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Title	MEDIN data guideline for marine gravimeter / gravity data
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Summary	This guideline defines the format of data and information produced from the acquisition of marine gravimeter and gravimetric data. Used correctly, the guideline facilitates easy use and re-use of the data. An Excel template is also provided if required.
Keywords	Geology, Gravimeters, Gravity field of the Earth, Gravity field gradient (horizontal) of the Earth

Change history		
Version	Date	Change
1.0	06/01/2012	First draft of document
1.1	24/01/2012	QC release
1.2	03/02/2012	INSPIRE assessment finalised
1.3	13/03/2012	Changes incorporated following QC process: draft for MEDIN review release
1.4	30/03/2012	Changes incorporated following review process: final release
2.0	23/08/2017	Updated to new MEDIN Data Guideline Format

1 Introduction

1.1 What are MEDIN compliant data?

There are 3 requirements to ensure that supplied gravimetric data are MEDIN compliant:

- 1) **Collectors supply General Metadata about the data** – See [Appendix A](#)
- 2) **Detailed Metadata are supplied with the data** – *This may be included in a survey/cruise report or as additional metadata* – See [Appendix B](#)
- 3) **The data are in a format that MEDIN accepts** – See [Appendix C](#)

Example of a MEDIN compliant species dataset:

A file containing General Metadata ([Appendix A](#)),
Detailed Metadata ([Appendix B](#)) and
Data ([Appendix C](#))

1.2 Scope

This guideline covers gravimeter/gravimetric data and information acquired during marine geophysical surveys. It covers the raw data, methodologies used and the derived processed data.

The guideline does not cover the derived data product contours. These are covered in the following MEDIN data guidelines

- MEDIN product guideline for seabed feature and contact interpretations
- MEDIN product guideline for contours

Marine gravimeter surveys are taken either using a towed gravimeter, or a shipborne gravimeter mounted on an inertial platform within the vessel. Data are acquired to represent the gravity field for the site of interest, with significant anomalies indicating geologic characteristics and presence of features of interest.

1.3 Archiving Data

The British Geological Survey (BGS) is the MEDIN Data Archive Centre (DAC) responsible for the archiving of marine gravity / gravimetric data recorded around the British Isles.

Contact Details:

British Geological Survey
E-mail: offshoredata@bgs.ac.uk
Tel: +44 (0) 131 6500275

1.4 Summary of the information required

A General Metadata:

This section lists the general metadata that should be provided with the data.

Users can use the form [here](#) to record General Metadata and can find additional information in [Appendix A](#)

The General Metadata fields are common throughout all MEDIN data guidelines and only need to be given once and referenced if your data set is composed of many data types and therefore conforms to a number of MEDIN Data Guidelines. If your collection of data forms part of a wider project or time series then the **Project Information** must be recorded but if the work is a small survey then project details may not be required.

What is a Survey/Project?

A **survey** is a uniquely identifiable programme of data collection such as a research cruise, moored instrument deployment or survey event. This information is likely to be the same for all sample events and subsamples in a given data set such as a cruise. Note that in the event that these are not common to all sample events then they should be specified for each one.

A **project** is a collection of surveys that have been completed for a common purpose. For example: an environmental impact assessment composed of a number of separate surveys; scientific research composed of a number of different research cruises; a legislative monitoring programme which is conducted each year over several years. A project is usually funded by the same organization(s) for its lifetime.

Survey Information:

This information is mandatory and **must** be supplied with the data to ensure they can be reused:

1. [surveyName](#)
2. [surveyType](#)
3. [surveyAbstract](#)
4. [surveyCode](#)
5. [originator](#)
6. [owner](#)
7. [surveyStartDate](#)
8. [timeZone](#)

Additional items:

Please provide as much of the following information as possible to help others assess the data:

Survey Information:

1. [surveyEndDate](#)
2. [platformName](#)
3. [platformType](#)
4. [cruiseReportReference](#)
5. [surveyReportReference](#)
6. [surveyMetadataURL](#)
7. [confidentiality](#)

Project Information:

Please provide as much of the following information as possible if the survey forms part of a wider project:

1. [projectName](#)
2. [projectCode](#)
3. [projectStartDate](#)
4. [projectEndDate](#)
5. [projectWebsite](#)
6. [projectMetadataURL](#)

B Detailed Metadata:

This section lists the detailed metadata that should be collected with the data. The detailed metadata contains information about the methods used during the survey, any calibrations applied to the data and the personnel who carried out the sampling.

Users can use the form [here](#) to record Detailed Metadata and can find additional information in [Appendix B](#).

The Detailed Metadata fields are specific to each data guideline and should be completed for each type of data. The information requested here may be supplied as additional metadata or may be supplied in a cruise or survey report, provided that all required information is included in the report.

Method Information

Details of any method or instruments used to collect the data are required in this section. This information is mandatory and **must** be supplied with the data to ensure they can be reused:

1. [methodID](#)
2. [systemMountingPoint](#)
3. [systemMounting](#)
4. [sensorDetails](#)
5. [spatialCRS](#)
6. [positionFix](#)
7. [horizontalAccuracy](#)

Additional items:

Please provide as much of the following information as possible to help others assess the data:

1. [originalCRS](#)
2. [transformation](#)
3. [depthCRS](#)
4. [verticalAccuracy](#)
5. [serialNumber](#)
6. [processingOrganisation](#)
7. [systemDetails](#)
8. [systemSamplingRate](#)
9. [systemLogRate](#)
10. [minMaxDepth](#)
11. [minMaxAltitude](#)
12. [theoreticalGravityFormula](#)
13. [corrections](#)
14. [acquisitionSoftware](#)
15. [acquisitionSoftwareVersion](#)
16. [processingSoftware](#)
17. [processingSoftwareVersion](#)
18. [storageMedium](#)
19. [storageFormat](#)

20. [proceduresUsed](#)
21. [samplingPersonnel](#)
22. [sampleNotes](#)
23. [processingPersonnel](#)
24. [processingNotes](#)
25. [processingQCNotes](#)
26. [QCScheme](#)

C Data:

This section gives a summary of the required data content and format for data collected by Gravimetric Survey recording. It covers:

Station Information

Line Event Information,

Processed Data (Observed), Processed Data (Gridded)

Users can use the form [here](#) to record the data and can find additional information in [Appendix C](#).

Format

To submit gravity and gravimetric data to BGS, the following formats are preferred:

- GeoTIFF/TIFF for records at 300 dpi
- ASCII (CSV or TAB delimited for data)

Where geophysical survey data are supplied to a DAC it is recommended that the data are incorporated within a standard documented folder structure as this reduces data archiving costs. For an example folder structure refer to the BGS Offshore Acquisition Folder Structure at <http://www.bgs.ac.uk/downloads/start.cfm?id=2256>.

An inventory of files and their respective sizes, and supply formats and media should be provided to the DAC. This can also be incorporated within the folder structure if necessary e.g. as part of the data processing log.

The following documented exchange data formats are accepted, but may incur a processing overhead due to potential import issues:

ICES

Standard GF3 Subset for Marine Geophysical Data (Bathymetry, Magnetics and Gravity)

<http://ocean.ices.dk/Formats/gf3.aspx>

NGDC (National Geophysical Data Center)

MGD-2000 Gridded Data Format

<http://ngdc.noaa.gov/mgg/dat/geodas/docs/grd98.htm>

MGD77/ MGD77T Marine Geophysical Data Exchange Format

<http://ngdc.noaa.gov/mgg/dat/geodas/docs/mgd77.htm> (comprehensive standard which allows for encoding of the project and survey metadata)

ASEG

GDF2 Format

<https://www.aseg.org.au/sites/default/files/pdf/ASEG-GDF2-REV4.pdf> (comprehensive standard which allows for encoding of the project and survey metadata)

GXF (Grid Exchange File – ASCII format) Format (for exchange of processed grid values, also used by USGS)

http://www.geosoft.com/media/uploads/resources/technical-notes/gxfr3d9_1.pdf

BODC

Ocean Data View Format

https://www.bodc.ac.uk/data/codes_and_formats/odv_format/

QXF (netCDF format) for gridded data

https://www.bodc.ac.uk/data/codes_and_formats/qxf_format/

NetCDF Technical Information

<http://www.unidata.ucar.edu/software/netcdf/>

The data example templates provided in [Appendix C](#) (Processed Data (Observed Data) and Processed Data (Gridded Data)) list the common elements for gravity/gravimetric data exchange.

Gravity data can also be provided in GIS formats compliant with the following geometries/ data types:

- Point geometry for provision of gravity readings at discrete locations over the area of interest
- Surface – grid/raster geometry to represent the gravity surface for the region of interest; due to a regular pixel size being chosen the value for that pixel will be representative
- Surface - TIN (triangulated irregular network) geometry to provide a surface representation based on all gravity readings (points) over the area of interest
- TIFF/ GeoTIFF at least 300 dpi resolution to provide colourised gravity map which also requires a provision of a key of value range over the colour ramp

Where data are submitted using exchange and GIS formats the information specified in General Metadata, Detailed Metadata, Station Information (Optional) and Line Event Information should be provided to accompany the data. Where data are provided using GIS point geometry the attributes tabled in Processed Data (Observed Data) & Processed Data (Gridded Data) can also be incorporated. Some exchange formats make provision for information supply as described by General Metadata, Detailed Metadata and Line Event tables (see below).

Content

What is a Station?

A station refers to a specific target location of repeat sampling being surveyed, such as a fixed mooring or defined area of seabed e.g. a named sandbank. It is useful to record the station position in addition to the location of the measurements (recorded in Line Event information), for example if a data collector is returning to a fixed target station as a basis for repeat replicate sample events and for repeat monitoring surveys. This is optional information.

What is a Line Event?

A line event is the collection of data along a transect or tow, with data being collected either continuously along the line or with discrete data values recorded at a specific time, date and location along the transect or tow.

Station Information:

Please provide as much of the following information as possible if the sampling takes place at defined stations:

1. [stationID](#)
2. [geometry](#)
3. [primaryXCoordinate](#)
4. [primaryYCoordinate](#)
5. [methodID](#)
6. [stationName](#)
7. [secondaryXCoordinate](#)
8. [secondaryYCoordinate](#)
9. [stationNotes](#)

Line Event Information

Gravimetric data are acquired in a grid or a certain line density for a site or route in order to achieve the resolution of data required for feature identification. These data can be cross-referenced with other findings to produce interpretations.

This information is mandatory and **must** be supplied with the gravimetric data to ensure they can be reused:

1. [lineEventID](#)
2. [surveyCode](#)
3. [methodID](#)
4. [startDateTime](#)
5. [endDateTime](#)
6. [startXCoordinate](#)
7. [startYCoordinate](#)
8. [endXCoordinate](#)
9. [endYCoordinate](#)

Additional items:

Please provide as much of the following information as possible to help others assess the data:

1. [stationID](#)
2. [startOriginalLatitude](#)
3. [startOriginalLongitude](#)
4. [endOriginalLatitude](#)
5. [endOriginalLongitude](#)
6. [departureBaseStation](#)
7. [departureBaseStationGravity](#)
8. [arrivalBaseStation](#)
9. [arrivalBaseStationGravity](#)
10. [startKPDistanceAlong](#)
11. [endKPDistanceAlong](#)
12. [lineQualityAssessment](#)
13. [lineNotes](#)
14. [eventName](#)

Processed Data (Observed Data) Information

When providing the gravity/gravimetric data, they must be clearly linked to the acquisition even information for a given file set and replicate. The preferred format for a gravimetric observation is where each observation is presented as a row with the following information in it. The fields are based on the contents of the MGD77 format.

This information is mandatory and **must** be supplied to ensure the observed gravimetric data can be reused:

1. [lineEventID](#)
2. [dateTime](#)
3. [fixPing](#)
4. [xCoordinate](#)
5. [yCoordinate](#)
6. [gravimetricUnits](#)
7. [rawGravity](#)
8. [theoreticalNormalGravity](#)
9. [freeAirGravity](#)
10. [freeAirAnomaly](#)
11. [driftTareBiasCorrection](#)
12. [eotvosCorrection](#)
13. [observedCorrectedGravity](#)
14. [altitudeGravimetricSensor](#)

Additional items:

Please provide as much of the following information as possible to help others assess the gravimetric observed data:

1. [depthGravimetricSensor](#)
2. [layback](#)
3. [kpDistanceAlong](#)
4. [referencePoint](#)

5. [qualityFlagPosition](#)
6. [qualityCodeGravimetrics](#)
7. [geometry](#)

Processed Data (Gridded Data) Information

When providing the gravity/gravimetric data, they must be clearly linked to the acquisition even information for a given file set and replicate. The preferred format for a gravimetric observation is where each observation is presented as a row. Gridded data refers to full density data which are processed to a regular representational grid of values at a chosen grid size. Because each value is a representation of several values, then the ping record information such as date/time is no longer relevant and is excluded.

This information is mandatory for gridded gravimetric data and **must** be supplied to ensure the data can be reused:

1. [observedCorrectedGravity](#)

Additional Items:

Please provide as much of the following information as possible to help others assess the gridded gravimetric data:

1. [xCoordinate](#)
2. [yCoordinate](#)
3. [surveycode](#)
4. [gridSize](#)
5. [gridUnits](#)
6. [surveyEndDate](#)
7. [geometry](#)

Appendix A

General Metadata:

This section describes the general metadata that should be provided with the data.

Users can use the form [here](#) to record General Metadata

To return to the summary above, click [here](#)

The General Metadata fields are common throughout all MEDIN data guidelines and only need to be given once and referenced if your dataset is composed of many data types and therefore conforms to a number of MEDIN guidelines. If your collection of data forms part of a wider project or time series then the **project information** must be recorded but if the work is a small survey then project details may not be required.

A.1 Guidance:

Detailed descriptions and examples are given below to help you create General Metadata to accompany your data.

Survey Information:

This information is mandatory and **must** be supplied with the data to ensure they can be reused:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
surveyName	M	Title of the survey	Free text;	2009 Total E&P UK Ltd Geophysical Site Survey Black Sail UKCS Block 206/04
surveyType	M	Give the type of survey	Free text or Controlled Vocabulary; OGP SSDM WORK CATEG ORY Domain	Geophysical and Hi-Res Seismic (Analogue and Digital Survey)

surveyAbstract	M	Brief description of the purpose of the survey and other types of measurements that were made for the survey.	Free text;	Survey was the first in a series of 3 in 2010 whose specific aim beyond that stated in the project was to identify sites suitable for further monitoring. A range of geophysical techniques were used to assess seabed type.
surveyCode	M	A unique code for the survey to allow links to be built between this and sample event data, (the cruise identifier code could be used). To ensure uniqueness, it is recommended that the website of the organization responsible for the work is used followed by a unique code designated by the responsible organization.	Free text;	http://www.bennett.ac.uk/RIBJULY_03_01
originator	M	The organization that has created the dataset. If the organization is not in EDMO please contact enquiries@oceannet.org to add it. If a person who is not associated with any organization generated the data then please provide the name in the sample event table.	Controlled vocabulary: European Directory of Marine Organizations (EDMO) at http://seadatanet.maris2.nl/edmo/	28: Centre for Environment, Fisheries and Aquaculture Science, Lowestoft Laboratory
owner	M	Organization that owns the data set. If the organization is not in EDMO please contact enquiries@oceannet.org to add it.	Controlled vocabulary: European Directory of Marine Organizations (EDMO) at http://seadatanet.maris2.nl/edmo/	53: BP Exploration and Production

surveyStartDate	M	The date and time that the survey started.	Date or DateTime; yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2013-01-24 12:33:00
timeZone	M	Give the time zone in which the date and time of the data acquisition is made (preferably Coordinated Universal Time (UTC))	Free text;	UTC

Additional Items:

Please provide as much of the following information as possible to help others assess the data:

Survey Information:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
surveyEndDate	C	The date and time that the survey ended. May be left null if the survey is ongoing.	Date or DateTime; yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2014-02-16 16:33:00
platformName	C	Mandatory if a vessel was used for the survey. The name of the ship from which the sampling device was deployed. If your ship is not on the list please contact accessions@ices.dk	Controlled vocabulary: ICES Reference Codes, Table SHIPC at http://vocab.ices.dk/	74LG: Lough Foyle AA30: Unspecified Ship 74E9: Cefas Endeavour AA36: Unspecified Fishing Vessel AA33: Unspecified Self-Propelled Small Boat
platformType	O	The platform type (e.g. Research Vessel) from which the sampling device was deployed.	Controlled vocabulary: NVS2 Platform Classes, Table L06 at https://www.bodc.ac.uk/data/codes_and_formats/vocabulary_search/L06/	31: Research Vessel; 13: beach/intertidal zone structure; 48: mooring; 71: human

cruiseReport Reference	O	Cruise report or boat log reference if applicable.	Free text; in reference format.	Litt, E.J. 2009. PHiXT 4. 30 July to 2 August 2009 RV Prince Madog POL Coastal Observatory Liverpool Bay Cruise Report. POL Coastal Observatory, Liverpool.
surveyReport Reference	O	Survey report reference if applicable.	Free text; in reference format.	Cutts, N., Hemingway, K., and Thompson. S (2011) Biological survey of the Intertidal sediments of the South Shore of the Solway Firth. Report to Natural England YBB170-F-2011
surveyMetadata URL	O	A URL which links to the metadata for the survey.	URL.	http://www.bgs.ac.uk/DECC_SS_REF_2090
confidentiality	O	Note if the survey is confidential	Free text;	Restricted access; Public;

Project Information:

Please provide as much of the following information as possible if the survey forms part of a wider project

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
projectName	M	The nationally/ internationally accepted version of the project name.	Free text;	Marine Conservation Zone Monitoring programme; North Hoyle Windfarm EIA; Rapid Climate Change;

projectCode	M	Provide a code to uniquely identify the project and allow links to be made between the tables. To ensure uniqueness, it is recommended that the website of organisation responsible for the work is used followed by a unique code designated by the responsible organisation which should reflect the code used by the funding organisation where possible.	Free text;	http://www.dassh.ac.uk/ME102 ;
projectStartDate	M	The date that the project started which is from when the funding was in place to start. Use the 1 st of the month if the exact date is not known.	Date; yyyy-mm-dd;	2012-01-24;
projectEndDate	C	The date that the project finished or is due to finish. Use the 1 st of the month if the exact date is not known.	Date; yyyy-mm-dd;	2015-01-24;
projectWebsite	C	If a project website exists give the address. This should be the web address of the environmental survey and not, in the case of environmental impact assessments, the engineering development.	URL;	http://www.southampton.ac.uk/oes/research/projects/rapid_meridional_overturning_circulation_moc_page
projectMetadataURL	O	A URL which links to the metadata for the project.	URL;	http://portal.oceanet.org/search/full/catalogue/dassh.ac.uk_MEDIN_2.3_9bc028bba91772eae38e3e6310f00fe4.xml

Appendix B

Detailed Metadata:

This section describes the detailed metadata that should be collected with the data. It contains specific information about the methods used, the people/organisations that carried out the work and any calibrations that have been applied to the data.

Users can use the form [here](#) to record Detailed Metadata

To return to the summary above, click [here](#)

The Detailed Metadata fields are specific to each data guideline and should be completed for each type of data. The information requested here may be supplied as additional metadata or may be supplied in a cruise or survey report, provided all the required information is included in the report.

B.1 Guidance:

Detailed descriptions and examples are given below to help users create Detailed Metadata to accompany their data.

Method Information:

This information is mandatory and **must** be supplied with the data to ensure they can be reused:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
methodID	M	Method Identifier. A unique code for the methods to allow links to be built between this and sample event data.	Free text;	METHOD_4376
systemMounting Point	M	State the mounting of the system: Gyroscope, Towed Platform	Free text;	Towed Platform
systemMounting	M	Give details of Gravimeter/ Gravimeter mounting arrangement	Free text;	A specially constructed sledge is used to tow the gravimeter

sensorDetails	M	State the name and number of the Magnetometer system used: manufacturer and model	Controlled Vocabulary; NVS2 SeaVOX Device Catalogue L22 at https://www.bodc.ac.uk/data/codes_and_formats/vocabulary_search/L22/ or Free text if new system	TOOL0752: Micro-g LaCoste air-sea gravity system II gravimeter
spatialCRS	M	Spatial coordinate reference system. Describes the system of spatial referencing i.e. the datum used to supply the decimal latitudes and longitudes. There are additional fields to indicate the datum of the original data if the coordinates have been transformed.	Controlled vocabulary: EPSG Geodetic Parameter Dataset at http://www.epsg-registry.org/	WGS84 code: EPSG::4326; British National Grid (projected) code: EPSG::27700; ETRS89 / UTM zone 28N code: EPSG::25828; ETRS89 / UTM zone 29N code: EPSG::25829; ED50 code: EPSG::4230; UTM31N code: EPSG::23031
positionFix	M	Position fix method and source. Give the method and source of the position fix instrument.	Free text;	Differential GPS taken from the ships navigation equipment. 4 point satellite fix achieved

horizontal Accuracy	M	Horizontal positional accuracy. How accurate the spatial positions are likely to be.	Decimal; units = metres	15.2
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Method Information

Additional items:

Please provide as much of the following information as possible to help others assess the data:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
originalCRS	C	Datum of original coordinate if different from the one used to supply data.	Controlled vocabulary: EPSG Geodetic Parameter Dataset at http://www.epsg-registry.org/ or other defined coordinate reference system register;	WGS84: EPSG:: 4326; British National Grid (projected): EPSG:: 27700; ETRS89 / UTM zone 28N: EPSG:: 25828; ETRS89 / UTM zone 29N: EPSG:: 25829; ED50: EPSG:: 4230; UTM31N: EPSG:: 23031
transformation	C	Transformation used to create decimal degrees if transformation undertaken.	Free text;	Data was converted from OSGB to WGS84 in ArcGIS using the petroleum transformation.

depthCRS	C	Give the reference to which the depth has been calculated e.g. Ordnance Datum Newlyn; Highest Astronomical Tide. Mandatory if seabed depths are given for each sample.	Controlled vocabulary: EPSG Geodetic Parameter Dataset at http://www.epsg-registry.org/	Ordnance Datum Newlyn code: EPSG::5701; Malin Head height code: EPSG::5731
verticalAccuracy	C	Vertical positional accuracy. How accurate the vertical resolution is. Must be provided if seabed depths are given.	Decimal; units = metres	0.5
serialNumber	C	State the serial number of the system	Free text;	1234567a
processing Organisation	C	The laboratory/organisation(s) (with EDMO record ID) that processed the data if different from the originator identified in the general metadata. Contact MEDIN to add an organisation to this list	Controlled Vocabulary; European Directory of Marine Organisations (EDMO) at http://seadatanet.maris2.nl/v_edmo/welcome.asp	2588: ABP Marine Environmental Services Ltd
systemDetails	C	Describe the system to indicate the type of configuration used, and include dimensions and offsets where relevant.	Free text.	System is mounted on gyroscope in hull x=1, y=3, Z=-5 from CRP
systemSampling Rate	O	State the sampling rate	Decimal Number; Units = Seconds (0 if continuous)	0.00001
systemLogRate	O	State the data logging/digitising rate	Decimal Number; Units = 10ths of minutes	0.001
minMaxDepth	O	Minimum/ maximum depth range of system if submarine system used	Free text; units = metres	2 - 20

minMaxAltitude	O	State the operating altitude above seabed for system if submarine system used	Free text; units = metres	1 - 2
theoreticalGravity Formula	O	State theoretical gravity free air formula used	Free text.	Heiskanen 1924 International 1930 IAG System 1967 IAG System 1980 Other, specify
corrections	O	Drift, tare and bias correction applied each day	Free text;	+0.075 mGal per day
acquisition Software	O	State data acquisition software used	Free text separated by semi-colon if more than one software system used; e.g. topside systems	Kongsberg SIS
acquisition SoftwareVersion	O	State data acquisition software version used	Free text separated by semi-colon if more than one software system used; e.g. topside systems	v 3.8.3
processing Software	O	State processing software used	Free text; separated by semi-colon if more than one software type used;	Fledermaus
processing SoftwareVersion	O	State data processing software version used	Free text; separated by semi-colon if more than one software type used	v 4.0

storageMedium	O	The storage medium used for the data	Free text;	1TB Portable Hard drive DVD Dell Precision R5500 4TB RAID 5 external hard drive
storageFormat	O	Data format for logged data	Free text;	QINSy DB
proceduresUsed	O	SOPs/Protocols used. Any written methodology used should be referenced and linked. If the methodology is not referenced then provide a full description here.	Free text.	Method- ology follows the IHO S-44 Standards for Hydro- graphic Surveys http://www.iho.int/iho_publications/standard/S-44_5E.pdf
samplingPersonnel	O	Names or the personnel who were involved in collecting and processing the data	Free text; full personnel names separated by semi-colon if a team collated the data;	Joe Bloggs; Brian Begger online surveyors and Jane Smith Data Processor
sampleNotes	O	Any further notes on the sample collection that may be of relevance to data acquisition	Free text;	Due to rough weather the survey ceased for WOW at date/time, re- commenced at date/time

processing Personnel	O	Names of the personnel who were involved in processing the gravimetric data and their role in the analysis.	Free text; personnel name(s) separated by semi-colon if more than one personnel involved; indicate organisation name in brackets if more than one organisation involved.	John Doe; Henry Rice (MEConsulting) QINSy Data Processing; Harriet Smith (MarineConsult) Charting; Jamie Creed (MarineConsult) Quality Control
processingNotes	O	Any further notes on data processing that may be of relevance	Free text;	Algorithm applied to remove data artefacts
processingQC Notes	O	Any further notes on data processing quality that may be of relevance	Free text;	QC procedure applied using Integrated Management System procedures
QCScheme	O	Description of any quality control scheme that data were audited under during the analysis.	Free text.	Data audited using outcomes defined in scope of work

Appendix C

Data:

This section gives a summary of the required data content and format for Gravimetric Survey data. It covers:

Station Information

Line Event Information,

Processed Data (Observed), Processed Data (Gridded)

Users can use the form [here](#) to record the data

To return to the summary above, click [here](#)

C.1 Guidance:

Detailed descriptions and examples are given below to help users to produce data in the preferred format.

Station Information:

If the data collection took place at target stations, this information **must** be supplied with the data to ensure it can be reused:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
stationID	M	Station identifier. A unique identifier for the station.	Free text.	Stanton_Bank_station_4 (point); EastChan_Innerdover_se04; Liverpool_Dublin_ferry_route1 (Video Transect); Lagan_Estuary (area)

geometry	M	Description of station spatial form. Describe if the fixed station is a point, video transect (curve) or an area (surface).	Controlled Vocabulary; NVS2 Geospatial Feature Type, Table L02 at https://www.bodc.ac.uk/data/code_s_and_formats/vocabulary_search/L02/	004: Point; 003: Curve; 005: Surface;
primaryX Coordinate	M	The primary X coordinate for the station as per the defined spatial coordinate reference system in the Detailed Metadata. For a point this field is not required; for a gravimetric survey it is set to the X coordinate of the start of the survey; for an area it is set to the western edge of the box. If supplying longitude, units are positive east (West is negative, East is positive)	Decimal degrees; minimum of four decimal places or Decimal Number if not degrees;	-3.476363, 234865.55
primaryY Coordinate	M	The primary Y coordinate for the station as per the defined spatial coordinate reference system in the Detailed Metadata. For a point this field is not required; for a gravimetric survey it is set to the Y coordinate of the start of the survey; for an area it is set to the southern edge of the box. If supplying longitude, units are positive east (West is negative, East is positive)	Decimal degrees; minimum of four decimal places or Decimal Number if not degrees;	54.583736, 5963487.00
methodID	M	Method identifier. Provides a link to methods including the relevant spatial coordinate reference system (copy from the Detailed Metadata Table).	Free text.	TIMES4376; 02465, 02896

Station Information

Additional items:

Please provide as much of the following information as possible to help others assess the data:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
stationName	O	The name by which a particular station is known	Free text.	L4 Stannock Head
secondaryX Coordinate	C	The secondary X coordinate for the station as per the defined spatial coordinate reference system in the Detailed Metadata. For a point this field is not required; for a gravimetric survey it is set to the X coordinate of the end of the survey; for an area it is set to the eastern edge of the box. If supplying longitude, units are positive east (West is negative, East is positive).	Decimal degrees; minimum of four decimal places or Decimal Number if not degrees;	-3.476363, 234865.55
secondaryY Coordinate	C	The secondary Y coordinate for the station as per the defined spatial coordinate reference system in the Detailed Metadata. For a point this field is not required; for a gravimetric survey it is set to the Y coordinate of the end of the survey; for an area it is set to the northern edge of the box. If supplying latitude, units are positive north (south is negative, north is positive).	Decimal degrees; minimum of four decimal places or Decimal Number if not degrees;	54.583736, 5963487.00
stationNotes	O	Any further notes on the station that may be of relevance can be added here.	Free text;	Rocky reef, west of West Maiden; Also known as Hell's Mouth

Line Event Information:

This information is mandatory and **must** be supplied with the data to ensure they can be reused:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
lineEventID	M	Line Event Identifier. A unique identifier for the line or transect under consideration. Replicate identifiers should be suffixed to the end of a sample identifier using an underscore such as <u>_1</u> or <u>_a</u>	Free text.	E5, PHJ7936, GB004_1, GB004_3
surveyCode	M	The survey code must be stated to allow links to be built between this table and the metadata. The cruise identifier code could be used. Copy from General Metadata table	Free text.	http://www.bennett.ac.uk/RIBJULY_03_01
methodID	M	Method identifier. Provide the identifier for the methods (copy from the Detailed Metadata Table). If multiple methods were used separate codes using a comma.	Free text.	TIMES4376; 02465, 02896
startDateTime	M	The start date/time of the line/transect (sample)	yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2014-01-24 13:33:00
endDateTime	M	The end date/time of the line/transect (sample)	yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2014-01-24 18:45:00
startX Coordinate	M	The X coordinate for the start point of the line or tow as per the defined spatial coordinate reference system in the Detailed Metadata. If recorded as longitude, units are positive east.	Decimal degrees; minimum of four decimal places or Decimal Number if not degrees;	-3.476363, 234865.55
startY Coordinate	M	The Y coordinate for the start point of the line or tow as per the defined spatial coordinate reference system in the Detailed Metadata. If recorded as latitude, units are positive north.	Decimal degrees; minimum of four decimal places or Decimal Number if not degrees;	54.583736, 5963487.00

endX Coordinate	M	The X coordinate for the end point of the line or tow as per the defined spatial coordinate reference system in the Detailed Metadata. If recorded as longitude, units are positive east.	Decimal degrees; minimum of four decimal places or Decimal Number if not degrees;	-3.476363, 234865.55
endY Coordinate	M	The Y coordinate for the end point of the line or tow as per the defined spatial coordinate reference system in the Detailed Metadata. If recorded as latitude, units are positive north.	Decimal degrees; minimum of four decimal places or Decimal Number if not degrees;	54.583736, 5963487.00

Line Event Information

Additional items:

Please provide as much of the following information as possible to help others assess the data:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
stationID	C	Station Identifier if applicable. Copy from Station Table.	Free text.	Stanton Bank site 4, PS74926
startOriginal Latitude	C	The latitude for the start point of the line or transect as recorded at the time of sampling if not recording decimal degrees.	Free text.	50°47'24"N
startOriginal Longitude	C	The longitude for the start point of the line or transect as recorded at the time of sampling if not recording decimal degrees.	Free text.	4°21'53"W
endOriginal Latitude	C	The end latitude of the line or transect as recorded at the time of sampling if not recording decimal degrees.	Free text.	50°47'24"N
endOriginal Longitude	C	The end longitude of the line or transect as recorded at the time of sampling if not recording decimal degrees.	Free text.	4°21'53"W
departureBase Station	C	Base station reference and location if used	Free text.	Shore station B56 at Sea Level 52° 52' 56"N 001° 25' 49"E

departureBase StationGravity	C	Log base station gravity at departure where used	Decimal number; units as specified in data	1280.024
arrivalBase Station	C	Base station reference and location if used	Free text.	Shore station B56 at Sea Level 52° 52' 56"N 001° 25' 49"E
arrivalBase StationGravity	C	Log base station gravity at arrival where used	Decimal number; units as specified in data	1302.056
startKP DistanceAlong	O	Start chainage according to kilometre post (KP) scheme or length and direction of programmed line/ transect. May be negative value if data logging commences before start of line is reached.	Decimal kilometres for KP scheme, Decimal metres for distance scheme	1.005, 1005.00
endKPDistance Along	O	End chainage according to kilometre post (KP) scheme or length and direction of programmed line/ transect. May be greater than programmed line length when logging finishes after end of line.	Decimal kilometres for KP scheme, Decimal metres for distance scheme	125.023, 125023.00
lineQuality Assessment	O	Option to include a line quality assessment if not covered in logs	Free text;	DNP (do not process)
lineNotes	O	Option to include line notes if not covered in logs	Free text;	Line re-run at 1.01
eventName	O	The name of the sampling location.	Free text	Colwyn Bay West; Hand Deeps; inner Orwell Estuary

Processed Data (Observed Data):

When providing the gravity/gravimetrics data it must be clearly linked to the acquisitions event information for a given file set and replicate. The preferred format for a gravimetric observation is where each observation is presented as a row. This table is based on the contents of the MGD77 format.

This information is mandatory and **must** be supplied with the data to ensure they can be reused:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
lineEventID	M	Line event identifier. This links to Line Event information.	Free text.	42
dateTime	M	Date and time of the gravimetry / gravity observation	yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2014-01-24 13:33:00
fixPing	M	Numeric fix number applicable	Number	1234
xCoordinate	M	X coordinate of the line, longitude or easting as per the defined coordinate reference system from the Detailed Metadata. For longitude, east is positive and west is negative.	Decimal degrees; minimum of six decimal places or Decimal Number; Units = metres	-3.476363, 234865.55
yCoordinate	M	Y coordinate of the line, latitude or easting as per the defined coordinate reference system from the Detailed Metadata. For latitude, north is positive and south is negative.	Decimal degrees; minimum of six decimal places or Decimal Number; Units = metres	54.583736, 5963487.00
gravimetric Units	M	Define gravimetric units used	Free text.	mGal, m/s2
rawGravity	M	Raw gravity measurement	Decimal number	
theoretical NormalGravity	M	Theoretical normal gravity at latitude of reading	Decimal number	
freeAirGravity	M	Correction made for elevation, using common vertical reference system	Decimal number	
freeAir Anomaly	M	Theoretical free-air minus observed (corrected) gravity	Decimal number	

driftTareBias Correction	M	Gravity drift tare and bias correction (daily correction or interpolated from base station readings)	Decimal number; (positive or negative)	
eotvos Correction	M	Eotvos correction for gravitational	Decimal number	
observed Corrected Gravity	M	Corrected for Eotvos, drift, tares and bias	Decimal number	
altitude Gravimetric Sensor	M	Altitude above reference system towed/ ship borne sensor	Decimal number Units = metres	

Processed Data (Observed Data):

Additional items:

Please provide as much of the following information as possible to help others assess the data:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
depthGravmetric Sensor	C	Logged depth of gravimetric sensor if towed system used	Decimal number Units = metres	
layback	C	Layback to 1st sensor or CRP of array. Detailed Metadata should be used to store array details	Decimal number Units = metres	1
kpDistanceAlong	O	Chainage according to kilometre post (KP) scheme or length and direction of programmed line/ transect. May be negative value if data logging commences before start of line is reached.	Decimal kilometres for KP scheme, Decimal metres for distance scheme	1.005, 1005.00
referencePoint	O	Option to define reference point if lay back used for towed sensor	Decimal number Units = metres	

qualityFlagPosition	O	Quality flag for position if logged	Controlled Vocabulary; NVS2 SeaDataNet measurand qualifier flags, Table L20 at https://www.bodc.ac.uk/data/codes_and_formats/vocabulary_research/L20/	1 good; 2 bad; 7 excess;
qualityCode Gravimetrics	O	Quality code for gravimetrics if logged	Controlled Vocabulary; NVS2 SeaDataNet measurand qualifier flags, Table L20 at https://www.bodc.ac.uk/data/codes_and_formats/vocabulary_research/L20/	1 good; 2 bad; 7 excess;
geometry	O	Storage of geometry of observation	Point; Surface – TIN for full density/irregular data; Surface –Grid/raster (interpolated)	Point;

Processed Data (Gridded Data)

When providing the gravity/gravimetric data it must be clearly linked to the acquisition event information for a given file set and replicate. The preferred format for a data point is where each representational data point is presented as a row. Gridded data refers to full density data which is processed to a regular representational grid of values at a chosen grid size. Because each value is a representation of several values then the ping record information such as date/time is no longer relevant and is not included.

This information is mandatory and **must** be supplied with the data to ensure they can be reused:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
observedCorrected Gravity	M	Representational observed corrected gravity	Decimal number Units = mGal	167.8

Processed Data (Gridded Data)

Additional items:

Please provide as much of the following information as possible to help others assess the data:

Field Title	M C O	Description	Recommended Controlled Vocabulary or Format	Examples
xCoordinate	C	X coordinate of the grid point as per the defined coordinate reference system from the Detailed Metadata. For longitude, east is positive and west is negative.	Decimal degrees; minimum of six decimal places or Decimal Number; Units = metres	-3.476363, 234865.55
yCoordinate	C	Y coordinate of the grid point as per the defined coordinate reference system from the Detailed Metadata. For latitude, north is positive and south is negative.	Decimal degrees; minimum of six decimal places or Decimal Number; Units = metres	54.583736, 5963487.00

surveyCode	O	A unique code for the survey to allow the gridded data output to be linked to the entire survey, where Line Event Identifier not applicable. Can be included in the file name as an alternative.	Free text;	http://www.bennett.ac.uk/RIBJULY_03_01
gridSize	O	Grid size (can be included in the file name as an alternative)	Decimal number	
gridUnits	O	Use to state grid size units (can be included in the file name as an alternative)	Text; From List Metres or Decimal Degrees	Metres
surveyEndDate	O	Survey end date/time to date the data (can be included in the file name as an alternative)	yyyy-mm-dd or yyyy-mm-dd hh:mm:ss	2014-01-24 13:05:00
geometry	O	Storage of geometry	Point Surface – Grid/Raster or TIN for full density/ irregular data	Point