
**Space environment (natural and
artificial) — Model of the Earth's
magnetospheric magnetic field**

*Environnement spatial (naturel et artificiel) — Modèle du champ
magnétique de la magnétosphère de la terre*



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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 20, *Aircraft and space vehicles*, Subcommittee SC 14, *Space systems and operations*.

This second edition cancels and replaces the first edition (ISO 22009:2009), which has been technically revised.

The main changes are as follows:

- upgraded list of the relevant models;
- added connection with the IGRF geomagnetic model;
- added field-aligned currents;
- added data availability information;
- added information about magnetospheric current systems modelling.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

This document describes the main requirements to the Earth's magnetospheric magnetic field model. A model satisfying the set of requirements is described in [Annexes A](#) and [B](#) as a working example. The model can be used in scientific and engineering applications and is intended to calculate the magnetic induction field generated from a variety of current systems located on the boundaries and within the boundaries of the Earth's magnetosphere under a wide range of environmental conditions, quiet and disturbed, affected by solar-terrestrial interactions simulated by solar activity such as solar flares and related phenomena which induce terrestrial magnetic disturbances such as magnetic storms.

The main goals of standardisation of the Earth's magnetospheric magnetic field are:

- providing the unambiguous presentation of the magnetic field in the Earth's magnetosphere;
- providing compatibility of results of interpretation and analysis of space experiments;
- providing less labour-consuming character of calculations of the magnetic field of magnetospheric currents in the space at geocentric distances of 1,0 to 6,6 Earth's radii (R_E);
- providing the most reliable calculations of all elements of the geomagnetic field in the space environment.

The magnetic field model presented in the [Annex A](#) (general description) and [Annex B](#) (submodels) can be used to forecast radiation situation in the space, including the periods of intense magnetic disturbances (magnetic storms) when developing systems of spacecraft magnetic orientation, when forecasting the influence of magnetic disturbances on transcontinental piping and power transmission lines.

Space environment (natural and artificial) — Model of the Earth's magnetospheric magnetic field

1 Scope

This document describes the main magnetospheric large-scale current systems and the magnetic field in the Earth's magnetosphere and provides the main requirements to the model of the magnetospheric magnetic field. Ionospheric currents are not considered in this document. The document also provides a working example of the model and establishes the parameters of magnetospheric large-scale current systems which are changing in accordance with conditions in the space environment. The document can be used to develop the new models of magnetospheric magnetic field. Such models are useful in investigating physical processes in the Earth's magnetosphere as well as in calculations, developing, testing and estimating the results of exploitation of spacecrafts and other equipment operating in the space environment.

2 Normative references

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminology databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at <https://www.iso.org/obp>
- IEC Electropedia: available at <https://www.electropedia.org/>

3.1

magnetospheric magnetic field

external magnetic field

external magnetospheric magnetic field

magnetic field produced by *magnetospheric magnetic field sources* (3.4)

3.2

geomagnetic dipole tilt angle

angle of inclination of the geomagnetic dipole to the plane orthogonal to the Earth-Sun line

3.3

internal magnetic field

magnetic field produced by the sources inside the Earth's core

Note 1 to entry: It can be presented in the form of a series of spherical harmonic functions.

Note 2 to entry: The expansion coefficients (IGRF model) undergo very slight changes in time.

Note 3 to entry: The International Association of Geomagnetism and Aeronomy (IAGA) is responsible for IGRF model development and modifications and approves its coefficients every 5 years.

Note 4 to entry: The internal magnetic field is described in ISO 16695.

3.4

magnetospheric magnetic field sources

sources of magnetic fields including the following: