

Longitudinal and Latitudinal Effect Estimated by Observations on Board the Soya

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宗谷船上観測による電離層経緯度効果の検討

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要 旨

我が国の南極観測隊は過去4回の遠征のうち3回に亘り観測船宗谷の船上において電離層の観測を行なったのである。このような観測については(1)船舶は時々刻々移動するものであるため観測地点が観測の度に変ること、(2)電離層の特性は日によりかなり大きく変動するため1日だけの観測によって1地点のその時期における特性を代表することが難かしいこと、等の理由から得られた観測値の利用価値について種々論議されるわけである。

このような論議に対して解決を与えるため実測された宗谷の船上観測値を緯度についてプロットした系列と、他の陸上固定観測所における観測値

の月中央値から求めた緯度変化とを比較して見た。またそれと同時に宗谷の航路附近の観測所であるSingaporeにおける月間標準偏差と、船上観測による観測値のバラツキとの関係を検べて見た。その結果、上記プロットは固定観測所の観測から求めた緯度効果と較べて妥当な形を示しており、且そのバラツキは附近の固定観測所のものと殆んど一致していることが明らかとなった。従ってこのような移動観測が移動の間途切れることなく続けられ、その間に異常変化がないならば、得られた観測値の系列は一種の確率過程と見られるものであって充分信頼出来る経緯度効果を推定出来るのである。その推定其の他の取扱い方法は凡べて時系列理論に準じて行うべきである。

In drawing the world maps of the characteristics of the ionosphere, it should be earnestly desired to make a collection of many data obtained at ionospheric sounding stations which are distributed widely in different regions of the world. During the IGY and the IGC, several new stations were established in the interior of Africa and South America, and the data obtained at such stations must surely help towards the construction of the world maps of the ionosphere. But in the oceanic parts, such as in the Pacific Ocean, the Atlantic Ocean, etc., there are few stations, and the conditions, and the condition of the ionosphere is completely unknown. The lack of knowledge of ionospheric conditions over these oceans enhances the difficulty of making up the world map of characteristics of ionosphere.

As a work of the first (1956-1957) and the third (1958-1959) Japanese Antarctic Research Expeditions, routine ionospheric soundings were carried out on board the "Soya" all the way between Japan and Antarctica. The data obtained by these observations are useful for finding the condition of the ionosphere over the Indian Ocean. These data, however, were obtained by observation on board a moving ship, and, of

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course, can not be of the same rank as those gained at fixed stations on land. To speak precisely, we can discuss the longitudinal and latitudinal effect or the locality of ionospheric condition with fairly good accuracy on the basis of the data obtained at fixed ionospheric observatories. But, on the contrary, from observations taken on board a moving ship we can not expect so much information on the geographical effect of ionospheric condition, because the place of observation varies with the time and, accordingly, the ionospheric condition at a fixed longitude and latitude would not be obtained in full detail. Next, we shall discuss the reliability of longitudinal and latitudinal effect obtained from these data and then try to estimate the effect actually.

In Fig. 1 the values of f_0F_2 at 12^h and 00^h U.T. are shown. As described above,

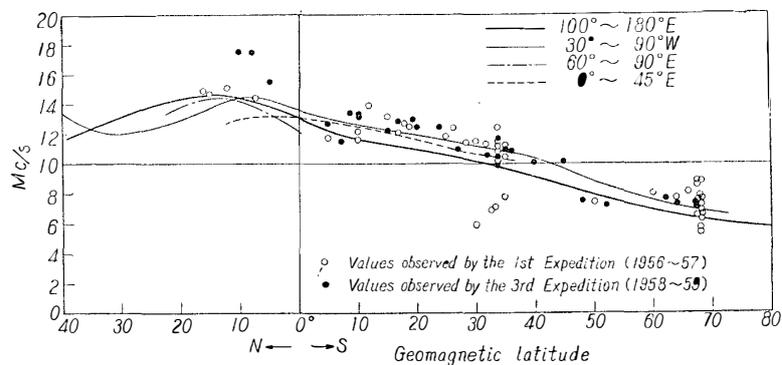


Fig. 1 (a). Values observed on board the Soya. 12^h (L.T.)

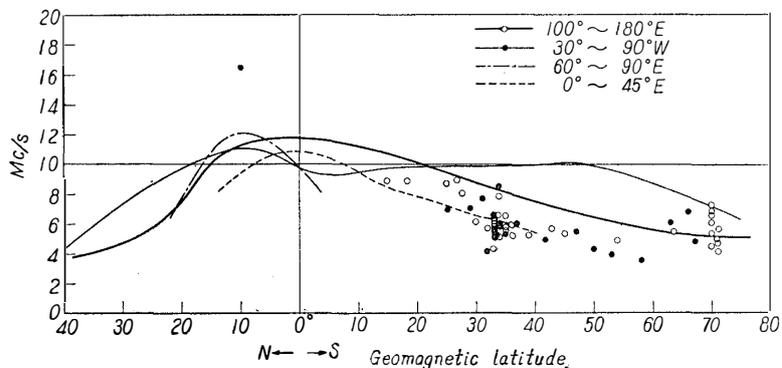


Fig. 1 (b). Values observed on board the Soya. 00^h (L.T.)

these values were obtained by observation on board a moving ship and the longitudinal or latitudinal effect of f_0F_2 can not be determined precisely.

And yet, these values may be put to good use for finding the effect for the following reasons. Namely, there occurred no remarkable disturbance in the ionosphere during these periods and the values shown in this figure are scattered around the estimated line which gives the variation of f_0F_2 against the latitude. The standard deviation of distribution of the logarithm of these values is about 0.03. This value of the standard deviation is nearly equal to that of $\log f_0F_2$ at Singapore, the distributions of which are shown in Fig. 2. (The values of the standard deviation which are estimated from this figure are 0.034 and 0.031, respectively, for December, 1958,

and January, 1959.) This fact shows that these values must probably be distributed around the normal mean (or median) value at each latitude with the same degree of extent as neighbouring fixed stations and the values obtained by the observation on board the moving ship may be effectively used for finding the latitudinal effect such as the monthly medians at fixed stations.

Further, we can assert that these values answer the purpose on the basis of the following fact. In Fig. 3 the median values of f_0F_2 at noon and at midnight for many stations are plotted. Different kinds of marks are used for distinguishing purposes and the latitudinal effects are obtained by zones. The curves in Fig. 1 are transferred from Fig. 3 to show the effects for comparison. It is obviously known from this figure that the f_0F_2 values observed on

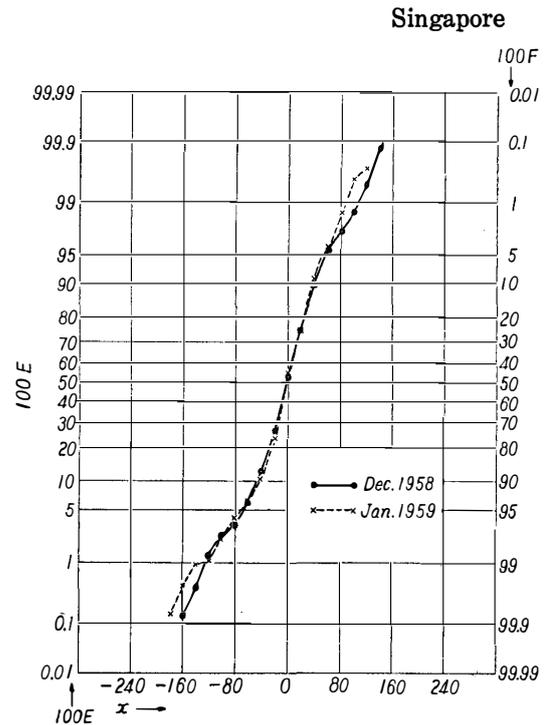


Fig. 2. Accumulative distribution of $\log f_0F_2$.

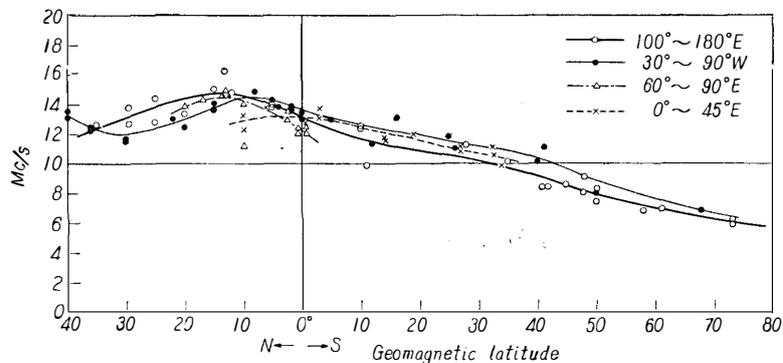


Fig. 3 (a). Latitudinal effect of f_0F_2 . 12^h (L.T.)

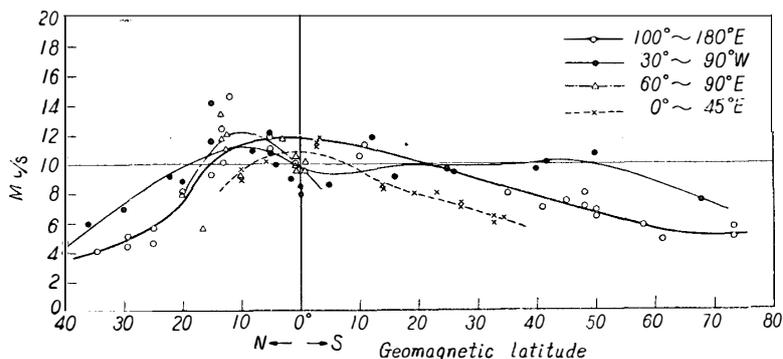


Fig. 3 (b). Latitudinal effect of f_0F_2 . 00^h (L.T.)

board the Soya are fit for the latitudinal effect of the Indian or African zone. This is the very proof of assumption that the values observed on board the sailing ship are still available for estimating the longitudinal and latitudinal effect.

It has resulted from the above discussions that the value of f_0F_2 varies geomagnetically rather than geographically for midnight, but, for the values at noon, we cannot decide by this data whether the variation follows geographically or geomagnetically.