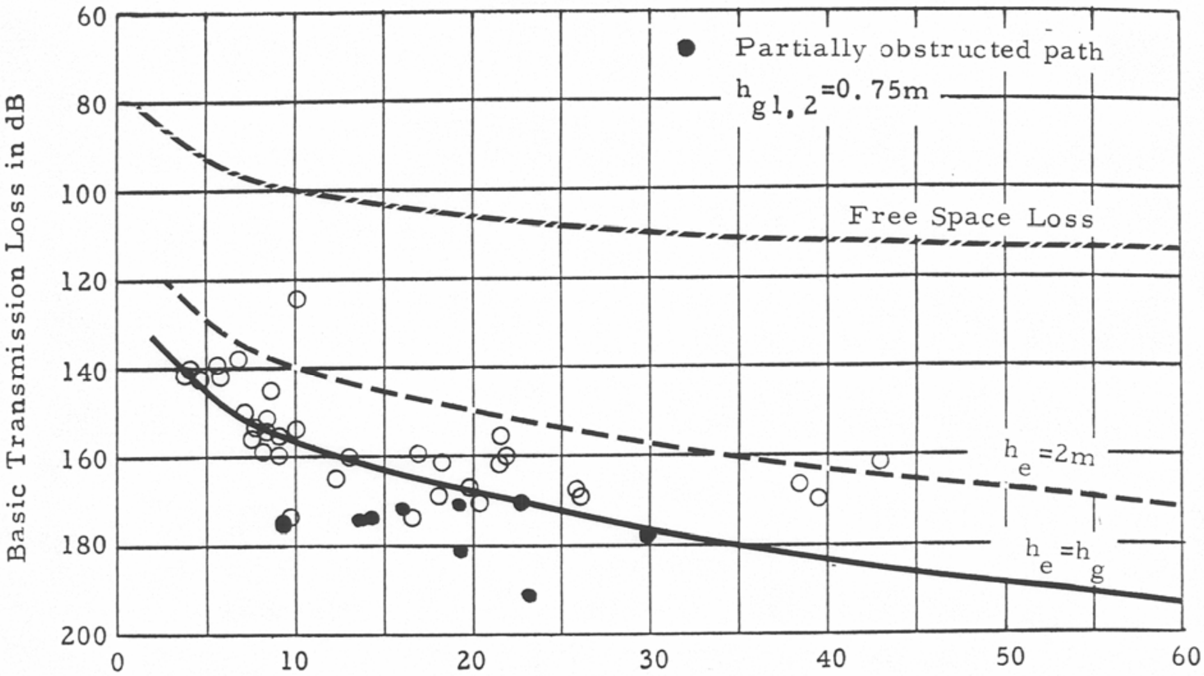

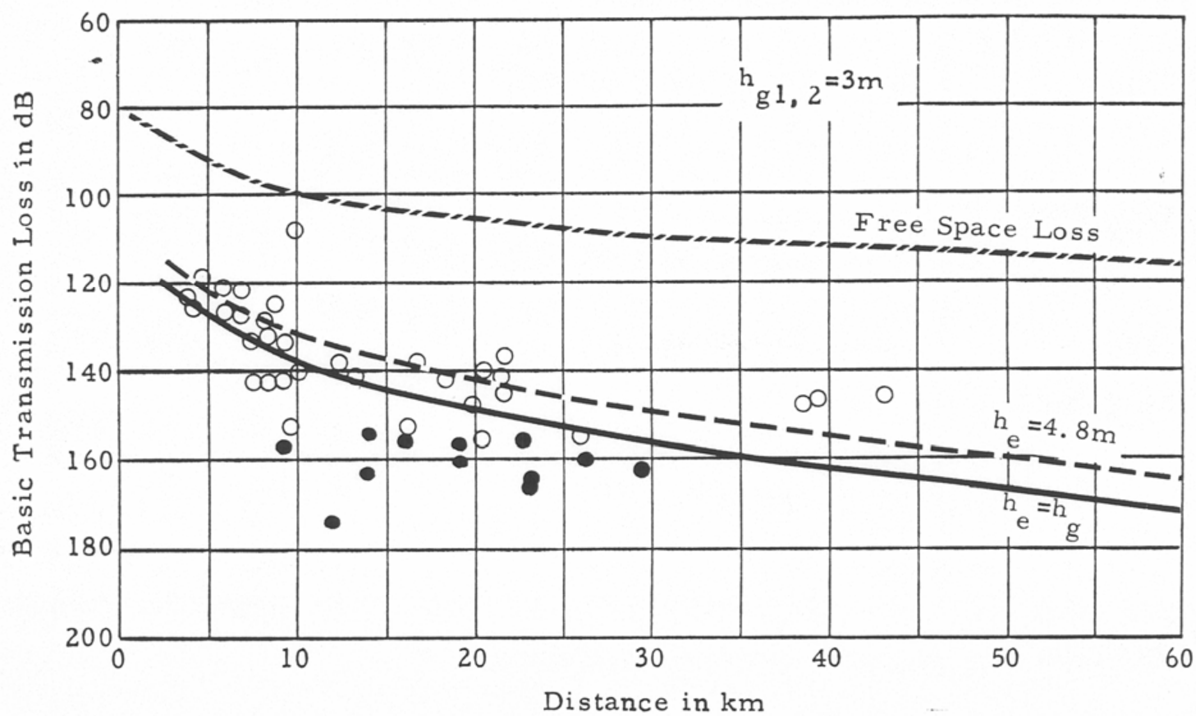

Figure 15. Basic transmission loss, measured and predicted, Laramie range, Wyoming, Δh=120m, f=230MHz.

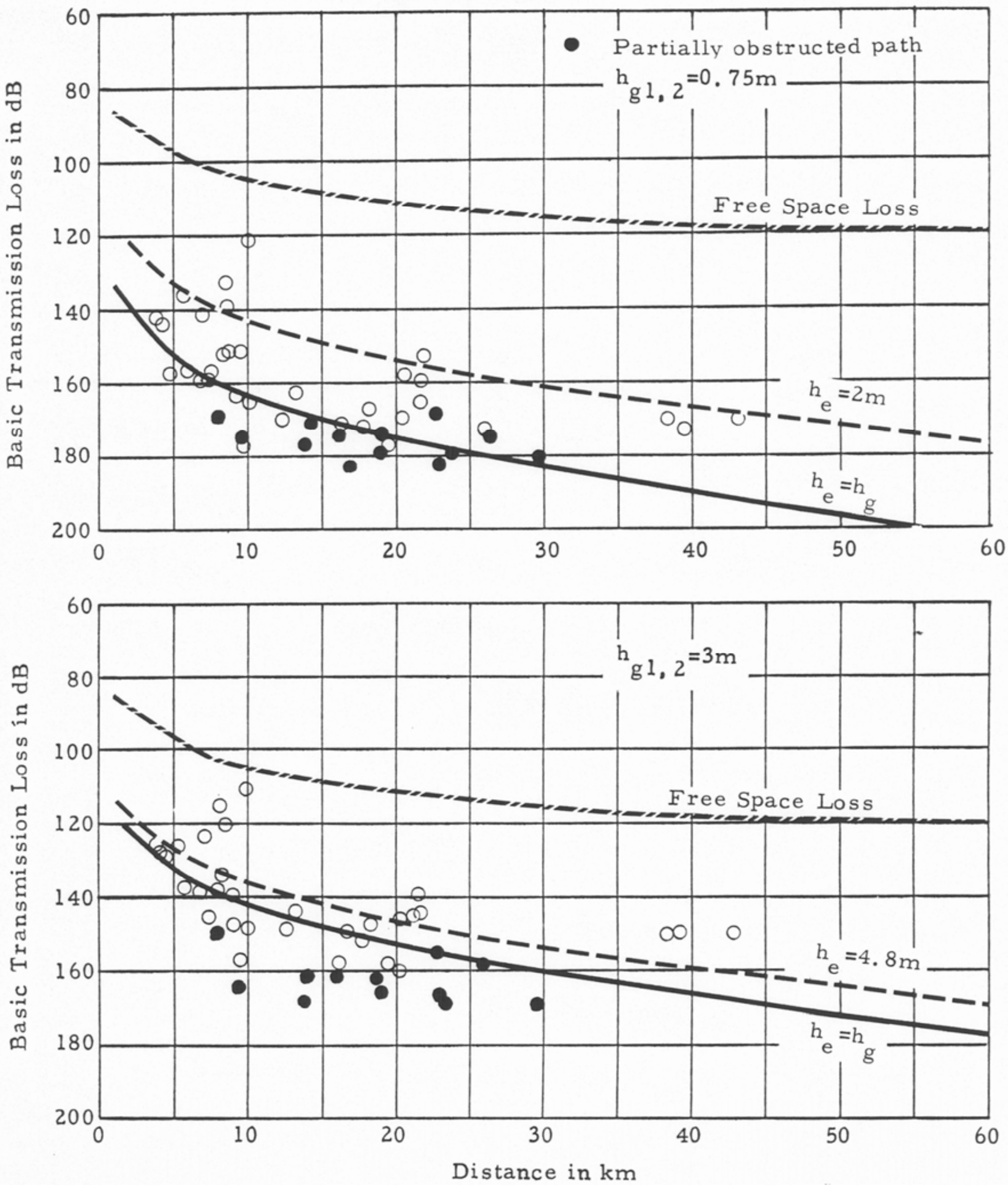

Figure 16. Basic transmission loss, measured and predicted, Laramie range, Wyoming, Δh=120m, f=416MHz.

shows that the three paths that are more than 38 km long are all single horizon knife-edge diffraction paths, where less than average transmission loss is expected.

The path-to-path or location variability is not very large, with a standard deviation of 9 or 10 dB. If care were exercised to select only antenna sites with clear foreground terrain, the larger values of transmission loss could be avoided, even with these very low antennas, and the path-to-path variability would be considerably reduced. For many applications the variability introduced by low values of transmission loss over unusually favorable line-of-sight or knife-edge diffraction paths is much less important than that resulting from unusually poor propagation conditions.

2.4.2 Idaho Paths

Measurements were made over some 31 paths in the lava flows of Idaho. The area consists of extensive plains cut by stream valleys. In the northeastern part much bare lava is exposed, while to the southwest there is a considerable depth of soil in places with some sagebrush and prairie grass cover. No detailed maps are available for most of the test area and profiles were read from one by two degree maps with a contour interval of 200 ft. Maps on this scale show only the gross features of terrain, so estimates of the terrain parameter, the horizon distances, and the elevation angles are subject to considerable error. For a few paths located in the southwestern part of the area, finer scale maps are available. Information from these was compared with that from the coarse-grained maps and for these few paths no major differences were noted. This is relatively smooth terrain, with a median value Δh = 60 m and an interdecile range of Δh from 25 to 116 m.

Figures 17 and 18 show measured and predicted values of transmission loss plotted as a function of distance for equal antenna

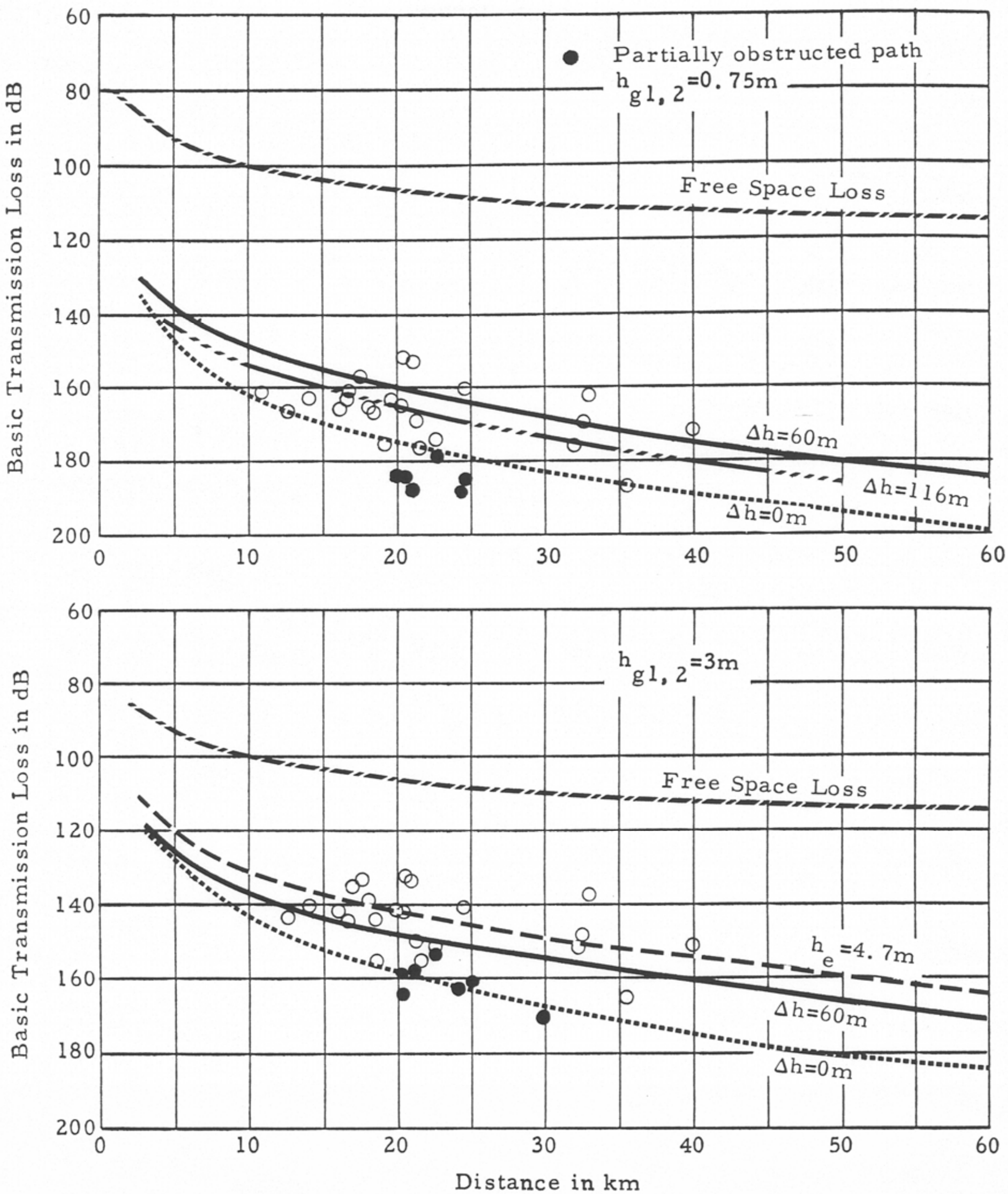

Figure 17. Basic transmission loss, measured and predicted, lava flows, Idaho, median Δh=60m, f=230MHz.

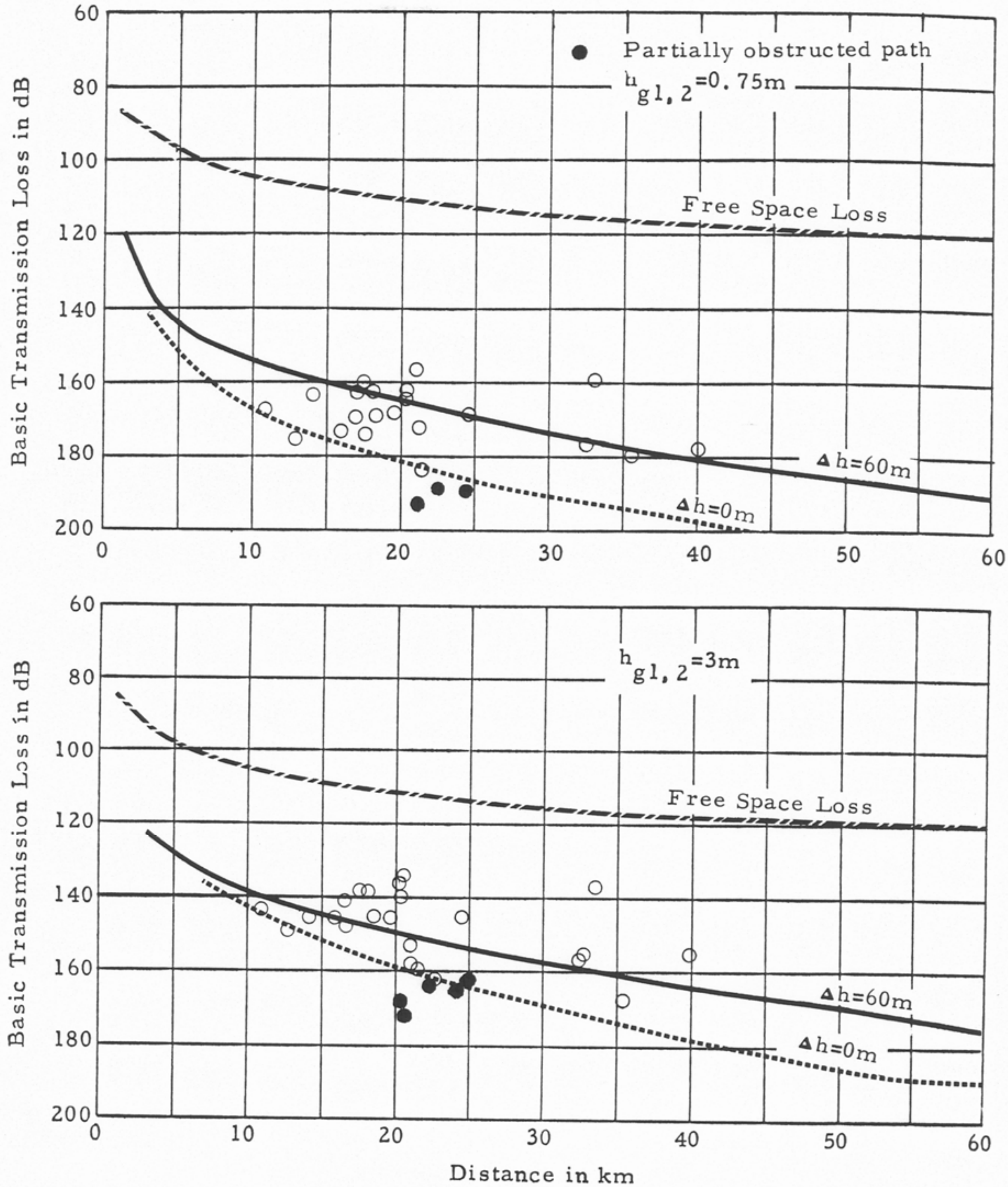

Figure 18. Basic transmission loss, measured and predicted, lava flows, Idaho, median Δh=60m, f=416MHz.

heights of 0.75 and 3 m, at frequencies of 230 and 416 MHz. Three curves of predicted basic transmission loss are shown in the upper half of figure 17 for values of Δh = 0, 60, and 116 m, assuming the effective antenna heights equal to the structural heights of 0.75 m. These curves show the minimum, median, and upper decile of the estimates of Δh for the 30 measurement paths. Note that as Δh increases from zero to 60 m, the predicted values of basic transmission loss decrease, but that a further increase in Δh results in an increase in the predicted loss. For the paths in this area the median value $\Delta h = 60$ m is an optimum value for propagation, so with the lowest height many of the measured values show more loss than predicted, and the medians of data lie about halfway between the curves for $\Delta h = 0$ and $\Delta h = 60$ m. The lower half of figure 17 shows three prediction curves, two with $h_e = h_g = 3$ m for Δh = 0 and 60 m, and one for $h_e = 4.7$ m, $\Delta h = 60$ m. In this figure the curve drawn for effective antenna heights equal to the structural heights with the median value of Δh describes the medians of the data. In figure 18, where only the curves for $h_e = h_g$ and for Δh = 0 and 60 m are drawn, similar results are observed.

Photographs from each site in the direction of the other antenna show that in some cases the path is partially obstructed by a nearby hill, or the immediate foreground is obscured by sagebrush. These paths are coded in the figures, and show larger than average values of transmission loss. Even in this comparatively smooth terrain care in site selection can avoid unusually poor paths and reduce location variability, but no great advantage can be gained from siting for unusually good propagation conditions because there are few isolated hills or ridges .

2.4.3 <u>Washington Paths</u>

Measurements were made in three localities in Washington at frequencies of 230 and 416 MHz. Fifteen paths were located in an area of plains and low hills near Ritzville, where some of the acreage is planted in wheat, and the rest is covered by prairie grasses. This terrain is characterized by a value $\Delta h = 70$ m. A second group of 39 paths were chosen in rugged terrain with steep hills, coulees, and deep canyons with almost vertical walls, where the principal ground cover is sagebrush. The median value of the terrain parameter $\Delta h = 210$ m for these paths is used to characterize the terrain in this area. A third group of 14 paths were selected in the Spokane river valley near Fort Spokane. These are short paths with a common receiver site in the valley and transmitter sites in the surrounding mountains. The terrain is very rugged, characterized by a value $\Delta h = 305$ m, and is largely covered by coniferous forest.

The measurements made near Ritzville and corresponding predicted values are shown in figures 19 and 20. The predictions are for randomly chosen sites, with the effective heights equal to the structural heights. The results in this area are quite comparable to those in Idaho.

Measurements made in the areas of rugged terrain are shown in figures 21 and 22. Data from the few short paths in the Spokane area are included with the larger sample. Although no specific attempt was made to choose sites that would provide good propagation conditions, an examination of the path profiles shows that most of the sites were selected on hilltops and provide an unusually large number of line-of-sight and single horizon paths. The curves showing predicted values are drawn for selected sites with $\Delta h = 210$ m. Using $\Delta h = 305$ m the predicted values are a little larger than those shown by the curve. At both 230 and

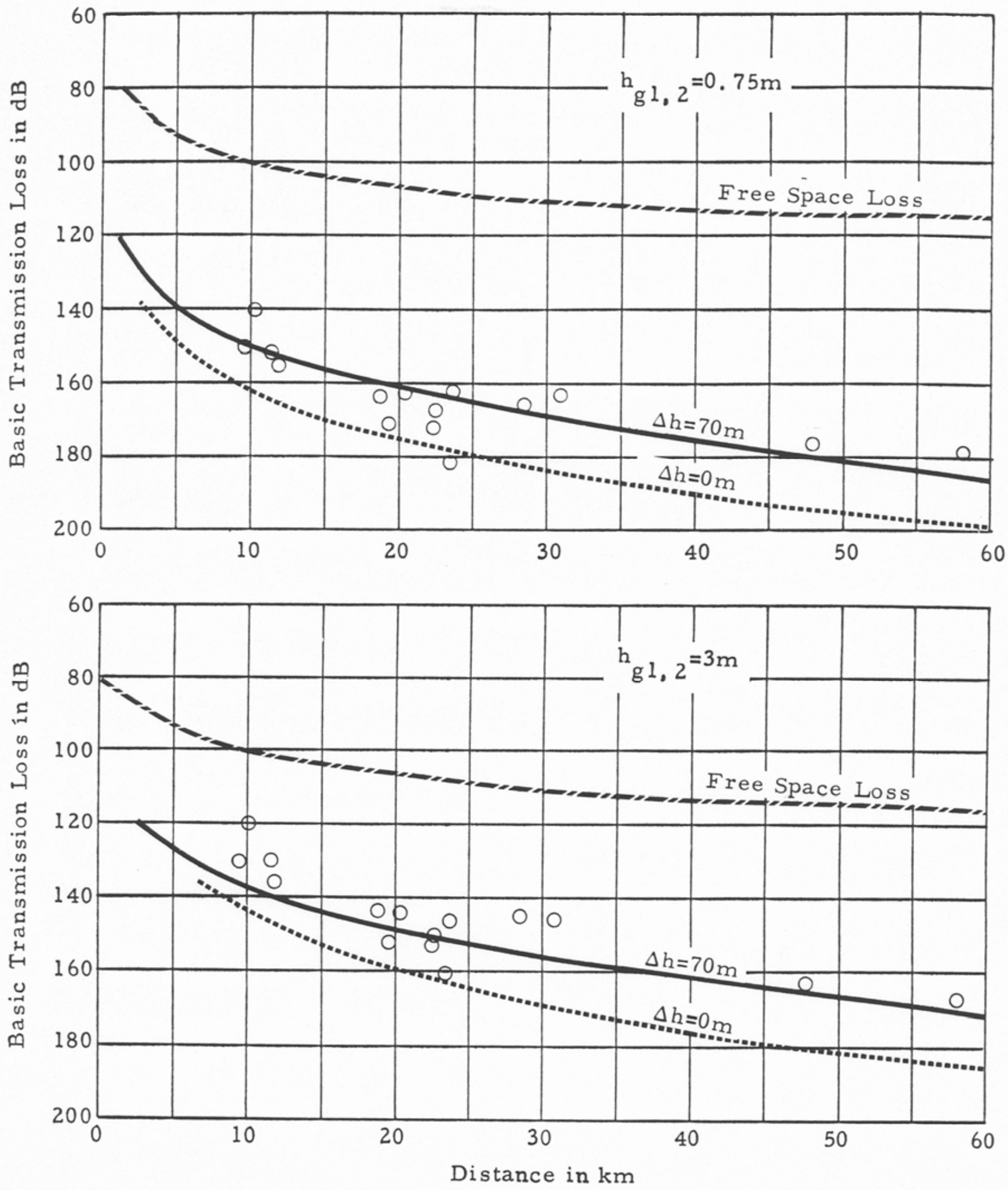

Figure 19. Basic transmission loss, measured and predicted, Ritzville area, Washington, Δh=70m, f=230MHz.