Following the Metric Conversion Act of July, 1970, the Metric Conversion Board has circulated Universities and will be encouraging industry to commence the conversion to the new International System (SI) units. In addition, there is the still valid reason that the new units are inherently simpler (Kofoed, 1967; Green, 1968) than the old units which they replace. The approved system is based on the following seven fundamental units:

- kilogram kg
- meter m
- second sec
- ampere A
- kelvin K
- candela cd
- mole n

With these units and with all derived units, only approved sub-multiples are to be used, e.g.:

- milli $10^{-3}$ m
- micro $10^{-6}$ μ
- nano $10^{-9}$ n
- pico $10^{-12}$ p
- femto $10^{-15}$ f

It is the sub-multiples which are usually of significance in Geophysics. Some inconvenience arises in the change from the traditional c.g.s. units to the SI units, but some inconvenience in passing is preferable to continuing confusion in the future.

Gravity: Density, in future, will be given in terms of k gram/cubic metre, in which case the density of water is 1000 kg m$^{-3}$, and the normal continental crust will be given as 2670 kg m$^{-3}$.

The expression for the International Formula (1924) is recast as:

$$T_i = 9.780490 (1 + 0.0052884 \sin^2 \phi - 0.0000059 \sin^2 2\phi) \text{ m-sec}^{-2}.$$ 

The old c.g.s. unit of cm sec$^{-2}$ or gal (named in honour of Galileo, Jung, 1961; Jeffreys, 1962) is to be replaced, and along with it will be the geophysical unit of the milligal. This is because the "gal" and the "milligal" are not approved sub-multiples in the SI and are to be replaced for this reason. However, the once popular "gravity unit" or 1/10 mgal turns out to be $10^{-6}$ m-sec$^{-2}$ and is thus an approved sub-multiple. Because of the need in geophysics for the unit of acceleration, it is advocated that the proposal (Reilly, 1971; Parasnis, 1971) for the unit of m sec$^{-2}$ be called the Galileo, be adopted. In this case the "gravity unit" becomes the micro-Galileo. Hence, 1 milli gal = 10 μ Galileo.

In other words, the gravimeter will be reading in steps of "μ Galileo" instead of the "gravity-unit" of 1/10 milli gal. Contour maps will be given in terms of the convenient unit of "Galileo" or...
0.1 milli gal.

Contour maps of the vertical gradient or of first derivative will be un-
changed with the new SI units. This is because it has been tradition to
give vertical gradients in terms of Eotvos units (≈ 10^{-9} sec^{-2}) which
depends only on the dimension sec^{-2} and consequently does not re-
quire any change.

In the case of the second derivative contour maps, the unit is strictly
m^{-1} sec^{-2} but usage has it to quote it in terms of milli gal/km^{2}, and
it would seem more meaningful to continue to use milli gal/km^{2} which
is 10^{-15} m^{-1} sec^{-2}. This quantity is an SI-approved sub-multiple of
the basic unit of m^{-1} sec^{-2} and the prefix to denote 10^{-15} is femto
(symbol f).

Consequently it would appear logi-
cal to continue to use milli gal/km;
contour maps of which would be un-
changed but expressed as femto
m^{-1} sec^{-2}.

The Universal Gravitational Constant,
G, is numerically equal to 66.7
10^{-12} m^{3} kg^{-1} sec^{-2} in the SI.

Magnetics: It is in geomagnetism
that there could well be the great-
est reluctance to change. Fortu-
nately the SI unit of magnetic
flux, B, is the Tesla (or Weber/m^{2})
and the geophysical unit that has
been in common use is the gamma, and

\[ 1 \text{ gamma} = 1 \text{ nano-Tesla} \]
\[ = 1 \text{ n Tesla} \]

In other words, the magnetic anomaly
map remains unchanged except that
the contours in gamma are renamed
as contours in n Tesla.

Susceptibilities of rocks, x,
being a dimensionless ratio between
the magnetization M and magnetic
intensity, H, remains unchanged.
However, let us hope that the old
silliness of quoting suscepti-
bilities (which are dimensionless)
as x c.g.s.e.m. units - it is a
pure number, unchanged in value
in the change to the SI units -
will be discontinued.

The magnetization, M, for rocks
presents a distinct difficulty
because the SI unit of amp m^{-1} is
1000/4\pi of the old unit of inten-
sity of magnetization. Where
maps of surface magnetization, M,
are presented there seems little
alternative but to present the
data in terms of milli amp/m. These
are convenient in magnitude being
1/4\pi numerically, of the contour
values of the the old units which
have been used. Also where the
dimension of the new SI unit is
clearly stated, there is little
room for confusion with c.g.s.
values.

In other fields of geophysics,
seismic velocities in m/sec are
well established, likewise resis-
tivity values in ohm-m are widely
used and there is no difficulty
in the change to SI units.

Conclusion: It would appear that
it is advisable for geophysicists
to make the change recommended
initially by the E.A.E.C. in 1967
(Koefoed, 1967) as soon as possible
so as to conform with the SI units,
especially as, in the future,
sience and later the general pub-
lic will use the SI units exclu-
sively. By making the change
now, continuing confusion may be
avoided in the future. Besides
asking for conformity with the
SI unit, there is the proposal that
the SI unit of acceleration be
called the Galileo (m sec^{-2}) in
which case the geophysical gravity
unit of 0.1 mgal would be 1 \mu
Galileo.
References:


