

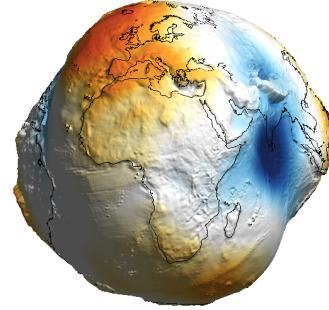
MATLAB script for visualizing geoid height and other elevation data on rotating 3D globe

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Research highlights

- A Matlab package for visualizing global data on 3D sphere.
- Possibly, rotation of the 3D sphere can be animated.
- For all examples shown, Matlab code is provided on the package website.
- Any global longitude-latitude scalar data can be visualized.
- The package is available for **free download**.
- Bezdek A, Sebera J, 2013. MATLAB script for 3D visualizing geodata on a rotating globe. *Computers & geosciences*, <http://dx.doi.org/10.1016/j.cageo.2013.03.007>



m

```
% MATLAB script for 3D visualizing geodata on a rotating globe
% We present a free Matlab package rotating_3d_globe.zip, with which you can produce your own 2D and 3D images, animated gifs or videos. Our idea was to offer the reader snippets of the Matlab code for "copy and paste" style of programming. In principle, any elevation data given on grid of longitudes and latitudes can be visualized with this package. We provide the Matlab code and the data sets used in creating the presented images and animations. A step-by-step manual is also included.
% The package is described in a paper: Bezdek A, Sebera J, 2012. MATLAB script for 3D visualizing geodata on a rotating globe. Submitted to Computers & geosciences. When the package, please cite this paper:
% Copyright & geosciences. When using the package, please cite this paper:
% Geoid height
% Originally this package was developed for 3D visualizing the geoid height of new global gravity field models.
% ▶ Variations in geoid height are thousand times exaggerated ("Earth potato"), in reality the Earth's shape is very close to a sphere (for more details, see the reference paper).
% ▶ Clicking on each image displays it in your browser, clicking on the image title will take you to its Matlab code.
% Geoid height on 3D globe
% Geoid height on 2D map
% Animation: rotating globe
% GIF
% WMV
% High resolution image
```

```
% MATLAB script for 3D visualizing geodata on a rotating globe: MANUAL
% This is a user's guide to a free Matlab package rotating_3d_globe.zip. It has an idea of images and animations that can be produced, a look at the package website: http://www.ssg.cas.cz/~bezdek/rotating\_3d\_globe/. It was our intention to prepare this package so that it can be used in a "copy and paste" style of programming. More eloquently: "Copy, paste and quickly modify according to your needs."
% Installation of the package
1.1. Running a test example
2. Installation of the package
2.1. Earth topography. Getting started
2.2. Earth topography. Label: larger image size and colorbar limits
2.3. Earth topography. Smooth motion
2.4. Earth topography. Draw data as color scales on perfect sphere
2.5. Earth topography. Changing the view point, zoom in, plot a point
2.6. Earth topography. Coastlines and country boundaries
3. Model of geoid height
3.1. Earth topography in 3D as animated GF: 36 degree segment, 1/1000 ips
3.2. Earth topography in 3D as animated GF: full resolution, smooth motion
3.3. Earth topography in 3D as animated GF: full resolution, 1000 ips
3.4. Earth topography in 3D as animated GF: full resolution, 10000 ips
4. Geoid height in 3D (image/animation)
4.1. Earth topography and computation/loading of the grid values
4.2. Geoid height in 3D as PNG image
4.3. Geoid height in 3D as animated GF (compressed video)
5. Earthtopo_3D images
6. Data formats
6.1. Choosing and editing a color scale
7. Troubleshooting
7.1. An error message was produced instead of HMV
7.2. Animated GF was not created
1. Installation of the package
▶ First download the package rotating_3d_globe.zip, unpack it and add it to your Matlab path. This package contains also the data for the lower resolution images.
```

Program description

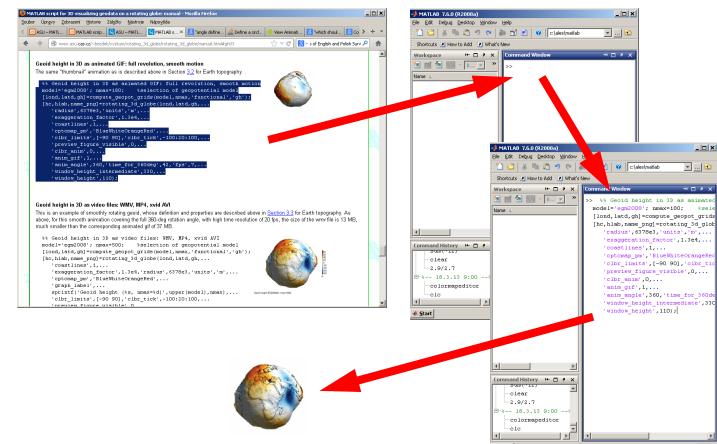
- This Matlab code will produce the PNG image shown:

```
%% Selection of geopotential model and computation/loading of the grid values
model='egm2008'; nmax=500;
% Computation of grid for the selected geopotential functional
[lond,latd,gh]=compute_geopot_grids(model,nmax,'functional','gh');

%% Geoid height in 3D as PNG image
[hc,hlab,name_png]=rotating_3d_globe(lond,latd,gh,'coastlines',1,...'exaggeration_factor',1.3e4,'radius',6378e3,'units','m',...
'graph_label',sprintf('Geoid height (%s, nmax=%d)',upper(model)),nmax),...
'clbr_limits',[-90 90],'clbr_tick',-100:20:100,...'cptcmappm','BlueWhiteOrangeRed',...
'preview_figure_visible',1,...'window_height',650);
```

Simple usage: Copy and paste

- More precisely: copy, paste and modify according to your needs



Input data

- Matrix of global scalar data on a longitude-latitude grid

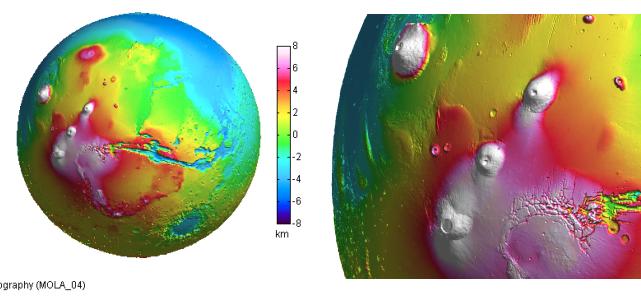
Output formats

- PNG images of data projected on 3D globe
- Animation of 3D globe: avi/wmv video; animated gif
- 2D geographical map of data (based on M_Map package)

Examples of application

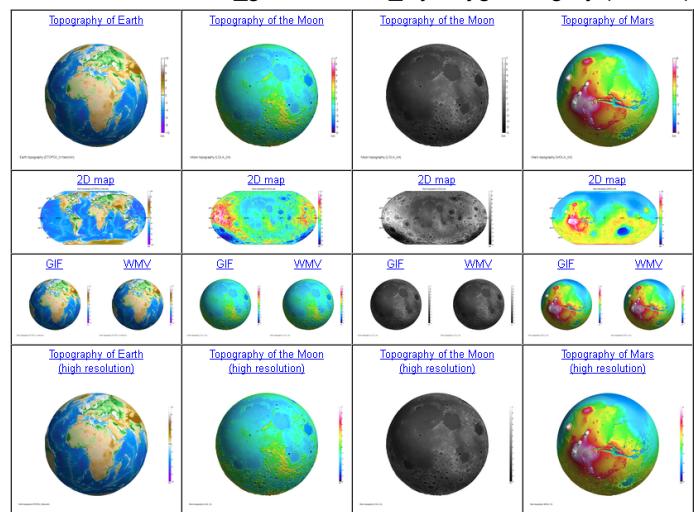
Topography of Mars

- Data: MOLA (Mars orbiter laser altimeter, NASA)



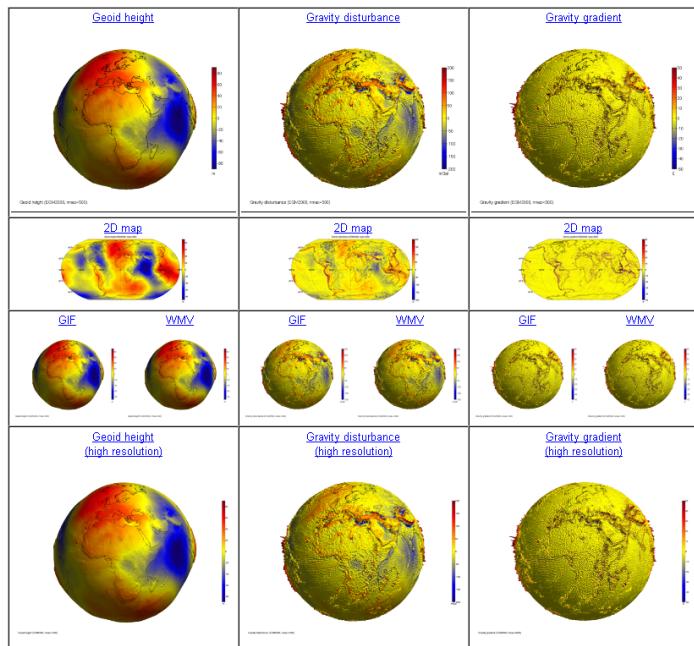
Topography of Earth, Moon, Mars

- Data: Etopo2 (NOAA); LOLA (NASA); MOLA (NASA)
- Colour scales: GMT_globe & GMT_wysiwygcont; gray (Matlab)



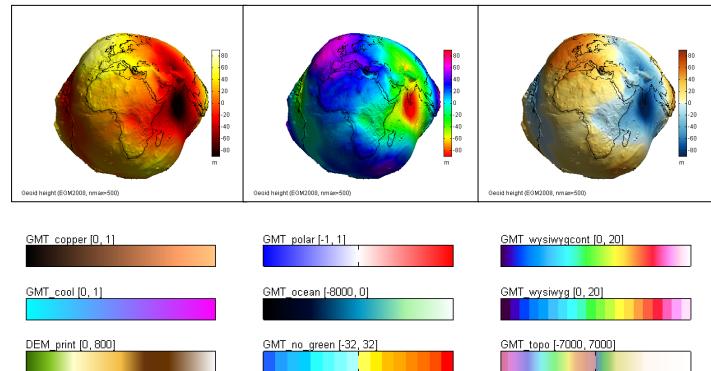
Gravity potential, disturbance, gradient

- Increasing order of differentiation highlights the local features
- Colour scale: clrmap_byr1 (created by authors)
- Data: EGM2008, max degree 500



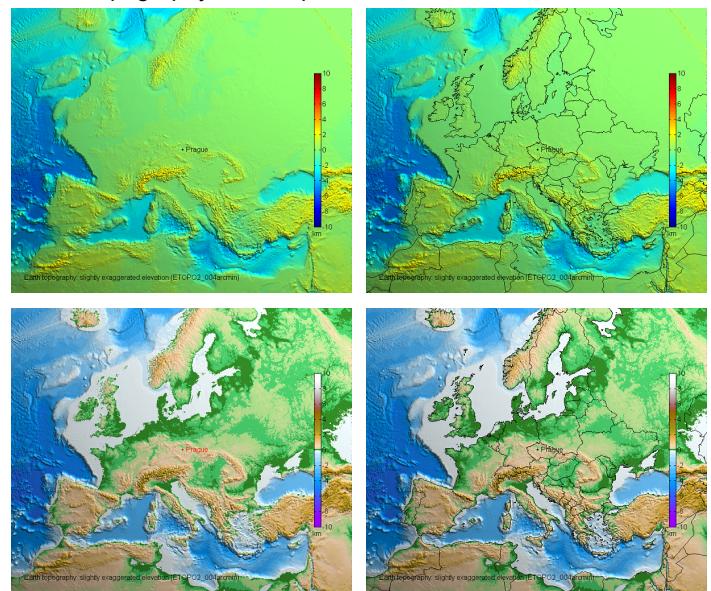
Easy use and modification of various colour scales

- Matlab: several built-in colormaps
- GMT color palette tables (cpt)
- Easy editing and creating by using the Matlab colormapeditor



Importance of using a proper colour scale

- Default colour scale: shelf seas indistinguishable from land
- Earth topography needs special colour scales



Program availability and system requirements

- Only the basic module of Matlab is needed
- The package is available for [free download](http://www.asu.cas.cz/~bezdek/vyzkum/rotating_3d_globe/):
http://www.asu.cas.cz/~bezdek/vyzkum/rotating_3d_globe/

