Multi-Sensor Precipitation Estimate: Product Guide

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Document Change Record

Issue / Revision	Date	DCN. No	Summary of Changes
1	6 October 2010		Initial release of Document
1A	24 July 2015		Added content to specify product output and specifications for GRIB-2 Encoded Product. Review by product expert.

Table of Contents

1 PRODUCT DESCRIPTION

The Multi-Sensor Precipitation Estimate (MPE) product provides estimated instantaneous rain rates in full pixel resolution. The algorithm is based on a combination of IR10.8 channel and passive microwave data from the SSM/I instrument on the US Defense Meteorological Satellite Program (DMSP) polar satellites. The IR10.8 channel data can be taken from Meteosat-8, Meteosat-9, or Meteosat-10 satellites (SEVIRI instrument) or from Meteosat-7 satellite (MVIRI). Processing is done in near-real time mode with a time delay of less than 10 minutes between image acquisition and data dissemination. The product is most suitable for convective precipitation, and is intended mainly for areas with poor radar coverage, especially in Africa and Asia.

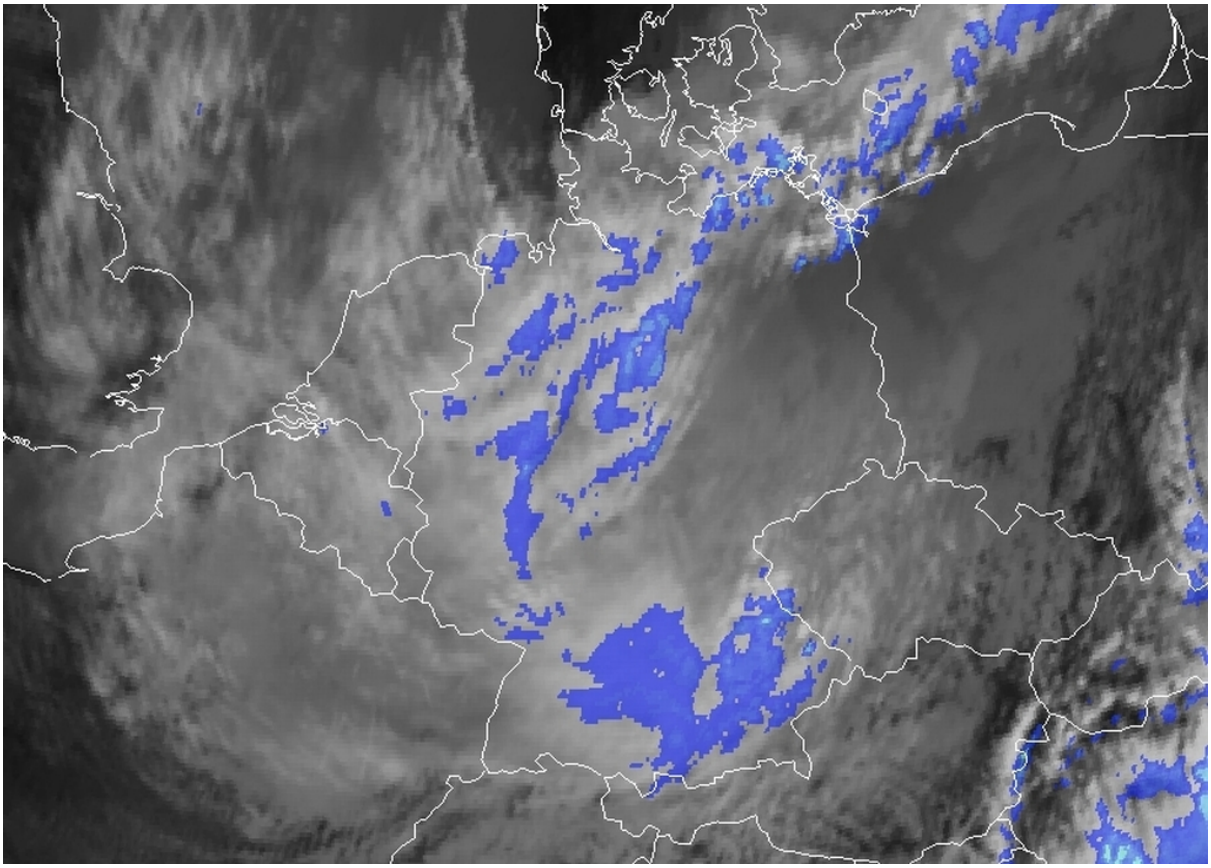

Figure 1: MPE image over central Europe during flooding in June 2013.

2 PRODUCT SPECIFICATIONS

Category	*Specification*
Type	Meteorological product
Applications and users	Severe weather forecasting, air traffic, navigation
Input satellite data	IR10.8 channel and passive microwave data from the SSM/I instrument on the US DMSP. Since 23 November 2009 on the MPE product generation has also used data from SSMIS onboard DMSP-16.
Product Distribution	• EUMETCast • EUMETSAT Data Centre
Product Area	• FES Area limited to 57° North and South, 57° East and West
Product Resolution	Pixel
Product Distribution Frequency	*Full Earth Scanning Area* • EUMETCast: every 15 minutes for the 00:00, 00:15, 00:30, …23:45 UTC products • EUMETSAT Data Centre: every 15 minutes for the 00:00, 00:15, 00:30, …23:45 UTC products *Rapid Scanning Service Area* ▪ EUMETCast: every 5 minutes for the 00:00, 00:05, 00:10, …23:55 UTC products ▪ EUMETSAT Data Centre: every 5 minutes for the 00:00, 00:05, 00:10, …23:55 UTC products *Meteosat Indian Ocean Data Coverage* ▪ EUMETCast: every 30 minutes for the 00:00, 00:30, 01:00, ...23:30 UTC products. ▪ EUMETSAT Data Centre: every 30 minutes for the 00:00, 00:30, 01:00, ...23:30 UTC products.
Product Format	Full Earth Scanning Area: GRIB2 format Rapid Scanning Service Area: GRIB2 format Meteosat Indian Ocean Data Coverage: GRIB2 format
Product Size	*Full Earth Scanning Area:* GRIB product about 2.3 MB (variable) JPEG product about 5.5 MB (variable) *Rapid Scanning Service Area:* Approximately 2 MB (variable) *Meteosat Indian Ocean Data Coverage:* Approximately 2 MB (variable)

The GRIB2 data files contain two quality indicators to identify area where the rain retrieval can be used with a high degree of confidence.

3 PRODUCT ILLUSTRATION

Real-time imagery is sent to the EUMETSAT Web Page, where animation of an image sequence is provided. As shown in Figure 2, users can choose the number of frames in the animation, as well as the speed, as well as other date/time stamps in the sequence.

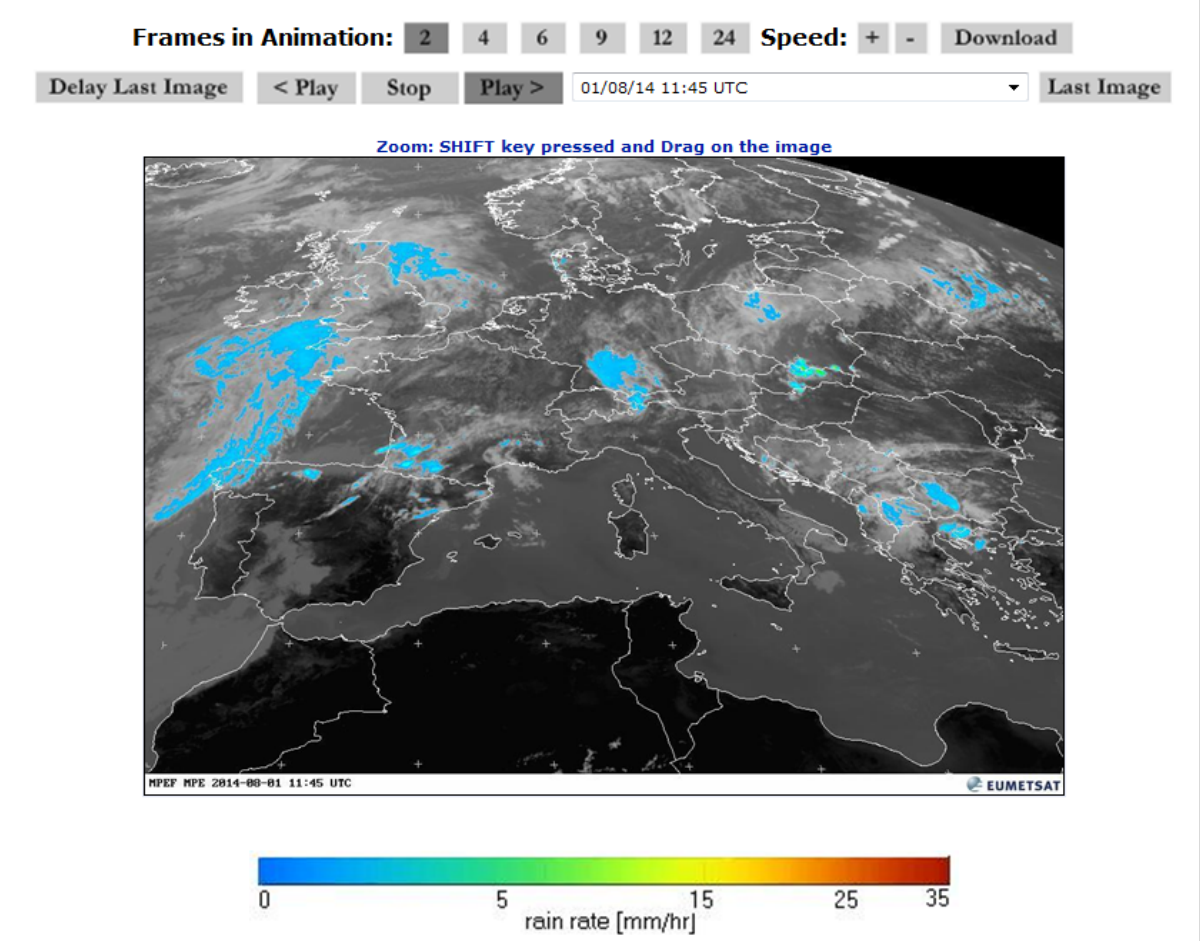

Figure 2: Meteosat 0 degree Multi-Sensor Precipitation Estimate Product at 08:45 UTC on 1 Aug 2014.

Commercial application: Commercial airliners normally do not have the capability to download satellite pictures while en route. However, satellite pictures are available and used for flight preparation, together with other meteorological documentation such as SigWx-Charts, Wind & Temperature Charts and others. The most common kind of satellite picture is infrared, perhaps enhanced infrared, that shows the temperature of the highest clouds. These pictures help, of course, but they may not always reveal the internal structure of weather systems.

Turbulence, lightning, icing, hail and excessive precipitation are the most common dangers associated with intense precipitation areas around or within thunderstorms. A satellite image that identifies precipitation amounts has the potential to give additional information that pilots can use to evade, to fly around, or to pick the best way through dangerous weather conditions. One such satellite precipitation depiction is this MPE product. Figure 3 shows a comparison of an MPE plot and weather radar image used by commercial airliners. For more images, both real-time and archived, type *MPE Products* into the EUMETSAT web site Product Navigator, or go to the images library in the EUMEATSAT web site. See Section 5 for web site links:

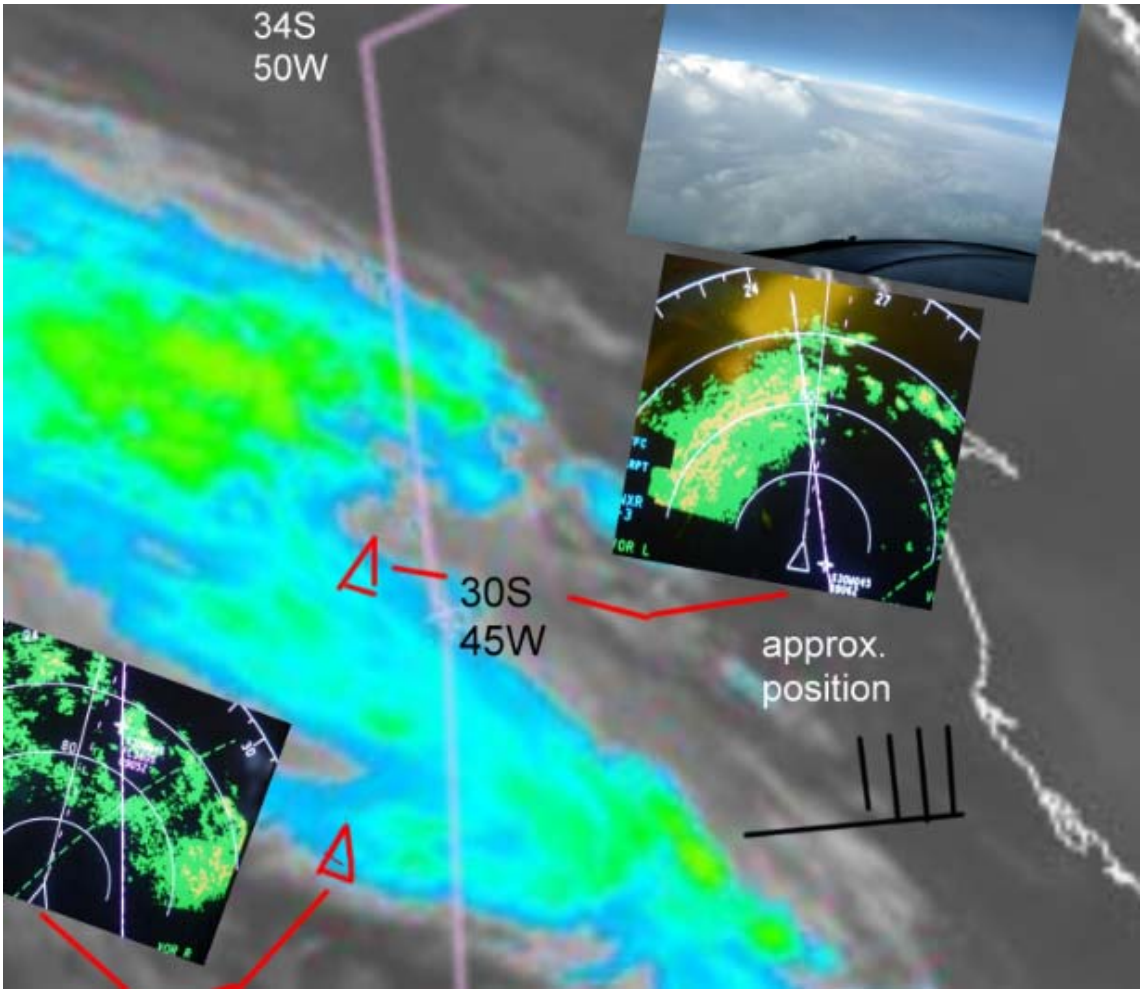

Figure 3: MPE Product (09:00 UTC) and weather radar (first radar image at approximately 8:30 UTC) flying off the coast of Brazil January 2012.

4 BASIC STRUCTURE OF THE MPE ALGORITHM

The MPE algorithm processes IR10.8 channel data in near real-time, or some time later in the event of delayed processing, and derives instantaneous rain rates at full pixel resolution. As additional input, external satellite data from the SSM/I instrument on board the DMSP satellite series are required from up to 24 hours before the acquisition time of the satellite image.

4.1 Inputs:

The main inputs to the MPE algorithm are derived from two separate satellite sources:

- Level 1.5 data from the IR10.8 channel.
- Microwave imager data from the SSM/I instruments on board the polar-orbiting satellites of the DMSP.
- Outputs from the Scenes Analysis (SCE) program.
  - EBBTs derived from the Level 1.5 image data for the IR10.8 channel
  - Scene type on pixel level from the Scenes Analysis
  - The SSM/I and/or SSMI/S rain rates derived from SSM/I and/or SSMI/S image data

4.2 Outputs

The derived rain rates for each pixel as well as the latest Quality Indicators (QIs) are written to the intermediate output files for each processing box.

4.2.1 Derived Rain Rates

Parameter	*Mnemonic*	*Units*	*Min*	*Max*	*Prec*	*Acc*	*To*
Estimated rain rate	R	mm/h	0	100	0.1	0.1	-
Standard deviation	Stdev	mm/h	0	100	0.1	0.1	-
Correlation coefficient	Correl	-	–1	1	0.1	0.1	-

4.2.2 GRIB-2 Encoded Product Table

The previous data are produced for each pixel for the MPE GRIB-2 encoded product according to WMO FM 92-XIII GRIB Code Table 4.2.

4.3 Known Operational Limitations

The product generation depends on the reception of the SSM/I and/or SSMI/S data. The derived rain rates are used to “calibrate” the rain rates derived using the satellite image data. These derived rain rates are used to estimate a “forward calibration in time” from the last received DMSP orbit till the next orbit has been received. The latter orbit will then be used to perform another calibration. When the last received orbit for a given processing area within the satellite image is more than 30 hours then this area is declared as “missing” in the product. When 50% or more of the boxes are declared as “missing” the product is not disseminated to the user community.

5 REFERENCES AND LINKS

5.1 Reference Documents

Type	*Document Name*	*Reference*
Validation	MSG-3 System Commissioning Product Validation Test Report	EUM/MSG/REP/12/0190
Detailed Algorithm	MSG Meteorological Products Extraction Facility Algorithm Specification Document	EUM/MSG/SPE/022

5.2 Online Resources and Assistance

All of the reference documents listed above are in the EUMETSAT Technical Documents page.

www.eumetsat.int > Satellites > Technical Documents > Meteosat Services > 0° Meteosat Meteorological Products

To register for data delivery from this product, go to the Data Registration page on the EUMETSAT web page:

www.eumetsat.int > Data > Data Delivery > Data Registration

GRIB (**GRI**dded **B**inary) is the WMO standard binary format for exchanging gridded data. GRIB Edition 2 is an extension of GRIB, with a much higher degree of flexibility and expandability. For complete details on the format, see the WMO web page:

http://www.wmo.int/pages/prog/www/WMOCodes.html

There is an excellent series of product animations in the EUMETSAT Image library:

Choose Multisensor Precipitation Estimate from the Product drop-menu on this page.

www.eumetsat.int > Images > Image Library

Information about the service status of EUMETSAT satellites and the data they deliver is this EUMETSAT web page:

www.eumetsat.int > Data > Service Status

To get answers to questions about data delivery, registration or documentation, contact the EUMETSAT User Service Help Desk:

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e-mail: ops@eumetsat.int