GLOBAL DATASETS OF THE GEOPHYSICAL FIELDS AS AN INSTRUMENT FOR IMPACT STRUCTURES DISCOVERY

L. A. Muravyev[1,2], [1]Institute of Geophysics Ural Branch of RAS, 620016, Amundsen st. 100, Ekaterinburg, Russia, mlev@igeoph.net, [2]Ural Federal University 620002, Myra st.19, Ekaterinburg, Russia, l.a.muravyev@urfu.ru.

Introduction: Imprints of shock processes, which the Earth's crust keeps till the present time, contain important information about the geological past of the lithosphere and the processes of impact metamorphism in rocks. Therefore, the study of impact structures is an important part of planetary science and the systematic identification of such structures on Earth is being conducted. Earth impact database [1] now contains 190 records of reliably confirmed structures, and many of them have the status of uncertain. The problem is also that some geological structures of a ring shape are exclusively terrestrial in origin. Now the remote sensing of the Earth is one of the most perspective methods for detecting new impact structures. Geological structures can be reflected in the geopotential fields (magnetic, gravitational), the present relief, and be visible in modern highly detailed satellite images. Of course, the geophysical criterion and the criterion of form cannot be the only method for identifying impact structures and irrefutable proof of their cosmic origin, but a focused study of modern datasources can lead to finding new objects and direct further ground-based geological research. A detailed study of the anomalous magnetic field of impact structures was performed [2] using the magnetic field database WDMAM ver. 1. But the quantity, quality, spatial resolution of modern global geophysical databases are increasing every year, keeping the relevance of analyzing and comparing these sources among themselves for solving the problem of identifying new geological structures of cosmic origin.

Methods. We explored modern global databases of magnetic, gravitational fields and relief. At 2003 the International Association of Geomagnetism and Aeronomy started work on creating a global map of magnetic anomalies of the Earth, which was finished in 2007 by the publication of the first version of the World Digital Magnetic Anomaly Map (WDMAM). Now available the second version of the WDMAM database [3] with spatial resolution 0.05 arc degrees. The corresponding altitude of the data is 5 km for terrain and sea level for marine model data. During this work, Maus et al. presented their own map, named EMAG2. The difference in the models is in different methods of processing of almost the same sets of source data. EMAG2 version 3 has the 2 arc min spatial resolution, and the height reduced to 4 km above the geoid [4].

There are several global databases of gravitational field anomalies, obtained by a number of scientific groups by merging terrestrial, altimetry-derived, and airborne gravity data and results of satellite projects Grace and GOCE. In these models the gravitational field described as a truncated series of spherical harmonics with maximum degree 2190, which corresponds to a spatial resolution of no worse than 10 km. The first of the most detailed models of global gravity is EGM2008, also we have reviewed newer models GECO and EIGEN-6C4, available for calculation on the website ICGEM and model WGM2012 [5], which available as 2 arc min grid.

We can use data from the SRTM project, implemented in 2000 and covering the territory from 56° S to 60° N, as a source of high-precision relief data. The CGIAR-CSI version 4 provides the best global coverage full resolution SRTM dataset [6]. Later this project was generalized and combined with ocean bathymetry data, but the spatial resolution of these data is significantly lower. The SRTM alternative has even better spatial resolution and greater coverage - the ASTER GDEM project, but this data contains many errors, outliers and voids.

Results and discussion. For the analysis, we selected the 20 largest confirmed impact structures according to the Earth impact database [1]. The smallest structures included in the analysis have a diameter of 40 km (Araguainha, Chesapeake Bay, Mjølnir, Puchezh-Katunki, Saint Martin, Woodleigh). This test set includes both ground and underwater structures. We have constructed maps of the databases listed above for the territories around them. The results of the comparison of different databases among themselves are given in the report. It was concluded that even large impact structures are reflected differently in geopotential fields. For some of them, the anomalies are weak and blurred, indistinguishable from the anomalies of other features of the geological structure, which were formed in subsequent periods. Interestingly, for some locations, the shapes of the anomalies are significantly different for different models due to deficiencies in the source data. However, the global databases of geophysical field anomalies, available online, can be a reliable tool for discovering new impact structures and modern computational resources and technology can automate this process. In addition to global databases, it is necessary to systematize the primary data of local digital field databases available for particular regions and countries and include into the processing procedure.

References: [1] Earth Impact Database, http://www.passc.net/EarthImpactDatabase/New%20website_05-2018/Index.html. [2] Anca Isac et al. (2016) *Advances in Space Research* **57**, 477–492. [3] Lesur, V. et.al. (2016) *Earth, Planets and Space,* **68**(1), 27. DOI:10.1186/s40623-016-0404-6. [4] Meyer B. et.al. (2017) EMAG2 Version 3. DOI:10.7289/V5H70CVX. [5] Balmino, G., Vales, N., Bonvalot, S. Briais, A. (2012) *Journal of Geodesy,* **86**(7), 499-520 [6] SRTM 90m DEM Digital Elevation Database, http://srtm.csi.cgiar.org/