

## Reply to “Comments on the paper entitled ‘Daily variations of geomagnetic $H$ , $D$ and $Z$ -fields at equatorial latitudes by F. N. Okeke and Y. Hamano’ ”

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1. It is not correct to rule out the possibility that the pronounced variation of  $Z$  observed in Kiritimati could be due to sea induction. See page 242 of Okeke and Hamano (2000) for detailed explanation.

2. There is no doubt in that  $\Delta Z$  and  $\Delta H$  should respectively show the minimum and the maximum values. We are merely claiming that the minimum value in  $Z$  variation is more pronounced at Kiritimati than those at Huancayo and Pohnpei. See figures for clarification.

3. We are very familiar with the studies of Fambitakoye (1971) and Doumouya *et al.* (1998), as can be seen from our references to these papers, and Rastogi's explanation on  $\Delta Z$  has been taken into consideration in our paper. See Fig. 4 in page 241.

4. The remark on the scale used is not relevant. We have used the same scale for plotting all the  $\Delta H$  diagrams and different scales for plotting all the  $\Delta D$  and  $\Delta Z$  diagrams. Since we are not comparing the different elements, the use of the same scale for all the elements is unnecessary, and we think no confusion will be generated.

5. Another weak point in Rastogi's argument is his tendency to draw conclusions from a single or a few persons' work. For example, we have observed that in Fig. 13(c) of Doumouya *et al.* (1998), the maximum value of  $\Delta H$ , which Rastogi claims to have appeared close to the dip equator at around 11:00 local time, appeared in fact at around 11:00 universal time.

6. Even though the ratio  $\Delta Z/\Delta H$  is approximately 0.63 as Rastogi quoted from Doumouya *et al.* (1998) and approximately 0.75 in Okeke and Hamano (2000), the fact remains

that the pronounced variation was observed.

7. Rastogi seems to have been confused and the abnormality in the behaviour of variation  $\Delta Z$  in Okeke and Hamano (2000) is taken as the abnormality in the data. In fact, the abnormal feature we referred to was seen on 23rd January when the  $Z$  component of the geomagnetic field showed the maximum value around local noon hours at Huancayo.

8. It is surprising to find that although  $D$  has deviated from the normal known variation such as the morning trough and the afternoon crest, as evident from Fig. 1(a), Rastogi termed it normal. We remark that it is common in research for some observations to deviate from the expected theoretical results.

9. Finally, we remark that the seasonal variations with more pronounced equinoctial maxima as observed in  $H$  than in  $Z$  could be a contribution from both the electric field as well as the enhanced electron density at equinox.

### References

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- Fambitakoye, O., Variabilite jour-a-jour de la variation journaliere reguliere du champ magnetique terrestre dans la region de electrojet equatorial, *C. R. Acad. Sci. Paris*, **272**, 637–640, 1971.
- Okeke, F. N. and Y. Hamano, Daily variations of geomagnetic  $H$ ,  $D$  and  $Z$ -fields at equatorial latitudes, *Earth Planets Space*, **52**, 237–243, 2000.

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