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COMPARISON OF TOOLANGI MAGNETIC STANDARDS WITH THE PROTON PRECESSION MAGNETOMETER AT WOOMERA, SOUTH AUSTRALIA 1960

by

R.G. Curedale

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SUMMARY

This Record describes the comparison between magnetic field instruments, which had been compared with the standard absolute instruments at Toolangi, and the proton precession magnetograph of Weapons Research Establishment. The observations were made on 27th and 28th June 1960 at Woomera.

1. PLAN OF OPERATIONS

The elements read by the field instruments were H (horizontal intensity), D (declination), and Z (vertical intensity). The proton magnetograph produces a digital output of F (total intensity), D, and I (inclination).

It was impossible to observe in the exact location of the proton magnetograph. Two stations, each about 200 ft from the magnetograph, were used while the magnetograph was in operation, and a third station, within a few feet of the magnetograph, was used while the magnetograph was not operating. Two instruments (HTM 507704 and QHM 305) were used for H and D, and one (BMZ 221) for Z. In this way station differences were established between the close and remote stations, and it was assumed that the station difference between the close station and the magnetograph was negligible. The comparison was effected by simultaneous observations of both H and D. Station differences in Z could not be determined. It was assumed that the value at the magnetograph was the mean of the values at the two remote stations. A previous Z-survey indicated that this was very nearly correct.

To determine F and I, observations were made in the sequence H, Z, H.

2. INSTRUMENT CORRECTIONS

Comparisons before and after the survey at Toolangi Observatory indicated the following corrections:

HTM 507704	+ 7 γ for H,	+ 2.0' for D
QHM 305	+ 3 γ for H,	+ 3.9' for D
BMZ 221	+ 11 γ for Z	

These are based on Toolangi final standard. The final standard for H is defined by corrections to Ruska No. 4813, which are based on comparisons with Rude Skov magnetic standard. The final standard for D is based on calibrations of Ruska No. 4813 at Cheltenham Observatory. The final standard of Z is based on the final H standard and observations with a Schulze earth-inductor, applying a correction of + 0.3'.

3. RESULTS

It is considered that the proton precession magnetograph measures F very accurately, but D and I less accurately than they can be determined by the field instruments. Therefore the comparisons of D and I must be considered to define corrections to the proton magnetograph, and the comparison of F to determine corrections to either H or Z standards at Toolangi.

F comparisons

Observed total intensity (F_o) is defined as the square root of the sum of the squares of observed H and observed Z. Writing F_p for the simultaneous value given by the proton magnetograph, the mean of 14 observations is

$$F_p - F_o = + 20 \gamma$$

D comparisons

The mean of 33 comparisons between D_o (observed with field instruments) and D_p (given by the proton magnetograph) is

$$D_p - D_o = - 4.0'$$

I comparisons

Comparisons of I can be made from two points of view. If I_o is defined as $\tan^{-1}(Z_o/H_o)$ the mean of 14 comparisons gives

$$I_p - I_o = + 2.16' \text{ algebraic}$$

Because Z_o is subject to more uncertainty than F_p, it may be more correct to define I_o as $\cos^{-1}(H_o/F_p)$.

In this case

$$I_p - I_o = + 2.65'$$

Z comparisons

A value of Z can be defined by H_o and F_p. Calling this Z_p so that

$$Z_p^2 = F_p^2 - H_o^2$$

the comparison with Toolangi Z standard is given by

$$Z_p - Z_o = + 22 \gamma$$