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ASAR PRODUCT SPECIFICATION UPDATE

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CHANGE RECORD

1.1   Updated following transfer to operations of PF-ASAR v6.02.

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Table Of Contents

1. INTRODUCTION

The latest version of the Envisat ASAR processor, PF-ASAR v6, was transferred to operations within the ESA ground segment on the following dates: at ESRIN on 10th December 2012, at Kiruna on 3rd January 2013, at D-PAC on 9th January, at the I-PAC on the 29th January and at the UK-PAC on 21st February 2013.

The PF-ASAR v6 product includes three new sets of Level 1 product header information (including an increased size of Main Processing Parameters (MPP) ADS) and a modification of the processor configuration file ASA_CON_AX. This note provides information of the additional header information to enable the user to include this in their analysis software.

The revised ASAR product specification (Issue 4, Revision C) is available from http://earth.esa.int/pub/ESA_DOC/ENVISAT/Vol08_ASAR_4C_20120120.pdf while the latest ASA_CON_AX files are available from http://earth.eo.esa.int/services/auxiliary_data/asar/current/.

2. ELAPSE TIME SINCE ASCENDIING NODE

The Main Processing Parameters ADS includes the elapse time between the first line of the product and the previous ascending node (also referred to as the ANX time). The ANX time is output in seconds. This field was previously part of a spare field. Table 2.1 below is the description of the new field from the product specification [1]:

Field #	ADSR Contents	Units	Byte Length	Data Type
15	Elapsed time between the zero Doppler time of first output image line and the preceding ascending node	s	4	fl

Table 2.1. Extract from the ASAR product specification for the ANX time [1].

3. CALIBRATION VECTORS

As an aid to deriving the radar cross-section (rcs) and gamma (= radar cross-section / cos (incidence angle)) for distributed targets within ASAR products, a calibration vector has been provided. These vectors enable the product digital numbers to be directly converted to either rcs or gamma and thus avoid the need to use the radiometric calibration equations described in the ASAR Absolute Calibration document [2].

The vectors are provided in a similar way as the elevation antenna pattern with values every 0.05° of look angle centred on the reference elevation angle. Thus for IM, AP and WSS products there are 201 vector values while for WSM and GM1 products there are 5 sets of 201 vector values (one set per sub-swath). Note that the vector values are in linear units and **not** in dB.

The calibration vectors are provided at the end of the Main Processing Parameters (MPP) ADS as seen in Table 3.1. As all the calibration vector fields occupy 8060 bytes, the size of the MPP ADS has been increased from 2009 to 10069 bytes. Note that as the new MPP size is given in the Specific Product Header (SPH), the increased size of the MPP should be taken into account when reading the subsequent parts of the header and image data.

Field #	ADSR Contents	Units	Byte Length	Data Type
	Absolute Calibration Information			
86	**Calibration Vector Reference Look Angle (per swath)** The centre of the elevation antenna pattern for each swath.	degrees	20	5*fl
87	**Gamma Calibration Vector** Multiplicative factor for DN^2 which yields gamma. One sample per 0.05 degrees of the look angle as per the elevation antenna profile, for a total of +/- 5 degrees around the reference look angle. Calculated at the first output image line zero Doppler time. 201 samples per swath (1005 samples for WSM and GM1 and 201 for AP, IM and WSS) NOTE: For WSM and GM1 there are 5 swaths. The 201 samples for each swath are placed contiguously in the 1005 sample array by swath. However, the samples for each swath overlap each other near the swath boundaries, just as with the antenna patterns. This must be taken into account when attempting to apply this information to the final product. The reader is referred to the *Absolute Calibration of ASAR Level 1 Products* document *(ENVI-CLVL-EOPG-TN-03-0010)* for additional information.	-	4020	1005*fl
88	**Sigma Calibration Vector** Multiplicative factor for DN^2 which yields sigma nought. One sample per 0.05 degrees of the look angle as per the elevation antenna profile, for a total of +/- 5 degrees around the reference look angle. Calculated at the first output image line zero Doppler time. 201 samples per swath (1005 samples for WSM and GM1 and 201 for AP, IM and WSS) NOTE: For WSM and GM1 there are 5 swaths. The 201 samples for each swath are placed contiguously in the 1005 sample array by swath. However, the samples for each swath overlap each other near the swath boundaries, just as with the antenna patterns. This must be taken into account when attempting to apply this information to the final product. The reader is referred to the *Absolute Calibration of ASAR Level 1 Products* document *(ENVI-CLVL-EOPG-TN-03-0010)* for additional information.	-	4020	1005*fl

Table 3.1. Extract from the ASAR product specification for the calibration vectors [1].

4. NOISE REMOVAL

A new algorithm has been developed to remove the presence of thermal noise in selected ASAR products. The algorithm will have most impact on low backscatter regions, such as in the ocean, by removing the impact of the elevation antenna pattern on such regions. The algorithm applies only to detected ASAR Alternating Polarisation products (APP, APG, APM) and the detected ASAR Wide Swath product (WSM) (these products are generated with the PF-ASAR SPECAN processor).

In order for PF-ASAR v6 to select whether or not to remove the presence of thermal noise in Level 1 products, modifications have been made to the processor configuration file ASA_CON_AX. These changes consist of a new set of noise subtraction flags and associated processing factors, as shown in Table 4.1.

Description	units	Byte length	Data Type
Noise subtraction flag for APP products (1=yes,0=no)	-	1	uc
Noise subtraction flag for APM products (1=yes,0=no)	-	1	uc
Noise subtraction flag for APG products (1=yes,0=no)	-	1	uc
Noise subtraction flag for WSM products (1=yes,0=no)	-	1	uc
Azimuth noise processing factor for APP products (7 values from swath IS1 to IS7)	-	28	7*fl
Azimuth noise processing factor for APM products (7 values from swath IS1 to IS7)	-	28	7*fl
Azimuth noise processing factor for APG products (7 values from swath IS1 to IS7)	-	28	7*fl
Azimuth noise processing factor for WSM products (MDS1) (5 values from swath SS1 to SS5)	-	20	5*fl

Table 4.1. Extract from the ASAR product specification (ASA_CON_AX) for the noise subtraction flag [1].

An additional field in the Level 1 product Main Processing Parameters ADS gives a flag as to whether the noise removal has been applied or not – see Table 4.2. This field was previously part of a spare field. The initial default setting of this flag will be 0, i.e. noise not subtracted – only after a validation of noise removed imagery will a decision be made as to whether all APP, APG, APM and WSM products will have noise removal applied or not. Thus the choice as to whether a product is to have noise removal applied or not is cannot be made by the user.

Field #	ADSR Contents	Units	Byte Length	Data Type
32	Noise Subtraction Applied (APP, APG, APM, WSM products only) 0 = noise not subtracted 1 = noise subtracted	-	1	uc

Table 4.2. Extract from the ASAR product specification for the noise subtraction flag [1].

5. ENVIVIEW

The ESA EnviView tool (http://earth.esa.int/enviview/) can be used to display the header parameters and image data from Envisat ASAR. At the present time, there are no plans to update EnviView to include the changes to the ASAR product specification as described above. Thus users are recommended to use another ESA tool, NEST (http://nest.array.ca/web/nest), for the examination of ASAR product header parameters and display of image data.

6. REFERENCES

[1] 'ENVISAT-1 Products Specification Volume 8: ASAR Product Specifications', PO-RS-MDA-GS-2009, Issue 4, Revision C, 22nd February 2011.

[2] 'Absolute Calibration of ASAR Level 1 Products Generated with PF-ASAR', ENVI-CLVL-EOPG-TN-03-0010, Issue 1, Revision 5, 7th October 2004.