

# Validation and upgrade of TET-1 L2 Data Products using the volcano Lascar as normative Reference

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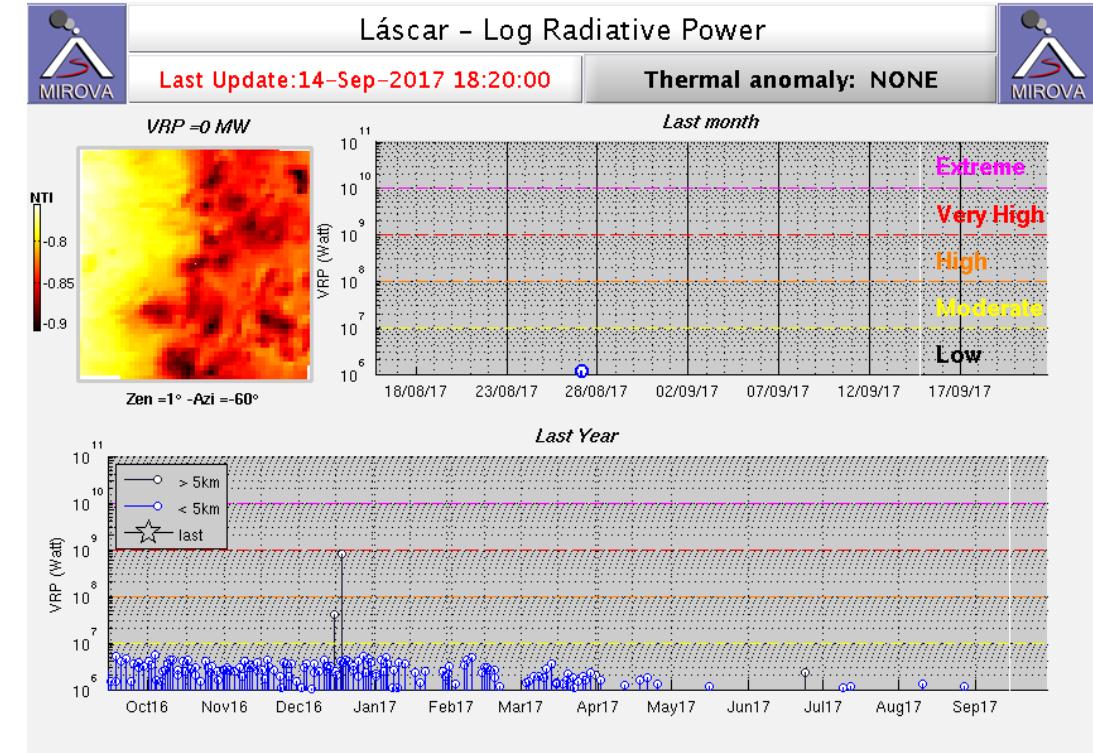
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# Validation Concept

- In the period from January 2016 up to June 2017 were tasked 92 date takes over the Lascar region, 40 at night and 52 at day. By manual inspection were selected 37 night time and 38 day time data sets offering a good visibility of the Lascar in the MWIR band.



<http://www.mirovaweb.it/>



# FireBird L2 Data Product Validation Results

index	false alarm	cluster size	mean x	mean y	latitude	longitude	FRP (MW)	T (K)	A (m2)
0	0	7	297,229691	1201,39443	-23,400687	-67,7192026	4,60312187	527,468274	1048,71023

Standard L2		Cluster
	Night	Day
definite detected	16,20%	15,80%
possible false alarm	62,20%	39,50%
not detected	21,60%	44,70%
Standard L2		Cluster
	Night	Day
Cluster size Mean	6,57	2,23
Cluster size Devation	3,34	1,72
Uncertainty Size %	50,85	77,06
Mean TF	596,29	1271,35
Deviation TF	373,76	762,05
Uncertainty TF %	62,68	59,94
Mean AF (m <sup>2</sup> )	24378,30	88,71
Deviation AF	34195,72	128,68
Uncertainty AF %	156,13	145,05
Mean Lineas Size (m)	156	9
Mean FRP (MW)	25,69	3,1
Deviation FRP	31,12	2,5
Uncertainty FRP %	121,14	82,1

## Standard FireBird L2 Data Product

- Besides the resulting parameters like the FRP a column 'false alarm' is included.
- If the number in this column is zero so the object was identified definitely as a hot spot.
- If this number is greater than zero so the object was classified as a possible false alarm.
- Also in case of a false alarm the parameters fire Temperature, Area and FRP will be calculated and enlisted.

## FireBird L2 Data Product Validation Results

- Summarising the results of the Table it has to recognise the detection is not satisfactory.
- The calculation of the mean parameter FRP is a bit lower than the MODIS values above and differs drastically for night and day
- This is valid also for the parameters TF and AF
- The uncertainties of the calculated parameters are higher than for MODIS

# Alternative Detection Models

- The effective emissivity is >1
- Detect values >1 in the emissivity image?
- An efficient method offers the histogram analysis
- A histogram represents the statistical properties of data set if the class width is optimal
- The optimal class width is given by Scott's rule
- In this context must be exist empty classes between normal and fire affected pixel values
- A fire is detectable if

$$\varepsilon_{mw}^{\text{eff}} = \frac{L_{mw}^{\text{ASK}}}{B(T_{Bgr}, \lambda_{mw})} = \varepsilon_{mw} * \left( a * \left( \frac{B(T_F, \lambda_{mw})}{B(T_{Bgr}, \lambda_{mw})} - 1 \right) + 1 \right)$$

$L_{mw}^{\text{ASK}}$  – atmospheric corrected, measured radiance flux in MW band

$T_{Bgr}$  – pixel brightness temperature to be estimated by LWIR

a – percentage of the fire in the pixel

## Scott's rule

$$h_w = \frac{3.49}{\sqrt[3]{n}} \sigma$$

$h_w$  - class (bin) width

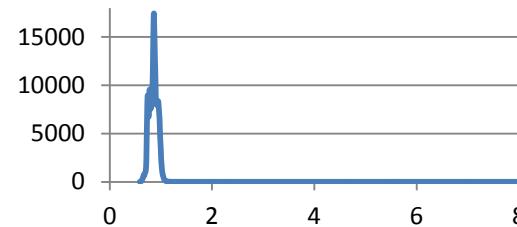
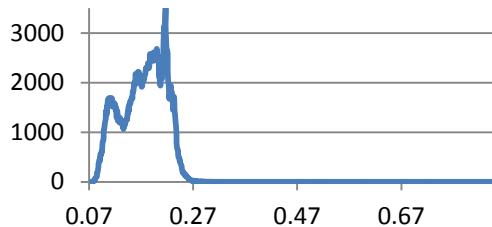
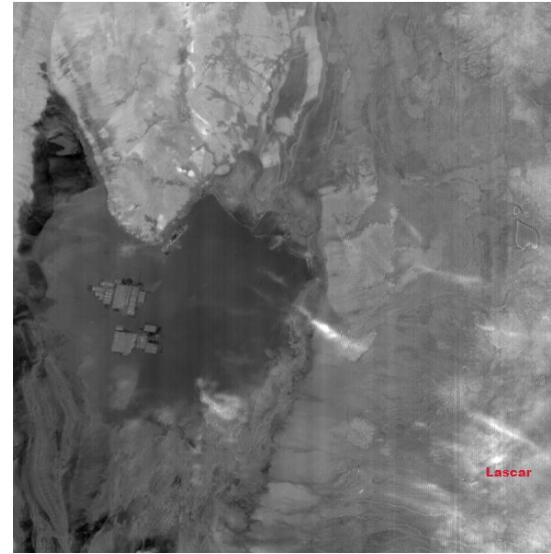
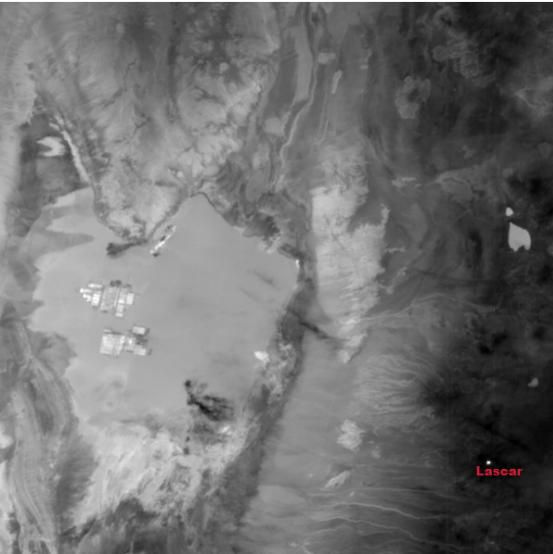
n - number of data samples

$\sigma$  - standard deviation of the analysed data set

$$a * \left( \frac{B(T_F, \lambda_{mw})}{B(T_{Bgr}, \lambda_{mw})} - 1 \right) > h_w$$



# Alternative Detection Models

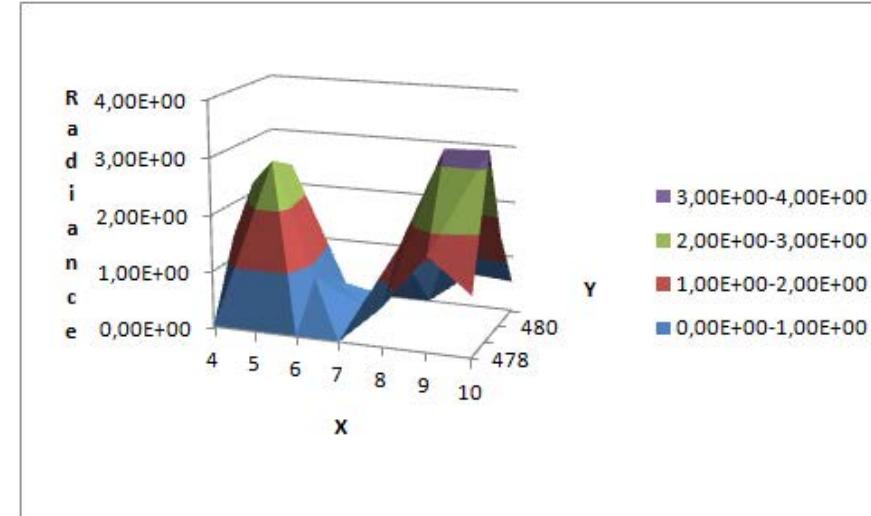
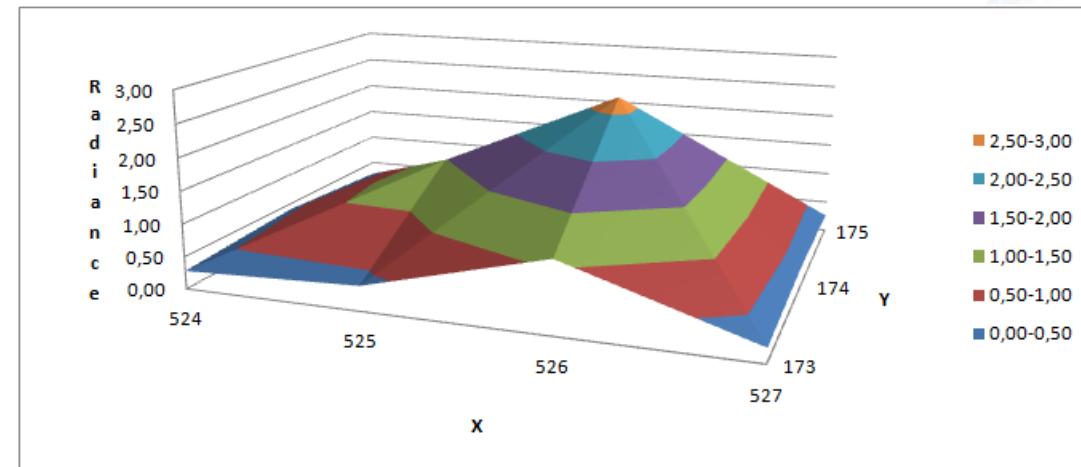


MW image (left) and ,Emissivity' image (right) and their histograms (bottom)

	Standard L2		Updated L2	
	Night	Day	Night	Day
definite detected	16,20%	15,80%	97,30%	86,80%
possible false alarm	62,20%	39,50%	0,00%	0,00%
not detected	21,60%	44,70%	2,70%	13,20%

# Cluster Models and Sub-Pixel Model

- The Cluster Model was introduced because a small (compared to the GSD) object will cover in the image more than 1 pixel due to blurring effects
- In the Standard L2 Products the Cluster ist homogeneous
- Analysing the Cluster Structure the Cluster has to be divided in Sub Clusters if necessary





# Alternative FRP Calculation Models

$$\varepsilon_{mw}^{\text{eff}} = \frac{L_{mw}^{\text{ASK}}}{B(T_{Bgr}, \lambda_{mw})} = \varepsilon_{mw} * \left( a * \left( \frac{B(T_F, \lambda_{mw})}{B(T_{Bgr}, \lambda_{mw})} - 1 \right) + 1 \right)$$

	<b>Standard L2</b>		Cluster	<b>Updated L2</b>		Cluster	<b>Updated L2</b>		SubPixel
	<b>Night</b>	<b>Day</b>		<b>Night</b>	<b>Day</b>		<b>Night</b>	<b>Day</b>	
definite detected	16,20%	15,80%		97,30%	86,80%				
possible false alarm	62,20%	39,50%		0,00%	0,00%				
not detected	21,60%	44,70%		2,70%	13,20%				
<b>Standard L2</b>		Cluster	<b>Updated L2</b>		Cluster	<b>Updated L2</b>		SubPixel	
<b>Night</b>		<b>Day</b>	<b>Night</b>		<b>Day</b>	<b>Night</b>		<b>Day</b>	
Cluster size Mean	6,57	2,23		7,61	3,11				
Cluster size Devotion	3,34	1,72		3,06	1,66				
Uncertainty Size %	50,85	77,06		40,28	53,36				
Mean TF	596,29	1271,35		429,67	444,27		565,55	554,21	
Deviation TF	373,76	762,05		42,36	25,38		81,23	56,88	
Uncertainty TF %	62,68	59,94		9,86	5,71		14,36	10,26	
Mean AF (m <sup>2</sup> )	24378,30	88,71		1065,37	1624,78		842,59	1094,25	
Deviation AF	34195,72	128,68		298,19	358,93		270,81	191,86	
Uncertainty AF %	156,13	145,05		27,99	22,09		32,14	17,53	
Mean Lineas Size (m)	156	9		33	40		29	33	
Mean FRP (MW)	25,69	3,1		2,01	3,54		4,78	5,86	
Deviation FRP	31,12	2,5		0,47	0,59		1,62	1,62	
Uncertainty FRP %	121,14	82,1		23,34	16,58		33,89	27,62	



**Thank You For Your Attention**  
BIROS, MWIR 19.02.2017; Greenland; 260 K