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Typical structural elements of seismicity and impact crater morphology identified in GIS ENDDB digital models.

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The subject database of the ENDDB system (Earth's Natural Disasters Database) is a combination of the EISC catalog (Earth's impact structures Catalog [1]) and seismological data of more than 60 earthquake catalogs (EC).
ENDDB geographic subsystem uses the NASA ASTER GDEM data arrays to obtain a high-resolution (1 arc-second) shaded relief model, as well as the digital mapping technology, which consists in shading surface points according to their brightness controlled by the illumination angle. For example, the identifying impact craters by means of ENDDB begins with selecting the optimum base colors of the image, the parameters of illumination and shadow depth for constructing a shaded model on a regular grid of values. This procedure allows obtaining precise 3D images of the terrain and gravity patterns, and, moreover, furnishes data for recognizing standard morphological elements according to which impact structures can be visually detected. For constructing a shaded gravity anomaly with the ENDDB tools, Global marine gravity data (of models V16.1 and V18.1 [2]) are embedded into the system. These models, which are arrays of gravity pixel values, are of the resolution increased from the equator to the poles, being 30 arc-seconds per point on average. This resolution is the same as in the more recent V21.1 model.
Due to these data, new morphological elements typical of impact structures, which are expressed in the shaded elevation and gravity models (identified using the ENDDB visualization tools) was found and compared in hundreds of craters from the EISC-catalog: tail-shaped asymmetry of relief, heart-shaped geometry of craters, and tail-shaped gravity lows [3] and so on. New diagnostic criteria associated with typical morphological elements revealed with advanced image processing technologies are very important to confirm the impact origin for many potential craters. The basic hypothesis of the impact-explosive tectonics [4] is that meteorite craters on the Earth must be as frequent as on the Moon or on the Mars. To see how many ring structures are there on the Earth, one can examine respective geological maps based on satellite imagery [5].
In addition, mathematical methods of catalog studies realized in GIS ENDDB allow revealing the pattern of EISC and EC catalogs spatial distribution by visualizing catalog samples in a pseudo-3D background map according to the legend, or in the scale. For example, the ENDDB tool can help to confirm a seismic morphological structures identified by special methods for grouping related earthquakes offered in it. The cases are shown of using gravity map to detect the pattern of aseismic or weak seismic zones by comparison with earthquake group distribution, seismic lineaments, faults and trenches, other geological-geophysical information from ENDDB database.

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