

# The ISG-format

## (version 1.0)

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The ISG-format accommodates local/regional geoid models given as undulations with respect to a certain reference ellipsoid on a grid of points.

Each individual data file consists of three sections:

1. The **comment-section** which starts at the beginning and ends with the keyword “begin\_of\_head” (as a separator between the comment section and the header). This section is optional.
2. The **header-section** which contains textual and numerical parameters. The beginning of the header is marked by the keyword “begin\_of\_head” while the end of the header is marked by the keyword “end\_of\_head”. This section is mandatory.
3. The **data-section** with the list of undulation values row by row. Values are separated by at least one blank (no tabs). The carriage return is typed at the end of the row only.

The records in the header have the following keywords with the following meaning:

Keywords	Type	Text or value
model name	textual	name of the geoid model; if it does not exist, indicate the name of the country or the geographical region covered by the data
model type	textual	type of the geoid model, i.e. “gravimetric” or “hybrid” model
units	textual	units of the geoid undulations in the data section, e.g. “meters”
reference	textual	reference ellipsoid of the geoid undulations in the data section, e.g. “GRS80” or “--” if it is unknown
lat min	numeric	grid minimum latitude in degrees, (format %10f.4)
lat max	numeric	grid maximum latitude in degrees, (format %10f.4)
lon min	numeric	grid minimum longitude in degrees, (format %10f.4)
lon max	numeric	grid maximum longitude in degrees, (format %10f.4)
delta lat	numeric	grid step in latitude in degrees, (format %10f.4)
delta lon	numeric	grid step in longitude in degrees, (format %10f.4)
nrows	numeric	grid number of rows, for consistency check, (format %10d)
ncols	numeric	grid number of columns, for consistency check, (format %10d)
nodata	numeric	fictitious value to be used for grid cells with no data available, e.g. “-9999.0000”, (format %10f.4)
ISG format	numeric	version of the ISG format, use “1.0” to refer to this document

Note that:

- keywords are left-aligned and always occupy 10 characters;
- between the keyword and the corresponding text or value, there is a separator that is “:” for textual records or “=” for numeric records;
- there is always a blank before and after the separator;
- textual records have no limits of characters and are left-aligned (after the “:” separator and the blank);
- numeric records occupy at most 10 characters (after the “=” separator and the blank) and are right-aligned.

Geoid undulations are referred to the center of the grid cell. The grid cell has a size that is defined by the fields “delta lat” and “delta lon” in the header section. The upper, lower, left and right grid limits are defined by the fields “max lat”, “min lat”, “min lon” and “max lon” in the header section, respectively. The grid number of rows and columns are reported in the header section for check and are given by the following relations:

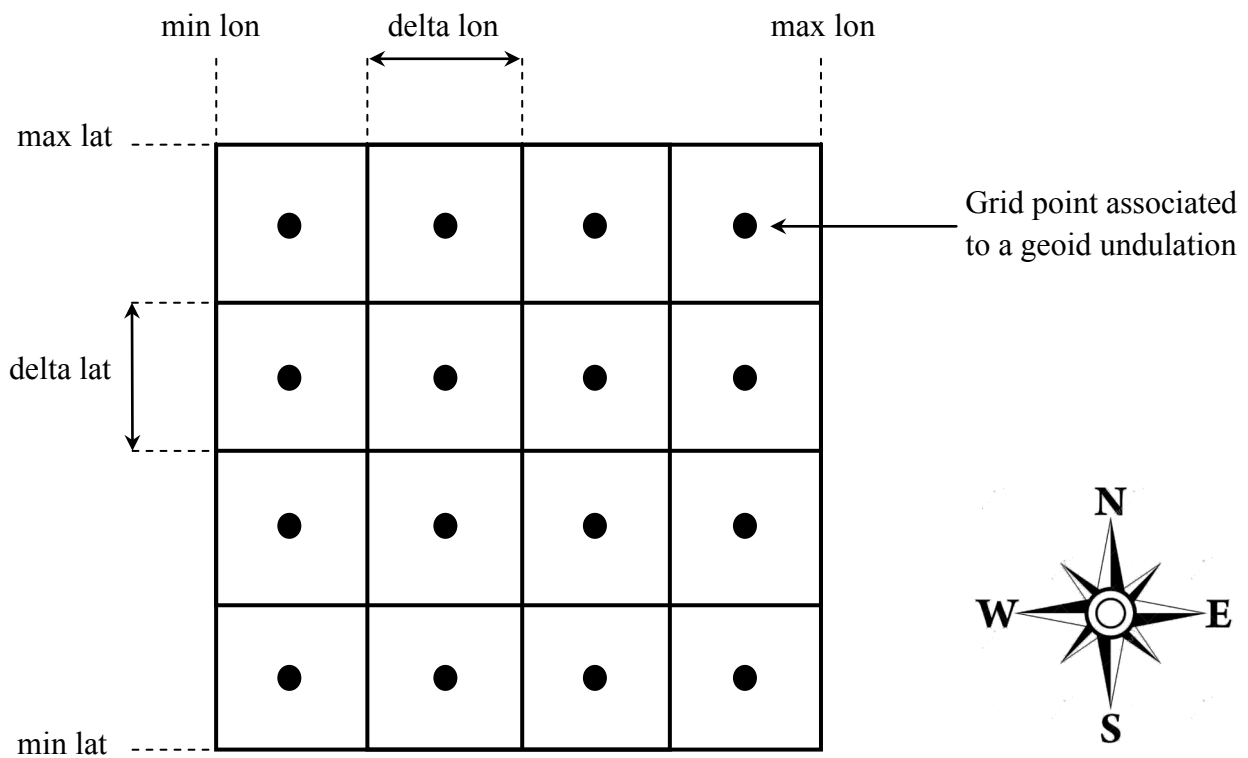
$$\text{“nrows”} = (\text{“max lon”} - \text{“min lon”}) / \text{“delta lon”}$$

$$\text{“ncols”} = (\text{“max lat”} - \text{“min lat”}) / \text{“delta lat”}$$

Latitude values range from -90 to +90 and are positive in the northern hemisphere and negative in the southern hemisphere. Longitude values generally range from -180 to 180 and are positive on the east side of the Greenwich meridian and negative on its west side. Alternatively longitude values can range from 0 to 360, rotating in the east direction from the Greenwich meridian. In any case the condition “max lon” > “min lon” in the header-section must be satisfied, this means that:

- if the model includes the Greenwich meridian, the convention  $-180 < \text{lon} < 180$  must be used;
- if the model includes the Greenwich antimeridian, the convention  $0 < \text{lon} < 360$  must be used.

The meaning of the grid parameters is displayed in the figure below:



According to the figure above, geoid undulations in the data-section goes from north to south when increasing rows, and from west to east when increasing columns.

## Example

This is an example.

Here some information about model computation can be provided.

Reference:

A. Name1, B. Name2 (year). Title. Journal, Volume(Number), pp. xxx-yyy.

```
begin_of_head =====
model name : EXAMPLE
model type : gravimetric
units      : meters
reference  : GRS80
lat min    =    40.0000
lat max    =    41.0000
lon min    =   120.0000
lon max    =   121.5000
delta lat  =     0.2500
delta lon  =     0.2500
nrows      =         4
ncols      =         6
nodata     = -9999.0000
ISG format =         1.0
end_of_head =====
  30.1234    31.2222    32.3456    33.4444    34.5678    36.6666
  41.1111    42.2345    43.3333    44.4567    45.5555    46.6789
  51.4321    52.9753    53.6543    54.8642 -9999.0000 -9999.0000
  61.9999    62.8888    63.7777    64.6666 -9999.0000 -9999.0000
```