

# Spatial Extent - Track

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## Element Description

The Track element provides orbit information for data collected via satellite including Cycle, Pass, and Tiles. This allows for file level searches on these orbital parameters. Track is a recently added element that is only available at the granule level.

## Best Practices

The Track element was designed to support the Surface Water and Ocean Topography (SWOT) mission managed by NASA's PO.DAAC data center, however, this concept can be applied to any data that can be described using orbital cycles, passes, and tiles. There are three main components to the Track element:

1. **Cycle:** A cycle is an integer that represents data from a specific set of satellite orbits. What constitutes a full cycle will vary from mission to mission. Typically, a cycle includes a full set of spatially varied data - a new cycle indicates that the spatial pattern of data collection is being repeated. For example, for the SWOT mission, a cycle is equivalent to 21 days of data made up of 14 full Earth orbits per day. Each of these orbits covers a slightly different spatial extent, and the exact same spatial area is not covered again until the next cycle. The cycle number also inherently includes a temporal component, since each cycle number indicates the passage of time (i.e. data from the 2nd cycle is collected after the 1st cycle, etc.).
2. **Pass:** A pass includes data from a half-orbit. Each spatially unique pass should be assigned a unique identifier, and thus, the pass is represented by an integer. Each pass is made up of a number of tiles, which are assigned identifiers based on their unique spatial location. A granule may be comprised of data from a single pass, or multiple passes.
3. **Tiles:** A tile is a subset of a pass' spatial extent. A set of consecutive tiles make up a pass. Each spatially unique tile has a unique identifier. The tile element holds the list of tile identifier(s) that exist in the granule, allowing a user to search by tile identifier. What constitutes a tile will vary from mission to mission. For example, for the SWOT mission, a tile is defined as a spatial extent that encompasses either a 64 km x 64 km square to the left or to the right of the ground track, or a rectangle that includes a full scanning swath both to the left and right of the ground track.

Each tile is contained within a pass (half-orbit), which is contained within a cycle. There will only be one instance of a particular pass number and tile identifier in a given cycle, therefore, the combination of tile, pass, and cycle can be used to constrain a data search.

### Examples:

Example 1: A granule from cycle 1 containing 2 passes, where each pass includes 12 tiles	A granule from cycle 12, containing 4 passes, where each pass contains 4 tiles
Track:  Cycle: 1  Passes:  Pass: 34  Tiles: ["396", "397", "398", "399", "400", "401", "402", "403", "404", "405", "406", "407"]  Pass: 35  Tiles: ["408", "409", "410", "411", "412", "413", "414", "415", "416", "417", "418", "419"]	Track:  Cycle: 12  Passes:  Pass: 1  Tiles: ["1L", "2R", "3L", "4R"]  Pass: 2  Tiles: ["5L", "6R", "7L", "8R"]  Pass: 3  Tiles: ["9L", "10R", "11L", "12R"]  Pass: 4  Tiles: ["13L", "14R", "15L", "16R"]

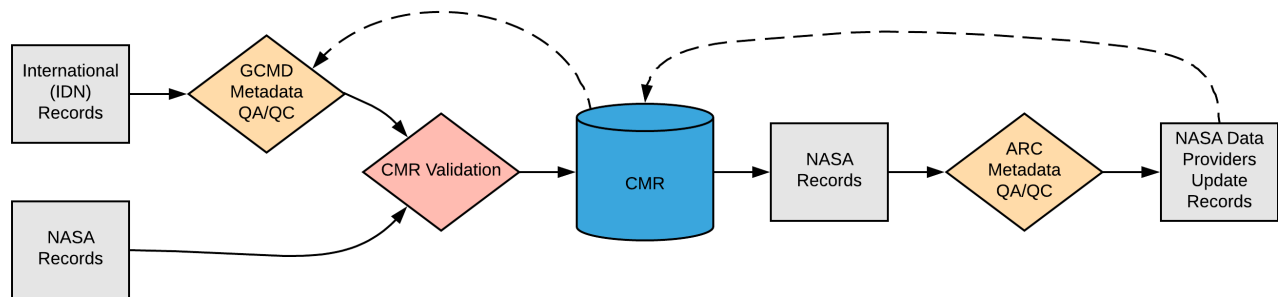
## Element Specification

Track is an optional element in the UMM-G (Cardinality: 0..1)

Model	Element	Type	Constraints	Required?	Cardinality	Notes
UMM-G	SpatialExtent/Track /Cycle	Integer	n/a	Yes, if applicable	1	Track is an optional metadata element. If provided, it is required that cycle, pass information be included.
UMM-G	SpatialExtent/Track /Passes/Pass	Integer	n/a	Yes, if applicable	1..*	A minimum of 1 pass number must be provided.
UMM-G	SpatialExtent/Track /Passes/Tiles	Array composed of Strings	n/a	No	0..*	Listing the tile identifiers within a pass is optional, but highly recommended.

## Metadata Validation and QA/QC

All metadata entering the CMR goes through the below process to ensure metadata quality requirements are met. All records undergo CMR validation before entering the system. The process of QA/QC is slightly different for NASA and non-NASA data providers. Non-NASA providers include interagency and international data providers and are referred to as the International Directory Network (IDN).



Please see the expandable sections below for flowchart details.

### <> ARC Priority Matrix

Priority Categorization	Justification
Red = High Priority Finding	This element is categorized as highest priority when: <ul style="list-style-type: none"><li>The Track information provided does not align with the granule data.</li><li>The Track is provided but either Cycle or Pass are missing. Both Cycle and Pass must be provided in the Track element.</li></ul>
Yellow = Medium Priority Finding	Not Applicable
Blue = Low Priority Finding	This element is categorized as low priority when: <ul style="list-style-type: none"><li>No Tiles are listed under Pass.</li></ul>
Green = No Findings/Issues	The element is provided and follows all applicable criteria specified in the best practices section above.

### ARC Automated Checks

ARC uses the [pyQuARC library](#) for automated metadata checks. Please see the [pyQuARC GitHub](#) for more information.

## Dialect Mappings

## ECHO 10

The Track element does not exist in ECHO 10.

### Example Mapping

None, since ECHO 10 doesn't support the Track element.

## ISO 19115-2 MENDS

Spatial Extent - Track is optional in ISO 19115-2 MENDS.

UMM-G Element	Path	Type	Notes
SpatialExtent/Track	/gmi:MI_Metadata /gmd:identificationInfo /gmd: MD_DataIdentification /gmd:extent/gmd: EX_Extent id="boundingExtent" [=>  [=>/gmd: geographicElement /gmd: EX_GeographicDescription id="Track"/gmd: geographicIdentifier /gmd:MD_Identifier [==>  [==>/gmd:description /gco:CharacterString = Track and [==>/gmd:codeSpace /gco:CharacterString = gov.nasa.esdis.umm. track	String	N/A
SpatialExtent/Track/Cycle	[==>/gmd:code/gco: CharacterString = "Cycle: {value}"	String	Cycle, Pass and Tiles are all provided in the "gmd:code" field. Cycle and Pass are differentiated by the "Cycle: " and "Passes: " prefixes. List the cycle number after the "Cycle: " prefix.
SpatialExtent/Track/Passes/Pass	[==>/gmd:code/gco: CharacterString = "Passes: [pass1 [tiles 1] pass2 [tiles 2]]"	String	Cycle, Pass and Tiles are all provided in the "gmd:code" field. Cycle and Pass are differentiated by the "Cycle: " and "Passes: " prefixes. Provide the first pass number in square brackets after the "Passes: " prefix. To list a set of Tiles within a Pass, open a second set of square brackets right after the Pass number and list the Tiles as an array. To list a second Pass number, close the second set of square brackets (containing the Tiles from the first pass) and then list the second Pass number. Repeat this pattern as many times as needed to provide all Passes and Tiles contained within the granule.
SpatialExtent/Track/Passes/Tiles	(see above)	String	

### Example Mapping

ISO 19115-2 MENDS

```

<gmi:MI_Metadata>
  <gmd:identificationInfo>
    <gmd:MD_DataIdentification>
      <gmd:extent>
        <gmd:EX_Extent> id="boundingExtent"
        ...
        <gmd:geographicElement>
          <gmd:EX_GeographicDescription> id="Track"
            <gmd:geographicIdentifier>
              <gmd:MD_Identifier>
                <gmd:description>
                  <gco:CharacterString>Track</gco:
CharacterString>
                </gmd:description>
                <gmd:codeSpace>
                  <gco:CharacterString>gov.nasa.
esdis.umm.track</gco:CharacterString>
                </gmd:codeSpace>
                <gmd:code>
                  <gco:CharacterString>Cycle:4
Passes:[13["1T", "2T", "3T", "4T"]14["5T", "6T",
"7T", "8T"]]</gco:CharacterString>
                </gmd:code>
              </gmd:MD_Identifier>
            </gmd:geographicIdentifier>
          </gmd:EX_GeographicDescription>
        </gmd:geographicElement>
        ...
      </gmd:EX_Extent>
    </gmd:extent>
  </gmd:MD_DataIdentification>
</gmd:identificationInfo>
</gmi:MI_Metadata>

```

## UMM

```

"SpatialExtent": {
  ...
},
"Track": {
  "Cycle": 4,
  "Passes": [
    {
      "Pass": 13,
      "Tiles": ["1T", "2T", "3T", "4T"]
    },
    {
      "Pass": 14,
      "Tiles": ["5T", "6T", "7T", "8T"]
    }
  ]
},
},

```

## ISO 19115-2 SMAP

Spatial Extent-Track currently does not map to ISO 19115-2 SMAP.

Specification	Path	Type	Notes
ISO 19115-2 SMAP	N/A	N/A	N/A

## Example Mapping

ISO 19115-2 SMAP

N/A

UMM

## UMM Migration

UMM Version 1.4.0	Translation Direction	UMM Version 1.5.0

## History

### UMM Versioning

Version	Date	What Changed
1.6.0	11/4/2019	No changes were made for Track during the transition from version 1.5.0 to 1.6.0.
1.5.0	01/30/2019	The Track element was added to the UMM-G schema during the transition from version 1.4.0 to 1.5.0.
1.4.0	08/01/2018	Track was not available in version 1.4.0.

### ARC Documentation

Version	Date	What Changed	Author
1.0	04/02/2019	Recommendations/priority matrix transferred from internal ARC documentation to wiki space	<a href="#">Camille Woods</a> <a href="#">Jeanne' le Roux</a>