**Recommended Template of Data Quality chapter of S-1xx Data Product Specifications**

**Data Quality Working Group**

**Document Control**

|  |  |  |  |
| --- | --- | --- | --- |
| **Edition Number** | **Date** | **Author** | **Notes** |
| **0.1** | **August 2022** | **DQWG DQ CHAPTER CROSS-CHECK subWG** | **Initial draft for further discussion and amendments** |
| **0.2** | **October 2022** | **DQWG DQ CHAPTER CROSS-CHECK subWG** | **Edited draft following review by DQ CHAPTER CROSS-CHECK subWG** |
| **1.0** | **November 2022** | **DQWG DQ CHAPTER CROSS-CHECK subWG** | **Edited draft following review by DQ CHAPTER CROSS-CHECK subWG** |
| **1.0** | **February 2023** | **DQWG** | **Approved by DQWG18** |
|  |  |  |  |
|  |  |  |  |

**X Data quality**

**X.1 Introduction to data quality**

Data quality allows users and user systems to assess fitness for use of the provided data. Data quality measures and the associated evaluation are reported as metadata of a data product. This metadata improves interoperability with other data products and provides usage by user groups that the data product was not originally intended for. The secondary users can make assessments of the data product usefulness in their application based on the reported data quality measures.

For <this Product Specification> the following Data Quality Elements have been included:

- Conformance to this Product Specification;

- Intended purpose of the data product;

- Completeness of the data product in terms of coverage;

- Logical Consistency;

- Positional Uncertainty and Accuracy;

- Thematic Accuracy;

- Temporal Quality;

- Aggregation measures;

- Validation checks or conformance checks including:

* General tests for dataset integrity;
* Specific tests for a specific data model.

**X.2 Completeness**

**X.2.1 Commission**

Commission is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>.

<This Product Specification> products must be tested with Commission checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option b1:]** The product specification shall describe how Commission is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results. Or

**[Or Option b2:]** In term of Commission, <This Product Specification> products shall at least populate numberOfExcessItems that indicates the number of items that should not have been present in the dataset, and numberOfDuplicateFeatureInstances that indicates the total number of exact duplications of feature instances within the data.

**X.2.2 Omission**

Omission is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>.

<This Product Specification> products must be tested with Omission checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option b1:]** The product specification shall describe how Omission is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option b2:]** In term of Omission, <This Product Specification> products shall at least populate numberOfMissingItems that is the total number of missing items.

**X.3 Logical Consistency**

**X.3.1 Conceptual Consistency**

**[Option1:]**

Conceptual Consistency isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Conceptual Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 1.

<This Product Specification> products must be tested with Conceptual Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Conceptual Consistency is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** In term of Conceptual Consistency, <This Product Specification> products shall at least populate numberOfInvalidSurfaceOverlaps that is the total number of erroneous overlaps within the data.

**X.3.2 Domain Consistency**

Domain Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 5.

<This Product Specification> products must be tested with Domain Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option b1:]** The product specification shall describe how Domain Consistency is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option b2:]** In term of Domain Consistency, <This Product Specification> products shall at least populate numberOfNonconformantItems that is a count of all items in the dataset that are not in conformance with their value domain.

**X.3.3 Format Consistency**

Format Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 10a/10b/10c.

<This Product Specification> products must be tested with Format Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option b1:]** The product specification shall describe how Format Consistency is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option b2:]** In term of Format Consistency, <This Product Specification> products shall at least populate physicalStructureConflictsNumber that is a count of all items in the dataset that are stored in conflict with the physical structure of the dataset.

**X.3.4 Topological Consistency**

**[Option1:]**

Topological Consistency isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Topological Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 7.

<This Product Specification> products must be tested with Topological Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Topological Consistency is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]**In term of Topological Consistency, <This Product Specification> products shall at least populate rateOfFaultyPoint CurveConnections that is the number of faulty link-node connections in relation to the number of supposed link-node connections, numberOfMissingConnectionsUndershoots that is a count of items in the dataset within the parameter tolerance that are mismatched due to undershoots, numberOfMissing ConnectionsOvershoots that is a count of items in the dataset within the parameter tolerance that are mismatched due to overshoots, numberOfInvalidSlivers that is a count of all items in the dataset that are invalid sliver surfaces, numberOfInvalidSelfIntersects that is a count of all items in the dataset that illegally intersect with themselves, and numberOfInvalidSelfOverlap that is all items in the dataset that illegally self-overlap.

**X.4 Positional Uncertainty and Accuracy**

**X.4.1 Absolute or External Accuracy**

**[Option1:]**

Absolute or External Accuracy isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Absolute or External Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Absolute or External Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a. 1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Absolute or External Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** In term of Absolute or External Accuracy, <This Product Specification> products shall at least populate RMSError that indicates the standard deviation, where the true value is not estimated from the observations but known a priori.

Recommendations for Absolute or External Accuracy are as follow:

Maximum RMSE (horizontal) = E / 10000

Maximum RMSE (vertical) = Vint / 6

Where:

E = Denominator of intended scale of mapping

Vint = Normal contour line interval

**X.4.2 Vertical Position Accuracy**

**[Option1:]**

Vertical Position Accuracy isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Vertical Position Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Vertical Position Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Vertical Position Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** In term of Vertical Position Accuracy, <This Product Specification> products shall at least populate linearMapAccuracy3Sigma that indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value lies with a probability of 90%.

**X.4.3 Horizontal Position Accuracy**

**[Option1:]**

Horizontal Position Accuracy isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Horizontal Position Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Horizontal Position Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Horizontal Position Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** In term of Horizontal Position Accuracy, <This Product Specification> products shall at least populate circularError95 that indicates the radius describing a circle in which the true point location lies with the probability of 95%.

**X.4.4 Relative or Internal Accuracy**

**[Option1:]**

Relative or Internal Accuracy isn’t applicable for <this Product Specification>.

**[Option2:]**

Relative or Internal Accuracy is applicable for <this Product Specification> or the data quality scope of <this Product Specification>and follow the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Relative or Internal Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a. 1:]** Data should only be published if it passes a particular test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Relative or Internal Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** In term of Relative or Internal Accuracy, <This Product Specification> products shall populate one or both of the relativeVerticalError that indicates an evaluation of the random errors of one relief feature to another in the same data set or on the same map/chart, and relativeHorizontalError that indicates an evaluation of the random errors in the horizontal position of one feature to another in the same data set or on the same map/chart.

**X.4.5 Gridded Data Positional Accuracy**

**[Option1:]**

Gridded Data Position Accuracy isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Gridded Data Position Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Gridded Data Position Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

Gridded positional accuracy is defined by the precision of the positional reference used to specify its location within its spatial projection. These positional references are contained within the spatial metadata of the <this Product Specification> grid. Nodes within a grid have an absolute position with no horizontal error with vertical values that are calculated for that position by the processes and procedures used by each data producer during the creation of the <this Product Specification> grid. Appropriate selection of both the origin reference points and positional resolution are important and are another factor in gridded positional accuracy.

In term of Gridded Data Position Accuracy, <This Product Specification> products shall at least populate RMSErrorPlanimetry that indicates the radius of a circle around the given point, in which the true value lies with probability P.

Recommendations for Gridded Data Position Accuracy are as follow:

Maximum RMSE (horizontal) = GSD / 6

Maximum RMSE (vertical) = GSD / 3

Where:

GSD = Ground Sampling Distance

**X.5 Thematic Accuracy**

**X.5.1 Thematic Classification Correctness**

Thematic Classification Correctness is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Thematic Classification Correctness checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option a1:]** Data should only be published if it passes the test. **[Or Option a2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option b1:]**The product specification shall describe how Thematic Classification Correctness is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option b2:]** In term of Thematic Classification Correctness, <This Product Specification> products shall at least populate miscalculationRate that is the number of incorrectly classified features in relation to the number of features that are supposed to be there.

**X.5.2 Non-Quantitative Attribute Accuracy**

**[Option1:]**

Non-Quantitative Attribute Accuracy isn’t applicable for <this Product Specification>.Thematic accuracy of <this Product Specification> data is wholly quantitative.

**[Or Option2:]**

Non-Quantitative Attribute Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Non-Quantitative Attribute Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Non-Quantitative Attribute Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** The accuracy of non-quantitative attributes can be correct or incorrect. <This Product Specification> products shall at least populate numberOfIncorrectAttributeValues that is a count of all attribute values where the value is incorrect.

**X.5.3 Quantitative Attribute Accuracy**

**[Option1:]**

Quantitative Attribute Accuracy isn’t applicable for <this Product Specification>.Thematic accuracy of <this Product Specification> data is wholly non-quantitative.

**[Or Option2:]**

Quantitative Attribute Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Quantitative Attribute Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Quantitative Attribute Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** The accuracy of quantitative attributes can be measured in terms of uncertainty intervals. <This Product Specification> products shall at least populate attributeValueUncertainty3Sigma that indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%.

**X.6 Temporal Quality**

**X.6.1 Temporal Consistency**

**[Option1:]**

Temporal Consistency isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Temporal Consistency is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Temporal Consistency checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

In term of Temporal Consistency, <This Product Specification> products shall populate chronologicalOrder that indicate that an event is incorrectly ordered against the other events.

**X.6.2 Temporal Validity**

**[Option1:]**

Temporal Validity isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Temporal Validity is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Temporal Validity checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]**The product specification shall describe how Temporal Validity is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** In term of Temporal Validity, <This Product Specification> products shall at least populate numberOfNonConformantItems that is a count of all items in the dataset that are not in conformance with their value domain.

**X.6.3 Temporal Accuracy**

**[Option1:]**

Temporal Accuracy isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Temporal Accuracy is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>and follows the guidelines from S-100 Part 4c.

<This Product Specification> products must be tested with Temporal Accuracy checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

**[Option 2b.1:]** The product specification shall describe how Temporal Accuracy is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** In term of Temporal Accuracy, <This Product Specification> products shall at least populate attributeValueUncertainty3Sigma that indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%.

**X.7 Aggregation**

**[Option1:]**

Aggregation isn’t applicable for <this Product Specification>.

**[Or Option2:]**

Aggregation is applicable for <this Product Specification> or the data quality scope<XXX> of <this Product Specification>. The aggregated Data Quality result provides a result if the dataset has passed conformance to the Data Product Specification.

<This Product Specification> products must be tested with Aggregation checks prior to release by the data producer. The data producer must review the check results and address any issues to ensure sufficient quality of the data products. The checks are listed in Annex X. **[Option 2a.1:]** Data should only be published if it passes the test. **[Or Option 2a.2:]** it is allowable to publish the data with a quality statement which indicates non-conformance.

<This Product Specification> product shall include a standalone quality report which provides full information on the original results (with evaluation procedures and measures applied), the aggregated result, and the aggregation method. The dataset or exchange set metadata that is distributed with the exchange set will describe only the aggregated result with a reference to the original results described in the standalone quality report.

**[Option 2b.1:]**The product specification shall describe how Aggregation is to be populated, for example, stating the mechanism to reference the quality evaluation procedure, and allowable values for the quality results.

**[Or Option 2b.2:]** In term of Aggregation, <This Product Specification> products shall at least populate DataProductSpecificationPassed that is a Boolean indicating that all requirements in the referred data product specification are fulfilled, and DataProductSpecificationFailRate that is a number indicating the number of data product specification requirements that are not fulfilled by the current product/dataset in relation to the total number of data product specification requirements.

**X.8 Quality Measure Elements**

The data quality measures recommended in S-97 (Part C) and their applicability in <this Product Specification> are indicated in Table X.1 below. NA indicates the measure is not applicable. The application schema above has indicated how the data quality elements will be related to the data items, and the encoding description below will indicate how the quality elements will be encoded.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| **No.** | **Data quality element and sub element** | **Definition** | **DQ measure / description** | **Evaluation scope** | **Scope in <this Product Specification>** |
| 1 | Completeness / Commission | Excess data present in a dataset, as described by the scope. | numberOfExcessItems / This data quality measure indicates the number of items in the dataset, that should not have been present in the dataset. | dataset/dataset series |  |
| 2 | Completeness / Commission | Excess data present in a dataset, as described by the scope. | numberOfDuplicateFeatureInstances / This data quality measure indicates the total number of exact duplications of feature instances within the data. | dataset/dataset series |  |
| 3 | Completeness / Omission | Data absent from the dataset, as described by the scope. | numberOfMissingItems / This data quality measure is an indicator that shows that a specific item is missing in the data. | dataset/dataset series/spatial object type |  |
| 4 | Logical Consistency / Conceptual Consistency | Adherence to the rules of a conceptual schema. | numberOfInvalidSurfaceOverlaps / This data quality measure is a count of the total number of erroneous overlaps within the data. Which surfaces may overlap and which must not is application dependent. Not all overlapping surfaces are necessarily erroneous. | spatial object / spatial object type |  |
| 5 | Logical Consistency / Domain Consistency | Adherence of the values to the value domains. | numberOfNonconformantItems / This data quality measure is a count of all items in the dataset that are not in conformance with their value domain. | spatial object / spatial object type |  |
| 6 | Logical Consistency / Format Consistency | Degree to which data is stored in accordance with the physical structure of the data set, as described by the scope | physicalStructureConflictsNumber / This data quality measure is a count of all items in the dataset that are stored in conflict with the physical structure of the dataset. | dataset/dataset series |  |
| 7 | Logical Consistency / Topological Consistency | Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope. | rateOfFaultyPointCurveConnections / This data quality measure indicates the number of faulty link-node connections in relation to the number of supposed link-node connections. This data quality measure gives the erroneous point-curve connections in relation to the total number of point-curve connections. | spatial object / spatial object type |  |
| 8 | Logical Consistency / Topological Consistency | Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope. | numberOfMissingConnectionsUndershoots / This data quality measure is a count of items in the dataset within the parameter tolerance that are mismatched due to undershoots. | spatial object / spatial object type |  |
| 9 | Logical Consistency / Topological Consistency | Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope. | numberOfMissingConnectionsOvershoots / This data quality measure is a count of items in the dataset within the parameter tolerance that are mismatched due to overshoots. | spatial object / spatial object type |  |
| 10 | Logical Consistency / Topological Consistency | Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope. | numberOfInvalidSlivers / This data quality measure is a count of all items in the dataset that are invalid sliver surfaces. A sliver is an unintended area that occurs when adjacent surfaces are not digitized properly. The borders of the adjacent surfaces may unintentionally gap or overlap to cause a topological error. | dataset / dataset series |  |
| 11 | Logical Consistency / Topological Consistency | Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope. | numberOfInvalidSelfIntersects / This data quality measure is a count of all items in the dataset that illegally intersect with themselves. | spatial object / spatial object type |  |
| 12 | Logical Consistency / Topological Consistency | Correctness of the explicitly encoded topological characteristics of the dataset, as described by the scope. | numberOfInvalidSelfOverlap / This data quality measure is a count of all items in the dataset that illegally self-overlap. | spatial object / spatial object type |  |
| 13 | Positional Accuracy / Absolute or External Accuracy | Closeness of reported coordinative values to values accepted as or being true. | RMSError / Standard deviation, where the true value is not estimated from the observations but known a priori. | spatial object / spatial object type |  |
| 14 | Positional Accuracy / Vertical Position Accuracy | Closeness of reported coordinative values to values accepted as or being true. | linearMapAccuracy3Sigma / Half length of the interval defined by an upper and lower limit in which the true value lies with probability 95%. | spatial object / spatial object type |  |
| 15 | Positional Accuracy / Horizontal Position Accuracy | Closeness of reported coordinative values to values accepted as or being true. | circularError95 / Radius describing a circle in which the true point location lies with the probability of 95%. | spatial object / spatial object type |  |
| 16 | Positional Accuracy / Relative or Internal Accuracy | Closeness of the relative positions of features in a dataset to their respective relative positions accepted as or being true. | relativeVerticalError/ An evaluation of the random errors of one relief feature to another in the same data set or on the same map/chart. It is a function of the random errors in the two elevations with respect to a common vertical datum. [Adapted from ISO 19157] | spatial object / spatial object type |  |
| 17 | Positional Accuracy / Relative or Internal Accuracy | Closeness of the relative positions of features in a dataset to their respective relative positions accepted as or being true. | relativeHorizontalError/ An evaluation of the random errors in the horizontal position of one feature to another in the same data set or on the same map/chart. [Adapted from ISO 19157] | spatial object / spatial object type |  |
| 18 | Positional Accuracy / Gridded Data Position Accuracy | Closeness of reported coordinative values to values accepted as or being true. | RMSErrorPlanimetry / Radius of a circle around the given point, in which the true value lies with probability P. | spatial object / spatial object type |  |
| 19 | Temporal Quality / Temporal Consistency | Correctness of ordered events or sequences, if reported. | chronologicalOrder/ This data quality measure that indicate that an event is incorrectly ordered against the other events. [Adapted from ISO 19157] | dataset/dataset series/spatial object type |  |
| 20 | Temporal Quality / Temporal Validity | Validity of data with respect to time | numberOfNonConformantItems/ This data quality measure is a count of all items in the dataset that are not in conformance with their value domain. [Adapted from ISO 19157] | dataset/dataset series/spatial object type |  |
| 21 | Temporal Quality / Temporal Accuracy | Correctness of the temporal references of an item (reporting of error in time measurement) | attributeValueUncertainty3Sigma/ This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%. [Adapted from ISO 19157] | dataset/dataset series/spatial object type. |  |
| 22 | Thematic Accuracy / Thematic Classification Correctness | Comparison of the classes assigned to features or their attributes to a universe of discourse. | miscalculationRate / This data quality measure indicates the number of incorrectly classified features in relation to the number of features that are supposed to be there. [Adapted from ISO 19157]  This is a RATE which is a ratio, and is expressed as a REAL number representing the rational fraction corresponding to the numerator and denominator of the ratio.  For example, if there are 1 items that are classified incorrectly and there are 100 of the items in the dataset then the ratio is 1/100 and the reported rate = 0.01. | dataset/dataset series/spatial object type |  |
| 23 | Thematic Accuracy / Non-Quantitative Attribute Accuracy | Correctness of non-quantitative attribute. | numberOfIncorrectAttributeValues / This data quality measure is count of the total number of erroneous attribute values within the relevant part of the dataset. It is a count of all attribute values where the value is incorrect. [Adapted from ISO 19157] | dataset/dataset series/spatial object type |  |
| 24 | Thematic Accuracy / Quantitative Attribute Accuracy | Accuracy of a quantitative attribute. | attributeValueUncertainty3Sigma / This data quality measure indicates the attribute value of uncertainty where half the length of the interval defined by an upper and lower limit in which the true value for the quantitative attribute lies with a probability of 95%. [Adapted from ISO 19157] | dataset/dataset series/spatial object type |  |
| 25 | Aggregation Measures / AggregationMeasures | In a data product specification, several requirements are set up for a product to conform to the specification. | DataProductSpecificationPassed / This data quality measure is a boolean indicating that all requirements in the referred data product specification are fulfilled. | dataset/dataset series/spatial object type |  |
| 26 | Aggregation Measures / AggregationMeasures | In a data product specification, several requirements are set up for a product to conform to the specification. | DataProductSpecificationFailRate / This data quality measure is a number indicating the number of data product specification requirements that are not fulfilled by the current product/dataset in relation to the total number of data product specification requirements. | dataset/dataset series/spatial object type |  |

Table X.1 - IHO recommended quality elements and their relevance to <this Product Specification>