

Erratum to: Analysis of the ground level enhancements on 14 July 2000 and on 13 December 2006 using neutron monitor data

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Published online: 16 June 2016
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Erratum to: *Solar Phys* (2016) 291:1225–1239 DOI [10.1007/s11207-016-0877-2](https://doi.org/10.1007/s11207-016-0877-2)

An error has been found in the paper by Mishev and Usoskin (2016) that is related to the presentation of Figure 6, which depicts the computed neutron monitor (NM) asymptotic directions during GLE 70 on 13 December 2006 and the apparent direction of the interplanetary magnetic field (IMF) at 03:00 UT as derived from the ACE satellite measurements. We note that the latter (the apparent position of the IMF direction) is incorrectly shown in the figure, with no consideration of the propagation time between the L1-point, where the ACE spacecraft is located, and the Earth's location. Moreover, the instant value of IMF was taken, without averaging for the period of gyration of energetic particles.

The correct IMF position has been recalculated, allowing for the propagation time and with a proper 20 min averaging. The correct IMF position near Earth at 03:00 UT on 13 December 2006 is $\approx 30^\circ\text{S}$ and $\approx 110^\circ\text{E}$, which is different from that shown in Figure 6 (about 30° by latitude and 20° by longitude) and is in good agreement with Figure 2 in Bütikofer *et al.* (2009). The corrected Figure 6 is shown as Figure 1 here.

We have checked that this error does not affect the main results of the article (reconstruction of the energy spectra and pitch-angle distribution) since the erroneous IMF position was used only as the first guess for the iterative fitting procedure, and the final result of the fit remains unaltered. Accordingly, the derived rigidity spectra and anisotropy characteristics shown in Figure 7 and summarized in Table 2 are correct.

The online version of the original article can be found under doi:[10.1007/s11207-016-0877-2](https://doi.org/10.1007/s11207-016-0877-2).

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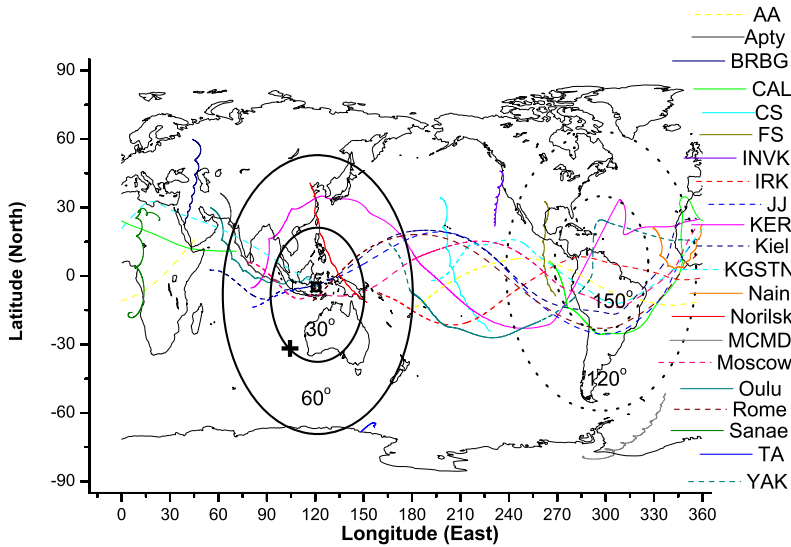


Figure 1 Calculated NM asymptotic directions during GLE 70 on 13 December 2006. The cross represents the direction of interplanetary magnetic field (IMF) derived from the ACE satellite measurements considering the time needed to propagate between the L1 point and the location of Earth and averaged for the period of gyration of energetic particles. The small circle represents the derived apparent source position. The lines of equal pitch angles relative to the derived anisotropy axis are plotted for 30° , 60° , 120° , and 150° . The asymptotic directions of polar NMs are plotted with solid lines, while mid-latitude NMs are plotted with dashed lines.

Acknowledgements We would like to acknowledge Leon Kocharov who found and discussed with us this error. This work was supported by the Center of Excellence ReSolVE (Academy of Finland project No. 272157).

References

- Bütikofer, R., Flückiger, E.O., Desorgher, L., Moser, M.R., Pirard, B.: 2009, The solar cosmic ray ground-level enhancements on 20 January 2005 and 13 December 2006. *Adv. Space Res.* **43**(4), 499. DOI.
- Mishev, A.L., Usoskin, I.G.: 2016, Analysis of the ground-level enhancements on 14 July 2000 and 13 December 2006 using neutron monitor data. *Solar Phys.* **291**(4), 1225. DOI.