GSHHG

A Global Self-consistent, Hierarchical, High-resolution Geography Database

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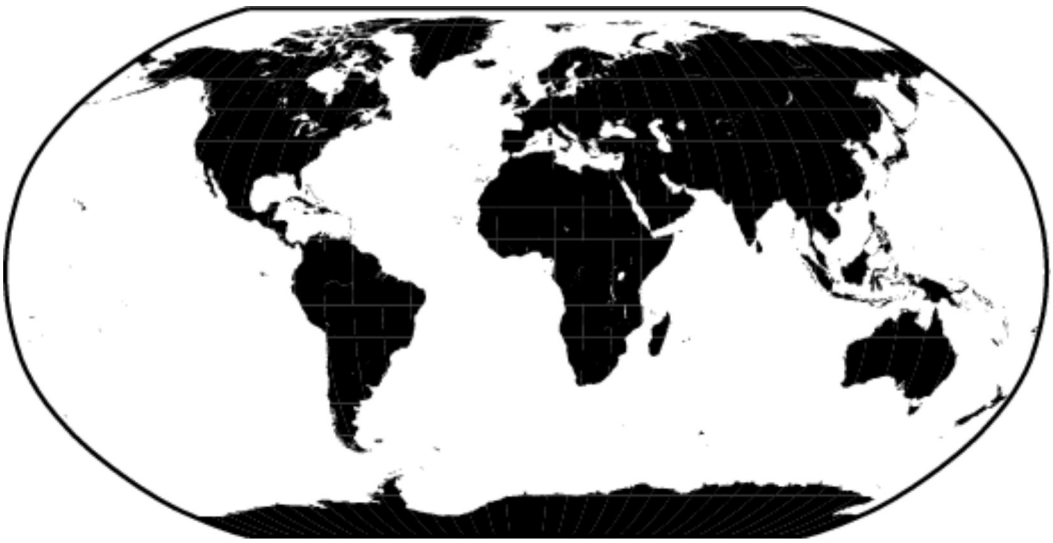

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GSHHG is developed and maintained by

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We present a high-resolution geography data set amalgamated from three data bases in the public domain:

1. World Vector Shorelines (**WVS**).
2. CIA World Data Bank II (**WDBII**).
3. Atlas of the Cryosphere (**AC**).

The **WVS** is our basis for shorelines except for Antarctica while the **WDBII** is the basis for lakes, although there are instances where differences in coastline representations necessitated adding **WDBII** islands to GSHHG. The **WDBII** source also provides all political borders and rivers. The addition of **AC** since 2.3.0 allows us to offer two choices for Antarctica coastlines: Ice-front or Grounding line. These are encoded as levels 5 and 6, respectively and users of GSHHG can choose which set to use. GSHHG data have undergone extensive processing and should be free of internal inconsistencies such as erratic points and crossing segments. The shorelines are constructed entirely from hierarchically arranged closed polygons. A modified version of GSHHG is used by GMT, the Generic Mapping Tools. Starting with version 2.2.2, GSHHG has been released under the GNU Lesser General Public License.
The shoreline polygon data can be used to simplify data searches and data selections, to study the statistical characteristics of shorelines and land-masses, or for custom applications requiring basic geography data. For convenience, the shoreline polygons and rivers/borders line data sets are distributed in two file formats:

1. **ESRI shapefiles**. This format is probably the most useful for users of GSHHG. Note that due to limitations of most (all?) GIS software and Google Earth, a handful of polygons straddling the Dateline (chief among them the Antarctic polar cap polygon) have been split into east and west

components.
2. **Native binary files**. No polygon dateline-splitting has occurred. Software to read these files are distributed as part of the gshhg supplement to GMT. Developers can use the descriptions of the gshhg format (in gshhg.[ch]) to deal with these data in their own programs.

Notes:

1. GMT uses a special netCDF-formatted version of these data that have been tiled to improve efficiency of map making. Normally, this flavor of GSHHG is offered as an installation option when GMT is installed; however, you can also obtain it below. We discourage anyone from using the netCDF version for custom programming applications [due to complexity and lack of documentation, mostly].
2. GSHHG used to be called GSHHS (Global Self-consistent, Hierarchical, High-resolution Shorelines) but since rivers and political boundaries were also included we changed it to GSHHG starting with version 2.2.1.
3. The netCDF version of GSHHG used to be distributed as a part of GMT but as of GMT 4.5.9 the GSHHG is a separate package. This means when GMT is updated and there are no changes to GSHHG you do not need to reinstall GSHHG. Likewise, GMT 4 and GMT 5 installations can now share a single GSHHG installation.
4. Older GMT releases such as 4.5.x and 5.1.0 (and earlier) can use the new GSHHG 2.3.7 release but will only see the improved ice-front Antarctica coastline. Versions 5.2.0 and later include new options to handle decisions related to the various Antarctica choices available in GSHHG since 2.3.0.

The geography data come in five resolutions:

1. **f**ull resolution: Original (full) data resolution.
2. **h**igh resolution: About 80 % reduction in size and quality.
3. **i**ntermediate resolution: Another ~80 % reduction.
4. **l**ow resolution: Another ~80 % reduction.
5. **c**rude resolution: Another ~80 % reduction.

Unlike the shoreline polygons at all resolutions, the lower resolution rivers are not guaranteed to be free of intersections.
Shorelines are furthermore organized into 6 hierarchical levels:

1. L1: boundary between land and ocean, except Antarctica.
2. L2: boundary between lake and land.
3. L3: boundary between island-in-lake and lake.
4. L4: boundary between pond-in-island and island.
5. L5: boundary between Antarctica ice and ocean.
6. L6: boundary between Antarctica grounding-line and ocean.

Rivers are organized into 10 classification levels:

1. L0: Double-lined rivers (river-lakes).
2. L1: Permanent major rivers.
3. L2: Additional major rivers.
4. L3: Additional rivers.
5. L4: Minor rivers.
6. L5: Intermittent rivers - major.
7. L6: Intermittent rivers - additional.
8. L7: Intermittent rivers - minor.
9. L8: Major canals.
10. L9: Minor canals.
11. L10: Irrigation canals.

Finally, borders are organized into three levels:

1. L1: National boundaries.
2. L2: State boundaries within the Americas.
3. L3: Marine boundaries.

Published information about GSHHG

The early processing and assembly of the shoreline data is described in

Wessel, P., and W. H. F. Smith, A Global Self-consistent, Hierarchical, High-resolution Shoreline Database, *J. Geophys. Res., 101*, 8741-8743, 1996 [PDF].

Availability of GSHHG data

The latest data files for version 2.3.7 were released on June 15, 2017; details on the changes are described in the README file. The data set can be accessed below as well as from the National Centers for Environmental Information [NCEI (formerly NGDC)], Boulder, Colorado. Note that the gshhg software is a GMT supplement so if you have installed GMT you already have the gshhg software. For GMT 4.5.x or GMT 5.*, you may download one of these files via ftp or http [these may also be available from various package managers]:

1. **FTP:** GSHHG coastlines, rivers, and borders for GMT in netCDF 4 format (gzipped tar archive).
2. **HTTP:** GSHHG coastlines, rivers, and borders for GMT in netCDF 4 format (gzipped tar archive).

For ESRI shapefiles of shoreline polygons, rivers, and borders you can choose to get via ftp or http:

- **FTP:** GSHHG coastlines, political borders and rivers in shapefile format (zip archive)
- **HTTP:** GSHHG coastlines, political borders and rivers in shapefile format (zip archive)

For native binary files of shoreline polygons, rivers, and borders you may download via ftp or http:

- **FTP:** GSHHG coastlines, rivers, and borders in native binary format (zip archive)
- **HTTP:** GSHHG coastlines, rivers, and borders in native binary format (zip archive)

The latter requires GMT's gshhg supplement or your own custom programs to access the data. The native binary shoreline data can also be converted into a GRASS GIS database with v.in.gshhs, a GRASS add-on by Markus Metz.
A related product is a global netCDF grid with distances to the nearest GSHHG shoreline in km (with negative distances in the oceans). This is a 1x1 arc minute grid based on GSHHS version 2.3.7 and can be obtained here: dist_to_GSHHG_v2.3.7_1m.nc [Note: it is 441 Mb].

Last update July 23, 2018 by Paul Wessel