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The feature of global current circuit in the ionosphere from polar to dip equator during Dp2 event

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In the ionosphere, it is well known that the electromagnetic coupling is formed globally from polar region to dip equator region in daytime seen as penetration of electric field during Dp2 events. Yoshikawa et al., [2012, AGU] suggests the formation of the current system by Cowling channel model as the explanation of this coupling. The highly gradient of electric conductivity at the terminator between sunlit region and shaded region at dawn and dusk sides is assumed in this paper, which produces positive polarization electric field there and this electric field forms the connection between polar and dip equator.

In our previous study, the asymmetry of the ionospheric electric field, which is calculated from observed magnetic field variation and the model of conductivity, is found between morning side and afternoon side in the dip equator region, and we concluded that the positive electric charge at both dawn side and dusk side by Cowling channel formation enhances and weakens at dawn side and dusk side, which are primary positive and negative electric fields respectively. However, it was still not clear that there is actually such asymmetry in not only dip equator region but also in global.

To clarify this existence of global asymmetric feature of the electric field and the possibility of the formation of global Dp2 current system by Cowling channel model, we investigated global feature of Dp2 variation on simultaneous and multipoint observations. More than 200 stations data are used in this study, and their spatial distributions are from approximately -85 to 85 degree of geomagnetic latitude. The result shows that there is obvious asymmetry on the polarity of horizontal component of Dp2 variation in low and mid latitude region between morning side and afternoon side, but not obvious asymmetry in polar region. This unclear asymmetry in polar region might be because of the complexity of primary electric field which is penetrated from magnetosphere.