README Document for the SMS/GOES Visible Infrared Spin-Scan Radiometer (VISSR) Visible and Infrared Image Products

VISSRSMS1IMIR	VISSRSMS1IMVIS
VISSRSMS2IMIR	VISSRSMS2IMVIS
VISSRGOES1IMIR	VISSRGOES1IMVIS
VISSRGOES2IMIR	VISSRGOES2IMVIS
VISSRGOES3IMIR	VISSRGOES3IMVIS

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Prepared By:

James E. Johnson	08/04/2022
Name	Date
GES DISC	
GSFC Code 610.2	

<div align="center">Reviewed By:</div>

Name	mm/dd/yyyy
Name	Date
GSFC Code xxx	

Name	mm/dd/yyyy
Name	Date
GSFC Code xxx	

<div align="center">
Goddard Space Flight Center

Greenbelt, Maryland
</div>

Revision History

Revision Date	Changes	Author
08/04/2022	Original	James E. Johnson

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1. Introduction

This document provides basic information on the SMS/GOES Visible Infrared Spin-Scan Radiometer (VISSR) Visible and Infrared Image products.

1.1 Data Product Description

The SMS/GOES VISSR Visible and Infrared Image products contain representations of brightness temperatures displayed as black and white images over a section of the Atlantic, Gulf of Mexico, or the Western Pacific. These products were previously available from the NASA National Space Science Data Center (NSSDC):

Short Name	Long Name	NSSDC Id	Old NSSDC Id
VISSRSMS1IMVIS	VISSR/SMS-1 Visible Imagery on 70mm Film	ESAD-00040	74-033A-01B
VISSRSMS1IMIR	VISSR/SMS-1 Infrared Imagery on 70mm Film	ESAD-00068	74-033A-01C
VISSRSMS2IMVIS	VISSR/SMS-2 Visible Imagery on 70mm Film	ESAD-00202	75-011A-04B
VISSRSMS2IMIR	VISSR/SMS-2 Infrared Imagery on 70mm Film	ESAD-00038	75-011A-04C
VISSRGOES1IMVIS	VISSR/GOES-1 Visible Imagery on 70mm Film	ESAD-00247	75-100A-01B
VISSRGOES1IMIR	VISSR/GOES-1 Infrared Imagery on 70mm Film	ESAD-00105	75-100A-01C
VISSRGOES2IMVIS	VISSR/GOES-2 Visible Imagery on 70mm Film	ESAD-00087	77-048A-01B
VISSRGOES2IMIR	VISSR/GOES-2 Infrared Imagery on 70mm Film	ESAD-00028	77-048A-01C
VISSRGOES3IMVIS	VISSR/GOES-3 Visible Imagery on 70mm Film	ESAD-00211	78-062A-01B
VISSRGOES3IMIR	VISSR/GOES-3 Infrared Imagery on 70mm Film	ESAD-00029	78-062A-01C

Data Coverage

ShortName	Begin Date	End Date
VISSRSMS1IMVIS	1974-07-28 13:33	1975-09-28 00:31
	1979-02-17 08:32	1979-04-19 20:02
VISSRSMS1IMIR	1974-07-28 13:33	1975-09-30 09:05
	1979-02-17 08:32	1979-04-19 21:02
VISSRSMS2IMVIS	1975-02-17 19:02	1975-09-22 19:22
	1979-04-19 22:02	1980-02-01 23:03
VISSRSMS2IMIR	1975-02-22 17:16	1975-09-22 18:35
	1979-04-19 22:02	1980-02-01 15:03
VISSRGOES1IMVIS	1976-01-27 19:02	1976-10-28 21:01
VISSRGOES1IMIR	1976-01-27 19:02	1976-10-28 21:01
VISSRGOES2IMVIS	1977-08-29 15:03	1977-09-09 00:32
	1979-01-03 09:32	1979-01-03 23:32
VISSRGOES2IMIR	1977-08-29 15:03	1977-09-09 00:32
	1979-01-03 09:32	1979-01-03 23:32
VISSRGOES3IMVIS	1979-05-02 18:54	1979-06-08 22:26
VISSRGOES3IMIR	1979-05-02 19:50	1979-06-07 18:26

1.1.1 Visible Infrared Spin-Scan Radiometer

The Visible Infrared Spin-Scan Radiometer (VISSR) was capable of providing both day and night observations of cloud cover and earth/cloud radiance derived temperature measurements from a synchronous spin-stabilized, geostationary satellite for use in operational weather analysis and forecasting. The two-channel instrument was able to take both full and partial pictures of the earth's disk. Both the infrared channel (10.5 to 12.5 micrometers) and the visible channel (0.55 to 0.75 micrometers) used a common optics system. Incoming radiation was received by an elliptically shaped scan mirror and collected by a Ritchey-Chretien optical system. The scan mirror was set at a nominal angle of 45 deg to the VISSR optical axis, which was aligned parallel to the spin axis of the spacecraft. The spinning motion of the spacecraft (approximately 100 rpm) provided a west-to-east scan motion when the spin axis of the spacecraft was oriented parallel to the earth's axis. The latitudinal scan was accomplished by sequentially tilting the scanning mirror north to south at the completion of each spin. A full picture of the Earth took 18.2 min to complete and about 2 min to retrace. During each scan, eight visible-spectrum detectors swept the earth, with a ground resolution of 0.9 km at zero nadir angle. A mercury-cadmium-telluride detector sensed the infrared portion of the spectrum with a horizontal resolution of approximately 9 km at zero nadir angle. The infrared portion of the detector measured radiance temperatures between 180 and 315 deg K with a proposed sensitivity between 0.4 and 1.4 deg K.

1.1.2 SMS/GOES Satellite

The two SMS and first three GOES (SMS-based) satellites were NASA-developed, NOAA-operated, geosynchronous, and operational spacecraft. The spin-stabilized spacecraft carried (1) a visible infrared spin-scan radiometer (VISSR) to provide high-quality day and night cloudcover data and to take radiance-derived temperatures of the earth/atmosphere system, (2) a meteorological data collection and transmission system to relay processed data from central weather facilities to APT-equipped regional stations and to collect and retransmit data from remotely located earth-based platforms, and (3) a space environment monitor (SEM) system to measure proton, electron, and solar X-ray fluxes and magnetic fields.

The cylindrical shaped spacecraft measured 190.5 cm in diameter and 230 cm in length, exclusive of a magnetometer that extended an additional 83 cm beyond the cylinder shell. The primary structural members were a honeycombed equipment shelf and thrust tube. The VISSR telescope was mounted on the equipment shelf and viewed the earth through a special aperture in the side of the spacecraft. A support structure extended radially from the thrust tube and was affixed to the solar panels, which formed the outer walls of the spacecraft and provided the primary source of electrical power. Located in the annulus-shaped space between the thrust tube and the solar panels were stationkeeping and dynamics control equipment, batteries, and most of the SEM equipment. Proper spacecraft attitude and spin rate (approximately 100 rpm) were maintained by two separate sets of jet thrusters mounted

around the spacecraft equator and activated by ground command. The spacecraft used both UHF-band and S-band frequencies in its telemetry and command subsystem. A low-power VHF transponder provided telemetry and command during launch and then served as a backup for the primary subsystem once the spacecraft had attained synchronous orbit.

Spacecraft Information

Satellite	Launch Date	Parking Position
SMS-1	1974-05-17	45°W (GATE position 06/07/1974 to 09/21/1974)
		75°W (from 09/21/1974)
SMS-2	1975-02-06	115°W (03/10/1975 to 01/19/1976)
		135°W (from 01/19/1976)
GOES-1	1975-10-16	75°W (from 10/17/1975)
GOES-2	1977-06-16	75°W (from 06/17/1977)
GOES-3	1978-06-16	135°W (from 06/17/1978)

*GATE = Global Atmospheric Research Program (GARP) Atlantic Tropical Experiment

1.2 Algorithm Background

The SMS/GOES VISRR images were originally produced on commercial image-generation equipment from digital tapes and were made available on 70-mm film. These film strips were scanned to digital TIFF image files. Information on the SMS/GOES data processing can be found in the GOES/SMS User's Guide and VISSR Data Processing Plan document.

1.3 Data Disclaimer

The data should be used with care and one should first read the GOES/SMS User's Guide. Users should cite these data products in their research.

NOAA NESDIS (2022), VISSR/SMS-1 Infrared Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/33TS0F8QDQOJ

NOAA NESDIS (2022), VISSR/SMS-1 Visible Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/SWYV7CLJV8AX

NOAA NESDIS (2022), VISSR/SMS-2 Infrared Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/UD00AOY66TU6

NOAA NESDIS (2022), VISSR/SMS-2 Visible Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/QD3ENYS29YN1

NOAA NESDIS (2022), VISSR/GOES-1 Infrared Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/W66HUFU4KYRQ

NOAA NESDIS (2022), VISSR/GOES-1 Visible Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/HI97S5EBWP1R

NOAA NESDIS (2022), VISSR/GOES-2 Infrared Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/2J1BEWBUKC3M

NOAA NESDIS (2022), VISSR/GOES-2 Visible Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/3VCST77FB49N

NOAA NESDIS (2022), VISSR/GOES-3 Infrared Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/IVA12OZC461E

NOAA NESDIS (2022), VISSR/GOES-3 Visible Imagery on 70mm Film V001, Greenbelt, MD, USA, Goddard Earth Sciences Data and Information Services Center (GES DISC), Accessed: [Data Access Date], 10.5067/WLUHTILISC6D
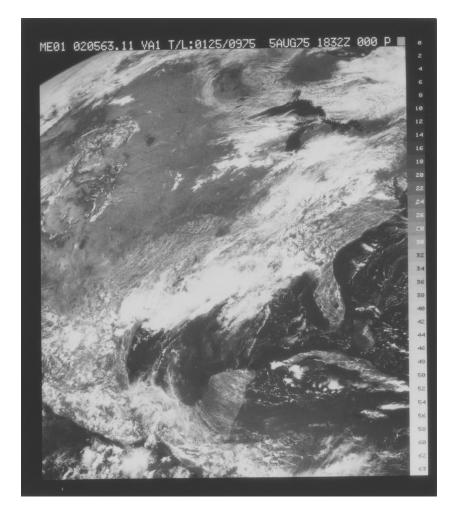
2. Data Organization

2.1 File Naming Convention

The data product files are named according to the name assigned to the film roll along with a scan sequence number followed by the suffix .tif. These are combined into a single ZIP file in a directory with the name as the film roll.

```
File name example: ym12287_014.tif
```

2.2 Image Format and Structure

Image scans are stored as TIFF files and have been combined into ZIP files. Each ZIP file contains several hundred scans, with each scan containing 2 to 3 full pictures. When unzipping the ZIP files there will be a directory containing the TIFF scanned images. Each scan is about 9880 x 3248 pixels, and the 2-3 pictures within are each about 2400 x 2200 pixels in size. The original image prints were 5" x 4" in size. A sample SMS/GOES image layout is shown below:

- **Satellite Identifier:** ME01, ME02, GS01, GS02 or GS03 (where ME=SMS, GS=GOES)
- **Picture . Reel Number**: 6 digit for picture and 2 digit reel number separated by a dot
- **Picture Type**: IR, VA = Visible Mode A or VB = Visible Mode B plus Section Number
- **Coordinate Numbers**: top left pixel relative to the IR sensor (line/pixel)
- **Date:** in format ddMONyy
- **Start Time:** in format hhmmZ
- **Pixel Scale:** pixel scaling table identification
- **Sector Size:** Code

Example:

```
ME01 02563.11 VA1 T/L:0125/0975  5AUG74 1832Z 000 P
```

On the right side is the 33 step gray scale. See the VISSR Data Processing Plan and the GOES/SMS Users Guide for more information.

2.3 Key Science Data Fields

The primary science data fields in these images are brightness temperatures in Kelvin on a 33 level gray scale.

3. Data Contents

The granularity of this data collection is 20 minutes.

4. Reading the Data

The image scans can be read using any software package that is able to display TIFF files. Individual TIFF files need to be unzipped using ZIP software.

5. Data Services

5.1 GES DISC Search

The GES DISC provides a keyword, spatial, temporal and advanced (event) searches through its unified search and download interface:

https://disc.gsfc.nasa.gov/

5.2 Data Download and Documentation

The data product landing page provides information about the data product, as well as links to download the data files and relevant documentation:

https://disc.gsfc.nasa.gov/datacollection/VISSRSMS1IMVIS_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRSMS1IMIR_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRSMS2IMVIS_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRSMS2IMIR_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRGOES1IMVIS_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRGOES1IMIR_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRGOES2IMVIS_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRGOES2IMIR_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRGOES3IMVIS_001.html
https://disc.gsfc.nasa.gov/datacollection/VISSRGOES3IMIR_001.html

6. More Information

6.1 Contact Information

Name: GES DISC Help Desk

URL: https://disc.gsfc.nasa.gov/

E-mail: gsfc-help-disc@lists.nasa.gov

Phone: 301-614-5224

Fax: 301-614-5228

Address: Goddard Earth Sciences Data and Information Services Center

Attn: Help Desk

Code 610.2

NASA Goddard Space Flight Center

Greenbelt, MD 20771, USA

6.2 References

"The GOES/SMS User's Guide", NOAA National Environmental Satellite Service and NASA Goddard Space Flight Center, 1976

"VISSR Data Processing Plan for Synchronous Meteorological and Geostationary Operational Environmental Satellites (SMS/GOES)", NASA Goddard Space Flight Center, September 1977

7. Appendices

7.1 Acknowledgments

7.2 Acronyms

EOS: Earth Observing System

ESDIS: Earth Science and Data Information System

GES DISC: Goddard Earth Sciences Data and Information Services Center

GOES: Geostationary Operational Environmental Satellite

GSFC: Goddard Space Flight Center

L1: Level-1 Data

NASA: National Aeronautics and Space Administration

QA: Quality Assessment

SMS: Synchronous Meteorological Satellite

TIFF: Tag Image File Format

UT: Universal Time

VISSR: Visible Infrared Spin-Scan Radiometer