Werk

Jahr: 1974
Kollektion: fid.geo
Signatur: 8 Z NAT 2148:40
Digitalisiert: Niedersächsische Staats- und Universitätsbibliothek Göttingen
Werk Id: PPN1015067948_0040
PURL: http://resolver.sub.uni-goettingen.de/purl?PPN1015067948_0040

LOG Id: LOG_0041
LOG Titel: Note on determining hourly mean values
LOG Typ: article

Übergeordnetes Werk

Werk Id: PPN1015067948
PURL: http://resolver.sub.uni-goettingen.de/purl?PPN1015067948
OPAC: http://opac.sub.uni-goettingen.de/DB=1/PPN?PPN=1015067948

Contact

Niedersächsische Staats- und Universitätsbibliothek Göttingen
Georg-August-Universität Göttingen
Platz der Göttinger Sieben 1
37073 Göttingen
Germany
Email: gdz@sub.uni-goettingen.de

J. Geophys. 40, 255–257, 1974

Short Communications

Note on Determining Hourly Mean Values

J. C. Larsen

Hawaii Institute of Geophysics, Honolulu

Received June 14, 1973; Revised Version January 16, 1974

Key words: Hourly Mean Values — Geomagnetic and Telluric Data Analysis.

Continuously recorded data are often reduced to hourly mean values in order to decrease the amount of stored information and aliasing.

Consider the time series $f(t)$ recorded on a strip chart with time marks at regular intervals Δt. The values of the desired new series are

$$\bar{f}_i = \frac{1}{\Delta t} \int_{t_i}^{t_i + \Delta t} f(t) dt \tag{1}$$

where $i = 1, \ldots, N$. The standard graphic technique for obtaining these mean values is based on fitting a straight horizontal line

$$s(t) = A_i \tag{2}$$

to the segment $t_i \leq t \leq t_i + \Delta t$ of the curve $f(t)$ such that the difference

$$n(t) = f(t) - s(t) \tag{3}$$

has vanishing mean, i.e., $\bar{n}_i = 0$. Then the mean of Eqs. (2) and (3) yields

$$\bar{f}_i = \bar{s}_i = A_i. \tag{4}$$

In other words, the desired mean is the ordinate of the horizontal line. This is the basis of the scaling procedure used at magnetic observatories (McComb, 1952).

The modification proposed by this paper is to fit a straight sloping line

$$s(t) = A_i + B_i t \tag{5}$$

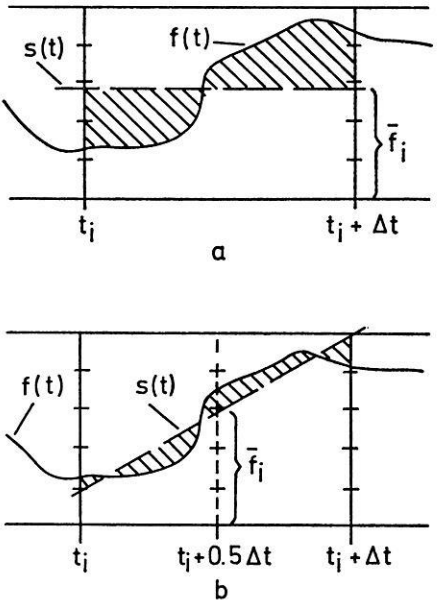

Fig. 1. Horizontal (a) and sloping (b) straight lines s(t) fitted to curve $f(t)$. Vertical lines are time marks. The hachured area, $f(t)$—$s(t)$, has zero mean. The mean value, $\bar{f}_i$, is the intersection of $s(t)$ with the vertical midpoint scale line (vertical dashed line)

to the segment $t_i < t < t_i + \Delta t$ of the curve $f(t)$ (Fig. 1) rather than fitting a horizontal line. As before, one requires the mean of the difference, $f(t)$—$s(t)$, to vanish. Then the mean of Eqs. (3) and (5) yields

$$\bar{f}_i = \bar{s}_i = A_i + B_i\,\bar{t}_i.$$

Thus, the desired mean is the midpoint value of the fitted sloping line, i.e., the value of $s(t)$ at $t = \bar{t}_i + 0.5\ \Delta t$.

Note that the actual value of the hourly mean is the same whether obtained by the best horizontal line or the best sloping line. The only advantage of fitting a slope is that it is easier to equalize the areas above and below the line if $\bar{n}_i^2$ is made small.

A very simple device has been used to obtain hourly mean values by the sloping line method. The device consists of a scale (Fig. 2a) that is placed on the strip chart record such that the hour marks of the record are aligned with the vertical hour mark lines, H, of the scale and the horizontal base line, L, is aligned with the base line of the strip chart. The midpoint scale line, M, divides the hour into equal parts. A movable piece (Fig. 2b) with

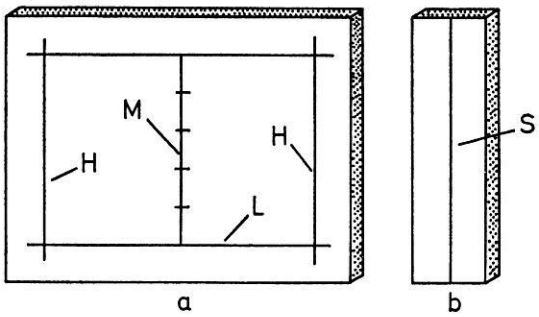

Fig. 2. The scale, a, has two vertical hour marks, H, a midpoint scale line that divides the time interval equally, M; and a base line, L. The movable piece, b, has a straight line S

a straight line, S, is then placed on top of the scale and fitted with any slope to hourly segments of the recorded curve. The fit is such that the difference between the sloping line and the curve has zero mean. The desired mean value is then the intersection of the sloping line with the midpoint scale line. To eliminate parallax, the scale (Fig. 2a) is photographed on a thin piece of plastic.

This device has been found to be fast, easy, and accurate. Routine application of the device to telluric data indicates that in less than four hours a month of data can be reduced to hourly mean values.

Reference

McComb, H. E.: Magnetic Observatory Manual, Special Pub. *283*, p. 177–178, U. S. Government Printing Office, Washington, D. C., 1952

Dr. Jim C. Larsen
Hawaii Institute of Geophysics
University of Hawaii
Tsunami Research Effort NOAA
Honolulu, Hawaii 96822, USA