ERS QLOPR and OPR

RANGE PROCESSING

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1 Introduction

The aim of this Technical Note (TN) is to provide information on the present ERS QLOPR and OPR range processing and conclusions on how the users will use the range calibration values produced by the CWG for both product types.

2 QLOPR and OPR processing status

The present situation for the QLOPR and the OPR processing is the following:

- QLOPR:

ERS-1 QLOPR has the Venice Bias applied to it (-41.6 cm) and the ERS-1 eps-tau-g characterisation data evaluated during the on-ground TV tests, (29.8 ns) is used in the FD Processing Chain. As a reminder, the value eps-tau-g represents delays within the radar altimeter within some parts of the radio frequency path, especially within the front end electronics (FEE) and the antenna.

ERS-2 QLOPR has no bias applied, and the ERS-1 eps-tau-g characterisation value is also used in the FD Processing Chain. That leads to an offset of about 41 cm, approximately the value of the Venice bias.

- OPR:

ERS-1 OPR has no bias applied and the ERS-1 eps-tau-g characterisation data (29.8 ns) is used in the OPR Processing Chain.

ERS-2 OPR has no bias applied to it and uses the ERS-2 esp-tau-g characterisation data equivalent to 27.07 for the A-chain.

The present relations between the ERS altimetric ranges are the following:

Range (ERS-2-opr - ERS-1-opr) = OPR CWG-bias

Range (ERS-2-qlopr - ERS-1-qlopr) = QLOPR CWG-bias

with:

OPR CWG-bias = Sys-bias + B

QLOPR CWG-bias = B

Range (ERS-1 qlopr) uncorrected for Venice bias

Venice-bias = -41.6 cm (Ref. D-PAF's note on QLOPR)

Sys-bias = 40.9 cm (difference in path of the 2 characterisation data).

B = B being a value non significantly different from zero

As a reminder , the official Venise bias is equivalent to : -41.5 +/- 5.2 cm as refered in 'the Calibration of the ERS-1 Radar Altimeter' document (ER-RP-ESA-RA-0257).

3 ERS relative range and system biases

The ERS-1/2 RA system has an intrinsic bias linked to the different features of the external radio frequency path (between the Front End Electronics (FEE) and the antenna) which was characterised on ground with the following measured values:

ERS-1 eps-tau-g: 29.80 ns +/- 0.10 ns (Ref., ER-MN-SES-RA-0444,Annex 2)

ERS-2 esp-tau-g: 27.07 ns +/- 0.27 ns (Ref. ER-TN-DSF-RA-1504, issue 1., 20-Sept.-1994)

Having taken into account these values in the OPR products, the RA & MWR CWG finds an OPR range bias of about 41 cm which represents the difference (in path) of these 2 characterisation data. See Figure II.

The RA & MWR CWG finds a QLOPR range bias of around zero as the same eps-tau-g value has been applied in first time to both ERS-1 and ERS-2 FD processing chains (The ERS-1 values is used). See Figure I.

With the assumption of null (or same) 'eps-tau-g' for both RA, the cross-calibration exercise demonstrates that the relative range bias between the 2 RA hardwares is not significantly different from zero.

4 Ground Segment Configuration

In order to get the best homogeneity between the products in the ground segment and without modifying the ERS-1 processing chains, the following should be done:

- QLOPR:

ERS-1: None

ERS-2: ESA to apply the right ERS-2 eps-tau-g value in the ERS-2 FD processing chain.

- OPR:

ERS-1: None

ERS-2: None

That leads to the global ERS-1/2 relation:

Relative Range (ERS-2 range - ERS-1 range) = OPR CWG-bias = Sys-bias + B

Considering that the ERS-1 QLOPR range is uncorrected for the Venice Bias. See figure III. .

5 ERS Absolute Altimetric Range Computation

5.1 ERS eps-tau-g evaluation

The value eps-tau-g represents delays within the radar altimeter within some parts of the radio frequency path, especially within the front end electronics and the antenna. This ERS-1 value (29.8 ns +/- 0.1 ns) was derived in the laboratory prior to the ERS-1 launch. The ERS-2 eps-tau-g value evaluation which has been realized with a more precise method that the one used for ERS-1 came out with the value, 27.07 ns +/- 0.27 ns.

The difference in path delay between the two values leads to a system bias equivalent to: 40.9 cm +/-5.5 cm which is very close to the OPR CWG-bias.

5.2 ERS Range Bias

The Venice campaign for the ERS-1 altitude absolute calibration demonstrated a range bias (the measured range is too short) of 41.5 +- 5.2 cm, we could easily impute to the ERS-1 eps-tau-g value too high as this value is very close to the above system bias value.

That means that we could consider 2 'external' altimetric range biases applicable to the range, being the Venice and the OPR CWG-bias one, different of 0.6 cm. In order to get a better confidence on one of these 2 bias values, a validation against T/P data could be done.

5.3 ERS absolute altimetric range

Taking into account the two above altimetric range biases and the ground segment configuration as defined in chapter 4, we get the following relations to compute the ERS absolute range from the one directly read in the product.

- OPR CWG-bias taken as external range bias:

Abs. Range (ERS-1opr) = Range(ERS-1opr) + OPR CWG-bias

Abs. Range (ERS-2opr) = Range(ERS-2opr)

Abs. Range (ERS-1qlopr) = Range(ERS-1qlopr) + Venice-bias + OPR CWG-bias

Abs. Range (ERS-2qlopr) = Range(ERS-2qlopr)

- Venice Bias taken as external range bias :

Abs. Range (ERS-1opr) = Range(ERS-1opr) - Venice-bias

Abs. Range (ERS-2opr) = Range(ERS-2opr) - Venice-bias - OPR CWG-bias

Abs. Range (ERS-1qlopr) = Range(ERS-1qlopr)

Abs. Range (ERS-2qlopr) = Range(ERS-2qlopr) - Venice-bias - OPR CWG-bias

with :

Venice bias = -41.5 +/- 5.2 cm

OPR CWG = 40.9 cm + B

B = B being a value non significantly different from zero

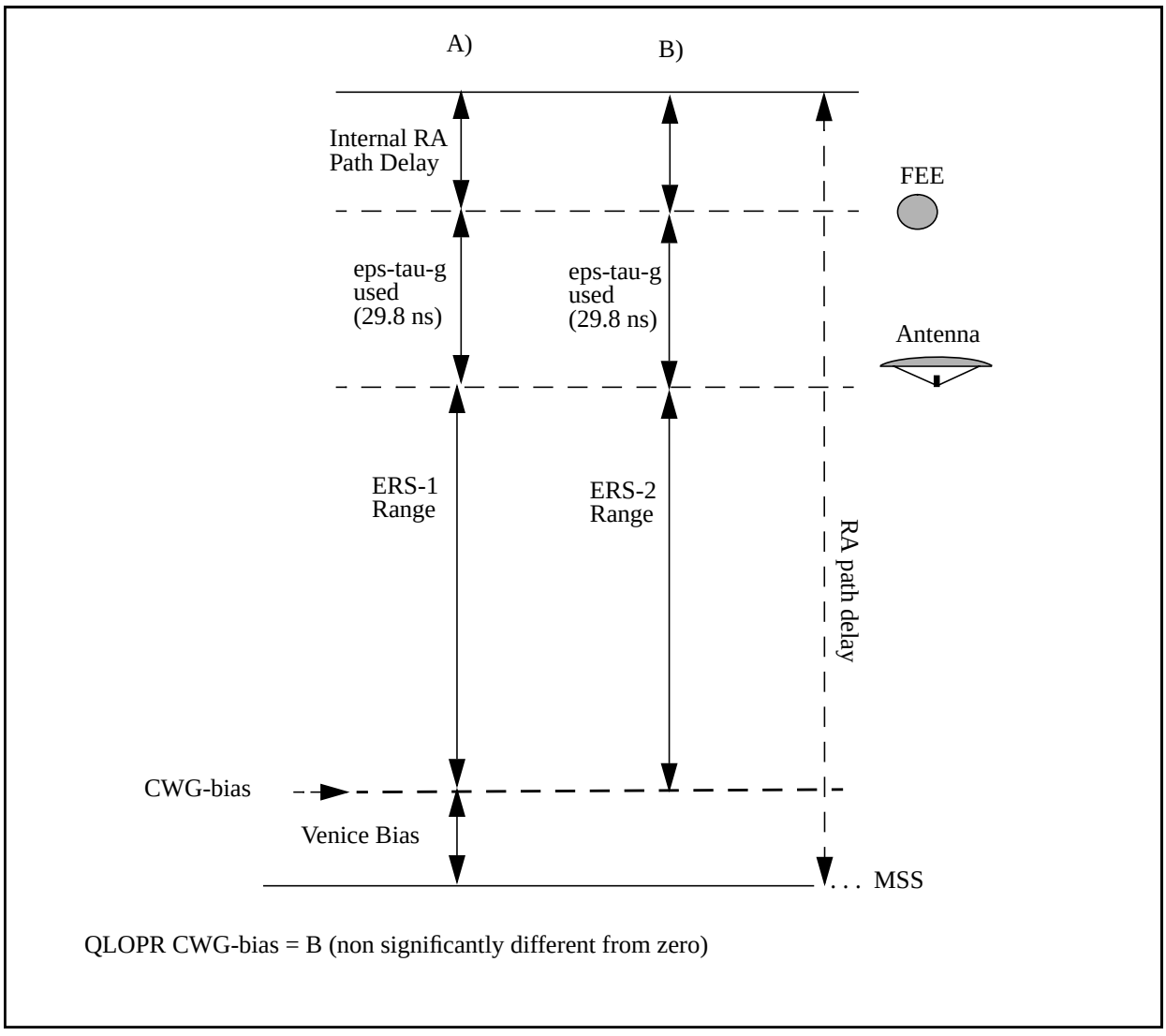

Figure I: Representation of the Radar Altimeter global path delay for the following configurations: A) Present ERS-1 QLOPR configuration, B) Present ERS-2 QLOPR configuration.

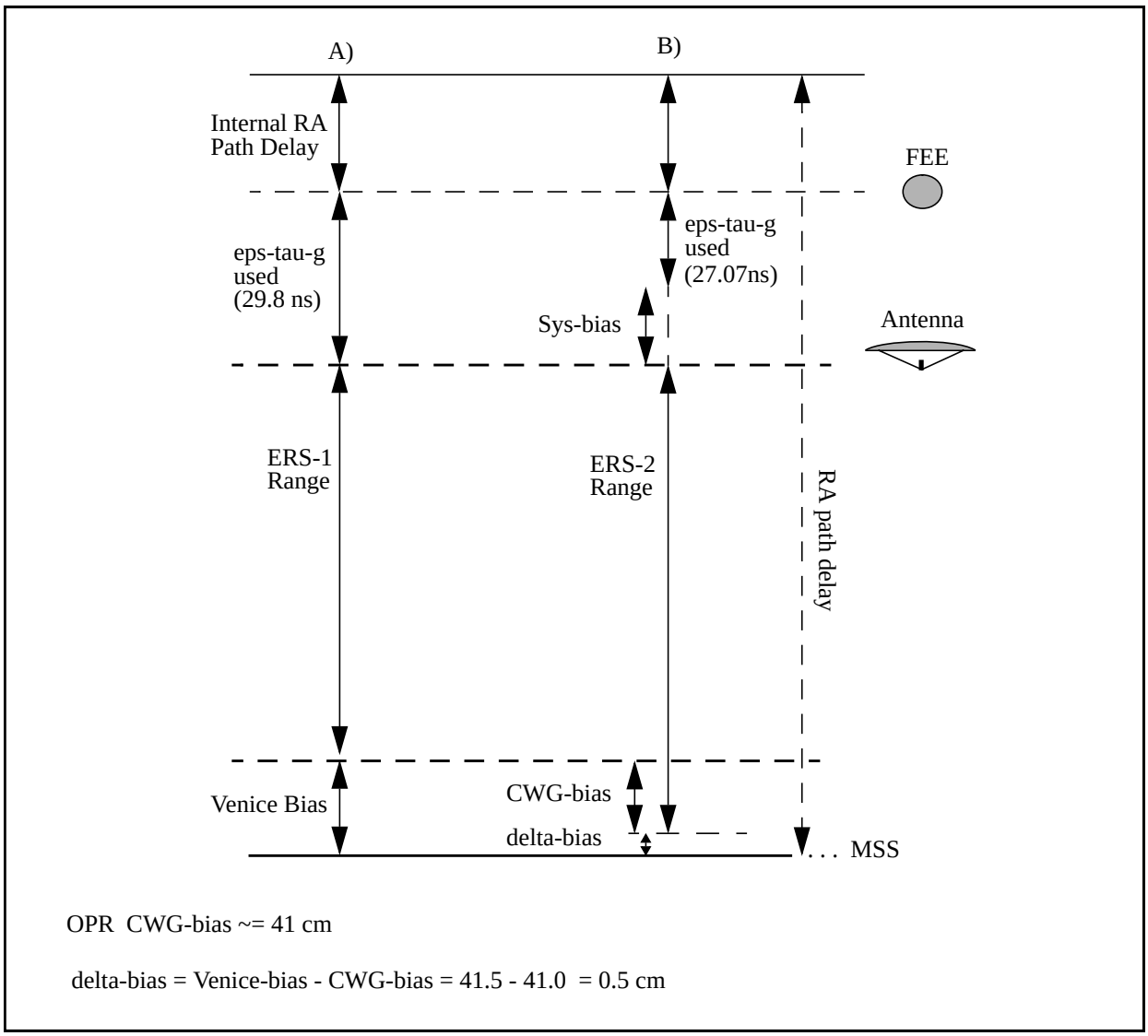

Figure II: Representation of the Radar Altimeter global path delay for the following configurations: A) Present ERS-1 OPR configuration., B) Present ERS-2 OPR configuration.

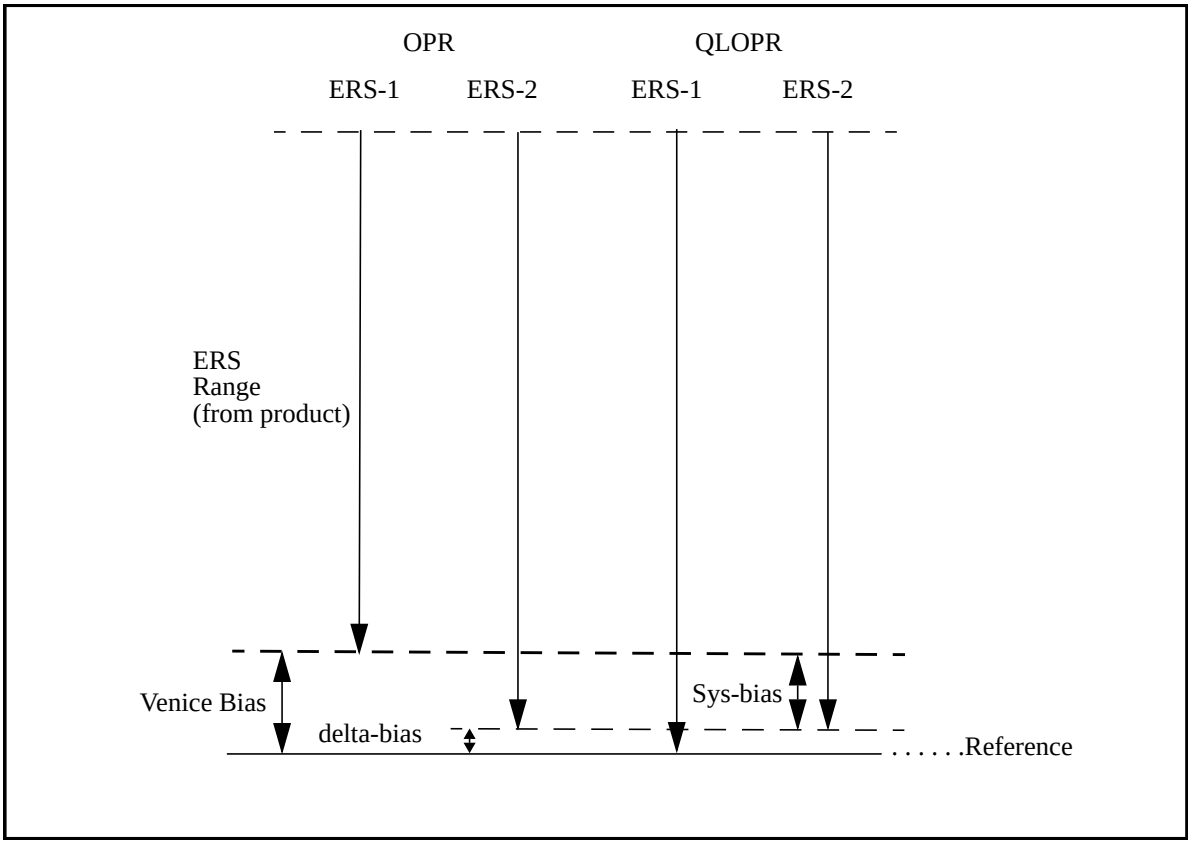

Figure III: Representation of the different ERS Altimetric Ranges as read from the products in the ERS Ground Segment Configuration as defined in chapter 4.