

EuroSDR project: Radiometric Aspects of Digital Photogrammetric Images Query to sensor manufacturers, data providers and data users Version 1.10.2008

Dear receiver,

EuroSDR has launched a project on radiometric aspects of digital photogrammetric airborne images in May 2008. The first phase of the project is a review to the state-of-the-art and theoretical issues. Many types of sensors are concerned, including medium- and large-format photogrammetric mapping sensors, small/medium-format cameras, multi- and hyper-spectral spectrometers and also high-resolution satellite sensors (GSD 1-5 m, e.g. SPOT5, Ikonos, etc.). In the second phase experimental investigations on radiometric properties of the large-format photogrammetric mapping sensors and imagery will be carried out. Details of the EuroSDR project as well as the project progress are given in the project Internet-pages that are available through <http://www.eurosdrr.net/2good/index.php>.

An important part of the review is a query to various interest groups dealing with image radiometry, i.e. sensor manufacturers, data providers and data users. Objectives of the query are to:

- Obtain a picture of the actual situation
- Detect main weaknesses of existing digital camera radiometric processing
- Look for main trends on existing and future development in this field.
- Know what are the advantages of better radiometric processing and find which applications ask for better radiometric processing.

The result of the first phase will be a report and a review article. The results will also be used as the background information in selecting topics for the empirical phase of the project.

The questions are grouped under the following themes:

1. Sensor
2. Calibration
3. Data collection
4. Post-processing
5. Utilization of the images

Under each theme the questions are further divided to questions related to A) current situation and to B) desired situation. The primary interest groups for each theme are named in the questionnaire. Please, primarily focus on themes addressed for your own interest group, but comments on other themes are also welcomed. You can return several replies if you belong to several interest groups. Besides the conventional radiometric properties, we are treating the spectral, colour and spatial resolution (PSF) properties as components of radiometry.

All kinds of input are important for the project. You can reply in a free format. You can use the questions as a checklist and you do not have to answer all questions. You can also present additional issues. You can provide information also in forms of literature and reports. And you can provide additional literature that is relevant for the review. Literatures in electronic form with proper reference information are desirable, but also references to publicly available literature are appropriate.

The answers should be sent back to the project leaders by 31.10.2008. The EuroSDR members that are participating the Cardiff meeting of the EuroSDR Science and Steering Committee, October 15-17, 2008, are encouraged to return their replies there.

Yours gratefully,

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Contact information

Contact person (name, e-mail address), Institute/Company, Address, Internet address

What is your interest group (sensor manufacturer, data provider, software developer, data user, other: what?).

1. Sensor

Sensor identification

A. Current situation

Primary interest group: Sensor manufacturer

Sensor construction (e.g. multi-head frame sensor, single-head frame sensor, single-head pushbroom sensor, etc.).

Technical details of various components of the sensor (Lens, CCD, filters, beam-splitters, ...). Give also marks and types.

How are the radiometric aspects taken into account in the sensor construction (e.g. temperature stabilization, dark signal correction, collection of information of conditions)?

How the sensor processes the incoming radiance?

Radiometric/colorimetric/spectral/spatial performance of the sensor (linearity, dynamic range, noise, spectral sensitivity, PSF, stability, etc.)?

Recommended system configuration and operating conditions (stabilized camera mount, flight speed, temperature, etc.)?

Intended application areas.

Additional material

Literature/reports about the sensor and its components

B. Desired situation

Primary interest group: Data provider, data user, sensor manufacturer

Questions and limitations related to the sensor.

Desired sensor properties.

2. Calibration

Sensor identification

A. Current situation

Primary interest group: Sensor manufacturer, data provider

What are the phases of the radiometric, colour, spectral and spatial resolution (PSF/MTF) calibration of the sensor/system, e.g.

- Laboratory calibration
- On-board calibration
- Test-field calibration (so-called vicarious calibration)
- Self-calibration (on-the-job; i.e. determining the system calibration based on the data from the mapping project)

For each phase and property: Describe the calibration method (instrumentation, calculation methods). What parameters are determined and at which accuracy/precision? What are the radiometric quality indicators? How often calibration is performed?

Additional material

- Literature/reports about the calibration process
- Information about the calibration laboratory
- Example calibration certificate or report

B. Desired situation

Primary interest group: Data provider, data user, sensor manufacturer

Questions and limitations related to the current calibration process?

Describe the desired calibration process (laboratory, on-board, test field, self-calibration) for each system property (radiometry, colour, spectral and spatial resolution). Describe the desired calibration method for each phase and property. What parameters should be determined and at which accuracy? What radiometric quality indicators are desirable?

3. Data collection

Sensor identification

A. Current situation

Primary interest group: Data provider

In addition to sensor, what other system components influence the radiometry and spatial resolution of the images (e.g. sensor mount, camera port window, vehicle)? What are your requirements for these components? What are technical details of these components in your system?

What sensor/system settings (e.g. aperture, exposure, flight speed) influence the radiometry and spatial resolution of the collected data?

How are the optimum sensor settings determined?

What are the recommended conditions for an image collection flight?

On-the-fly quality control methods.

Reference targets and reference measurements during the data collection (e.g. reflectance panels in field, atmospheric radio soundings, sun photometers...).

Additional material

Literature/reports about the data collection process

Example data collection log file

B. Desired situation

Primary interest group: Data provider, data user

Questions and limitations related to the current data collection process.

Describe desired system properties and data collection process.

4. Post-processing

Sensor identification

A. Current situation

Primary interest group: Sensor manufacturer, data provider

How is the data post-processed? Which software is used in the post-processing?

- System corrections for the digital numbers (DNs)
- Atmospheric correction
- BRDF-correction
- Radiometric adjustment of the images (e.g. radiometric block adjustment, statistical adjustment of gray values).
- Color balancing
- Pansharpening
- Restoration
- Image enhancement
- Various conversions e.g. 16 bit to 8 bit
- Relative radiometric adjustment between various bands, different parts of the images, different images of a single acquisition, images from different acquisitions?
- Etc.

Quality control of the imagery (e.g. spatial resolution, dynamic range, saturation, noise, color quality, linearity, radiometric correctness, histograms, PSF, MTF). Parameters and methods? Quality requirements?

What is the traceability of the DN's?

Describe post-processing processes for

- different image products: orthophotos/orthophoto mosaics, stereomodels, ...
- different applications: aerial triangulation, DEMs, background image in visual analysis, classification, ...

Additional material

Literature/reports concerning the post-processing
Example post-processing log-file/report

B. Desired situation

Primary interest group: Data provider, data user, sensor manufacturer

Questions and limitations related to the current post-processing.

Desired post-processing method for different image products and applications.

5. Utilization of the images

A. Current situation

Primary interest group: data user

In which applications the airborne images are used?

For each application

- Requirements for the imagery (**geometry**, radiometry, spectral, color, PSF)
- What is the basic image product?
- Steps of the post-processing (Section 4)

Additional material

Literature/reports concerning the application

B. Desired situation

Primary interest group: data user

For each application

- Questions and limitations related to the utilization of the image radiometry at current situation?
- What would be the ideal imagery?
- What would be the ideal post-processing?
- What is the expected benefit of accurate radiometric processing?