

Muldrew D B. Flayer ionization troughs deduced from Alouette data.
J. Geophys. Res. 70: 2635-50, 1965.

A pronounced minimum of electron density, having a relatively narrow latitudinal range, exists in the F region of the earth's ionosphere from late afternoon until sunrise. This minimum or trough extends in the east-west direction and approximately circles the earth's magnetic pole at a distance of about 30° of latitude from it at night. During magnetic disturbances the trough can move 10° of latitude or more southward. [The SCJ® indicates that this paper was cited 148 times in the period 1965-1977.]

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"The Alouette I Canadian-built satellite was launched by the United States on September 30, 1962. If a satellite's success can be measured by the number of scientific papers resulting from data collected by it, then Alouette I is the most successful near-space scientific satellite ever built. I was fortunate to be in the group of scientists at the Defence Research Telecommunications Establishment of the Defence Research Board who first looked at the Alouette I ionograms (i.e., radio soundings of the earth's ionized atmosphere). The first few years after launch were exciting times, because in the space of a few years a great deal was learned about the ionosphere.

"It was not until at least a year after launch that I started working on troughs. In the first year, I studied irregularities or depletions of electron density in the ionized

atmosphere, which are about one kilometer in diameter and are up to 10,000 km long, extending along the earth's magnetic field lines from one hemisphere of the earth to the other. At that time, and even now, I found these irregularities more fascinating than the trough. However, the trough was more closely related to the gross structure and dynamics of the magnetosphere, and these subjects were being pursued, and still are, by a large number of geophysicists around the world.

"Also, just two years before the publication of the trough paper, Carpenter had published his paper on the 'knee' in the magnetospheric ionization density profile at a distance of about 4 earth radii from the centre of the earth at the equator.¹ This knee is presently referred to as the plasmopause. At the time of publication of my trough paper there was a great deal of interest in the plasmopause, and since the plasmopause and trough at night lie approximately on the same magnetic field lines, it is natural that researchers would try to relate the two.

"It might be interesting to state how the trough was first discovered. The fact that large horizontal gradients in electron density occur in the midlatitude ionosphere was known both from the first Alouette I ionograms and from bottomside ionograms recorded before Alouette was launched. I think researchers thought that these occurred randomly and were probably local depressions or holes in ionization. However, after examining hundreds of Alouette I passes (each pass containing about 30 ionograms recorded about one degree of latitude apart), it struck me that there was a repeatability from pass to pass which was not random. Further examination, of course, proved this to be correct."

1. Carpenter D L. Whistler evidence of a 'knee' in the magnetospheric ionization density profile, *J. Geophys. Res.* 68:1675-82, 1963.