Is there a FAI-scatterer above Budapest?

by Volker Grassmann, DF5AI, Hannoversche Str. 103, D-Göttingen-Weende

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FAI observations made in Europe are often supposed to be created in particular geographical regions, see e.g. [1] to [3]. Such regions are assumed to be above the QTH-locator squares JH (Budapest), DG (Geneva) and CK/CL (Bruxelles). There is no doubt that the ionosphere is sensitive to diurnal and seasonal variations and such dependencies are more or less well known. The presumption that particular areas in the E-region level could be responsible for a very special FAI activity goes even further and promotes the idea of so called "hot spots". To answer the question given in the title of this paper: yes, certainly there have been FAI events above the mentioned locator squares. The FAI-report 1986 [3] proves that a great number of FAI-QSOs hacve been performed by just a few scatterers. Did radio amateurs discover a remarkable geophysical phenomenon? The observations reported are reliable and there is no reason to believe that these results were obtained by chance as the FAI-report summarizes long term observations.

Several conditions are required to establish a FAI radio link, see e.g. [4]. First, suitable ionospheric conditions must be available. Furthermore, a suitable scatter geometry must be set up by the locations of the transmitter, receiver and scatterer. In particular both the transmitter's and receiver's antenna must be directed at a common scatter volume. These requirements were fulfilled for the observations in concern, otherwise these QSOs could not have been made. The TX- and RX-antenna headings may be used to estimate the location of the scatterer involved. Due to the relatively broad beam width of amateur aerials a limited spatial resolution must, however, be considered. In a distance range of 700km a 30° beam, for e.g., is blown up to a total width of 375km (measured perpendicular to the antenna axis)! This ambiguity in resolution may not be neglected. As an example, let us refer to picture 1 in the FAI-report ([3], page 155) where a FAI-QSO from the ZH- to the II-square is analysed. Both radio terminals lie on the 3° -contour as indicated. Now consider what would happen if the contour-set is shifted to the right so that both stations then lie on the 0° -contour. The scatterer would move from the BL- to the DL-square accordingly. Thus another solution is found which would also be valid for this particular QSO! There is also the possibility of an extended scatterer from BL to DL, rather than a localized one. In fact, our antennas do not allow sufficient resolution to distinguish between these two cases. The conclusion to be drawn from this experiment is that there are always several scatterers which can contribute to a given FAI radio link. More generally speaking, we have to consider a "scatter-line" rather than a "scatter-point".

Radio amateurs profit from a relatively dense and very valuable network. However, the geographical distribution of stations is not uniform. During my SWL-time of amateur radio I marked all 2m-observations on a large locator map. Centres of VHF-activity were found to accumulate near large cities in DL, G and F and along mountain chains. FAI observations are also weighted by the distribution of radio stations. One of the most active European areas for FAI-communication is, for e.g., HB9 and south-DL. From these locations propagation tests were organized to Bulgarian amateurs. We may assume one of the Bulgarian VHF-centres to be located in the LC-square. The computer program briefly described in [4] is able to display all the scatterers which could establish a FAI-link between the EH- and the LC-square (please note that there is an additional paper explaining this program in detail). The picture (please refer to DUBUS 1/88, page 22) shows the scatter-line extending from the FJ- to the MG-square. The center of the scatter-line is close to the JH-square (Budapest). Thus we immediatly have an indication for why this square is especially important. Assuming the actual scatterer to be at the FJ-position leads to less favourable conditions for the QSO-partner located in LC. The propagation path from Sofia to the scatter-volume is farest away. Furthermore, an antenna elevation of

20° is required in the EH-square. The problem is reversed when one assumes that the scatterer is above MG. Now the distance from HB9 or south-DL to the scatterer is maximum (about 1100km). Using the midpoint of the scatter-line instead of the end points would imply equal conditions for both the radio stations. The distances are reduced to about 750km for both and an elevation of 5° is also favourable. This area is above the JH-square! The same considerations may be made for the FAI-link between ZH and II.

We should, therefore, not expect "hot FAI-spots" to be associated with very special geophysical conditions. Instead we have to consider that some scatterers are favoured due to the scatter geometry involved with a specific radio link. Radio amateurs interested in FAI-propagation may find such an optimal scatterer in conjunction with a particular test partner. This scatterer may not be identical to scatter-locations published by other amateurs.

However, a scientific task is left for radio amateurs. It is of great interest to obtain information on the latitudinal dependency of FAI. Is the FAI-zone separated from the radio-aurora zone or is there a gradual transition between them? Using the example already given here, the sked partners in HB9/DL and LZ should try to perform special tests via the end point scatterers. The distance dependency could be removed by theoretical considerations and what remains is a distribution function of FAI-activity along the scatter-line. In this case the FAI-activity in the range of 45° to 50° latitude could be obtained. Tests like this could be made in other parts of Europe in order to deduce a more complete picture of latitudinal dependance. Results of this kind would be very valuable for the physics of the ionosphere.

References:

[1] FAI-Informationen, DUBUS 4/1986, S. 358-360
[2] FAI-Information, DUBUS 1/1987, S. 64-66
[3] FAI-reports 1986, DUBUS 2/1987, S. 151-158
[4] Rückstreuungen ultrakurzer Wellen an Feldlienien-orientierten Irregularitäten, DUBUS 3/1987, S. 182-189