Title: Gridded data and HDF5 Format - data offset (Revised S100WG4_A5)

S-100 Maintenance - Change Proposal Form (Draft)

Organisation	Raphael Malyankar	**Date**	11-Feb-2019 Revised 25-Feb-2020.
Contact	Raphael Malyankar	**Email**	raphaelm@portolansciences.com

Change Proposal Type *(Select only one option)*

1.Clarification	2.Correction	3.Extension
		X

Location (*Identify all change proposal locations*)

S-100 Version No.	Part No.	Section No.	Proposal Summary
4.0.0	10c	9.6 Table 10c-10	Add optional attributes to indicate the location of the sample point within a cell.

Change Proposal

The change proposal for clause 10c-9.6 and Table 10c-10 extends the HDF5 format with two attributes to indicate the location of the sample point within a grid cell. Bathymetry and potentially other product specifications may need to define grids where the nominal sample data point is located elsewhere than exactly at the grid point at the lower left corner of a cell. The enumeration dataOffsetCode provides an efficient way to indicate whether the sample points are located at corners or centers of grid cells. dataOffsetVector generalizes this to higher-dimensional grids or more complex situations.

[Note: After discussions with the S-111 team, dataCodingFormat=3 (unrectified gridded arrays) has been removed from the scope of the proposal. Significant changes from S-100 WG4 are in red font. Also, all revisions to Part 8 in the WG4 proposal will be rolled into the Part 8 review.]

10c-9.6 Feature container group
[Add the following attribute to Table 10c-10 in each of the sections for dataCodingFormat = 2 (Regularly-gridded arrays), 5 (Irregular grid), 6 (Variable cell size). Add 10c-9.6.1 to explain the use of the new attributes.]

Name	Camel case	Mult.	Data Type	Remarks and/or units
Offset of data point in cell	dataOffsetCode	0..1	Enumeration	1: XMin, YMin ("Lower left") corner ("Cell origin") 2: XMax, YMax ("Upper right") corner 3: XMax, YMin ("Lower right") corner 4: XMin, YMax ("Upper left") corner 5: Barycenter (centroid) of cell

Offset of data point in cell as vector	dataOffsetVector	0..1	Float	Array (1-D) 0..D-1 where D is the value of the dimension attribute Values must be real numbers in the range [0,1].

10c-9.6.1 Location of data point within cell

Product specifications may require their data products to indicate the relative location of the data point corresponding to a grid cell in relation to the corners of the cell. The location can be indicated using either the *dataOffsetCode* or *dataOffsetVector* attribute. These attributes can be used only with grid-based coverages and not with time series, TIN, or moving platform data. Product specifications may use either *dataOffsetCode* or *dataOffsetVector* but not both.

Product specifications in which the data point is located at the (XMin, YMin) grid point need not use either *dataOffsetCode* or *dataOffsetVector*.

The attribute *dataOffsetCode* can be used only with two-dimensional grids. It indicates whether the data point is one of the four cell corners or the centre of the cell. Note that the definitions of the codes indicting the corners are in terms of X and Y grid coordinates relative to the grid origin. (This means that in a grid with its X axis directed from east to west and Y axis from north to south the "lower left" corner is different from the "lower left" corner in a grid with X axis directed west to east and Y axis south to north.)

The attribute *dataOffsetVector* is intended for use with higher-dimension grids or in cases where the data point location is not at one of the corners or the centre of the cell. The values in this array indicate the relative offset along each axis of the data point from the grid point whose grid coordinates are closest to those of the grid origin. In a two-dimensional grid, this will be the point with smallest X and Y grid coordinates. Again, it should be noted that the direction of the axes and the location of the grid origin determines which corner is the cell origin. Each offset is relative to the dimension of the cell along the corresponding axis. The order of values in *dataOffsetVector* must correspond to the order of axes in the *axisNames* array (Table 10c-9).

Change Proposal Justification

This proposal provides additional functionality requested by product specification teams (the attributes defining where the sample points are placed in a cell);

Use cases
dataOffsetCode:
Different commercial packages generate gridded surfaces in different ways, A grid is a collection of nodes who have an exact spatial location on a defined CRS and value(s) that was calculated at that specific location. There are innumerable ways in which to perform this generation. Sometimes a node is generated in the center of a specified point cloud, in which case the dataOffsetCode would indicate "center-cell". Other times, the node is generated at an edge of a point cloud, in which case the dataOffetCode would indicate on of the "corner-cell" options. The reason this is important is that in order to properly visualize or otherwise utilize a gridded dataset, one needs to know how to producer generated the grid to prevent the introduction of error and uncertainty. An extreme use case would be for a data consumer to need to ingest data from multiple HOs, each of which generate their grids based on a different node orientation (center, corner, etc..) This would be impossible to perform correctly with the information in dataOffsetCode.

dataOffsetVector
This is the same as dataOffsetCode with the inclusion of additional spatial axes such as time or depth. Imagine I wanted to store depth of a bay over the course of a year to account for river output during the wet/dry season. I would need latitude, longitude, depth and then another axes for whatever my time increment is. This would not be a common S-102 need, but I could definite see its use for time based specifications such as under-keel clearance or tides/water levels.

What parts of the S-100 Infrastructure will this proposal affect?

☐   S-100 Feature Concept Dictionary Interface or Database
☐   S-100 Portrayal Register
☐   S-100 Feature Catalogue Builder
☐   S-100 Portrayal Catalogue Builder
☐   S-100 UML Models

Please send completed forms and supporting documentation to the secretary S-100WG.