

July 4th, 1950
P.O. Box 4868
Cleveland Park Station
Washington, D.C.

Dr. J. L. Pawsey
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Dear Pawsey:

For the past several months I've been investigating the problems surrounding interferometry over the sea. My present thoughts run along the following lines.

The question of sea roughness is still uncertain. However if other factors are absent, it appears the sea is a good reflector to wavelengths as short as 3cm quite often and to 10cm under most conditions. On June 4th I wrote to Piddington on this matter and mentioned some tests off Oahu. These appear to be the best that have been carried out so far. While no printed account seems to exist yet, I've seen the chart records and the data is excellent. Under separate cover I am sending a copy of a rather old report on some experiments carried out near Boston. The data isn't as good as the Hawaiian data but it gives an idea of what may be accomplished. The text also explains the various difficulties with this type of experiment.

The second major problem is atmospheric bending. An extra copy of a CRPL report is also being sent. For precision work the refraction should be known to better than a minute of arc. From the above report it seems that no approximation using a factor for effective earth curvature (such as $4/3$ times the radius) will suffice. This is because the shape of the refraction curve will not fit any such simple factor. To achieve precision results a ray tracing scheme will have to be invoked such as is described in the report.

The next thing that needs to be known is the condition and stability of the atmosphere in the region where the measurements are being made. Since the radio refraction is greatly dependent upon temperature and watervapor, both daily and annual cycles will be encountered. These will be less pronounced in the tropics and on islands in large oceans.

The question of stability is quite difficult to handle. Thin layers of heated air which cause optical shimmering do not seem to be important at radio wavelengths. Day to day changes in pressure, temperature and humidity probably will introduce more gross errors. At the present time I'm

in the process of analyzing a lot of radio sonde data. Both daily and annual cycles are readily observable, and the analysis is incomplete. However a first estimate indicates that 80% of the measures will be within the desired one minute accuracy if (a) the angle of incidence is one degree or greater, (b) the same month of the year is used, (c) the same quarter of the day is used. I find the charts in the back of the report very useful but difficult to read. Therefore I've had some enlargements made which greatly facilitates matters. A set of these are being sent.

I hope the above remarks will be of some use. If you disagree, I'll be pleased to learn in what way.

Your movies showing activities in radio astronomy, ionosphere and moon echoes were very interesting and I enjoyed them greatly.

Best regards,

Grote Reber