JRC Scientific and Technical Reports

# Kompsat-2: Initial findings of Geometric Image Quality Analysis

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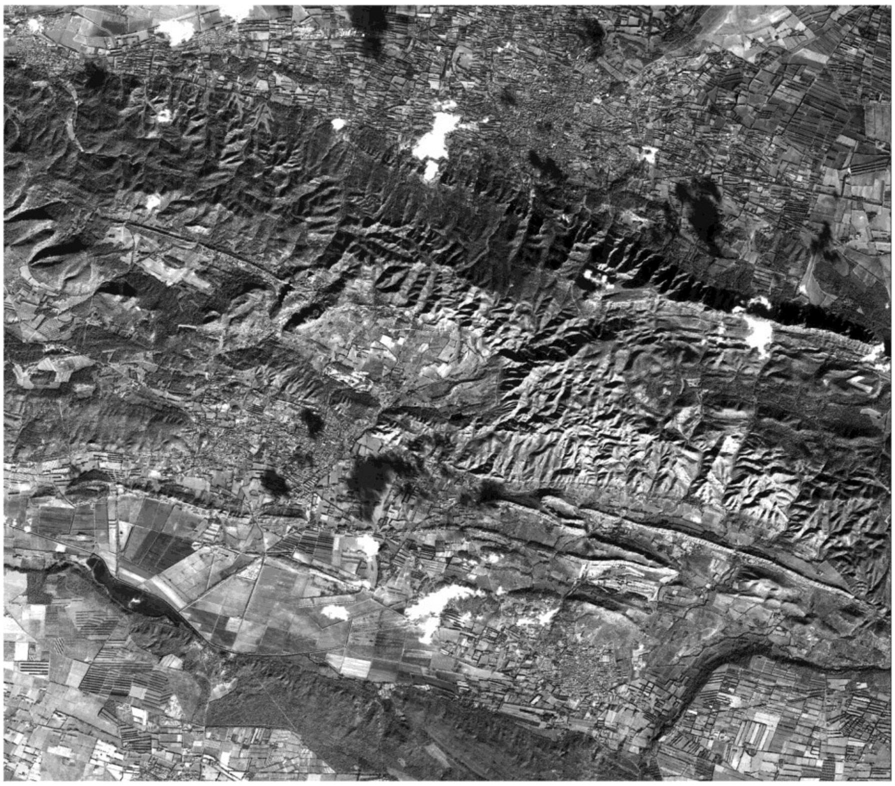

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# 1. Objective

This report summarizes the outcome of the geometric quality analysis of the single sample of the radiometrically corrected Kompsat-2 image acquired over the JRC Maussane Terrestrial Test Site.

The objective of this study is threefold:

(1) to evaluate the planimetric accuracy in a routine basis production of orthorectified Kompsat-2 imagery;

(2) to determine the optimal number and spatial distribution of the GCPs (Ground Control Points) for the Kompsat-2 orthorectification process;

(3) to check if the orthorectified imagery of the Kompsat-2 optical sensor fall within the required accuracy criteria for the CwRS 1:10.000 scale of absolute 1-D RMSE of < 2.5m;

# 2. Data description

## 2.1. Kompsat-2 Image Data

KOMPSAT-2 (KOrean MultiPurpose SATellite) - the very-high-resolution satellite was developed by the (South) Korean Aerospace Research Institute (KARI).

KOMPSAT-2, equipped with an MSC (Multi-Spectral Camera) able to acquire 1 m resolution panchromatic images and 4 m resolution color images. KOMPSAT- 2 was successfully launched on July 28, 2006 by a Rockot launch vehicle at the Plesetsk Cosmodrome in northern Russia. It weighs 800 kg and has 1,000 watts of power and is operating at the same orbital altitude of KOMPSAT-1, i.e. 685km (source: *http://www.kari.re.kr/english/* , *http://www.spotimage.com*).

| **Orbital elements** | |
|---|---|
| Orbit type | Near polar, Sun synchronous |
| Altitude | 685 km |
| Inclination | 98° (Sun synchronous) |
| Orbital per day | 28 |
| Revisit rate | 3 days |
| Repetivity | |
| **Instruments** | |
| Payload | B&W (PAN) and 4 MS (R, V, B, PIR) |
| Spectral band | PAN: 0,50 - 0,90 µm<br>MS1 (blue): 0,45 - 0,52 µm<br>MS2 (green): 0,52 - 0,60 µm<br>MS3 (red): 0,63 - 0,69 µm<br>MS4 (near-infrared): 0,76 - 0,90 µm |
| Spatial resolution | 1 m (PAN) and 4m (MS) at nadir |
| Radiometric resolution | 10 bits/pixel (delivery 16bits/pixel) |
| Swath (footprint) | 15 km x15 km |
| Viewing angle | 30° (cross track, roll angle) |

**Table 1: Kompsat-2 parameters** (source: http://www.spotimage.com)

The following Cartosat-2 Standard Image Products are available at the SpotImage, distributor of KOMPSAT-2 imagery for Europe (http://www.spotimage.com):

- B&W: 1m
- Color (4 bands): 1m
- MS (B,G,R,NIR): 4m

Processing levels:

- Kompsat 1A (also referred as to 1R) - basic radiometric normalization for detectors' calibration (done on board MSC using Non- Uniformity Correction), optionally MTFC, delivered in TIFF format;
- Kompsat 1G - System Corrected Georeferenced – radiometry, sensor and geometry corrected (true north oriented), georeferenced data (default is UTM WGS84) delivered in GeoTIFF format accompanied by XML metadata file and RPC (rational polynomial coefficients) text file.
- Kompsat-2 Ortho

### 2.1. Study area and Kartosat-2 data for testing

The MARS Unit was provided with the single sample of Kompsat-2 image product, level 1R, stored at: S:\Data\CID\MAUSSANE\KOMPSAT2_MAUSANNE

The range of the available ADS40 ortho tiles, and the test Kompsat-2 image (2009-AO-0185-MAUSANNE-1R-Bundle-20090128-1-1-1), and the Maussane 10x10km test site is presented on the Fig.1.

The image GeoTIFF file was accompanied by image support data, i.e. metadata file and RPC file, in the simple ASCII format (MSC_090128093655_13367_01251327PN00_1R.txt and MSC_090128093655_13367_01251327PN00_1R_rpc.txt, respectively).

The basic characteristics of our K2 image are as follows:

| | |
|---|---|
| Acquisition Date | 28 January 2009, 09:59 |
| Viewing Angle - along-track | -0.4 deg |
| Viewing Angle - across-track | -0.4 deg |
| Satellite Azimuth | 148.98 deg |
| Incidence Angle | 1.32 deg |
| Resolution Along | 0.982 m |
| Resolution Across | 0.996 m |
| Map Projection | UTM |
| Ellipsoid | WGS_84 |
| Datum | WGS_84 |
| Resampling | none |

**Table 2: Basic metadata of the Kompsat-2 2009-AO-0185-MAUSANNE-1R-Bundle-20090128-1-1-1 image**

### 2.2. Auxiliary Data

The following auxiliary data was used during sensor orientation and orthorectification of the Cartosat-2 image:

- Set of 2 GCPs from the ADS40 project: RMSEx < 0.05m; RMSEy = 0.10m (110014, 110022);
- Set of 5 GCPs from the VEXEL project: RMSEx = 0.49m; RMSEy = 0.50m (440002, 440004, 440005, 440014, 440024);
- Set of 9 GCPs chosen and measured on the aerial ADS40 ortho: RMSEx = 0.90m; RMSEy = 0.76m (G0002, G0003, G0005, G0007, G0008, G0009, G0010, G0011, G0012);
- DEM_ ADS40 – digital elevation model generated from ADS40 (Leica Geosystems) digital airborne image with 2m resolution and RMSEz=0.6m.

The projection and datum details of the above listed data are UTM zone 31N ellipsoid WGS84.

From the 16-point calibration set (440002, 440004, 440005, G0008, 110014, 110022, G0007, 440014, G0003, 440024, G0002, G0005) different GCPs configurations were chosen and studied, while the set of the independent check points (ICPs) remained unchanged

### 2.3. Validation Data

The points with known position that were not used during the used during the geometric correction model phase served as the validation sets[1] in order to evaluate planimetric error of the test orthoimage data.

The ICP control set consisted of the following 13 points:

- Set of 7 GCPs from the VEXEL project: RMSEx = 0.49m; RMSEy = 0.50m (440003, 440008, 440009, 440013, 440019, 440020, 440025);
- Set of 3 GCPs measured on the aerial ADS40 ortho: RMSEx = 0.90m; RMSEy = 0.76m (G0001, G0004, G0006);
- Set of 2 GCPs from the Maussane_2009 project: RMSEx = 0.65; RMSEy = 0.65m (66049, 66038);
- Set of 1 GCPs from the ADS40 project: RMSEx < 0.05m; RMSEy = 0.10m (110020);

The projection and datum details of the above listed data are UTM zone 31N ellipsoid WGS84.

[1] also referred as to independent control points (ICPs)

## 3. Methodology

The EU standard for the orthoimagery to be used for the purpose of the Common Agriculture Policy (CAP) Control with Remote Sensing (CwRS) requires the quality assessment of the final orthoimage ('Guidelines …,' 2008).

The RMS error calculated for Independent Control Points (i.e. points not included in the sensor model parameter estimation process, derived from an independent source of higher accuracy) in each dimension (either Easting or Northing) is used to describe the geometric characteristics of the orthoimage (product accuracy). This procedure is often referred as to external quality control (EQC).

Our workflow consisted of the following phases:

(a) geometric correction model phase, also referred as to image correction phase, sensor orientation phase, space resection or bundle adjustment phase;

(b) orthocorrection - elimination of the terrain and relief related distortions through the use of sensor and terrain (elevation) information, then reprojection and resampling;

(c) external quality control (EQC) of the final product, also referred as to absolute accuracy check or validation phase.

During the image correction phase the following mathematical models were introduced to model the tested Cartosat-2 Standard SystemCorrected image:

- Rational Functions model (RPC) by PCI Geomatica V10.2., OrthoEngine module;
- Toutin's Rigorous model by PCI Geomatica V10.2., OrthoEngine module.

The planimetric accuracy of orthoimage is quite sensitive to the number and distribution of the several ground control points (GCPs) used during image correction phase and orthorectification. Therefore, we studied several ground control points (GCPs) configurations, while the set of the independent check points (ICPs) remained unchanged for all tested variants. Each time, the 1-D RMS errors, for both X and Y directions were calculated for GCPs during the geometric correction model phase, and for ICPs – during the validation phase (EQC).

While using the RPC method, different polynomial orders were tested, however, the final conclusions are based on the variants where the polynomial order was set to one.

Additionally, the one-dimensional RMS errors for the set of the independent check points were also calculated during the image correction phase. For the same set of independent check points, the difference between its RMSE values before (model) and after (actual) image orthorectification can be attributed to the following: 1. terrain related distortions, 2. cartographic reprojection errors, and 3. resampling errors.

# 4. Results

### 4.1. Image correction results – RPC model

We analysed geometric characteristics of the provided Kompsat-2 image depending on the number and distribution of the ground control points, i.e. points used for image correction and orthorectification. The name of the variant includes the number that corresponds to the number of the GCPs used for geometric correction (compare Tab.3).

| Variant name | Number of GCP | GCPs distribution | List of GCPs | Number of ICPs |
|---|---|---|---|---|
| V_0 | 0 | n/a | | 13 |
| V_1 | 1 | n/a | 440014 | 13 |
| V_2 | 2 | n/a | 440002, G0005 | 13 |
| V_3 | 3 | good | 440002, 440005, G0005 | 13 |
| V_4 | 4 | good | 440002, 440005, G0002, G0005 | 13 |
| V_6 | 6 | good | 440002, 440005, 110022, G0003, G0002, G0005 | 13 |
| V_9 | 9 | good | 440002, 440004, 440005, 110014, 110022, G0003, 440024, G0002, G0005 | 13 |
| V_12 | 12 | good | 440002, 440004, 440005, G0008, 110014, 110022, G0007, 440014, G0003, 440024, G0002, G0005 | 13 |
| V_16 | 16 | good | 440002, 440004, 440005, G0008, 110014, 110022, G0007, 440014, G0003, 440024, G0002, G0005, G0009, G0010, G0011, G0012 | 13 |

**Table 3: The analysed variants of different GCPs number and distribution over Kompsat-2 2009-AO-0185-MAUSANNE-1R-Bundle-20090128-1-1-1 image (geometric correction model phase)**

For all variants (GCPs configurations), we tried to keep the set of the independent check points unchanged. It consists of the following thirteen points: 440003, 110020, 440009, 440008, 66049, 66038, 440013, 440020, G0004, 440019, G0001, G0006, 440025.

### 4.2. Image correction results – RPC model

Applying the model based on provided RPC parameters, we obtain the following RMSE results summarised in the Table 4 and 5 (compare Appendix XX). In the first table the polynomial order varies with the GCPs. while Tab.5 shows the RMSE results where the rational functions (RPC) degree is constantly set to one.

| | | | GCPs | | ICPs | |
|---|---|---|---|---|---|---|
| Variant name | Number of GCPs | RPC order | **RMSE_X [m] Easting** | **RMSE_Y [m] Northing** | RMSE_X [m] Easting | RMSE_Y [m] Northing |
| V_0 | 0 | 0 | **n/a** | **n/a** | 5.50 | 63.99 |
| V_1 | 1 | 0 | **0.05** | **0.94** | 2.73 | 2.75 |
| V_2 | 2 | 0 | **0.90** | **0.93** | 2.01 | 2.55 |
| V_3 | 3 | 0 | **1.27** | **2.54** | 2.25 | 3.20 |
| V_4 | 4 | 1 | **1.74** | **1.15** | 1.83 | 2.57 |
| V_6 | 6 | 1 | **3.38** | **1.57** | 3.63 | 2.25 |
| V_9 | 9 | 2 | **1.36** | **1.40** | 2.99 | 2.21 |
| V_12 | 12 | 2 | **1.71** | **1.36** | 3.02 | 2.20 |

**Table 4: The 1-D RMS errors obtained during the geometric correction model phase (RPC method) for different GCPs number and distribution while the number and distribution of the ICPs is constant and rational functions (RPC) degree varies.**

| | | | GCPs | | ICPs | |
|---|---|---|---|---|---|---|
| Variant name | Number of GCPs | RPC order | **RMSE_X [m] Easting** | **RMSE_Y [m] Northing** | RMSE_X [m] Easting | RMSE_Y [m] Northing |
| V_0 | 0 | 1 | **n/a** | **n/a** | 12.28 | 62.07 |
| V_1 | 1 | 1 | **0.05** | **0.94** | 2.28 | 2.82 |
| V_2 | 2 | 1 | **0.90** | **0.93** | 1.17 | 2.88 |
| V_3 | 3 | 1 | **0.09** | **1.09** | 1.80 | 2.14 |
| V_4 | 4 | 1 | **1.74** | **1.15** | 1.54 | 2.53 |
| V_6 | 6 | 1 | **3.38** | **1.57** | 3.93 | 2.20 |
| V_9 | 9 | 1 | **3.26** | **2.21** | 3.64 | 2.53 |
| V_12 | 12 | 1 | **3.39** | **2.29** | 3.62 | 2.51 |
| V_16 | 16 | 1 | **3.02** | **1.77** | 2.68 | 1.91 |

**Table 5: The 1-D RMS errors obtained during the geometric correction model phase (RPC method) for different GCPs number and distribution while the number and distribution of the ICPs is constant, and so is the rational function order.**

### 4.3. Outcome of the external quality control (RPC model)

We performed the external quality control on each of the orthoimage produced for each image correction variant of the Kompsat-2 2009-AO-0185-MAUSANNE-1R-Bundle-20090128-1-1-1 image. The number and distribution of the ICPs is constant (thirteen-point data set). The result are provided in Appendix XXX and summarised in the Tab.6 and 7 for variable and not variable RPC polynomial order (introduced during previous, i.e. in the image correction phase geometric correction phase).

| | | | ICPs | |
|---|---|---|---|---|
| Variant name | Number of GCPs | RPC order | **RMSE_X [m] Easting** | **RMSE_Y [m] Northing** |
| V_0 | 0 | 0 | **5.16** | **62.49** |
| V_1 | 1 | 0 | **1.11** | **2.79** |
| V_2 | 2 | 0 | **1.12** | **2.71** |
| V_3 | 3 | 0 | **1.30** | **3.05** |
| V_4 | 4 | 1 | **1.31** | **2.17** |
| V_6 | 6 | 1 | **3.31** | **1.99** |
| V_9 | 9 | 2 | **2.93** | **2.03** |
| V_12 | 12 | 2 | **2.90** | **2.13** |

**Table 6: The 1-D RMS errors obtained during the external quality control. The number and distribution of the ICPs is constant (rational function order varies in the image correction phase).**

| | | | ICPs | |
|---|---|---|---|---|
| Variant name | Number of GCPs | RPC order | **RMSE_X [m] Easting** | **RMSE_Y [m] Northing** |
| V_0 | 0 | 1 | **5.03** | **62.43** |
| V_1 | 1 | 1 | **1.70** | **2.76** |
| V_2 | 2 | 1 | **1.08** | **2.56** |
| V_3 | 3 | 1 | **1.64** | **1.74** |
| V_4 | 4 | 1 | **1.31** | **2.17** |
| V_6 | 6 | 1 | **3.31** | **1.99** |
| V_9 | 9 | 1 | **3.15** | **1.84** |
| V_12 | 12 | 1 | **3.30** | **1.93** |
| V_16 | 16 | 1 | **2.36** | **1.53** |

**Table 7: The 1-D RMS errors obtained during the external quality control. The number and distribution of the ICPs is constant (in image correction phase rational function order was set to 1).**

### 4.4. Image correction results – Rigorous model

Applying the Toutin's rigorous model, we obtained the following RMSE results summarised in the Table 8.

| | | **GCPs** | | ICPs | |
|---|---|---|---|---|---|
| Variant name | Number of GCPs | **RMSE_X [m] Easting** | **RMSE_X [m] Easting** | RMSE_X [m] Easting | RMSE_X [m] Easting |
| V_6 | 6 | **0** | **0** | 3.03 | 4.53 |
| V_9 | 9 | **1.12** | **0.61** | 2.26 | 5.31 |
| V_12 | 12 | **1.48** | **1.52** | 2.20 | 2.22 |
| V_16 | 16 | **1.64** | **1.70** | 1.47 | 2.25 |

**Table 8: The 1-D RMS errors obtained during the geometric correction model phase using rigorous Toutin's model for different GCPs number and distribution while the number and distribution of the ICPs is constant.**

### 4.5. Outcome of the external quality control (Rigorous model)

We performed the external quality control on each of the orthoimage produced for each image correction variant using Toutin's rigorous model implemented in the PCI Geomatica 10.2. OrthoEngine. The number and distribution of the ICPs is constant (thirteen-point data set).

| | | **ICPs** | |
|---|---|---|---|
| Variant name | Number of GCPs | **RMSE_X [m] Easting** | **RMSE_Y [m] Northing** |
| V_6 | 6 | **2.99** | **3.99** |
| V_9 | 9 | **2.06** | **4.16** |
| V_12 | 12 | **2.02** | **1.94** |
| V_16 | 16 | **1.71** | **1.79** |

**Table 9: The 1-D RMS errors obtained during the external quality control of the orthoimages obtained after introducing the rigorous Toutin's model.**

# 5. Discussion

### 5.1. Point Data Quality

As regards validation data quality, check points used for orthoimage external quality control (Kay et al., 2003; Chmiel et al., 2004):

- must not be used during the image correction phase;
- should come from different measurement source than points used during orthorectification;
- should be characterised by accuracy at least 3 times more than the expected ortho-product accuracy (5-times recommended).

During the Kompsat-2 2009-AO-0185-MAUSANNE-1R-Bundle-20090128-1-1-1 image testing, the first condition was fulfilled. The ground control points used for geometric image correction differ from the points used during the final product (orthoimage) quality control.

The second condition is not fully accomplished: the Kompsat-2 point validation data source is the same one used for 50% of the ground control points (GCPs). Only the resting 50% of GCPs comes from different source.

The accuracy of point validation data is bellow 0.50m, taking into account the influence of the error of the point identification on the being analysed Kompsat-2 image. Therefore, according to the third condition, our point validation data is enough accurate for the ortho-product of the 1-D RMSE of 2.5m, however, the Kompsat-2 spatial resolution (1m - PAN) can lead to better results provided accurate GCPs and DEM data.

### 5.2. EQC Results Comparison

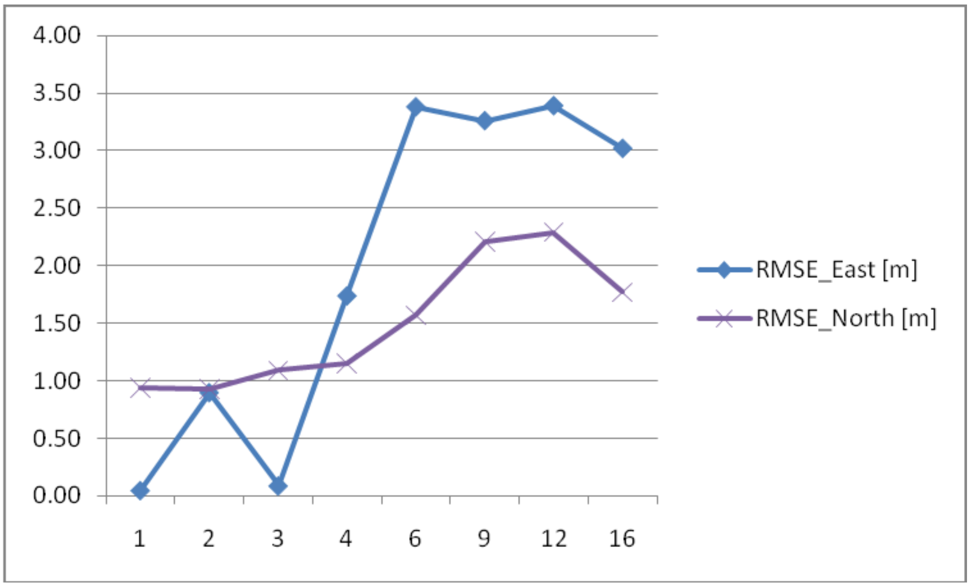


**Figure 3: The influence of the GCPs number on the image geometric accuracy during the geometric correction model phase based on RPC method.**

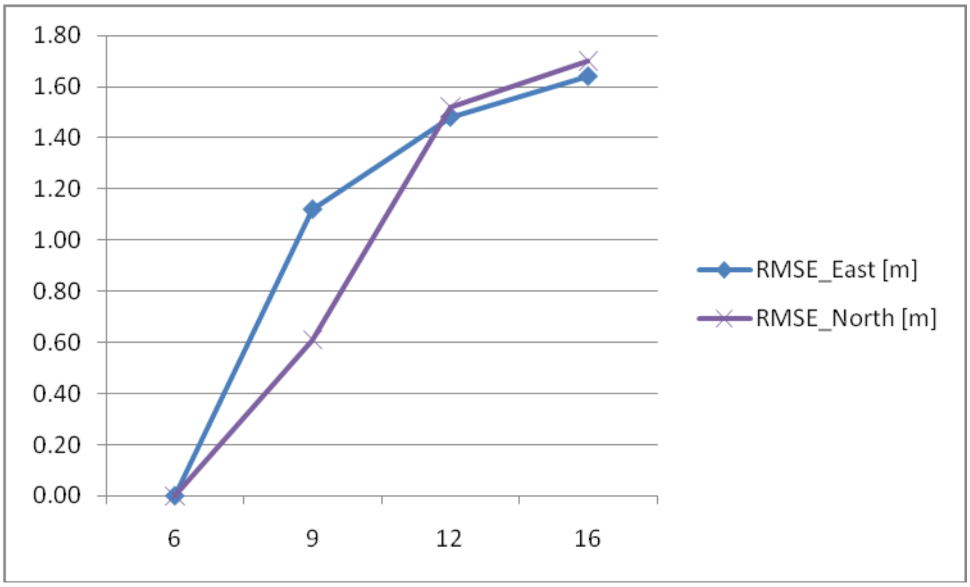


**Figure 4: The influence of the GCPs number on the image geometric accuracy during the geometric correction model phase based on Toutin's rigorous model.**

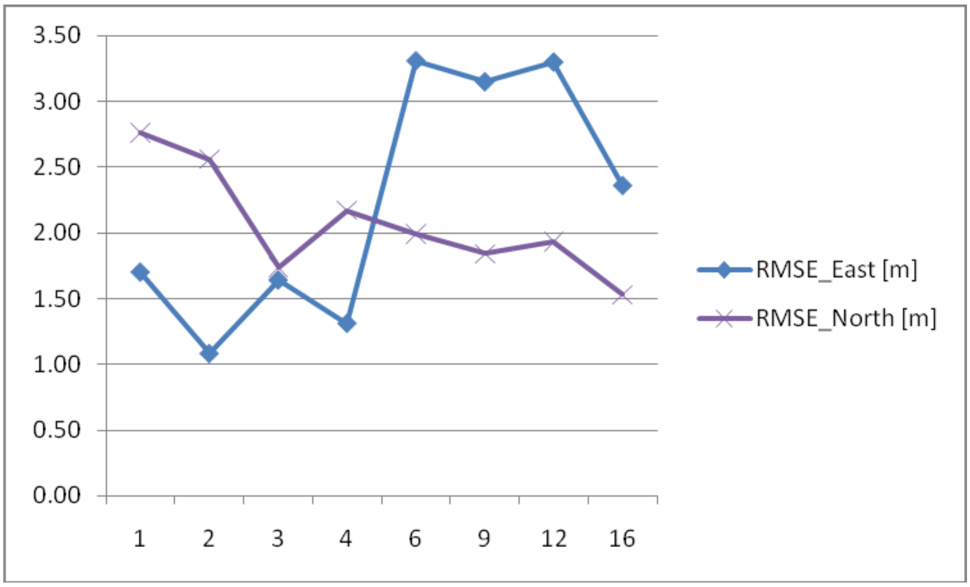


**Figure 5: The final product (orthoimage) accuracy as a function of the GCPs number used during the RPC-based geometric image correction.**

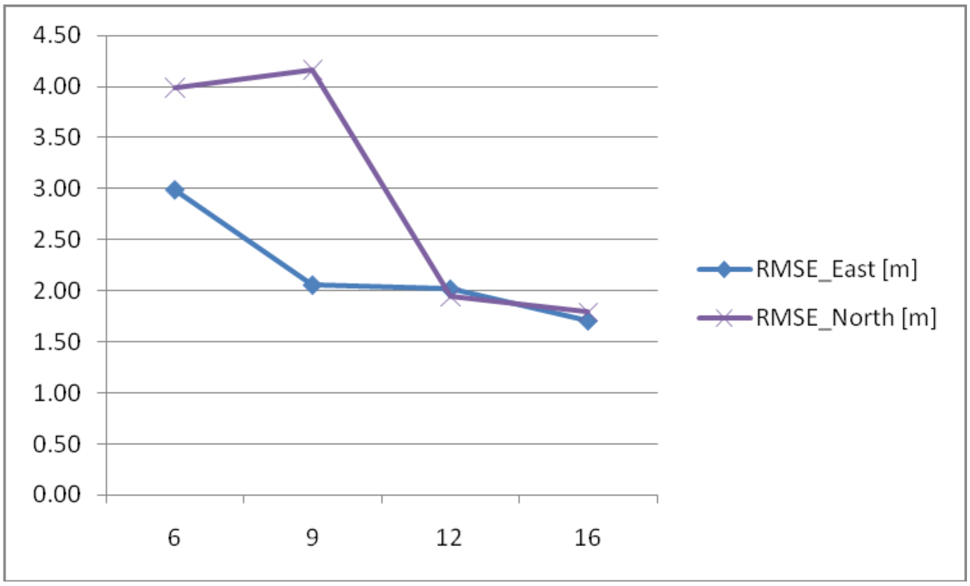


**Figure 6: The final product (orthoimage) accuracy as a function of the GCPs number used during the geometric image correction by Toutin's rigorous model.**

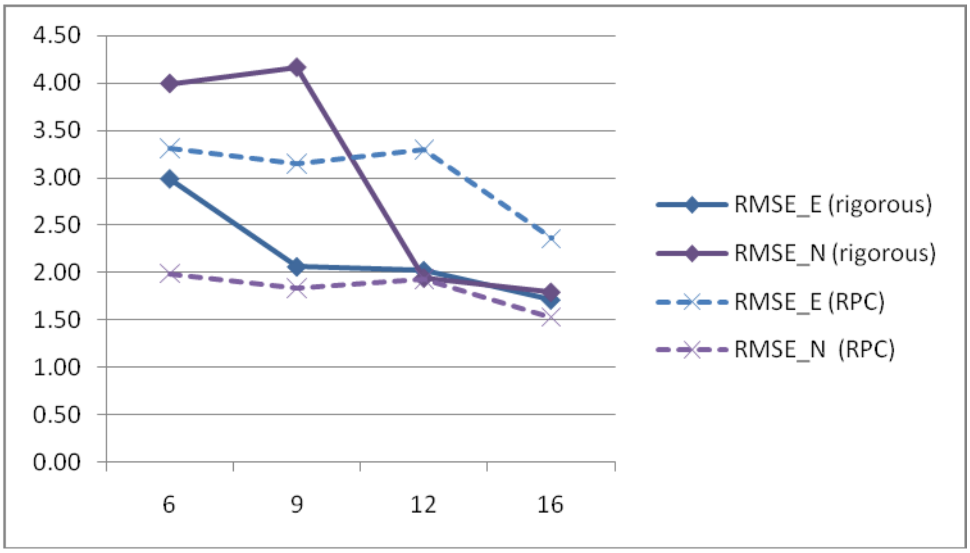


**Figure 7: The final product (orthoimage) accuracy as a function of the GCPs number used during the geometric image correction by Toutin's rigorous model vs. RPC method.**

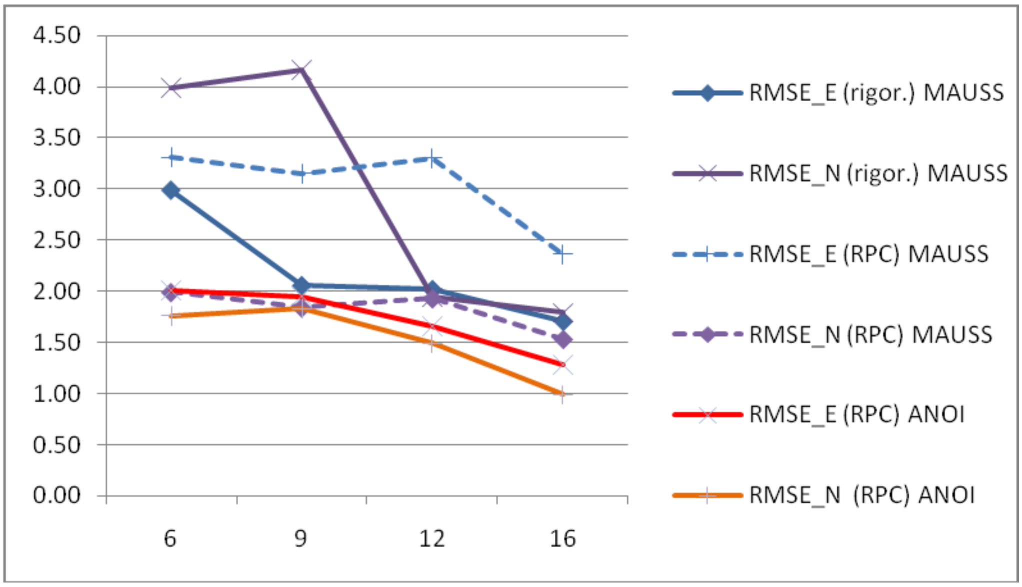


**Figure 8: The final product (orthoimage) accuracy as a function of the GCPs number used during the geometric image correction by Toutin's rigorous model vs. RPC method on Maussane (FR) and comparison with accuracy results of ANOI (ES) block adjustment of two K2 images corrected using RPC method.**

The ANOI (ES) test consists of two overlaping Kompsat-2 images that were processed together during image correction phase, i.e. block adjustment was carried out. Rational Functions of first order were introduced into the RPC for Ikonos/Quickbird/Kompsat-2 model (PCI Geomatica OrthoEngine).

The fig.8 shows the comparison between the results obtained using the same method (RPC-based) for image correction, however, in case of Maussane image it is a single K2 image processing and in the case of the ANOI it is a block adjustment of two K2 images.

The betetr ANOI results can be can be attributed to the following: 1. block adjustment, 2. introduction of tie points (that both reinforce the photogrammetric network), 3. accuracy of the auxiliary data (0.4-0.6m for ANOI vs. 0.7-0.9m for Maussane), and 4. less number of ICPs (8 ICPs for ANOI vs. 13 ICPs for Maussane).

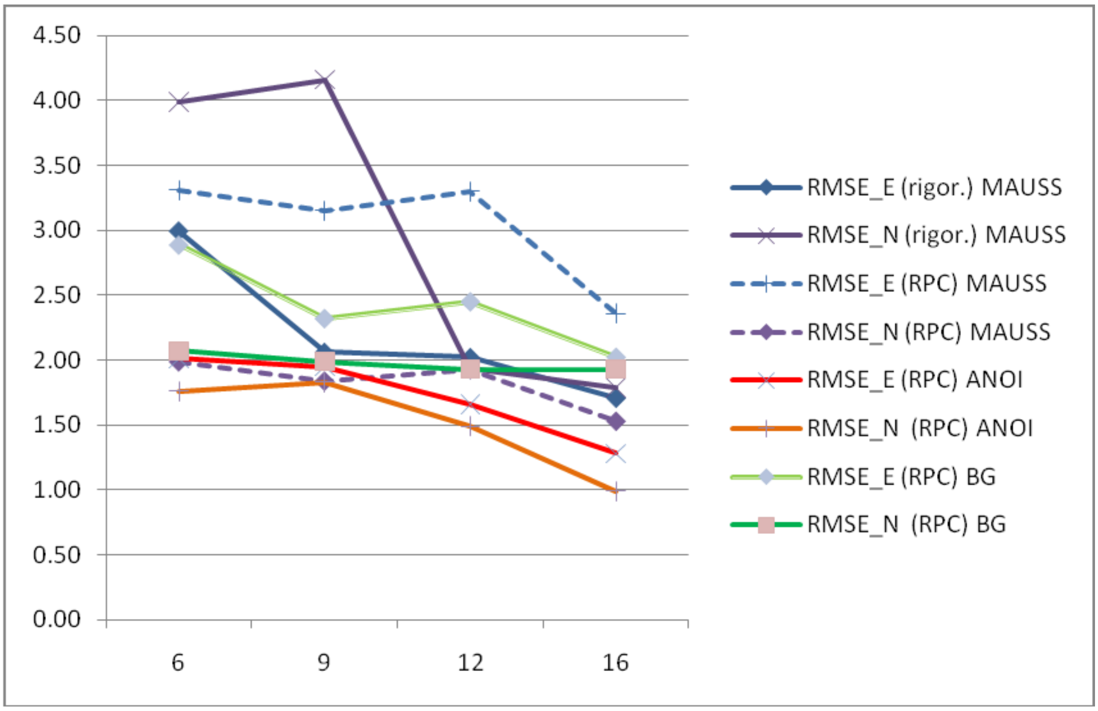


**Figure 9: The final product accuracy as a function of the GCPs number used during the geometric image correction by Toutin's rigorous model vs. RPC method on Maussane (FR) and comparison with accuracy results of ANOI (ES) block adjustment of two K2 images corrected using RPC method and with Bulgarian results (single scene processing, RPC method).**

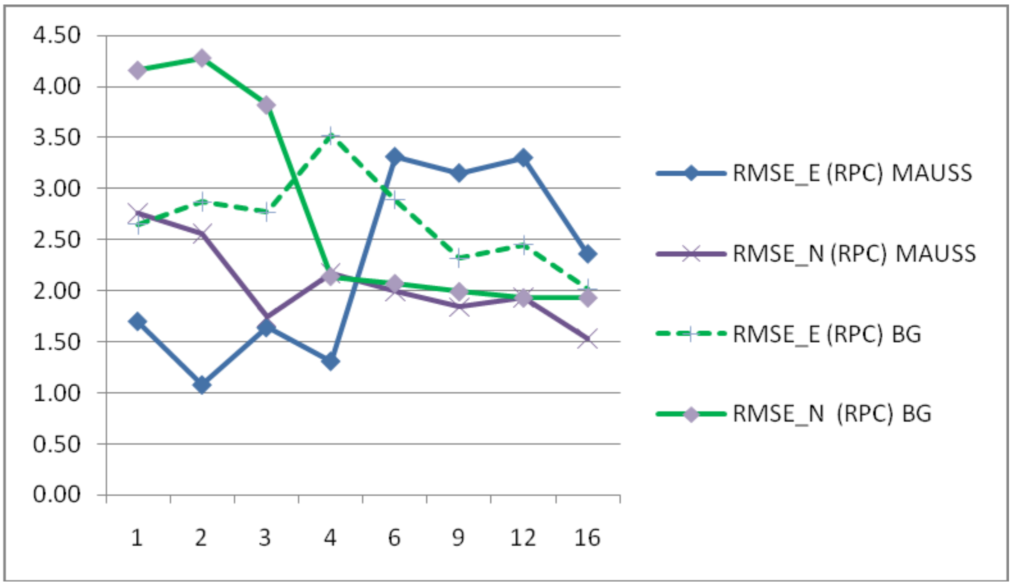


**Figure 10: The final product accuracy as a function of the GCPs number used during the single scene correction by RPC method on Kompsat-2 over Maussane (FR) and Bulgarian site.**

| | JRC Maussane Terrestrial Test Site | | | | ANOI, Spain | | K2, Bulgaria | |
|---|---|---|---|---|---|---|---|---|
| # GCPs | RMSE_E [m] (rigorous) | RMSE_N [m] (rigorous) | RMSE_E [m] (RPC) | RMSE_N [m] (RPC) | RMSE_E [m] (RPC) | RMSE_N [m] (RPC) | RMSE_E [m] (RPC) | RMSE_N [m] (RPC) |
| 0 | | | 5.03 | 62.43 | 32.13 | 143.93 | 23.12 | 26.01 |
| 1 | | | 1.70 | 2.76 | | | 2.65 | 4.16 |
| 2 | | | 1.08 | 2.56 | | | 2.87 | 4.28 |
| 3 | | | 1.64 | 1.74 | | | 2.77 | 3.82 |
| 4 | | | 1.31 | 2.17 | | | 3.52 | 2.14 |
| 6 | 2.99 | 3.99 | 3.31 | 1.99 | 2.01 | 1.76 | 2.89 | 2.07 |
| 9 | 2.06 | 4.16 | 3.15 | 1.84 | 1.95 | 1.83 | 2.32 | 1.99 |
| 12 | 2.02 | 1.94 | 3.30 | 1.93 | 1.66 | 1.49 | 2.45 | 1.93 |
| 16 | 1.71 | 1.79 | 2.36 | 1.53 | 1.28 | 0.99 | 2.02 | 1.93 |

**Table 9: The 1-D RMS errors obtained during the external quality control of the orthoimages obtained after introducing the rigorous Toutin's model or RPC model on Maussane (France), and RPC model on ANOI (Spain).**

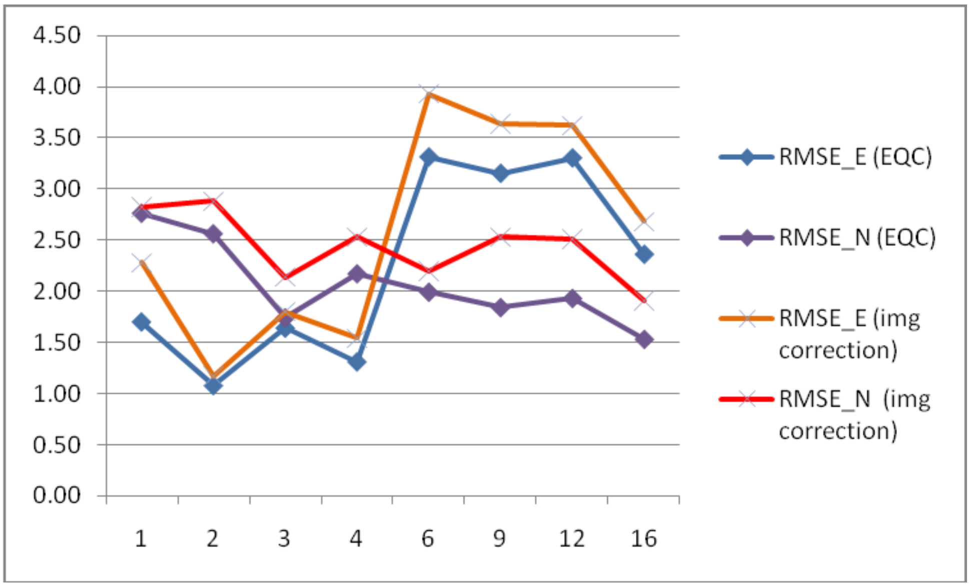


**Figure 11: The difference between its RMSE values before (model) and after (actual) image orthorectification based on RPC method – for the same set of independent check points.**

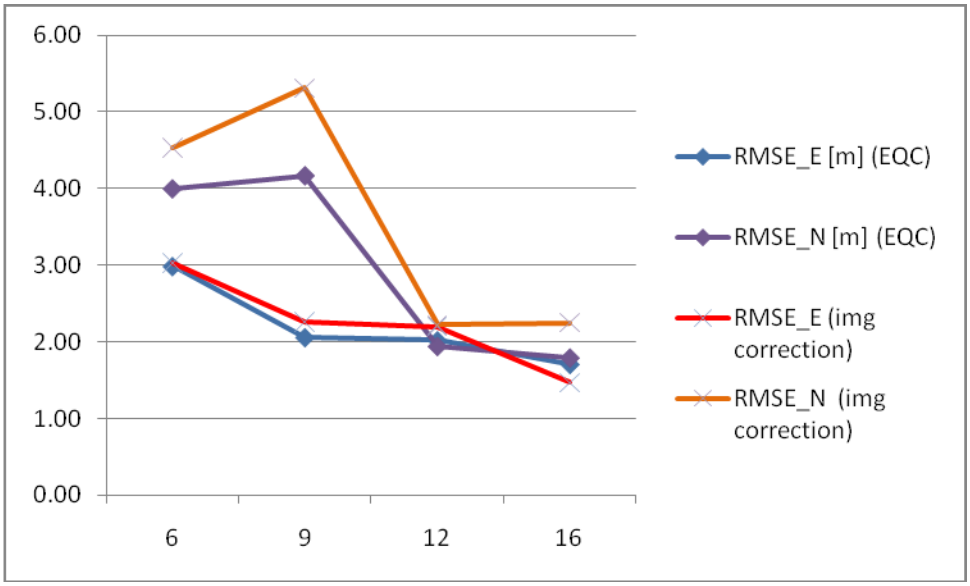


**Figure 12: The difference between its RMSE values before (model) and after (actual) image orthorectification based on Toutin's rigorous model – for the same set of independent check points.**

## 6. Summary of Key Issues

This report presents results recorded for Kompsat-2 2009-AO-0185-MAUSANNE-1R-Bundle-20090128-1-1-1, standard radiometrically corrected image, applying different approaches, i.e. GCPs configurations and sensor models to orthorectification, to a standardized orthorectification protocol.

The key issues identified during the geometric quality analysis of the provided Kompsat-2 image 13 constant ICPs) are summarised below:

- The validation data do not fulfil the suitability requirements: point validation data source is the same one used for 50% of the ground control points (GCPs).
- The influence of the GCPs number on the image geometric accuracy during the geometric correction model phase base on RPC method is variable.
- The final product (orthoimage) accuracy as a function of the GCPs number used during the RPC-based geometric image correction meets the geometric specification of 2.5m (1D) RMSE corresponding to EU technical requirements using 16 well-distributed ground control points.
- The influence of the GCPs number on the image geometric accuracy during the geometric correction model phase based on Toutin's rigorous model follows the well-know rule: the more GCPs, the better accuracy.
- The final product (orthoimage) accuracy as a function of the GCPs number used during the geometric image correction by Toutin's rigorous model correction meets the geometric specification of 2.5m (1D) RMSE corresponding to EU technical requirements using 12 well-distributed ground control points.

While interpreting these accuracy results it should be taken into account that the study is based on the single Kompsat-2 image. In order to comprehensively verify the RMSE values, the quality analysis must be repeated using more Kompsat-2 sample images, preferably characterised by wide range of their off-nadir angles. This action requires also the provision of the reliable validation data.

Additionally, the one-dimensional RMS errors for the set of the independent check points were also calculated during the image correction phase. For the same set of independent check points, the difference between its RMSE values before (model) and after (actual) image orthorectification can be attributed to the following: 1. terrain related distortions, 2. cartographic reprojection errors, and 3. resampling errors.

**Based on the limited sample images, the Kompsat-2 orthoimage product accuracy meets the geometric specification of 2.5m (1D) RMSE corresponding to EU technical requirements ON THE CONDITION of using at least 12 well-distributed ground control points for image correction and orthorectification.**

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**Abstract**
This report summarizes the initial evaluation of the geometric characteristics of the single sample the radiometrically corrected Kompsat-2 image acquired over the JRC Maussane Terrestrial Test Site.
The objective of this study is threefold:
(1) to evaluate the planimetric accuracy in a routine basis production of orthorectified Kompsat-2 imagery;
(2) to determine the optimal number and spatial distribution of the GCPs (Ground Control Points) for the Kompsat-2 orthorectification process;
(3) to check if the orthorectified imagery of the Kompsat-2 optical sensor fall within the required accuracy criteria for the CwRS 1:10.000 scale of absolute 1-D RMSE of < 2.5m.
Based on the limited sample images, the Kompsat-2 orthoimage product accuracy meets the geometric specification of 2.5m (1D) RMSE corresponding to EU technical requirements on the condition of using at least 12 well-distributed ground control points for image correction and orthorectification.

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