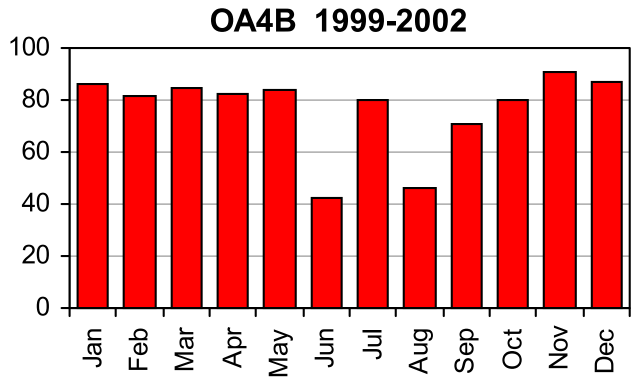
OH2B: (*Until the theft of the beacon transmitter, OH2B had an excellent reliability record and only September 1999 and December 2002 are not included in the analysis).* There are three components to this chart. (1) Single hop direct F-layer propagation with little or no summertime propagation and a pattern like that of RR9O. (2) F-layer backscatter present when direct path skip distances can not be attained – this has the same distribution as for the direct path. (3) Strong single hop sporadic E during the summer which overlaps with the F-layer modes in late spring and early autumn.

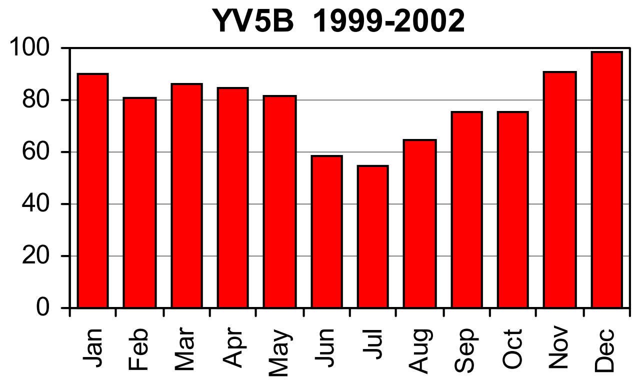




CS3B: (*This beacons was out of service for most of the period November 2000 to May 2001 and data for these months have not been included in the analysis).* The pattern for CS3B is similar to that for OH2B, I believe for similar reasons. The F-layer modes (direct path rather than backscatter) peak in the winter but unlike OH2B are present all year - this is because CS3B is further from the UK than OH2B. Sporadic E (usually a long single hop but sometimes possibly 2 short hops) adds to the reliability of the circuit during the summer – though the 100% reliability in June is a surprise.

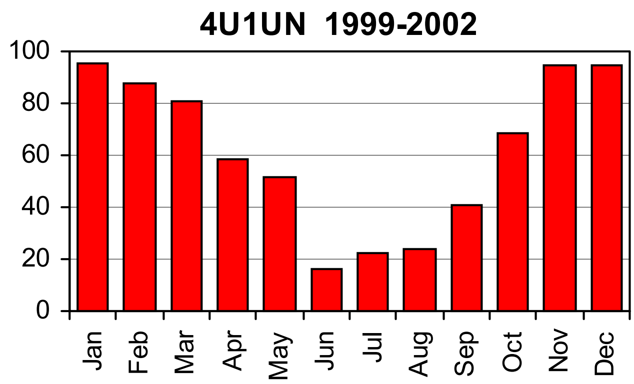
LU4AA: (*Unlike other Argentine beacons, LU4AA has had a good record of continuous operation. Only June 2001 has been left out of the graph because of a two-week outage*). 50MHz data shows F-layer propagation on this circuit is most effective around the equinoxes and also suggests that E-layer links are required on 6m during the summer. At 28 MHz, path MUFs were normally exceeded at some point every day. This means that, as with the other "north-south DX" beacon ZS6DN, propagation trends are not easily discernible in the 28 MHz data.

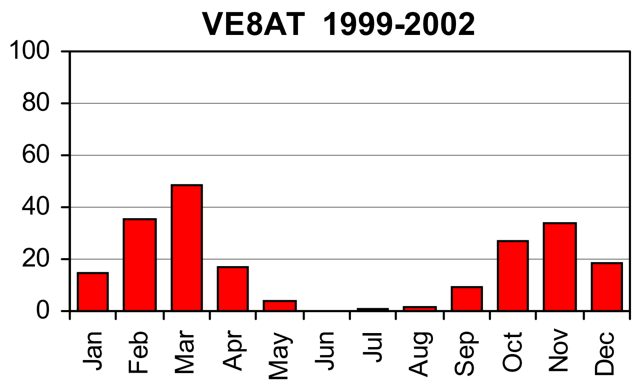




OA4B: (*Outages occurred in the periods July-September 2000, June-July 2001 and July-December 2002, and the beacon is still off air as of March 2003)*. There is rather poor information for the summer months for OA4B as this beacon seems to fail often and preferentially during the summer. There is a suggestion that propagation dips in the summer. The propagation patterns appear fall somewhere in a continuum between those of LU4AA and YV5B.

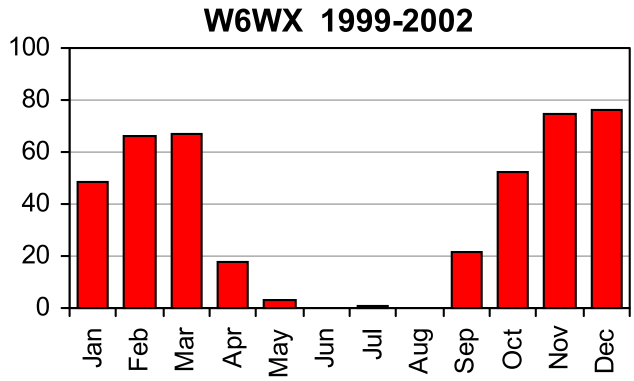
YV5B: There was n*o or poor data for out-of-service periods September-October 1999 and December 2000 and these months are excluded from the graph.* The pattern shown by YV5B is not particularly smooth but clearly shows that winter propagation was more reliable than summer. The trend of greater dominance of winter over summer propagation the further north the circuit lies is seen nicely in the sequence LU4AA – OA4B – YV5B – 4U1UN.

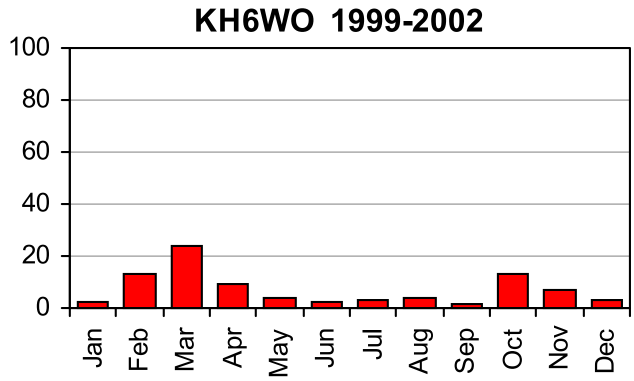




4U1UN: (*No major outages but 4U1UN suffered from reduced reliability in January and February 2002 and these two months are omitted from the study results).* The New York beacon exhibits a pattern typical of paths lying entirely within the Northern Hemisphere and is very similar to that for RR9O. Winter reliability regularly exceeds 90% of days. The summer null would have been even more pronounced but for the presence of multi-hop sporadic E. In June and July the 20% daily reliability is almost entirely due to Es, and it is likely that multi-hop Es was also responsible for some of the mid summer propagation to RR9O.

VE8AT: (*It is not clear from the results if outages occurred so data for all months have been incorporated in the results)*. The results for VE8AT are interesting as they match closely the patterns shown by JA2IGY and other beacons where the path passes high latitudes. I am not sure why there should be such pronounced peaks close to the equinoxes in these cases. Paths at slightly lower latitudes (as exhibited by RR9O and 4U1UN) show a distinctly different circumstance with a peak in mid-winter





W6WX: (Un*til recent storms. W6WX had an excellent service record. Only November and December 2002 are excluded from the graphs because of non-operation)*. The monthly patterns for the path to California resemble those for New York but at reduced reliability. The low relaibility for the month of January hints at the feature described for VE8AT for near-polar paths

KH6WO: (*No significant outages are known and all months are included in the analysis).* Of all the NCDXF beacon locations, Hawaii is the most difficult to achieve on 28 MHz from the UK. Daily reliabilities only approached 20% in March and October. The pattern of peaks at the equinoxes resembles the VE8AT pattern rather than that for JA2IGY and ZL6B. Both long and short path are represented in the graph with morning long path responsible for the low reliability propagation seen in the summer months and late afternoon and early evening short path for the relatively high reliability propagation between October and April

The challenge now is to produce an equivalent set of graphs for the solar minimum years. I hope we can call upon some dedicated listening from Six and Ten club members!