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THE FUTURE SPACEBORNE HYPERSPECTRAL IMAGER ENMAP: ITS IN-FLIGHT RADIOMETRIC AND GEOMETRIC CALIBRATION CONCEPT

M. Schneider¹, R. Müller¹, H. Krawczyk², M. Bachmann¹, T. Storch¹, V. Mogulsky³, and S. Hofer³

¹Deutsches Zentrum für Luft- und Raumfahrt (DLR), Oberpfaffenhofen, Germany

²Deutsches Zentrum für Luft- und Raumfahrt (DLR), Rutherfordstr. 2, 12489 Berlin, Germany

³Kayser-Threde GmbH, Wolfratshauer Straße 48, 81379 Munich, Germany

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Abstract. The German Aerospace Center DLR – namely the Earth Observation Center EOC and the German Space Operations Center GSOC – is responsible for the establishment of the ground segment of the future German hyperspectral satellite mission EnMAP (Environmental Mapping and Analysis Program). The Earth Observation Center has long lasting experiences with air- and spaceborne acquisition, processing, and analysis of hyperspectral image data. In the first part of this paper, an overview of the radiometric in-flight calibration concept including dark value measurements, deep space measurements, internal lamps measurements and sun measurements is presented. Complemented by pre-launch calibration and characterization these analyses will deliver a detailed and quantitative assessment of possible changes of spectral and radiometric characteristics of the hyperspectral instrument, e.g. due to degradation of single elements. A geometric accuracy of 100 m, which will be improved to 30 m with respect to a used reference image, if it exists, will be achieved by ground processing. Therefore, and for the required co-registration accuracy between SWIR and VNIR channels, additional to the radiometric calibration, also a geometric calibration is necessary. In the second part of this paper, the concept of the geometric calibration is presented in detail. The geometric processing of EnMAP scenes will be based on laboratory calibration results. During repeated passes over selected calibration areas images will be acquired. The update of geometric camera model parameters will be done by an adjustment using ground control points, which will be extracted by automatic image matching. In the adjustment, the improvements of the attitude angles (boresight angles), the improvements of the interior orientation (view vector) and the improvements of the position data are estimated. In this paper, the improvement of the boresight angles is presented in detail as an example. The other values and combinations follow the same rules. The geometric calibration will mainly be executed during the commissioning phase, later in the mission it is only executed if required, i.e. if the geometric accuracy of the produced images is close to or exceeds the requirements of 100 m or 30 m respectively, whereas the radiometric calibration will be executed periodically during the mission with a higher frequency during commissioning phase.

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