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Further examination of the geoelectromagnetic jerk hypothesis

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Short time-scale geomagnetic main field variations such as a geomagnetic jerk may be influenced by electromagnetic induction and conduction in the lower mantle. Similar variations were seen in long baseline geoelectric field measurements that are in progress in the northwestern Pacific using thousand-kilometer-scale submarine cables. Geoelectric secular variation data from such measurements have potential to discuss the significance of the influence and to clarify the cause of the phenomenon if they are analyzed simultaneously with geomagnetic data. In our previous work, we found a sudden change of the geoelectric field trend at around 2006. By supposing simply that the geoelectric field variation has the same origin with the geomagnetic jerk in 2007 (geoelectromagnetic jerk hypothesis), which was evident in the south Atlantic and Africa, we made a numerical study to understand possible cause and conductivity structure in the mantle. As a result, it was found that the geoelectric and geomagnetic field variations were both explained if the variations were originated from a toroidal magnetic field at the core-mantle boundary. It was also suggested that significant electrical conduction currents existed in the D" layer beneath the area where the geomagnetic field variation was evident. In this presentation, the validity of the geoelectromagnetic jerk hypothesis is discussed by extending the analyses adding more recent geoelectric and geomagnetic field data. Also, we estimate the amplitude of motionally induced electric field variation in the ocean by using a large-scale ocean circulation model, ECCO (Estimating the Circulation and Climate of the Ocean), to confirm that motional induction is not the cause of the observed geoelectric signal.

Keywords: geomagnetic jerk, gelelectric field, electrical conductivity of mantle