Geophysical Research Abstracts
Vol. 21, EGU2019-6758, 2019
EGU General Assembly 2019

Characterizing the time-dependent sources of GICs by including temporal basis functions in the technique of SECS

Santiago Marsal (1), Joan Miquel Torta (1), Mirko Piersanti (2), Francisco Javier Pavón-Carrasco (3,4)

(1) Observatorio del Ebro, Universitat Ramon Llull-CSIC, Roquetes, Spain (smarsal@obsebre.es, jmtorta@obsebre.es), (2) Instituto Nazionale di Fisica Nucleare (INFN), Roma, Italy (mirko.piersanti@roma2.infn.it), (3) Universidad Complutense de Madrid (UCM), Madrid, Spain (fjpavon@ucm.es), (4) Instituto de Geociencias (CSIC-UCM), Madrid, Spain (fjpavon@ucm.es)

Spherical Elementary Current Systems (SECS) is an equivalent source method aimed at explaining the observed ground magnetic variations in terms of its current sources, flowing either at the Earth's ionosphere or at the subsurface. This technique has contributed valuable results for magnetic interpolation purposes, as well as for modeling equivalent currents in their source region, thus distinguishing between their external and internal origin. Its outcome gives a realistic picture of the ongoing electrodynamic processes on the occasion of severe Space Weather (SW) events, with applications in the field of geomagnetically induced currents (GIC). Although different modalities of SECS exist (either 1D, 2D or 3D) depending on the number of space dimensions involved, the method is limited to providing a sequence of instantaneous pictures of those source currents. The extension presented hereby consists in introducing a temporal dependence in the formulation based on a cubic B-splines expansion. The technique thus adds one dimension, becoming 4D in general (e.g., 3D + t). Its reliability is demonstrated by comparing the modeled currents with those obtained for different snapshots using the traditional spatial version of SECS. However, its range of application is extended to cases of heterogeneous geomagnetic datasets which could hardly be treated otherwise, such as those containing gaps, different sampling rates or diverse data sources, especially common in the past decades before the gradual standardization of the geomagnetic observations worldwide. Tests so far in this sense reveal results that are consistent with known upper atmospheric processes.