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Information Fields in Space Research

Gospodinov Slaveyko Gospodinov [a, *]

[a] University of Architecture, Civil Engineering and Geodesy, Sofia, Bulgaria

Abstract

The article explores the information fields in space research. It is shown that the information field is a multidimensional concept. There is no single model of the information field. There is a clear or objective information field. There is a combined information field. In an object information field, the information units of the field are units of objects. They have object semantics. In a combined information field, the information units of the field are spaces, not objects. They may or may not be meaningful. They can be clear or fuzzy. These units have no semantics. The information units of the combined information field are interpreted in a group or in a cluster. There are information fields that reflect certain physical fields. An information space is associated with information fields. The information space allows you to link and combine information fields, as well as superimpose them on each other. The information field in space research is a complex information model that contains space, spatial and parametric information.

Keywords: space research, information field, information space, general information field, space sciences, integration of sciences.

1. Introduction

The world is a system of systems (Monakhov i dr., 2004) and a system of nested spaces (Tsvetkov, 2015). Information is the basis for the development of modern civilization. Space research develops a model of the world and a model of society. The importance of space research is determined by how much its theories, concepts and models contribute to the development of civilization. Considering the process of space exploration as a process of cognition of the world, it is possible to consider the process of cognition of the world. To believe that space research expands the space of knowledge of mankind. When exploring the surrounding world, a field concept is used. The development of this concept is reflected in the emergence of the model of the information field (Raev, 2021). Therefore, it is quite natural that the ideas of the information field began to be used in space research (Bondur, 2015). Information fields in space research are a reflection and information description of real fields in outer space and near-Earth space.

2. Discussion and results

Fields in near-Earth space.

The information field performs two functions (Tsvetkov, 2014a): reflection and description. The function of reflection is that the information field reflects real fields. In this reflection, a person has an idea of real fields and models them in an information field. The function of description is that the information field is a global model of the world and how a photograph reflects everything.

* Corresponding author
E-mail addresses: sgospodinov@mail.bg (G.S. Gospodinov)

In this reflection, a person has no idea about real fields and objects. He learns them on the basis of information modeling in the information field.

Thus, it is necessary to distinguish between two qualitative types of information field. The first type is an information field with a clear selection of objects and the exclusion of uncertainty. There is no redundant information in this field. The second type is the information field with the presence of certainty and uncertainty. In this field, you should select the necessary information. There is a lot of redundant information in it and the information volume of the models of such an information field is 3-4 orders of magnitude higher than the information volume of the models of the information field of the first type. Analogues of such fields are vector and raster models.

It is necessary to distinguish between information fields and information space. Information space as a description of the world can contain different information fields reflecting different physical fields. An information field contains a field variable (Tsvetkov, 2014b). If there is no field variable, then there is no field. The information space is a shell and serves as a tool to support the description of information fields. The most striking example is the coordinate information space. The peculiarity of the information space is that its description depends on the chosen coordinate system: spherical, cylindrical or Cartesian system Coordinate. An example of the relationship between fields and spaces is near-Earth space (Barmin et al., 2014)

The following types of spaces are divided (Tsvetkov, 2015; Barmin et al., 2014) as they move away from the Earth's surface: atmosphere (100 km); near-Earth space (60 Earth radii); sublunar space (radius of the Moon's orbit); Saline space (1 astronomical unit from the Earth); near space (Solar System); deep space (outside the Solar System) Near-Earth space space (OKP) (60 radii of the Earth). It is characteristic that all types of spaces are characterized by a geometric characteristic of a certain radius associated with a geocentric or heliocentric system. There are a number of fields, field processes, and these include:

- Continuous gravitational, magnetic and electric fields of the Earth;
- Field processes in the Earth's ionosphere;
- Field process thermal radiation;
- Field processes cosmic rays and solar radiation;
- Discretely continuous fields are the Radiation Belts of the Earth.
- Discrete fields of space debris.

Each of the considered physical fields has its own private information field.

Integration of sciences and information fields

Information fields reflect real physical fields and physical processes. Such fields can be interpreted as specialized information models. They are all connected to space and through space to each other. Hence the important role of the information space: it integrates models and fields into a single model. It should be emphasized here that we are talking about real space, not phase space or parametric space.

The basis for the integration of space sciences is geoinformatics. It arose and is developing on the basis of integrations of various scientific areas (Savinykh, 2015). As the first feature of the integration of space sciences, it should be noted the integration of geoinformatics with remote sensing technologies (Savinykh, Tsvetkov, 1999). As a second feature of the integration of space sciences, it should be noted the transformation of Earth sciences into space disciplines: space geoinformatics (Bondur, Tsvetkov, 2015), space geodesy (Jin, van Dam, Wdowinski, 2013), geodetic astronomy (Gospodinov, 2018; Gospodinov, 2022) and so on.

As a third feature of the integration of space sciences, it is necessary to single out the problem of big data (Buravtsev, Tsvetkov, 2019), characteristic of information fields of the second type.

Integration in space research is related to space geoinformatics. Space geoinformatics unites private sciences and solves the global problem of space exploration.

Space geoinformatics implements the compatibility of different data in a single model called geodata (Zuo, 2020). The essence of this model is not the term "geo", but a special structuring. It consists in dividing all data into three categories: coordinates, time and thematic data. But the main thing in geodata is to combine three categories into a single model, which is called a single integrated information base (Kovalenko, 2014). The integrated information base ensures the comparability of data from different sources.

Space geodesy serves as the basis for transferring geodetic methods and measurements into space. But the main thing in it is the use of geodetic measurement methodology for processing space information. However, space geodesy works with real space and does not affect the information space. Comparative planetology stands apart (Tsvetkov, 2018), which is the transfer of the theory of comparative analysis into the processing of cosmic information. Comparative analysis is effective in information fields.

In addition to space geodesy, space geoinformatics extracts information from the information field, studies and creates spatial knowledge (Tsvetkov, 2016) and geoscience (Tsvetkov, 2016) and cosmic knowledge (Savinych, 2016). As a means of forming a picture of the world, space geoinformatics creates an information description of the picture of the world (Tsvetkov, 2014). Research methods. Space geoinformatics are aimed at the study of outer space.

3. Conclusion

An information field is not a single model, but a collection of different information fields. There is a clear or object information field. An example of such a field would be a map or drawing. This field contains recognizable objects and does not contain uncertainties. In this information field, the information units of the field are units of objects. They have object semantics and content. They are interpreted independently of other information units. For example, conventional signs. There is a combined clear and fuzzy information field. An example of such a field would be a photograph or a bitmap. In this information field, the information units of the field are not units of objects. They reflect the value (density) of the pixel. They do not have object semantics. Their interpretation is possible by combining a group of neighboring information units into a cluster. These two types of fields are generalized, applicable to most real-world phenomena.

There are different physical fields, for example, magnetic, electric, gravitational. To describe a field, it is important to choose a spatial coordinate system. Therefore, the information space is inextricably linked with the information field. Selecting a coordinate system specifies the description of objects and fields. The information space plays an integrating role. It allows you to combine fields and superimpose them on top of each other. The information field is an important generalized information model that includes smaller models of objects and processes. The use of the information field model allows you to systematically study the processes and phenomena of the surrounding world. The information field allows you to more fully form a picture of the world. The information field in space research can be considered as a complex information model containing space information that is connected to space using coordinate space. The information field and information space play an integrating role in building a picture of the world and describing spatial phenomena. From the standpoint of the integration of sciences, the information field is an integrated model that combines different models and different sciences. Information the field allows you to conduct comprehensive research.

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