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Modification of one-dimensional spherical elementary current systems for applying at low/mid latitude

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The technique of 1-dimensional spherical elementary current systems (1D SECS) is one way of determining real ionospheric and field-aligned currents (FAC) from magnetic field measurements observed at a low-orbit satellite. The SECS consist of two sets of basis functions that are either divergence-free (DF) or curl-free (CF), and cause poloidal and toroidal magnetic fields, respectively. In previous studies the full 1D SECS method has been applied only at high latitudes, where we can make the simplifying assumption of radial FAC. This way the full ionospheric current distribution (i.e. both DF and CF horizontal currents and field-aligned currents) can be determined. At low/mid latitudes, on the other hand, only DF equivalent current owing in the ionosphere has been determined from ground magnetic field measurements. In this study, the 1D SECS is applied at low/mid latitudes by including dipole geometry for the FAC associated with the CF elementary systems. The modified 1D SECS is tested to determine both DF and CF ionospheric currents and FAC using both synthetic and real data from the CHAMP satellite and comparing these results with the equivalent current obtained from MAGDAS/CPMN ground magnetic data in 210 MM.

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