

 <p><b>STANDARD</b></p> <p><b>Meteorological Metadata Local Set</b></p>	<p><b>MISB ST 0809.2</b></p> <p><b>1 November 2018</b></p>
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## 1 Scope and Introduction

This Standard defines KLV metadata to convey meteorological information within a Local Set construct.

## 2 References

- [1] MISB ST 0807.22 MISB KLV Metadata Registry, Jun 2018.
- [2] MISB ST 0107.3 KLV Metadata in Motion Imagery, Nov 2018.
- [3] MISB ST 0603.5 MISP Time System and Timestamps, Oct 2017.
- [4] SMPTE RP 210v13:2012 Metadata Element Dictionary.
- [5] *Range Commanders Council Document 351-97, A Glossary of Selected Meteorological Terms*, Jun 1997.

## 3 Acronyms

<b>AGI</b>	Advanced Geospatial Intelligence
<b>KLV</b>	Key-Length-Value
<b>MASINT</b>	Measurement and Signatures Intelligence
<b>MSL</b>	Mean Sea Level
<b>PPM</b>	Parts per Million
<b>ST</b>	Standard

## 4 Revision History

Revision	Date	Summary of Changes
ST 0809.2	11/01/2018	<ul style="list-style-type: none"> <li>• Renamed document</li> <li>• Removed Section 6.1; Moved Section 6.2 to after Table 1</li> <li>• Combined Table 1 notes with those in Section 8</li> <li>• Data type ISO7 changed to utf8 in Table 1</li> <li>• Added Local Set Universal Label</li> <li>• Updated References [1]-[3]</li> </ul>

## 5 Introduction

Advanced Geospatial Intelligence (AGI) (also known as Imagery Derived MASINT) entails the quantitative analysis of imagery sensor data. Fundamental to almost all AGI techniques is the characterization of the atmosphere between an observed object/activity and the sensor that records it. This standard provides both the language with which to describe the atmosphere and the mechanisms to convey that knowledge.

There is no intent in this document to imply the exploitation of any particular phenomenology in any specific region(s) of the electromagnetic spectrum. Rather, this document establishes the means to describe and convey a broad range of basic information about the atmosphere applicable to many purposes.

The Meteorological Metadata Local Set 16-Byte Universal Label is registered in MISB ST 0807 [1] as:

06.0E.2B.34.02.2B.01.01.0E.01.03.01.0E.00.00.00 (CRC 41809)
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## 6 Meteorological Metadata Local Set

Requirement(s)	
ST 0809.1-01	All metadata shall be expressed in accordance with MISB ST 0107 [2].
ST 0809.1-02	Each instance of the Meteorological Metadata Local Set shall contain as its first item the time at which the measurement(s) were valid in accordance with MISB ST 0603 [3].
ST 0809.1-03	Each instance of the Meteorological Metadata Local Set shall contain as its second item the Version Number of this ST from which it is constructed.
ST 0809.1-04	Each specific metadata item shall appear only once in any instance of the Meteorological Metadata Local Set.

Table 1 is a list of the Meteorological Metadata Local Set metadata items. Aside from the order of the first two items, a valid instance of the Local Set may contain any or all the remaining metadata items in the Meteorological Metadata Local Set in any order. Details of each item can be found in Section 7.

**Table 1: Meteorological Metadata Local Set**

Local Set Key			Name		
06.0E.2B.34.02.2B.01.01.0E.01.03.01.0E.00.00.00 (CRC 41809)			Meteorological Metadata Local Set		
Tag	Item Name	Key Value (hex)	Type	Units / Range	Len (bytes)
1	Precision Time Stamp	06 0E 2B 34 01 01 01 03 07 02 01 01 01 05 00 00 (CRC 64827)	uint	ms	8
2	Version	06 0E 2B 34 01 01 01 01 0E 01 02 05 04 00 00 00 (CRC 43652)	uint	None	2
3	Reporting ID	06 0E 2B 34 01 01 01 01 0E 01 02 03 33 00 00 00 (CRC 6853)	utf8	String	40 max
4	Device Latitude	06 0E 2B 34 01 01 01 03 07 01 02 01 02 04 02 00 (CRC 8663)	float	+/- 90 degrees (North positive)	8
5	Device Longitude	06 0E 2B 34 01 01 01 03 07 01 02 01 02 06 02 00 (CRC 20407)	float	+/- 180 degrees (East Positive)	8
6	Barometric Pressure	06 0E 2B 34 01 01 01 01 0E 01 02 03 34 00 00 00 (CRC 19432)	float	Pascals	4
7	Black Globe Temperature	06 0E 2B 34 01 01 01 01 0E 01 02 03 35 00 00 00 (CRC 15708)	float	°C	4
8	Wet Bulb Temperature Heat Index	06 0E 2B 34 01 01 01 01 0E 01 02 03 13 00 00 00 (CRC 11659)	float	°C	4
9	Cloud Cover Percentage	06 0E 2B 34 01 01 01 01 0E 01 02 03 14 00 00 00 (CRC 31910)	float	[0 .. 100]	4
10	Cloud Sky Cover Type	06 0E 2B 34 01 01 01 01 0E 01 02 03 15 00 00 00 (CRC 2578)	utf8	String	40 max
11	Cloud Base Height	06 0E 2B 34 01 01 01 01 0E 01 02 03 16 00 00 00 (CRC 37326)	float	m	4
12	Cloud Top Height	06 0E 2B 34 01 01 01 01 0E 01 02 03 17 00 00 00 (CRC 59258)	float	m	4
13	Cloud Thickness	06 0E 2B 34 01 01 01 01 0E 01 02 03 18 00 00 00 (CRC 13204)	float	m	4

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14	Carbon Dioxide Concentration	06 0E 2B 34 01 01 01 01 0E 01 02 03 19 00 00 00 (CRC 17696)	float	Parts per million	4
15	Ozone Concentration	06 0E 2B 34 01 01 01 01 0E 01 02 03 1A 00 00 00 (CRC 57084)	float	Parts per million	4
16	Temperature	06 0E 2B 34 01 01 01 01 0E 01 02 03 1B 00 00 00 (CRC 43080)	float	°C	4
17	Dry Bulb Temperature	06 0E 2B 34 01 01 01 01 0E 01 02 03 1C 00 00 00 (CRC 63845)	float	°C	4
18	Wet Bulb Temperature	06 0E 2B 34 01 01 01 01 0E 01 02 03 1D 00 00 00 (CRC 36817)	float	°C	4
19	Relative Humidity	06 0E 2B 34 01 01 01 01 0E 01 02 03 1E 00 00 00 (CRC 5133)	float	[0 .. 100]	4
20	Dew Point	06 0E 2B 34 01 01 01 01 0E 01 02 03 1F 00 00 00 (CRC 25273)	float	°C	4
21	Temperature Lapse Rate	06 0E 2B 34 01 01 01 01 0E 01 02 03 20 00 00 00 (CRC 39614)	float	°C	4
22	Lighting Conditions	06 0E 2B 34 01 01 01 01 0E 01 02 03 21 00 00 00 (CRC 60426)	utf8	String	40 max
23	Ambient Light Color Temperature	06 0E 2B 34 01 01 01 01 0E 01 02 03 22 00 00 00 (CRC 30678)	float	Kelvin	4
24	Visibility Conditions	06 0E 2B 34 01 01 01 01 0E 01 02 03 23 00 00 00 (CRC 354)	utf8	String	40 max
25	Visibility	06 0E 2B 34 01 01 01 01 0E 01 02 03 24 00 00 00 (CRC 20559)	float	km	4
26	Solar Illumination Diffuse	06 0E 2B 34 01 01 01 01 0E 01 02 03 25 00 00 00 (CRC 9979)	float	Lux	4
27	Solar Illumination Direct	06 0E 2B 34 01 01 01 01 0E 01 02 03 26 00 00 00 (CRC 48423)	float	Lux	4
28	Total Illumination Direct	06 0E 2B 34 01 01 01 01 0E 01 02 03 27 00 00 00 (CRC 52115)	float	Lux	4
29	Fog Presence	06 0E 2B 34 01 01 01 01 0E 01 02 03 28 00 00 00 (CRC 8061)	Boolean	N/A	1

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30	Fog Thickness	06 0E 2B 34 01 01 01 01 0E 01 02 03 29 00 00 00 (CRC 27081)	float	m	4
31	Fog Cover Percentage	06 0E 2B 34 01 01 01 01 0E 01 02 03 2A 00 00 00 (CRC 61973)	float	[0..100]	4
32	Fog Extinction Coefficient	06 0E 2B 34 01 01 01 01 0E 01 02 03 2B 00 00 00 (CRC 33953)	float	1/m	4
33	Precipitation Type	06 0E 2B 34 01 01 01 01 0E 01 02 03 2C 00 00 00 (CRC 54668)	utf8	String	40 max
34	Precipitation Rate	06 0E 2B 34 01 01 01 01 0E 01 02 03 2D 00 00 00 (CRC 41784)	float	mm/hr	4
35	R Naught	06 0E 2B 34 01 01 01 01 0E 01 02 03 2E 00 00 00 (CRC 14564)	float	cm	4
36	Theta Naught	06 0E 2B 34 01 01 01 01 0E 01 02 03 2F 00 00 00 (CRC 20048)	float	micro-radians	4
37	Greenwood Frequency	06 0E 2B 34 01 01 01 01 0E 01 02 03 30 00 00 00 (CRC 33049)	float	Hz	4
38	Rytov Parameter	06 0E 2B 34 01 01 01 01 0E 01 02 03 31 00 00 00 (CRC 63405)	float	N/A	4
39	Tyler Tracking Frequency	06 0E 2B 34 01 01 01 01 0E 01 02 03 32 00 00 00 (CRC 27761)	float	Hz	4

## 7 Local Set Item Details

### 7.1 Precision Time Stamp

Microsecond count of time as defined in MISB ST 0603 [3].

### 7.2 Version

Version number of this standard used in creating the Local Set.

### 7.3 Reporting ID

The name/location of the entity providing the meteorological data.

## **7.4 Device Latitude**

Latitude of the sensor/ station reporting the data in this Local Set (see SMPTE RP 210 [4].)

## **7.5 Device Longitude**

Longitude of the sensor/station reporting the data (see SMPTE RP 210 [4].)

## **7.6 Barometric Pressure**

Atmospheric pressure as measured by a barometer using a column of liquid.

## **7.7 Black Globe Temperature**

Temperature of a dry bulb inside a black copper sphere (usually 150 mm in diameter). Used to calculate effects of solar radiation and wind on apparent temperature.

## **7.8 Wet Bulb Temperature Heat Index**

A composite temperature used to estimate the effect of temperature, humidity, and solar radiation on people. Consists of weighted sum of Web Bulb Temperature (0.7), Dry Bulb Temperature (0.1), and Black Globe Temperature (0.2).

## **7.9 Cloud Cover Percentage**

The portion of the celestial dome which is obscured by cloud; described by the terms clear (0/10), scattered (1/10 to 5/10), broken (6/10 to 9/10), and overcast (10/10).

## **7.10 Cloud Sky Cover Type**

Qualitative description of cloud cover (*e. g.*: “cirrus”).

## **7.11 Cloud Base Height**

Mean Sea Level (MSL) elevation of base of cloud base in meters.

## **7.12 Cloud Top Height**

MSL elevation of cloud deck in meters.

## **7.13 Cloud Thickness**

Difference between Cloud Top Height and Cloud Base Height.

## **7.14 Carbon Dioxide Concentration**

Atmospheric CO<sub>2</sub> concentration in parts per million (ppm).

### **7.15 Ozone Concentration**

Atmospheric O<sub>3</sub> concentration in parts per million (ppm).

### **7.16 Temperature**

Atmospheric temperature in Celsius.

### **7.17 Dry Bulb Temperature**

The temperature in Celsius of the air as measured by the dry-bulb thermometer of a psychrometer.

### **7.18 Wet Bulb Temperature**

The temperature in Celsius a parcel of air would have if cooled adiabatically to saturation at constant pressure by evaporation of water into it with all latent heat supplied by the parcel.

### **7.19 Relative Humidity**

The ratio of the partial pressure of water vapor in the atmosphere to the partial pressure of water vapor for a saturated atmosphere at a given temperature.

### **7.20 Dew Point**

- The temperature to which a given parcel of air must be cooled at constant pressure and constant water-vapor content for saturation to occur. When this temperature is 0 °C, it is sometimes called the Frost Point.
- The temperature at which the saturation vapor pressure of the parcel is equal to the actual vapor pressure of the contained water vapor.

### **7.21 Temperature Lapse Rate**

The negative of the rate of change of temperature with respect to altitude ( $-dT/dz$ ) in dry, unperturbed air.

### **7.22 Lighting Conditions**

Qualitative description of lighting conditions generally including time of day (“dawn,” “pre-dawn”) and cloud conditions (“partly cloudy”).

### **7.23 Ambient Light Color Temperature**

The color temperature of the ambient scene in Kelvin.

### **7.24 Visibility Conditions**

Qualitative description of visibility conditions (“clear,” “haze,” *etc.*)

## **7.25 Visibility**

Visibility range defined by Koschmider formula in km.

## **7.26 Solar Illumination Diffuse**

In Lux.

## **7.27 Solar Illumination Direct**

In Lux.

## **7.28 Total Illumination Direct**

In Lux.

## **7.29 Fog Presence**

Boolean flag for presence of fog.

## **7.30 Fog Thickness**

Fog thickness in meters.

## **7.31 Fog Cover Percentage**

Percentage of scene covered with fog.

## **7.32 Fog Extinction Coefficient**

The Fog Extinction Coefficient is the fraction of light lost to scattering and absorption per unit distance due to fog. It has units of 1/m.

## **7.33 Precipitation Type**

Qualitative description of precipitation (“rain,” “snow,” *etc.*).

## **7.34 Precipitation Rate**

Rate of precipitation in mm/hr.

## **7.35 R Naught**

Fried’s seeing parameter or transverse coherence length (in cm) at 5000 Å.



### **7.36 Theta Naught**

Isoplanatic angle; the measure of how quickly atmospheric turbulence changes relative to the viewing angle as seen from a receiver. Given in micro-radians.

### **7.37 Greenwood Frequency**

Measure of the temporal scale of atmospheric turbulence in Hz.

### **7.38 Rytov Parameter**

Log-amplitude variance predicted by an approximate solution to Maxwell's Equations for propagation through a medium with a random Index of Refraction (unit less).

### **7.39 Tyler Tracking Frequency**

First order tip/tilt tracking frequency required for an adaptive optics system. Given in Hz.