

Interpretation flags in OMI Level 1B data products

| | | Date | Signature |
|------------------|--------------------------------------|------------------|-----------|
| Author: | Bert van den Oord Pepijn Veefkind | 22 November 2002 | |
| Checked: | N/A | | |
| Approved: | N/A | | |
| Archive: | Rene Noordhoek | 22 November 2002 | |

Distribution list:

Science team

| | |
|-------------------|-------|
| Bert van den Oord | KNMI |
| Pepijn Veefkind | KNMI |
| Pieter Levelt | KNMI |
| Ted Johnson | OSIPS |
| Kostas Stefanidis | OSIPS |
| Al Fleig | OSIPS |

Agency

| | |
|---------------|------|
| Joost Carpay | NIVR |
| Harry Forster | NIVR |
| Anssi Malkki | FMI |

Change status:

| Issue | Date | Comments | Affected pages |
|--------------|------------------|-----------------|-----------------------|
| 1 | 22 November 2002 | First issue | All |

1 Introduction

1.1 Purpose of the document

In this document we present some information for Level 2 product developers on the use and interpretation of the flags contained in the OMI Level 1B data products. We emphasize that each Level 2 product developer has his/her own responsibility for using the information contained in the flags. This document serves merely as a guide. The flags are described in RD1. Because RD1 is a draft document it is anticipated that this document will be updated with future updates of RD1, if required.

1.2 Referenced documents

RD1 OMI Level 1B Product Format Specification, SE-OMIE-0562-DS/02, issue 1 (draft7), 9 August 2002

1.3 Contents of the document

| | |
|-----------|---|
| Chapter 1 | Introduction |
| Chapter 2 | Approach for flagging used for OMI Level 1B data products |
| Chapter 3 | Handling of PixelQualityFlags |
| Chapter 4 | Handling of GroundPixelQualityFlags |
| Chapter 5 | Handling of MeasurementQualityFlags |

2 Approach for flagging

The flags in the OMI Level 1B output products serve the following three purposes

1. inform the users of the data about the reliability of the information. This is especially important when the data is used for Level 2 processing.
2. provide the (in-flight) calibration scientist with information to assess at a high-level the performance of the instrument and/or the GDPS.
3. provide information for the purpose of Quality Assessment (QA).

Because of the desire to limit the size of the output product it is impossible to fulfil these three purposes to their full extent. The total amount of information contained in the flags cannot be optimised in the sense that every bit of information is contained in a specific flag. The scientists, who will use the data for Level 2 processing, will make use highly automated processing flows so that the flags should be designed for that purpose. This implies that the flags should be kept simple to avoid complicated processing options in the Level 2 software.

For data in the Level 1B product the user is mainly interested in the following information:

1. is the data MISSING
2. is the data not to be used (BAD quality).
3. was there an ERROR when the data was generated.
4. was an expected limit exceeded when the data was generated calling for a WARNING to the user.

When for data neither MISSING, BAD, ERROR or WARNING is assigned, a user should fully trust the information contained in the data. Data with BAD or ERROR flags should not be processed to higher-level data products. Data with WARNING flags must be inspected on whether the generated warnings are relevant for a specific use of the data. Of course, flags can also used to provide additional information that may be useful for higher level processing (e.g., land/water or Sunlint flags).

The flags can be found on four levels:

1. image pixel level (PixelQualityFlags).
2. ground pixel level (GroundpixelQualityFlags).
3. measurement level (MeasurementQualityFlags).

For the available flags we have identified whether these fall in the categories MISSING, BAD, ERROR, WARNING or INFORMATION and then regrouped them according to these categories.

3 PixelQualityFlags

The Table below shows the PixelQualityFlags contained in the Level 1B product. These flags are set for each spectral pixel, e.g., for each wavelength of a ground pixel the PixelQualityFlags are available. The third column provides suggestions for the handling of the flag in a Level 2 PGE.

| Bit | Description | Handling in Level 2 PGE |
|-------|--------------------------------------|--|
| 0 | MISSING flag | Do not process pixel/Exclude from fit window |
| 1 | BAD_PIXEL flag | Do not process pixel/Exclude from fit window |
| 2 | PROCESSING_ERROR flag | Do not process pixel/Exclude from fit window |
| 3 | TRANSIENT_PIXEL_WARNING flag | Process pixel/Set warning flag |
| 4 | RTS_PIXEL_WARNING flag | Process pixel/Set warning flag |
| 5 | SATURATION_POSSIBILITY_WARNING flag | Process pixel/Set warning flag |
| 6 | NOISE_CALCULATION_WARNING flag | Process pixel/Set warning flag |
| 7 | DARK_CURRENT_WARNING flag | Process pixel/Set warning flag |
| 8 | OFFSET_WARNING flag | Process pixel/Set warning flag |
| 9 | EXPOSURE_SMEAR_WARNING flag | Process pixel/Set warning flag |
| 10 | STRAY_LIGHT_WARNING flag | Process pixel/Set warning flag |
| 11-13 | Reserved for future use | No action/Ignore |
| 14 | DEAD_PIXEL_IDENTIFICATION flag | No action/Ignore |
| 15 | DEAD_PIXEL_IDENTIFICATION_ERROR flag | No action/Ignore |

The Level 1B WARNING flags provide warnings, as reflected in their name, that an expected limit was exceeded in the Level 1B PGE. We advice that Level 2 PGE developers combine these Level 1B warning flags into a single Level 2 warning flag. The Level 2 warning flag set should be set when any, or more, of the Level 1B WARNING flags are set. The Level 2 warning flag should also be set if the WavelengthPrecision exceeds a threshold, or if the (ir)radiancePrecision exceeds a threshold. The Level 2 PGE developer of a specific data product/algorithm must determine the latter two thresholds.

Whenever for a fit window too many pixels are excluded in the Earth radiance data, making a fit useless, we advice to set an Earth_Radiance_Error flag on ground pixel level.

Whenever for a fit window too many pixels are excluded in the Solar irradiance data, making a fit useless, we advice to set a Solar_Product_Error flag on ground pixel level. The Level 2 PGE developer may consider using a backup irradiance measurement in case in the initial irradiance product too many pixels are excluded.

If for any of the spectral pixels in a fit window the Level 2 warning flag is set for the radiance spectrum, an Earth_Radiance_Warning flag could be set on groundpixel level.

If for any of the spectral pixels in a fit window the Level 2 warning flag is set for the irradiance spectrum, a Solar_Product_Warning flag could be set on groundpixel level.

4 GroundPixelQualityFlags

The GroundPixelQualityFlags in the Level 1B radiance products contain mainly INFORMATION flags about the geolocation data fields. We advice to copy the Level 1B GroundpixelQualityFlags integral into the Level 2 products. The only flag that requires special attention is the Geolocation Error flag contained in bit 6. This flag indicates that the geolocation of the ground pixel could not be determined and is a true ERROR flag.

| Bit | Description | Handling in Level 2 PGE |
|------|-------------------------------------|--|
| 0-3 | Land/Water flags | Copy to output product |
| 4 | Sun Glint Possibility flag | Copy to output product |
| 5 | Solar Eclipse possibility flag | Copy to output product |
| 6 | Geolocation Error flag | Ground pixel does not have geolocation. Level 2 PGE developers should flag this in their product or could even consider skipping the ground pixel. |
| 7 | Reserved for future use | Copy to output product |
| 8-14 | Snow/Ice flags [based on NISE] | Copy to output product |
| 15 | NISE nearest neighbour filling flag | Copy to output product |

The GroundPixelQualityFlags have a size equal to two bytes. The Land/Water flags start at the LSB of the first byte. The Snow/Ice flags start at the LSB of the second byte. This may have some advantages for S/W developers.

5 MeasurementQualityFlags

The MeasurementQualityFlags contain flags that apply to all ground pixels of a measurement. Please pay special attention to the Geolocation Error flag (bit 12).

| Bit | Description | Handling in Level 2 PGE |
|-------|--|---|
| 0 | WARNING Instrument Test Mode flag | Do <u>not</u> process measurement/Set Measurement Error Flag |
| 1 | ERROR Alternative Engineering Data flag | Do <u>not</u> process measurement/Set Measurement Error Flag |
| 2 | WARNING Alternating Sequencing Readout flag | Process measurement/Set Measurement Warning Flag |
| 3 | ERROR Co-adder Error flag | Do <u>not</u> process measurement/Set Measurement Error Flag |
| 4 | WARNING Invalid Co-addition Period flag | Process measurement/Set Measurement Warning Flag |
| 5 | WARNING Co-addition Overflow Possibility flag | Process measurement/Set Measurement Warning Flag |
| 6 | WARNING Measurement Combination flag | No action |
| 7 | WARNING Rebinning flag | Process measurement/Set Rebinning flag |
| 8 | WARNING Dark Current Correction Processing Option flag | Process measurement/Set Measurement Warning Flag |
| 9 | WARNING Detector Smear Calculation Processing Option flag | Process measurement/Set Measurement Warning Flag |
| 10 | WARNING SAA Possibility flag | Process measurement/Set SAA Possibility flag |
| 11 | WARNING Spacecraft Maneuver flag | Process measurement/Set Spacecraft Maneuver flag |
| 12 | ERROR Geolocation Error flag | Whenever this flag occurs in an irradiance product, it should <u>not</u> be used and a backup irradiance product should be considered. For radiance products this flag has no direct impact. It can indicate that the SAA Possibility Flag or the Spacecraft Maneuver flag are erroneously set. Note that errors in the geolocation of ground pixels are <u>not</u> covered by this flag (but by bit 6 of the L1B GroundPixelQualityFlags) |
| 13-15 | Reserved for future use | No action |

Whenever a flag is set in bits 0-4, investigative actions by the Operations and/or Calibration Team are required. Level 2 PGE developers should simply not process the measurement when any of bits 0-3 is set. Whenever a flag in bit 4 is set, there is an unexpected instrument setting but there is a high probability that the 0-1b processor has autonomously remedied this and the measurement can be used.