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A web-system of virtual morphometric globes

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Virtual globes — programs implementing interactive three-dimensional (3D) models of planets — are increasingly used in geo- and planetary sciences. We develop a web-system of virtual morphometric globes. As the initial data, we used the following global digital elevation models (DEMs): (1) a DEM of the Earth extracted from SRTM30_PLUS database; (2) a DEM of Mars extracted from the Mars Orbiter Laser Altimeter (MOLA) gridded data record archive; and (3) A DEM of the Moon extracted from the Lunar Orbiter Laser Altimeter (LOLA) gridded data record archive.

From these DEMs, we derived global digital models of the following 16 local, nonlocal, and combined morphometric variables: horizontal curvature, vertical curvature, mean curvature, Gaussian curvature, minimal curvature, maximal curvature, unsphericity curvature, difference curvature, vertical excess curvature, horizontal excess curvature, ring curvature, accumulation curvature, catchment area, dispersive area, topographic index, and stream power index (definitions, formulae, and interpretations can be found elsewhere [1]). To calculate local morphometric variables, we applied a finite-difference method intended for spheroidal equal angular grids [1]. Digital models of a nonlocal and combined morphometric variables were derived by a method of Martz and de Jong adapted to spheroidal equal angular grids [1]. DEM processing was performed in the software LandLord [1].

The calculated morphometric models were integrated into the testing version of the system. The following main functions are implemented in the system: (1) selection of a celestial body; (2) selection of a morphometric variable; (3) 2D visualization of a calculated global morphometric model (a map in equirectangular projection); (4) 3D visualization of a calculated global morphometric model on the sphere surface (a globe by itself); (5) change of a globe scale (zooming); and (6) globe rotation by an arbitrary angle.

The testing version of the system represents morphometric models with the resolution of 15’. In the final version of the system, we plan to implement a multiscale 3D visualization for models of 17 morphometric variables with the resolution from 15’ to 30". The web-system of virtual morphometric globes is designed as a separate unit of a 3D web GIS for storage, processing, and access to planetary data [2], which is currently developed as an extension of an existing 2D web GIS (http://cartsrv.mexlab.ru/geoportal). Free, real-time web access to the system of virtual globes will be provided. The testing version of the system is available at: http://cartsrv.mexlab.ru/virtualglobe.

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References

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