

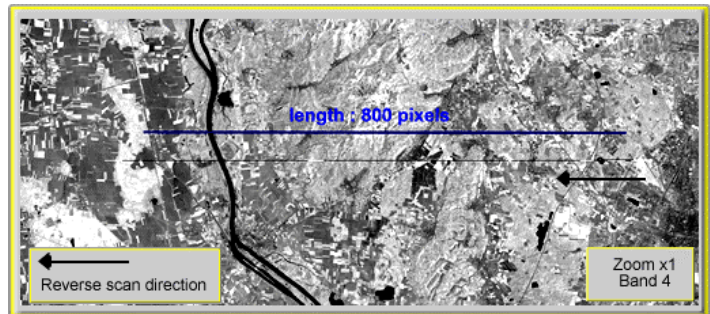
Detectors oversaturation

Anomaly occurs on <i>LANDSAT 5 - 7</i>	Anomaly status <i>OPEN</i>	Related QUISS test: <i>Striping</i>	Anomaly slip <i>07</i> Version <i>01</i> 23/04/2003
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Anomaly description



Area extracted from order 2557-1.
Path 196 - Row 26.
Date : 10-05-2001. Band 1 2 3.



On figure above, we observe a comet-like artefact on a reverse scan direction of a width depending on the band. It sizes for example 800 pixels on band 4. It includes a main saturated area followed by a queue. This artefact occurs on VNIR/SWIR and panchromatic bands. No observation has been made on the thermal band (band 6).

The height of the saturated area is typically around 4 pixels, but any neighbored pixels of the image swath are impacted (see detailed figure of band 1). Its width depends on the image band, for example on the figure above, it reaches about 80 pixels on band 4 and about 50 pixels on band 1.

The queue part of the comet-like artefact is a one or two pixels height trail. Its width depends on the detector and the image band.

Causes

The comet-like artefact is caused by a very bright object on the ground that exceed the dynamic range of the instrument. On one hand, it can be due to a glass oriented in such a way reflecting the sunlight directly on the spacecraft. On the other hand, the over saturation are due for example to the petroleum burn-off, the forest fires or the erupting volcano as well.

The origin of the bright target is rare and difficult to predict. The detector oversaturation depends on the sun elevation, the season, the structure and the spectrum of the target.

Consequences

The image part affected by the detectors oversaturation cannot be repaired.

Disposition

GAEL Consultant proposes the “scrap” disposition and the product has to be segregated.

Preventive and corrective actions

Preventive actions

GAEL Consultant proposes the following set of preventive actions:

- No action could be taken to prevent the generation of products where the detectors over saturation anomaly occurred.
- QUISS “saturated pixels” test may be helpful for the station operator to visualize the detectors over saturation. The anomaly remains on any bands but the band 6, in contradiction with other anomalies due to a wrong gain setting on one band.
- USGS should monitor bright target areas in order to avoid their acquisitions.
- For LANDSAT 7, the operation consisting in switching the gain states over suspicious area would not be efficient. In fact, over saturation will always be acquired out of the sensor dynamic range, low and high gain mode.

Corrective actions

No corrective actions could be taken to products where the detectors over saturation anomaly occurred.

Some advice to go further

Caution

The detectors over saturation pattern may be confused by swath and line defect.

Details on the saturation of one detector

The detector over saturation includes different states. The examples below illustrate the saturation of the detectors 2 and 3 related to the image bands. The scan direction is from left to right 1 and 4. Obviously, after the saturated centre, the time to restore the detector capability varies according to the image band and the spectrum of the bright target as well.

Details on detector over saturation – band 1

The following figure is an area extracted from the band 1 where the detectors oversaturation occurred.

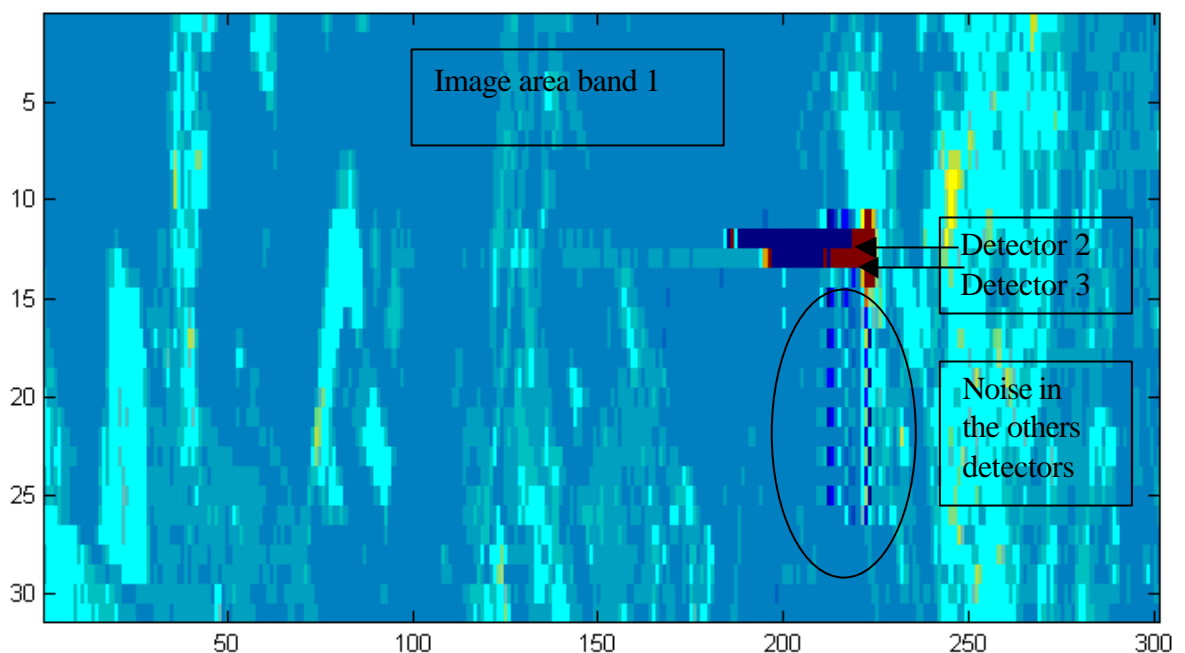


fig. 1 - Detectors oversaturation, band 1 (image has been stretched vertically).

The two figures below demonstrate a plot of detector response related the image area above. For each column it corresponds to the digital number value of the detector number 2 and number3.

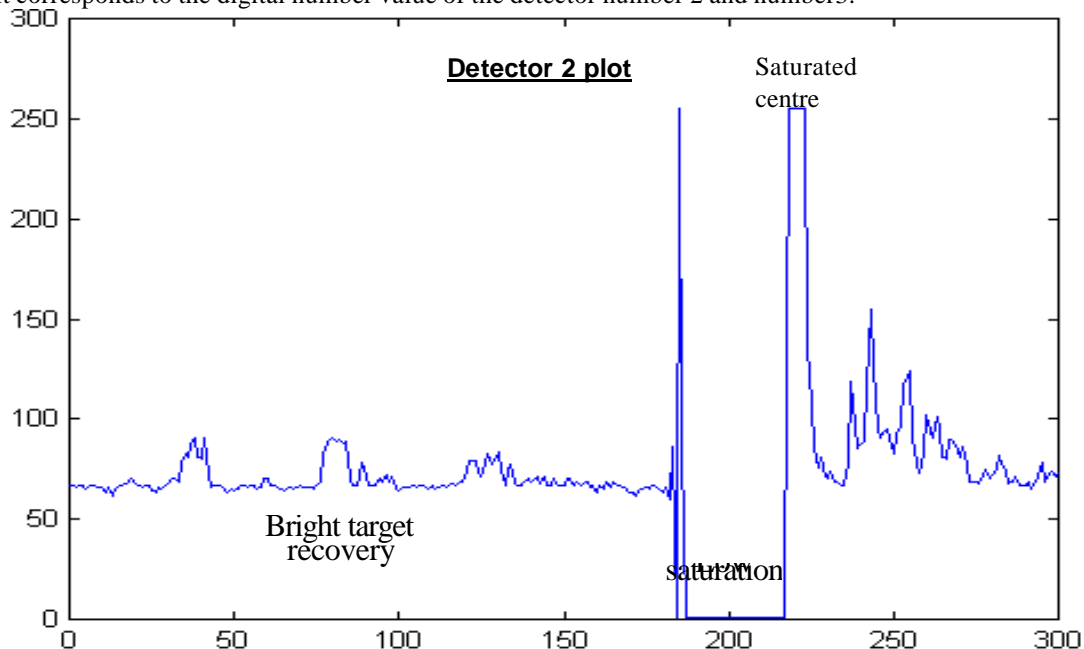


fig.2 - Detector 2 oversaturation plot, band 1.

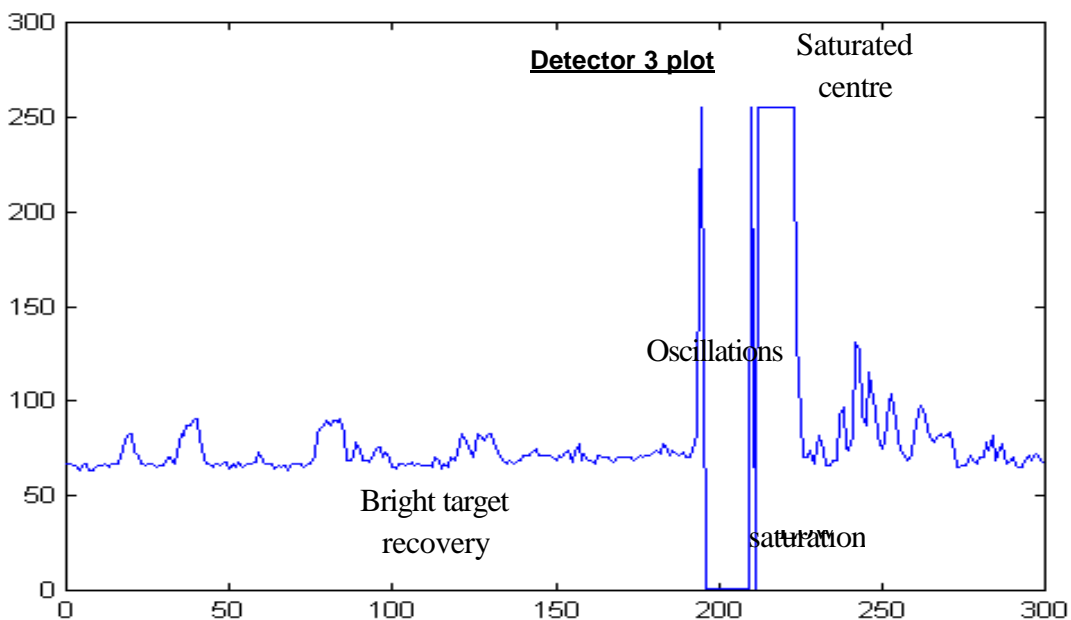


fig.3 - Detector 3 oversaturation plot, band 1.

Details on detector over saturation – band 4

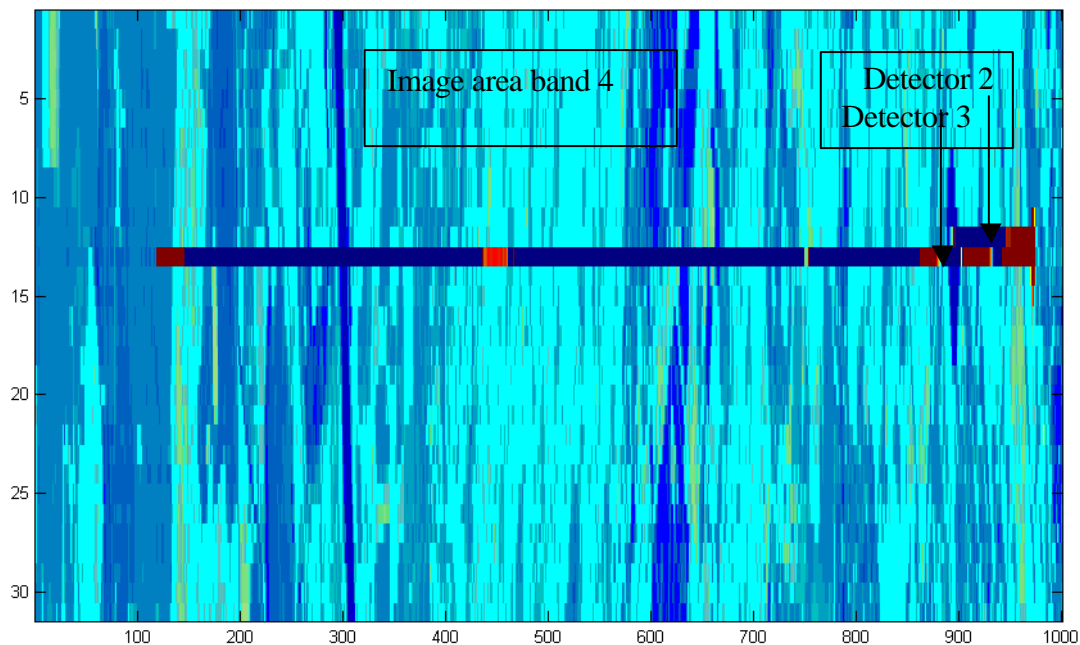


fig. 4 - Detectors oversaturation, band 4.

Figures below illustrate the profile plots along the saturated line of the image above. For each column it corresponds to the digital number value of the detector number 2 and number3.

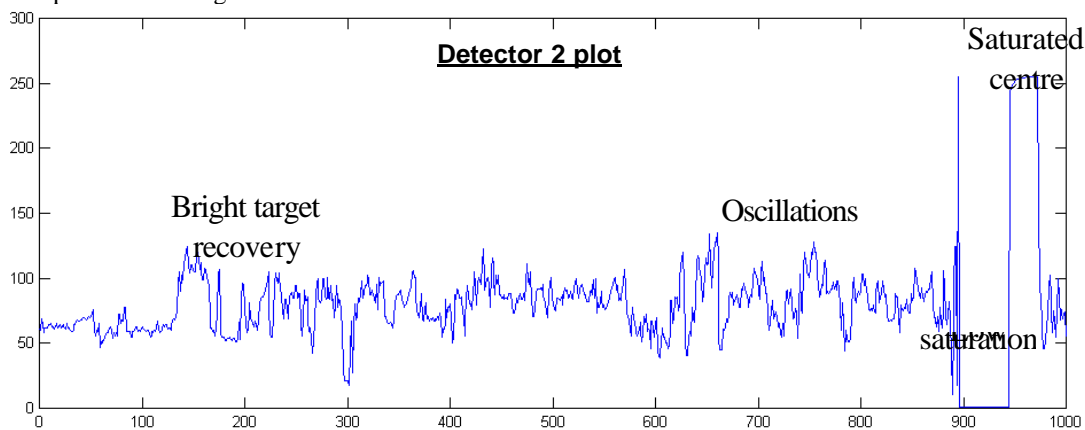


fig. 5 - Detector 2 oversaturation plot, band 4.

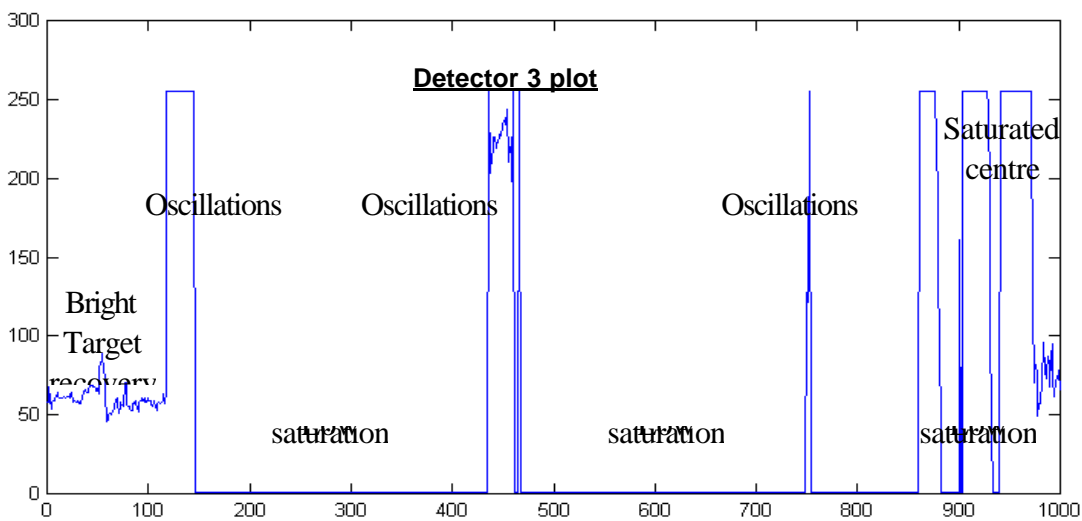


fig. 6 - Detector 3 oversaturation plot, band 4.