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Radiometric and geometric characteristics of Pleiades images

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Abstract. Pleiades images are distributed with 50 cm ground sampling distance (GSD) even if the physical resolution for nadir images is just 70 cm. By theory this should influence the effective GSD determined by means of point spread function at image edges. Nevertheless by edge enhancement the effective GSD can be improved, but this should cause enlarged image noise. Again image noise can be reduced by image restoration. Finally even optimized image restoration cannot improve the image information from 70 cm to 50 cm without loss of details, requiring a comparison of Pleiades image details with other very high resolution space images. The image noise has been determined by analysis of the whole images for any sub-area with 5 pixels times 5 pixels. Based on the standard deviation of grey values in the small sub-areas the image noise has been determined by frequency analysis. This leads to realistic results, checked by test targets. On the other hand the visual determination of image noise based on apparently homogenous sub-areas results in too high values because the human eye is not able to identify small grey value differences – it is limited to just approximately 40 grey value steps over the available gray value range, so small difference in grey values cannot be seen, enlarging results of a manual noise determination.

A tri-stereo combination of Pleiades 1A in a mountainous, but partially urban, area has been analyzed and compared with images of the same area from WorldView-1, QuickBird and IKONOS. The image restoration of the Pleiades images is very good, so the effective image resolution resulted in a factor 1.0, meaning that the effective resolution corresponds to the nominal resolution of 50 cm. This does not correspond to the physical resolution of 70 cm, but by edge enhancement the steepness of the grey value profile across the edge can be enlarged, reducing the width of the point spread function. Without additional filtering edge enhancement enlarges the image noise, but the average image noise of approximately 1.0 grey values related to 8 bit images is very small, not indicating the edge enhancement and the down sampling of the GSD from 70 cm to 50 cm. So the direct comparison with the other images has to give the answer if the image quality of Pleiades images is on similar level as corresponding to the nominal resolution. As expected with the image geometry there is no problem. This is the case for all used space images in the test area, where the point

identification limits the accuracy of the scene orientation.

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