

Note to users of VEGETATION data: problems with radiometric calibration of VEGETATION 2 data.

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Update: 01 October 2006: see impact for users

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Description of the problem

The VEGETATION instrument calibration is regularly updated based on measurements made with an on board calibration device. This calibration device includes a calibrated light source (“lamp”) and a movable optical device which brings the reference light in sight of the radiometers during the night part of the orbit. Full description of the system can be found on the VEGETATION programme web site at page <http://www.spot-vegetation.com/vegetationprogramme/index.htm> and in [Henry and Meyret \(2001\)](#). Calibration procedures described in this latter paper are similar for both VEGETATION 1 and VEGETATION 2. On-board calibration is cross checked with a series of external calibration methods. For VEGETATION 2 (launched on 4th May 2002 onboard SPOT 5) the whole range of controls was carried out during the four-month in-flight commissioning phase. During this period the evolution of the on-board device was “as expected” (fig 1), with tendency to stabilization of the evolution, except for band B2 (red). This was consistent with other similar devices mounted on other satellite instruments. Consistency between calibration methods was considered to be good, with differences between results from different methodologies better than 4%.

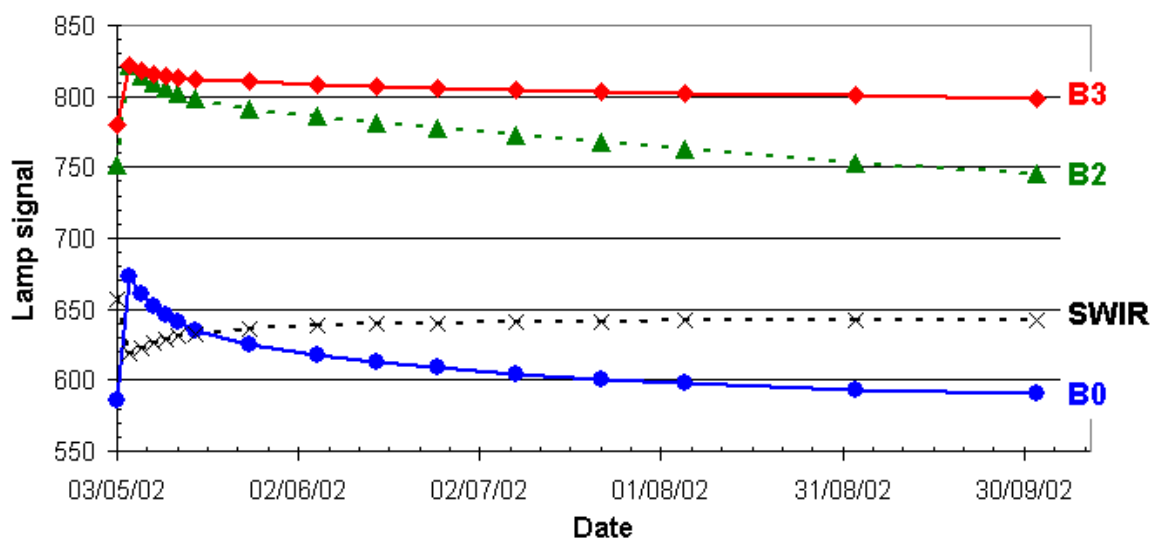


Fig. 1: initial evolution of the calibration lamp onboard VEGETATION 2.

Since the start of operational exploitation of VEGETATION 2 (1st February 2003), calibration coefficient updates have therefore been based on on-board calibration measurements and an a priori assumption of the intrinsic evolution of the lamp signal.

A recent cross-calibration campaign has shown that the VEGETATION 2 calibration lamp was not evolving as anticipated. Fig.2 shows that for the period from March 2003 (start of operational exploitation of VEGETATION 2) until present the evolution is near linear. Comparison between the lamp-based calibration and ground measurements (fig. 3 and table 1) shows that the on-board calibration system has overestimated the losses in the spectral bands. VEGETATION 2 calibration coefficients values are therefore lower than they should be and so the provided reflectance values are higher.

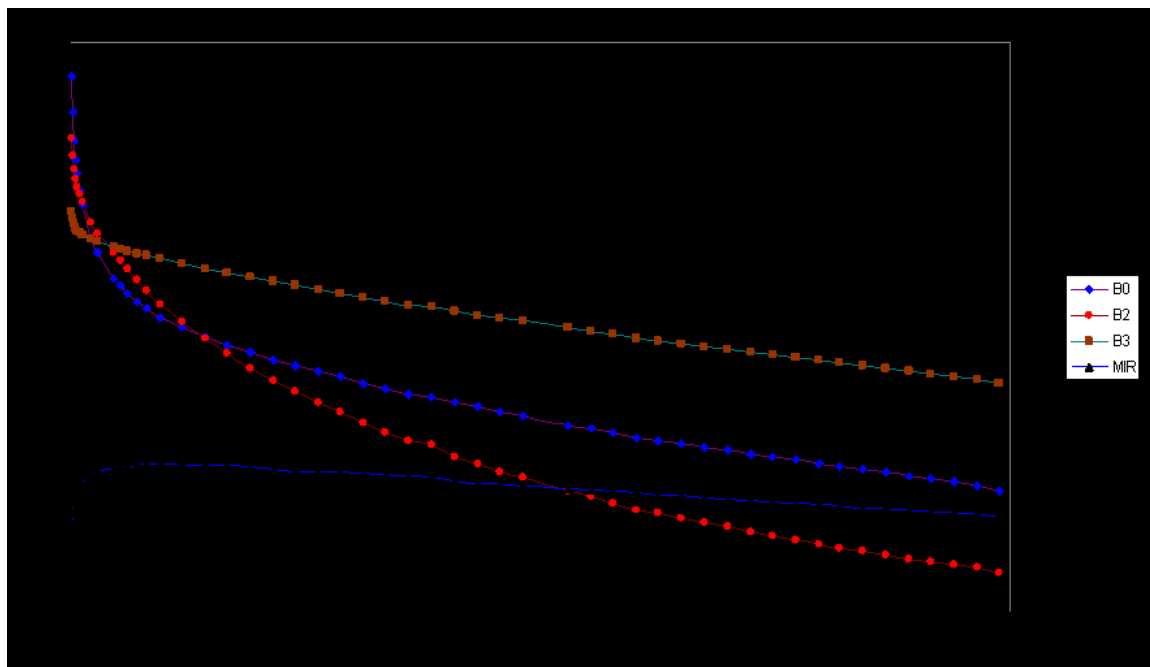


Fig. 2: evolution of the calibration signal between start of measurements and fall 2005.

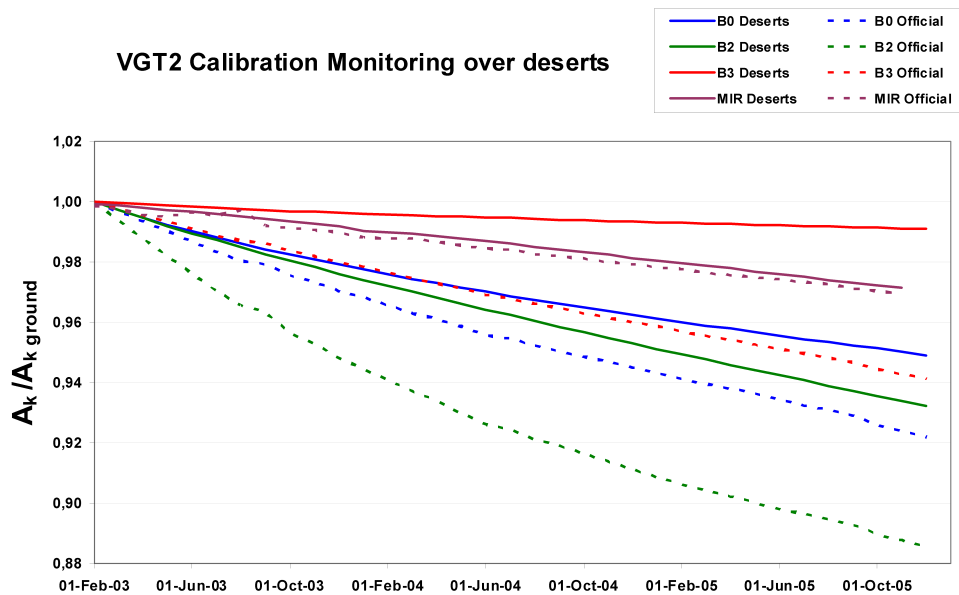


Fig. 3: comparison between spectral measurements over deserts and from the calibration lamp (“official”).

Remedies

In order to tackle the above-mentioned problem, the Steering Committee of the VEGETATION programme has decided:

- 1) To introduce new calibration coefficients as from 01 June 2006.
- 2) To reprocess the time series of the data acquired between 1st February 2003 and 31 May 2006, so that new and consistent P and S10 products will be available for temporal analysis. The reprocessing is being organized in such a way that the 2005 data will be available as soon as possible (i. e. at the same time as the delivery of the same dekad of 2006) for year-to-year comparison purposes.

02/2003 – 10/2005	Deserts Calibration	Official Calibration
B0	-4.9%	-7.4%
B2	-6.4%	-11.0%
B3	-0.9%	-5.6%
MIR	-2.7%	-2.9%

Table 1: loss in signal for 3 spectral bands of VEGETATION 2: The Desert calibration shows for instance for B2 that there was an actual loss of sensitivity equal to 6.4%, whereas the official B2 sensitivity loss based on the lamp calibration was of 11%.

Impact for users (updated)

Users who work mainly with S10 NDVI data: there is no simple correction applicable to the S10 NDVI because they are computed after an atmospheric correction which does not react linearly to radiometric calibration modification. It was initially anticipated that the impact could be in adverse conditions in the order of 10% of reduction of the NDVI value over 3 years, i. e. the NDVI values of end of 2005 could be as much as 10% lower now than in 2003. In fact the comparison between the data with the old correction and the data with the updated correction for the last dekad of June 2006 (i. e. by the time the divergence between old and new calibration values is maximum and therefore maximum discrepancies can be expected) shows that **the impact on the NDVI is mainly in the order of -1% to +3%** (fig 5) , i. e. much less than the 10% announced earlier. A quick inspection of the spatial distribution of differences indicates that there is no major geographical bias. This preliminary observation will need to be completed by more systematic analysis, but already suggests that the difference between old and new top of canopy reflectance data and NDVI might probably be smaller than anticipated earlier.

The user will have to decide whether such differences are significant for his/her application or can be considered as part of the acceptable noise of the data set before reprocessing his/her historical dataset.

The new NDVI can be downloaded when they become available in the free VGT web site at <http://free.vgt.vito.be> .

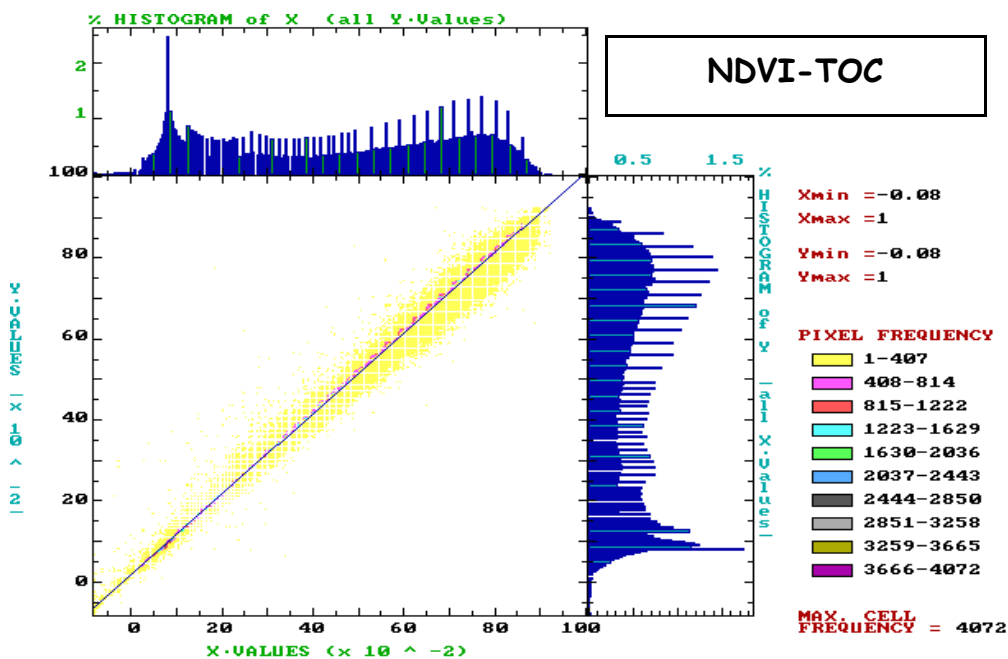


Fig. 4: comparison between new (Y) and old (X) NDVI values for the 3rd dekad of

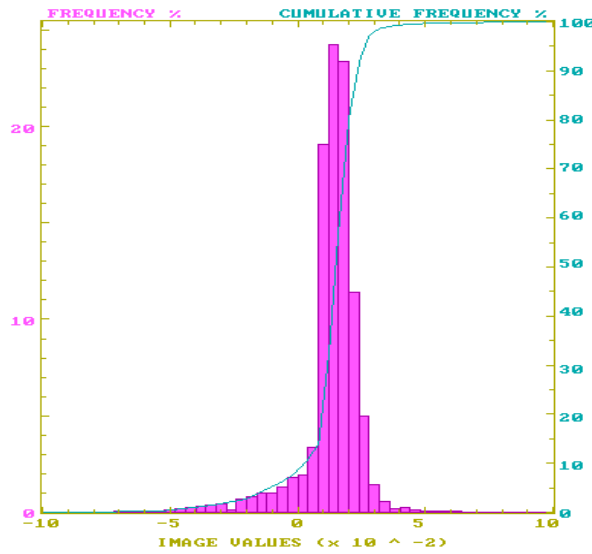


Fig. 5: distribution of NDVI differences: NEW-OLD. Mean difference: 0.014

Users who have acquired P data can apply correction factors directly to their data (see table 2 here after). The reflectance values have to be multiplied by these coefficients to obtain an upgraded reflectance.

Users who have acquired S10 data can replace their old dataset with newly processed data as soon as they become

available on the free VGT ftp site.

The VEGETATION programme apologises for any inconvenience.

Reference

Henry P. & Meygret A. 2001: CALIBRATION OF VEGETATION CAMERAS ON-BOARD SPOT4. Proceedings of the VEGETATION 2000 conference, Belgirate-Italy, 3-6 April 2000 , Saint G. Ed, CNES - Toulouse & JRC - Ispra, pp 23-32

	B0	B2	B3	MIR
1-Feb.-03	0.992	0.971	0.998	1.001
1-Mar.-03	0.992	0.967	0.996	0.999
1-Apr.-03	0.991	0.964	0.994	1.001
1-May-03	0.993	0.967	0.994	1.002
1-Jun.-03	0.988	0.958	0.990	0.999
1-Jul.-03	0.987	0.955	0.988	1.003
1-Aug.-03	0.986	0.952	0.986	1.004
1-Sep.-03	0.986	0.952	0.985	1.007
1-Oct.-03	0.984	0.948	0.983	1.004
1-Nov.-03	0.983	0.946	0.981	1.000
1-Dec.-03	0.982	0.944	0.979	1.005
1-Jan.-04	0.981	0.942	0.978	1.006
1-Feb.-04	0.979	0.940	0.976	1.007
1-Mar.-04	0.978	0.938	0.974	1.008
1-Apr.-04	0.978	0.936	0.973	1.007
1-May-04	0.977	0.934	0.972	1.007
1-Jun.-04	0.975	0.933	0.972	1.006
1-Jul.-04	0.975	0.934	0.973	1.006

1-Aug.-04	0.975	0.933	0.971	1.006
1-Sep.-04	0.975	0.933	0.969	1.004
1-Oct.-04	0.975	0.932	0.968	1.004
1-Nov.-04	0.975	0.931	0.966	1.003
1-Dec.-04	0.975	0.930	0.965	1.003
1-Jan.-05	0.976	0.930	0.963	1.003
1-Feb.-05	0.976	0.930	0.961	1.003
1-Mar.-05	0.975	0.929	0.960	1.003
1-Apr.-05	0.974	0.928	0.959	1.003
1-May-05	0.974	0.928	0.957	1.003
1-Jun.-05	0.973	0.928	0.956	1.003
1-Jul.-05	0.973	0.929	0.954	1.002
1-Aug.-05	0.972	0.929	0.953	1.002
1-Sep.-05	0.971	0.929	0.951	1.003
1-Oct.-05	0.970	0.929	0.950	1.003
1-Nov.-05	0.969	0.929	0.949	1.003
1-Dec.-05	0.969	0.928	0.948	1.003
1-Jan.-06	0.967	0.927	0.948	1.003
1-Feb.-06	0.968	0.928	0.948	1.004
1-Mar.-06	0.969	0.929	0.949	1.005
1-Apr.-06	0.970	0.931	0.950	1.006
1-May-06	0.971	0.932	0.950	1.006

*Table 2: coefficient to be applied to TOA spectral reflectance values of VEGETATION 2 P products generated until 31st May 2006 to obtain updated reflectance values (updated TOA values = old TOA values * coefficient).*