Annual variations of IMF and the north-south anisotropy of cosmic ray intensity with the muon detector network

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North-south anisotropy of the galactic cosmic ray (GCR) intensity observed with the global muon detector network (xi_z) is investigated. xi_z is caused by the drift streaming expressed as a vector product between the radial density gradient of GCR (Gr) and the IMF vector. Since the average Gr directs outward from the Sun regardless the IMF sector polarity, the direction of xi_z is expected to be reversed when the direction of the IMF reverses.

Such a north-south anisotropy has been actually observed in a directional channel called GG component, which is the difference between GCR intensities recorded in the north-pointing and south-pointing directional channels of the multi-directional muon detector at Nagoya [Mori and Nagashima, PSS, 27, 39, 1979]. In this paper, we report that the rotation average of xi_z shows an annual variation with large amplitude (~0.3%). The method to infer the IMF sector polarity from the GG component has been also reported [Laurenza et al., JGR, 108, 1069, 2003]. However, the annual variation of GG component was missed since deviation values of GG component from the rotational averages was used in their studies.

In this study, we first investigate the cause for the annual variation of xi_z. A correlation with the annual variation of the IMF Bz component. This indicates that an annual change in the direction of the GCR diffusion flow aligned with the IMF direction generates the annual variation of xi_z. We then obtain deviation values of xi_z from the annual variation and evaluate a separation of them between IMF toward and away sectors quantitatively. We will report these results.