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<http://www.bgu.ac.il/BIDR/research/phys/remote>

Science from Above

November 30, 2019

Dear colleagues,

Re: VEN μ S periodic news – November 30, 2019

1 VEN μ S image processing updates

The VEN μ S Scientific Center, at Ben Gurion University, is still producing L2 Q2 5 m resolution in real-time.

During December 2019, we will produce the L3 Q2 5 m resolutions (that we stopped in June 2019) from June 2019 to Nov. 2019.

In parallel, we have reprocessed the L1 Q2 from Nov. 2017 to March 2018. L2 and L3 Q2 5 m are now available on the website. The updated L2/L3 for April will be available on the website very soon.

2 Technological mission month

The VEN μ S technological mission is aimed at evaluating and qualifying the Israeli Hall Effect Thruster (IHET) performance in space and demonstrating its usefulness and capabilities in performing orbit control tasks such as transferring from Low Earth Orbit (LEO) to another LEO and autonomous orbit maintenance at low altitudes while enabling imaging in a high drag environment.

The Israeli Hall Effect Thruster (IHET) was developed, built, and operated by RAFAEL.

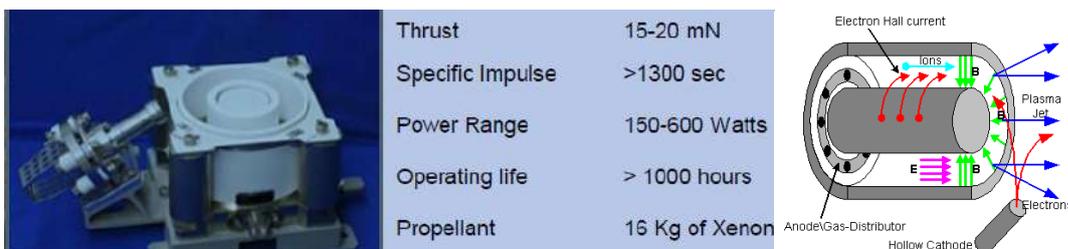


Figure 1: The Israeli Hall Effect Thruster (IHET), its characteristics, and operation principles.

The uniqueness of electrical propulsion: thrust is produced by accelerating mass to high exhaust velocity. Electrical Propulsion Systems (EPS) use solar energy

(usually captured by solar panels) to accelerate propellant ions (Xenon). Chemical propulsion systems store all their energy in the consumable propellant (Hydrazine). Thus, the EPS is much more efficient in fuel consumption.

To fulfill the above-mentioned technological mission aim, the satellite will perform maneuvers with the HIET alone for one month every year.

For this reason, during Dec. 2019, the VEN μ S scientific mission will stop for one month, and the satellite will be focused only on the technological mission. This means that there will be no VEN μ S products in Dec. 2019.

More information about the technological mission is posted in the following link:

<https://karnieli-rsl.com/technological-mission>

3 Upcoming Q3 products

In the next months, we are going to receive from CNES the L1 Q3 products.

Q stands for Quality. Q3 means the third improvement of VEN μ S products. The main evolutions of L1 Q3 products, in comparison with L1 Q2 products, are the followings:

Radiometric type:

Update on radiometric absolute calibration coefficients using the latest Moon acquisitions (with respect with products processed before 03/2019);

Cloud detection and quantification (with respect with products processed before 12/2018): Corrections of

- over-detections due to repetitive landscape patterns or cloud shadows, global improvements on cloud detection using stereoscopy
- an anomaly triggered by the previous cloud detection parameters (randomly wrong cloud percentages values), which should lead to more valid products overall.

Geometric type:

Product registration (v2 products, 12/2018):

- Multi-temporal registration with an enhancement of the correlation with the reference image
- Multi-spectral registration is improved with the correction of radiometric sliding. This affected in particular B01 and B02 bands (which have a large number of TDI stages) on sites acquired with high roll/pitch

Other types:

Switched equivalent spectral wavelengths for real calculated values in products metadata (with respect to products processed before 26/10/2018), we will produce the L3 Q2 5m resolutions (that we stopped in June 2019) from June 2019 to Nov. 2019.



4 Can VEN μ S surface reflectance be greater than 1?

The VEN μ S Scientific Centers in France and Israel have received several complains that VEN μ S products were providing maximum surface reflectance values greater than 1, as presented in Figure 2:



Figure 2: Example of reflectances greater than one observed over roof windows in a VEN μ S image.

Such an unusual phenomenon might happen only in case of (near) perfect specular reflectance. Then, the reflectance is not constant but null in all directions, except in a little cone that corresponds to the solid angle of the sun. More physical explanation is posted in the following link:

<https://labo.obs-mip.fr/multitemp/16885-2/>

5 Statistics: sites Quality L1 temporal coverage

VEN μ S acquires data from 159 sites worldwide, including 27 tiles over Israel. Figure 3 shows the statistics of valid data percentage of the different sites. The figure reveals that Israel is among the sites with the highest percentage of L1 temporal coverage due to a high number of clear days with no clouds.



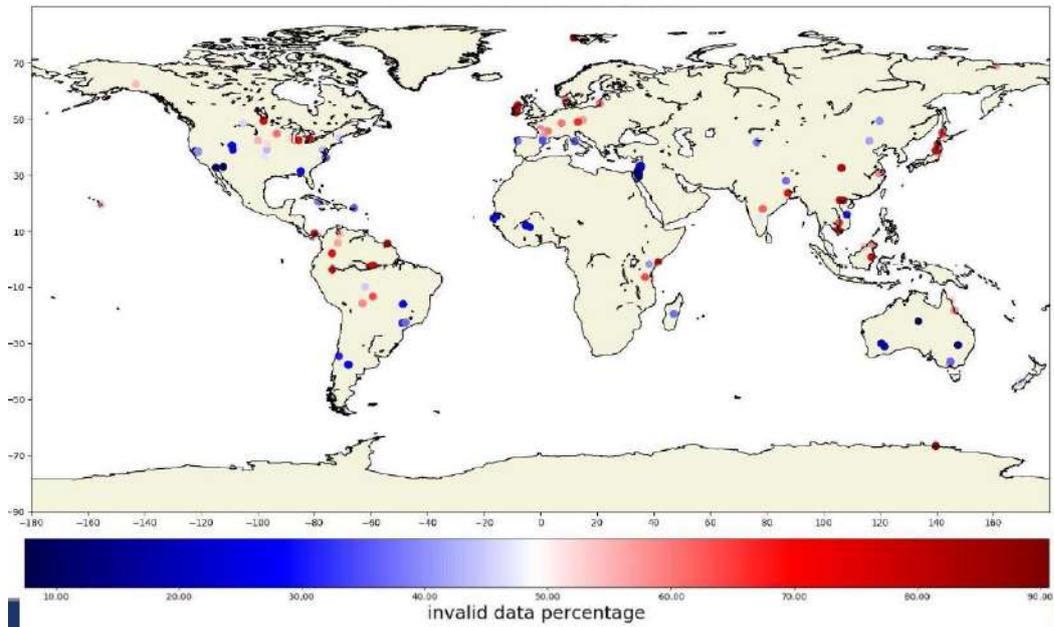


Figure 3: Statistics of sites quality L1 temporal coverage.

6 VEN μ S in 4D

VEN μ S bands 5 and 6, both in the red (638 nm), located on different ends of the camera's focal plane, acquire images in 1.45-degree difference (2.7 sec). Such a unique configuration enables to create a digital elevation model (DEM) from one single VEN μ S acquisition.

The video in the following link shows 109 available VEN μ S images, since the launch, over the Khumbu icefall near Mt. Everest. The images are RGB composites of Level 1C bands 7,4,3 (5 m resolution)



Figure 4: Snapshot from the VEN μ S 4D animation over the Khumbu icefall.

<https://labo.obs-mip.fr/multitemp/khumbu-icefall-in-4d/>



7 COSPAR 2019

The 4th COSPAR Symposium on 'Small satellites for sustainable Science and Development' was held on 8 - 4 November 2019, in Herzelia, Israel. The COSPAR's objectives are the promotion of scientific research in space on an international level. In the symposium, four sessions, including 20 presentations, were devoted to the VEN μ S program.

The detailed program appears in the following link:

<http://www.cospar2019.org/wp-content/uploads/2019/08/cospar-2019-book-web-29.10.19-A.pdf>

8 Previous VEN μ S Newsletters

Previous VEN μ S Newsletters along with more information about VEN μ S can be read in the following link:

<https://karnieli-rsl.com/newsletters>

Best wishes,

Manuel and Arnon

Ben Gurion University

