ALGORITHM DESCRIPTION DOCUMENT
Multispectral Imagery Products from the Metop-SG METImage Instrument

Prepared by:
Bill Line (NOAA/NESDIS/STAR)
Curtis Seaman (CIRA/CSU)
on behalf of the NESDIS STAR Imagery Science Team
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1. Overview

The METImage instrument onboard the Metop-SG-A1 satellite is a new-generation, polar-orbiting imaging radiometer that provides visible and infrared (IR) multispectral imagery at high spatial resolution. Designed to replace AVHRR and complement VIIRS, METImage delivers radiometrically and geometrically calibrated Level 1B (L1B) radiance data across 20 spectral bands. These include several unique channels not present on VIIRS, particularly in the near-IR, water vapor, and CO_2 absorption regions.

NOAA, through its STAR Imagery Team, is developing and validating METImage single-band and RGB imagery for integration into operational forecaster workflows, particularly via AWIPS and CIRA Polar SLIDER. These products will be delivered alongside VIIRS imagery when applicable, providing seamless, temporally extended animations over the poles and other high-latitude regions where geostationary coverage is absent or limited. Over the low-latitudes, METImage and VIIRS will be used together to provide complementary, and sometimes unique, value to geostationary satellites.

2. Instrument and Input Data Description

2.1 METImage Overview

METImage is the multispectral imaging instrument on the Metop-SG-A satellites within the EUMETSAT Polar System - Second Generation (EPS-SG). It provides:

- **Spectral coverage:** 20 channels spanning approximately 0.443 to 13.35 µm.
- **Spatial resolution:** 500 m at nadir for all channels.
- **Swath width:** ~2670 km
- **Orbit:** Mid-morning sun-synchronous orbit with a nominal equator crossing time near 09:30 LT

2.2 Relationship to JPSS VIIRS

Summary of Imagery Specifications:

Feature	METImage	VIIRS
Bands	20	22
Unique Bands	WV, CO_2, O_2-A, 0.91 µm	DNB, finer-resolution I-bands

Resolution @ Nadir	500 m	375 m (I) / 750 m (M)
Swath Width	2670 km	3030 km
Temporal Frequency	12 hr revisit	12 hr revisit
Equatorial Overpass Time	0930 local	1330 local

Details of Band Selection:

- Many METImage bands have close spectral analogs to VIIRS M- and I-bands, which supports viewing of imagery together and direct reuse of VIIRS imagery algorithms. Channels overlapping VIIRS include: "true color" visible bands near 0.443, 0.555, 0.67 µm; NIR bands near 0.865, 1.24, 1.38, 1.6, 2.25 µm; mid-IR window bands around 3.7–4.0 µm; and thermal IR window bands around 8.6, 10.8, 12.0 µm.
- METImage-unique bands:
    - 0.762 µm Oxygen-A band for cloud-top height and atmospheric correction.
    - 0.914 µm VNIR water vapor absorption band for low-level moisture.
    - 6.7 and 7.3 µm IR water vapor bands for upper and lower tropospheric moisture.
    - 13.35 µm CO_2 band for cloud height estimation.
- METImage does not include a Day/Night Band equivalent, so low-light visible imagery is not part of the METImage product set.

Other Details

- METImage offers a mid-morning (~09:30 LT) and early evening (~21:30 LT) overpass time, compared to the early afternoon (~13:30 LT) and overnight (~01:30 LT) overpass of VIIRS. This temporal offset provides complementary observations of cloud and surface conditions, particularly valuable in high latitudes.
- METImage has a narrower swath (~2,670 km) than VIIRS (~3,040 km), resulting in equatorial gaps but good overlapping high-latitude coverage and achieves global coverage.
- METImage features consistent 500 m spatial resolution across all bands, whereas VIIRS combines higher-resolution imaging (375 m I-bands) with moderate-resolution bands (750 m M-bands).

These similarities and differences support synergistic viewing when METImage and VIIRS imagery are interleaved within tools like AWIPS and Polar SLIDER, enabling forecasters to extract more complete temporal and spectral insight.

3. Imagery Types and Products

3.1 Single-Band Imagery

Single-band imagery products are generated directly from METImage L1B radiance data without the need for additional gridding or EDR-style remapping. Due to the fine native resolution and absence of the bowtie deletion artifact present in VIIRS SDRs, imagery can be remapped directly using standard projections (e.g., Plate Carrée or Polar Stereographic) without additional geometric correction.

Single-band imagery includes 20 bands reflective and thermal bands between the wavelengths of 0.443 µm and 13.345 µm.

A table detailing the specific MetImage bands can be found in Appendix A.

3.1.1 Theoretical basis

Single-band imagery converts calibrated L1b radiances into physically meaningful quantities:

- Top-of-atmosphere reflectance for solar channels,
- Brightness temperature for infrared channels.

These quantities are then mapped to a display range and color-enhanced.

3.1.2 Scaling and enhancement

Each METImage band will have a nominal scaling recipe and colormap defined for standard visualization:

- Visible and NIR reflectance bands: typical reflectance range of 0 to 0.6-1.3 (depending on channel) with a linear or square-root grayscale colormap.
- IR bands: typical brightness temperature ranges and colormaps as applied to similar channels on other instruments.

The basic formulation of the scaling follows World Meteorological Organization (WMO) conventions using the following equation:

$$I = 255 * \left(\frac{x - min}{max - min}\right)^{1/gamma} \quad (1)$$

where:

- *I* is the output image intensity or brightness value (byte value between 0 and 255)
- *x* is the input data (calibrated radiance, reflectance or brightness temperature)
- *min* and *max* are the lower and upper bounds of the scaling range, respectively (same units as the input data)
- *gamma* is an optional parameter that allows for a non-linear scaling (for gamma ≠ 1) used to highlight or suppress features at certain ends of the scaling range. For *gamma* < 1, values of *x* on the lower end of the scaling range (i.e. near *min*) are suppressed relative to values of *x* on the higher end of the scaling range (near *max*). For *gamma* > 1, the opposite is true, and values of *x* near *min* are highlighted to a greater extent than values of *x* near *max*.

The output intensity values are then mapped to specific colors (or grayscale) through the use of colormaps. Baseline ranges and colormaps will be adopted from VIIRS, GOES, and EUMETSAT practice, then refined using post-launch validation and VIIRS cross-comparisons. Where a similar VIIRS channel exists, identical ranges and colormaps will be used.

In certain imagery products, the scaling is “inverted”, and the resulting image intensity value = 255 - *I* as given by equation (1). In this case, the values of *min* and *max* are reported such than *min* > *max*. In either case, *min* defines the value at which the output intensity is 0 and *max* defines the value at which the output intensity is 255. As the output intensity is defined as a 1-byte integer, values outside the range between *min* and *max* are capped at 0 and 255, respectively.

3.2 Multispectral (RGB) Imagery

Multispectral Imagery products utilize data from multiple spectral bands that are combined into a single image that provides qualitative information through the use of color. Multispectral Imagery may be further classified as simple RGB image composites or advanced and simple multispectral imagery algorithms. RGB imagery includes composites adapted from VIIRS and other sensors (SEVIRI, ABI, FCI) as well as new RGBs tailored to METImage's unique spectral capabilities. RGB imagery includes both True and False color imagery, for general applications (e.g., cloud monitoring) and hazard specific applications (e.g., blowing snow). RGBs will be produced using standardized ranges (*min*, *max*, *gamma*) for each band. Recipes are detailed in Appendix B. Unique-to-METImage RGBs will continue to be developed post-launch.

In addition to standard RGBs, several advanced multispectral imagery products are being explored for METImage that combine spectral information with ancillary datasets to generate enhanced environmental insights. These products go beyond basic reflectance or brightness temperature composites by incorporating external inputs such as radiative transfer corrections, surface properties, or static reference datasets to improve feature detection and interpretation. Advanced multispectral imagery products applied to METImage are also listed in Appendix B.

Simple multispectral imagery products beyond RGBs and advanced algorithms are also included in Appendix B. These products apply straightforward spectral combinations to highlight environmental features and provide additional context for interpretation.

3.2.1 General RGB formulation

An RGB composite is defined as a combination of spectral channel radiances or derived quantities (reflectance in %, brightness temperature in Kelvin degrees, channel differences and/or ratios), that are projected into the Red-Green-Blue (RGB) color space using the scaling function presented in equation (1). Typically, a set of three instances of equation (1) using different input data and/or different scaling bounds is used to define the red (R), green (G) and blue (B) components of the image. Each component (R, G and B) is comprised of one or more spectral bands.

For METImage, RGBs are produced directly from L1b-derived radiance, reflectance and/or brightness temperature fields, with recipes inherited where possible from VIIRS, ABI, and SEVIRI and extended to exploit METImage unique bands.

4. Data Access, Distribution, and Display

The METImage instrument aboard Metop-SG-A1 will generate L1b radiance files formatted similarly to heritage EUMETSAT sensors but tailored for enhanced spatial and spectral fidelity. Initial access and operational use in the United States will be enabled through a coordinated approach involving direct broadcast reception and distribution of METImage data through the same mechanisms used for JPSS, including cloud-based services. These access pathways will be supported through collaboration across NOAA, its cooperative institutes, and international partners, ensuring reliable availability of the full METImage data stream.

EUMETSAT and its Direct Broadcast partners distribute METImage L1b radiance files that conform to netCDF-4 file format standards according to specifications set in the *EPS-SG VII Level 1B Product Format Specification* document (PDF), which is available for download at the following URL: https://user.eumetsat.int/resources/user-guides/metop-sg-me-timage-l1b-data-guide.

Unlike VIIRS, METImage L1b data files contain the geolocation data and the radiance data for all 20 spectral bands in a single netCDF file. In contrast, the JPSS ground system provides VIIRS Imagery data as a set of 25 HDF-5 files for each granule (22 spectral bands in separate files and three geolocation file types). As detailed in the document referenced above, the geolocation data, as provided in the L1b files, are sub-sampled (i.e. not reported at every pixel) and users need to follow the procedure outlined in the EUMETSAT document in order to retrieve accurate geolocation information for every pixel. Information from a digital elevation map (DEM) is included with each file that allows the user to correct for the parallax effects of terrain ("terrain correction") on the geolocation data as desired. The referenced document also outlines the procedure for converting the calibrated radiance data to reflectance and/or brightness temperature which, unlike VIIRS, must be done by the user.

4.1 Direct Broadcast Reception

The Geographic Information Network of Alaska (GINA) will serve as the primary U.S. direct broadcast reception site for METImage data. Using their polar-orbiting ground station antennas, GINA will acquire METImage data in real time as the satellite passes overhead. These data will be processed on-site into AWIPS-compatible NetCDF formats for downstream ingest and display by the National Weather Service (NWS) in Alaska. This data provides coverage of the high-latitudes within range of the GINA antennas, including northwestern North America, far-eastern Russia and the Arctic. In parallel, the Space Science and Engineering Center (SSEC) at the University of Wisconsin will receive METImage data via their CONUS direct broadcast antennas, providing coverage of most of North America (excluding Alaska, far northern Canada, and southern Mexico) for enhanced situational awareness and expanded utility of low-latency METImage imagery beyond Alaska.

4.2 AWIPS Integration

Once formatted, GINA will transmit the NetCDF imagery files directly to NWS Alaska Region systems for real-time visualization within the Advanced Weather Interactive Processing System (AWIPS) CAVE/D2D. AWIPS configuration file updates, to allow for product ingest and display, will be delivered to NWS for installation ahead of product distribution, and tweaked as needed. These files will be developed as a collaboration between the STAR Imagery Team, GINA, and the NWS. RGB Imagery will be generated "on-the-fly" in AWIPS using existing plugins and the L1b-derived reflectance and brightness temperature fields, replicating how VIIRS imagery is ingested and displayed. Advanced multispectral imagery products will be developed and tested at CIRA and installed at GINA for image generation and delivery to NWS.

Production, development and analysis of CONUS METImage imagery from the SSEC direct broadcast antenna will be conducted at CIRA. Delivery to CONUS NWS offices will be explored as part of a broader effort (currently ongoing) to enable low-latency VIIRS imagery access through cloud-based infrastructure. If successful, this framework could also support the distribution of METImage imagery to CONUS offices.

4.3 Polar SLIDER Integration

The Cooperative Institute for Research in the Atmosphere (CIRA) is committed to provide METImage imagery products on the Polar Satellite Loop Interactive Data Explorer in Realtime (SLIDER) web display tool: https://slider.cira.colostate.edu. Polar SLIDER will host standalone METImage imagery for all available bands and multispectral products, including unique channels such as 0.914 µm, 6.7 µm, 7.3 µm, and 13.3 µm. The platform will display METImage imagery in its native form to highlight these new capabilities. The CONUS sector on Polar SLIDER will display SSEC direct broadcast METImage imagery, helping reduce latency.

4.4 Integration with VIIRS

Integration of METImage imagery with VIIRS will be explored where the sensors share common channels and where their overpasses overlap. This includes the development of blended or sequential VIIRS–METImage animations on both AWIPS and Polar SLIDER, using only spectral bands that exist on both instruments. These blended displays will support seamless visual transitions between sensors, improve temporal continuity, and enhance situational awareness, especially in high-latitude regions. Differences in spectral response, spatial resolution, and radiometric characteristics between sensors will be accounted for to preserve visual consistency. Where no spectral or temporal overlap exists, each instrument's imagery will be viewed as standalone.

5. Validation Approach

Imagery validation will be primarily qualitative and visual. Key activities include:

- Checking for known artifacts: striping, geolocation errors, detector noise, and dropouts
- Cross-comparisons with VIIRS: brightness/reflectance consistency for common bands
- RGB comparisons to ensure consistent hazard depiction (e.g., dust, snow, fog)
- Testing geographic alignment with other satellite products

Additional comparisons will be made with MODIS, SEVIRI, ABI, and CrIS/IASI imagery when appropriate.

6. User Engagement and Applications

The METImage imagery suite is intended to serve forecasters, researchers, and educators. Planned activities include:

- Training modules (quick reference guides, training videos, webinar training sessions)
- Presentations at local and national meetings, workshops, and conferences
- Social media and Satellite Blog content highlighting METImage cases

- Coordination with satellite liaisons and operational users to refine products based on user feedback

Use cases include:

- Fill temporal gaps in polar-orbiting imagery by interleaving METImage with VIIRS in animations, improving continuity for:
    - Cloud monitoring (evolution, clearing, development)
    - Blowing snow and freezing sea spray detection in polar regions
    - Volcanic ash tracking and plume extent monitoring
    - Wildfire hot spot detection/monitoring and smoke dispersion tracking
    - Vegetation monitoring and seasonal greenness assessment
    - Aerosol detection and transport visualization
    - Land surface change detection (e.g., snowmelt, flooding, dust sources)
- New IR and NIR water vapor bands (e.g., 6.7 µm, 7.3 µm, 0.91 µm) enable enhanced synoptic-scale feature analysis, including:
    - Jet streak identification
    - Deformation zones and baroclinic boundaries
    - Areas of cyclogenesis or frontogenesis
    - Moisture advection and drying patterns
    - Embedded shortwaves in large-scale flow
    - Upper-level high and low pressure centers
- Support forecaster decision-making where geostationary imagery is not available or lacks detail, especially in high-latitude regions like Alaska and the Arctic.
- Enable RGBs not possible with VIIRS, such as blended water vapor imagery for detailed moisture structure.
- Serve as a pathfinder for future capabilities in NOAA LEO systems by testing single-band imagery and advanced RGBs and multispectral products in operations.

Appendix A: METImage Band List and Corresponding VIIRS Channels

METImage Band ID	Central Wavelength (µm)	Description	Closest VIIRS Band(s)
VII-4	0.443	Violet/Blue	M-2
VII-8	0.555	Green	M-4
VII-12	0.670	Red	M-5 / I-1
VII-15	0.752	NIR (Cloud/Snow Phase)	M-6
VII-16	0.763	O_2-A Band (Cloud Height)	*No VIIRS equivalent*
VII-17	0.865	Vegetation	M-7 / I-2
VII-20	0.914	NIR Water Vapor	*No VIIRS equivalent*
VII-22	1.24	Snow Discrimination	M-8
VII-23	1.38	Upper-Level Water Vapor	M-9
VII-24	1.63	Snow/Ice	M-10 / I-3
VII-25	2.25	Cloud Phase	M-11
VII-26	3.74	Mid-IR Window	M-12 / I-4
VII-28	3.96	Mid-IR Window	M-13
VII-30	4.04	Mid-IR Window	M-13
VII-33	6.72	Upper-Level Water Vapor	*No VIIRS equivalent*
VII-34	7.33	Mid-Level Water Vapor	*No VIIRS equivalent*
VII-35	8.54	Longwave IR Window	M-14
VII-37	10.69	Longwave IR Window	M-15
VII-39	12.02	Longwave IR Window	M-16
VII-40	13.35	CO_2	*No VIIRS equivalent*

Appendix B. Multispectral Imagery Product Recipes Catalog

This appendix includes detailed numerical recipes for each RGB and advanced and simple multispectral imagery product, suitable for direct implementation in AWIPS, SLIDER, and other tools.

METImage Imagery algorithms are based primarily on those from VIIRS and GOES, mapped to METImage bands via the crosswalk in Appendix A. Where appropriate they are marked as TBD. As METImage begins producing on-orbit data, these tables will be updated with tuned value ranges and potentially additional RGBs, and will be cross-checked against other instrument implementations and forecaster feedback.

B.1 RGB Imagery Products

B.1.1 RGBs Available for Both METImage and VIIRS

These RGBs can be implemented with both METImage and VIIRS because all required bands have close spectral analogs on VIIRS.

RGB name	R component (band, λ, min-max, γ)	G component (band, λ, min-max, γ)	B component (band, λ, min-max, γ)	Primary application
Natural Color/Day Land Cloud	VII-24 (1.63 µm) 0-97.5 % γ = 1.0	VII-17 (0.865 µm) 0-108.6 % γ = 1.0	VII-12 (0.67 µm) 0-100 % γ = 1.0	Daytime land, vegetation, snow and cloud discrimination
True Color	VII-12 (0.67 µm) 0-100 % γ = 1.0	VII-8 (0.56 µm) 0-100 % γ = 1.0	VII-4 (0.44 µm) 0-100 % γ = 1.0	Public-friendly scene depiction, aerosols and smoke
Snowmelt	VII-24 (1.63 µm) 0-100 % γ = 1.0	VII-22 (1.24 µm) 0-100 % γ = 1.0	VII-12 (0.67 µm) 0-100 % γ = 1.0	Distinguish wet snow, dry snow, bare ground and water
Blowing Snow	VII-12 (0.67 µm) 10-110 % γ = 1.0	VII-24 (1.63 µm) 5-40 % γ = 1.0	VII-26 (3.74 µm) minus VII-37 (10.69 µm) 0-15 K γ = 1.0	Low-level blowing snow over snow-covered surfaces
Sea Spray	VII-26 (3.74 µm) minus VII-37 (10.69 µm) 0-10 K γ = 1.0	VII-17 (0.865 µm) 1-20 % γ = 0.6	VII-12 (0.67 µm) 2-25 % γ = 0.6	Sea spray and marine boundary layer in high winds
RGB name	**R component (band, λ, min-max, γ)**	**G component (band, λ, min-max, γ)**	**B component (band, λ, min-max, γ)**	**Primary application**
Dust	VII-39 (12.02 µm) minus VII-37 (10.69 µm) -6.7 to +2.6 K γ = 1.0	VII-37 (10.69 µm) minus VII-35 (8.54 µm) -0.5 to +20 K γ = 2.5	VII-37 (10.69 µm) 261.2-288.7 K γ = 1.0	Blowing and lofted dust, day and night
CVD Dust	VII-37 (10.69 µm) minus VII-35 (8.54 µm) +6 to -0.5 K γ = 0.67	VII-39 (12.02 µm) minus VII-37 (10.69 µm) -6 to +2.5 K γ = 0.67	VII-37 (10.69 µm) 213-313 K γ = 1.0	Improved detection of blowing and lofted dust for users with color vision deficiency
Ash	VII-39 (12.02 µm) minus VII-37 (10.69 µm) -6.7 to +2.6 K γ = 1.0	VII-37 (10.69 µm) minus VII-35 (8.54 µm) -6 to +6.3 K γ = 1.0	VII-37 (10.69 µm) 243.6-302.4 K γ = 1.0	Volcanic ash detection and height cues
Day Cloud Phase Distinction	VII-37 (10.69 µm) 280.7-219.6 K γ = 1.0	VII-12 (0.67 µm) 0-78 % γ = 1.0	VII-24 (1.63 µm) 1-59 % γ = 1.0	Cloud phase, optical thickness, glaciation

Day Snow-Fog	VII-17 (0.865 µm) 0-100 % γ = 1.7	VII-24 (1.63 µm) 0-70 % γ = 1.7	VII-26 (3.74 µm) minus VII-37 (10.69 µm) 0 to 30 K γ = 1.7	Differentiate low cloud/fog from snow-covered surfaces
Nighttime Microphysics	VII-39 (12.02 µm) minus VII-37 (10.69 µm) -6.7 to +2.6 K γ = 1.0	VII-37 (10.69 µm) minus VII-26 (3.74 µm) -3.1 to +5.2 K γ = 1.0	VII-37 (10.69 µm) 243.6-292.7 K γ = 1.0	Low cloud and fog at night, thin cirrus, cloud-top structure
Day Cloud Phase Microphysics	VII-24 (1.63 µm) 0-50 % γ = 1.0	VII-25 (2.25 µm) 0-50% γ= 1.0	VII-12 (0.67 µm) 0-100 % γ = 0.6	Cloud phase and cloud particle size; cloud/snow discrimination
Day Land Cloud Fire	VII-26 (3.74 µm) 0-60 °C γ = 0.4	VII-17 (0.865 µm) 0-100 % γ = 1.0	VII-12 (0.67 µm) 0-100 % γ = 1.0	Combined land, cloud, smoke, and hot spot depiction
Fire Temperature	VII-26 (3.74 µm) 273-333 K γ = 0.4	VII-25 (2.25 µm) 0-100% γ= 1.0	VII-24 (1.63 µm) 0-75% γ = 1.0	Fire hotspot detection and qualitative fire intensity
NGFS Microphysics	VII-37 (10.69 µm) minus VII-39 (12.02 µm) +5 to -1 K γ = 1.0	VII-26 (3.74 µm) minus VII-37 (10.69 µm) +30 to -5 K γ = 1.0	VII-37 (10.69 µm) 243-293 K γ = 1.0	Early detection of hot spots; improved detection of low-intensity fires at night

B.1.2 RGBs Unique or Enhanced for METImage

These RGBs depend on bands that do not exist on VIIRS (for example, 0.914 µm VNIR water vapor, 6.72 and 7.33 µm water vapor bands, or the 13.35 µm CO2 band), or on combinations that are intended primarily for METImage.

RGB name	**R component (band, λ, min-max, γ)**	**G component (band, λ min-max, γ)**	**B component (band, λ, min-max, γ)**	**Primary application**
Volcanic Emissions and SO2	VII-33 (6.725 µm) minus VII-34 (7.325 µm) -4 to +2 K γ = 1.0	VII-37 (10.69 µm) minus VII-35 (8.54 µm) -4 to +5 K γ = 1.0	VII-37 (10.69 µm) 243-303 K γ = 1.0	Volcanic SO_2 plume identification
Daytime Severe Storms	VII-33 (6.725 µm) minus VII-34 (7.325 µm) range TBD	VII-26 (3.74 µm) minus VII-37 (10.69 µm) range TBD	VII-24 (1.63 µm) minus VII-12 (0.67 µm) range TBD	Deep convection, overshooting tops, cold anvil structure
Simple Water Vapor	VII-37 (10.69 µm) range TBD	VII-33 (6.72 µm) range TBD	VII-34 (7.33 µm) range TBD	Water vapor distribution
Differential Water Vapor	VII-34 (7.325 µm) minus VII-33 (6.725 µm) range TBD	VII-34 (7.33 µm) range TBD	VII-33 (6.72 µm) range TBD	Water vapor distribution
Day Land Cloud-Water Vapor Transmittance	VII-24 (1.63 µm) 0-100 % γ = 1.5	VII-20 (0.914 µm) / VII-17 (0.865 µm) ratio 0.6-1.0 [unitless] γ = 1.5	VII-12 (0.67 µm) 0-100% γ = 1.5	Low-level moisture gradients, convective initiation, cloud phase

B.2 Advanced Multispectral Imagery Products for METImage

Advanced multispectral imagery products combine METImage bands with ancillary datasets to enhance feature detection beyond standard RGBs. The table below summarizes each product's inputs and primary application for operational use.

Product Name	**METImage Bands**	**Ancillary Data**	**Primary application**
GeoColor	VII-12 (0.67 µm) VII-8 (0.56 µm) VII-4 (0.44 µm) VII-37 (10.69 µm) VII-26 (3.74 µm)	Rayleigh correction City lights data Land/water mask	Cloud and aerosol monitoring, land surface changes
DEBRA-Dust	VII-39 (12.02 µm) VII-37 (10.69 µm) VII-35 (8.54 µm)	Cloud Mask Surface emissivity Land/water mask Land surface temperature	Blowing dust detection
Snow/Cloud Discriminator (Day)	VII-4 (0.44 µm) VII-12 (0.67 µm) VII-23 (1.38 µm) VII-24 (1.63 µm) VII-25 (2.25 µm) VII-37 (10.69 µm)	Solar zenith angle	Separation of snow cover and multiple cloud layers in daytime
Day/Night Fire Temperature	VII-24 (1.63 µm) VII-25 (2.25 µm) VII-26 (3.74 µm) VII-37 (10.69 µm)	City lights data Solar zenith angle	Fire hotspot detection and qualitative fire intensity with cloud detection and improved georeferencing at night
Shortwave Albedo	VII-26 (3.74 µm) VII-37 (10.69 µm)	Solar zenith angle	Hot spot detection; cloud detection over snow

B.3 Simple Multispectral Imagery Products for METImage

Simple band combinations that provide basic environmental insights without full RGB or advanced algorithmic processing.

Product Name	**METImage Bands**	**Details**	**Primary application**
Split Window Difference	VII-37 (10.69 µm) VII-39 (12.02 µm)	Simple band difference with range of around -2 to 10 K (10.7 minus 12)	Dust detection, volcanic ash detection, low-level moisture gradients
VIS/IR Sandwich	VII-12 (0.67 µm) VII-37 (10.69 µm)	VIS underlay (grayscale) with IR-Window overlay (semi-transparent, non-gray, cold BTs)	Convection, general cloud monitoring