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פרופ' ארנון קרניאלי

המעבדה לחישה מרחוק
המחלקה לאנרגיה סולרית ופיסיקה של הסביבה
המכונים לחקר המדבר ע"ש יעקב בלאושטיין
אוניברסיטת בן-גוריון בנגב
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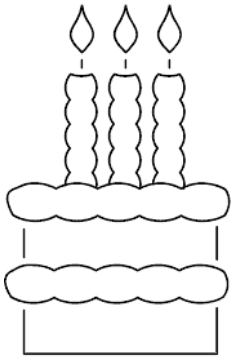
Science from Above

October 30, 2020

Dear colleagues,

Re: VENµS periodic news – October 30, 2020



1. Celebration

This month we are celebrating three years (November 2017 – October 2020) of data obtained from the VENµS satellite. Modestly, VENµS is a very successful space mission providing unique high-quality images to the scientific community worldwide.

2. VENµS product updates

2.1 L1 products

Recently, we have updated the website with L1 of quality 3 (Q3). These products cover the period from Nov. 2017 to 06 Jan. 2020. After 06 Jan. 2020, the L1 that we received in real-time from CNES were already in L1 Q3.

The main improvements of L1 Q3 are the following:

Radiometric correction:

- Update on radiometric absolute calibration coefficients using the latest Moon acquisitions;
- Cloud detection and quantification. Corrections of (1) over-detections due to repetitive landscape patterns or cloud shadows, global improvements on cloud detection using stereoscopy; and (2) an anomaly triggered by the previous cloud detection parameters (randomly wrong cloud percentages values), which should lead to more valid products overall.

Geometric correction (product registration):

- 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;

Others:

- Switched equivalent spectral wavelengths for real calculated values in products metadata;

2.2 L2 and L3 products

In Nov. 2020, we will receive from CNES an update of the ground image processing parameters (GIPP) used by the MAJA atmospheric correction procedure that has been improved for better estimation of the aerosol optical thickness (AOT). The reprocessing of the entire dataset (i.e., from Nov. 2017 to the end of Oct. 2020) will end with L2&L3 at in 5 m resolution for all the Israeli tiles.

Since the reprocessing will take several months, we will treat the images tile by tile. The first tile that will be treated is W10 (the most downloaded tile). The order of reprocessing the other tiles will be published in the next Newsletters.

2.3 Some statistics

- Number of L1 Q3 received from CNES for Nov. 2017 - Oct. 2020: 11,243;
- Percent of valid L1 Q3: 86%;
- Number of L1 Q3 available on the website: 9,631;
- Number of L2 Q2 (from Nov. 2017 to Jan 2020) available on the website: 5,747;
- Number of L2 Q3 (from Jan. 2020 to end Oct. 2020) available on the website: 2,526;
- Percent of valid L2 (i.e., with cloud < 90%): 92%;
- Number of L3 available on the website: 2,468.

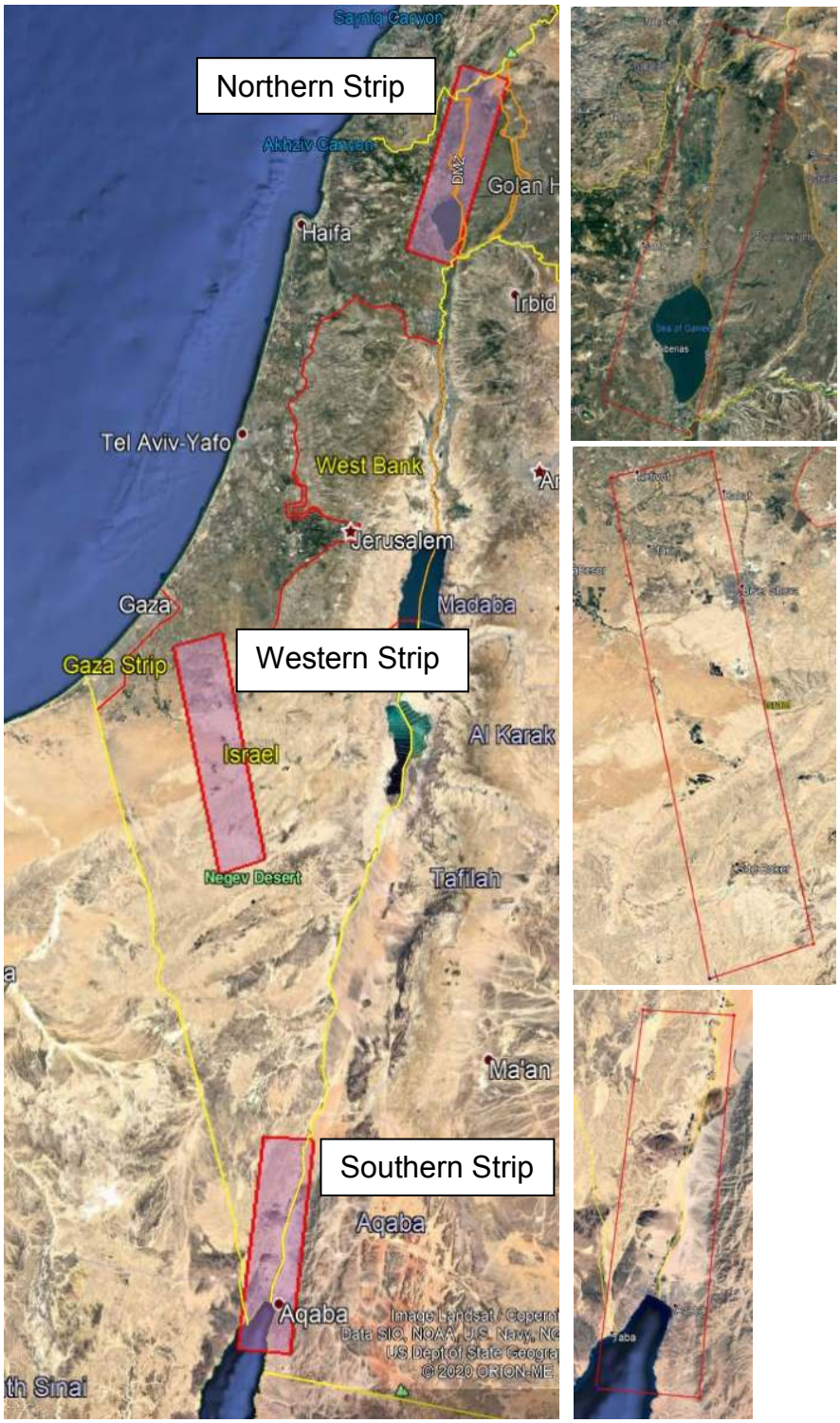
3. VENµS future updates

3.1 VENµS Mission 3 (VM3)

According to the original plan, in Nov. 2020, the VENµS orbit will be lowered, for six months, to 410 km (VM2). VENµS will be devoted to its technological mission (VM3) for about three months. From this orbit, no international sites will be observed but only three strips over Israel, as illustreted below.

Researchers are welcome to plan their studies accordingly. The VENµS website will be modified. some parts of Israel will be imagined at two days revisit time and about 3 m resolution.

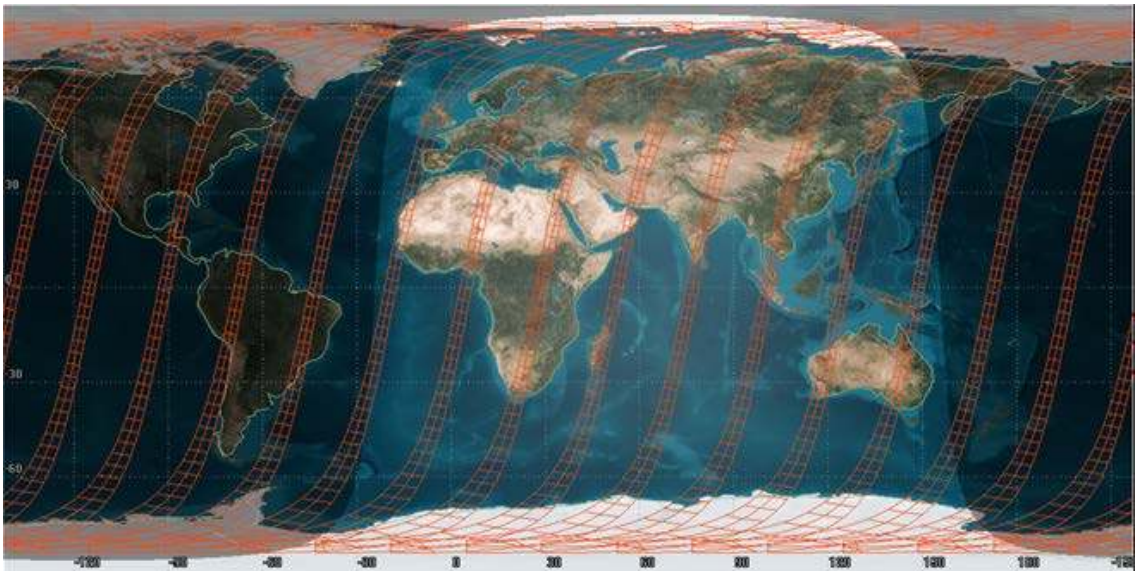
During VM3, no international sites will be observed but only three strips over Israel as illustreted below. Researchers are welcome to plan their studies accordingly. The VENµS website will be modified.



Three strips over Israel during VM3

3.2 VENμS Mission 5 (VM5)

At the end of Jul. 2021, the end of VM3, the VENμS orbit will be changed again (VM4) until reaching 560 km. From this altitude, from November 2021, Israel and other parts of the world will be imagined for two years, once a day at 4 m resolution (VM5). The map below shows the areas that will be covered during VM5.



In the next month, a new call for proposals will be announced to suggest international research sites within the area covered by the VM5. International collaboration is encouraged.

For more information, contact: Arnon Karnieli, karnieli@bgu.ac.il, 052-8795925.

4. Feature paper

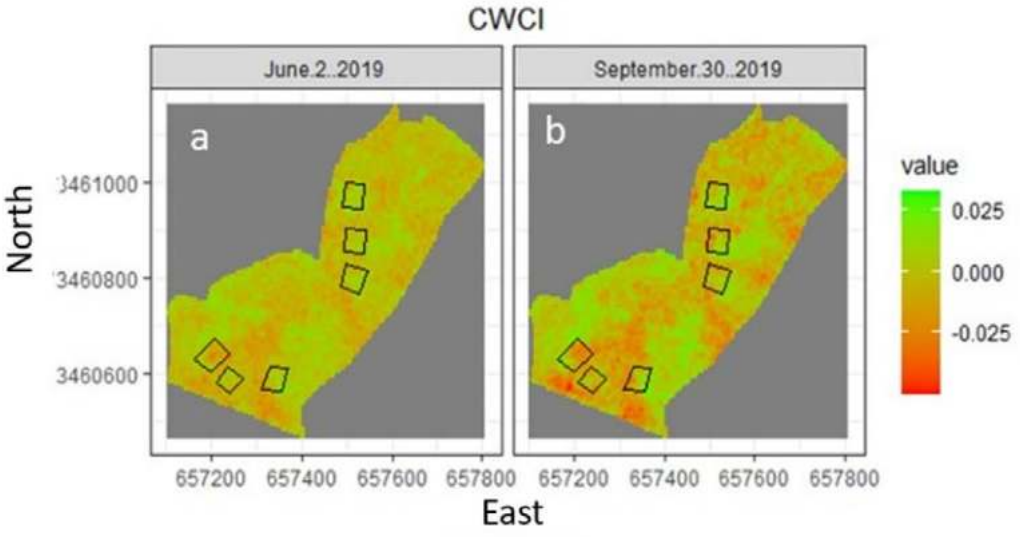
Using LANDSAT 8 and VENμS Data to Study the Effect of Geodiversity on Soil Moisture Dynamics in a Semiarid Shrubland

Vladislav, D., Svoray, T., Stavi, T., and Yizhaq, H (2020) Using LANDSAT 8 and VENμS Data to Study the Effect of Geodiversity on Soil Moisture Dynamics in a Semiarid Shrubland. *Remote Sensing*, 12, 3377. DOI: doi:10.3390/rs12203377

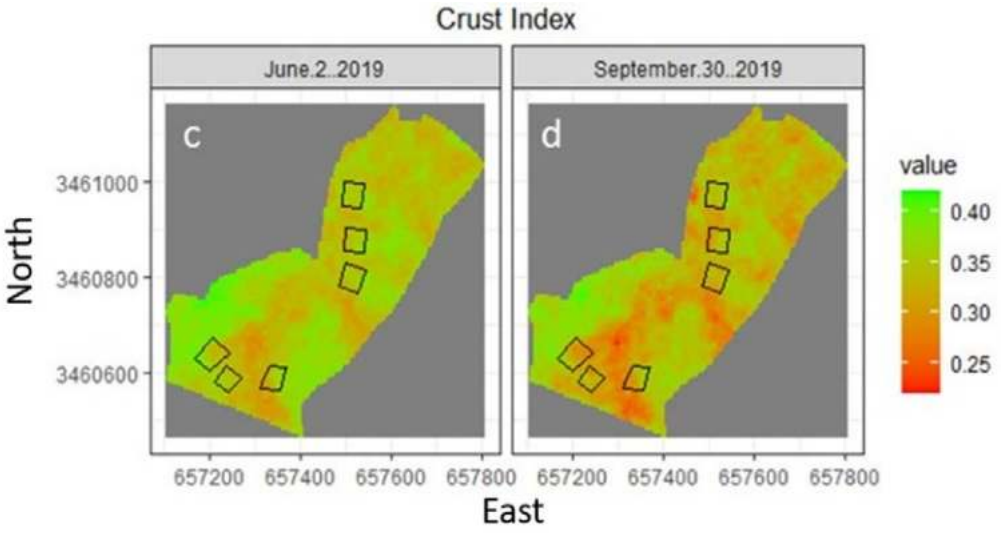
Abstract: Soil moisture content (SMC) is a limiting factor to ecosystem productivity in semiarid shrublands. Long-term droughts due to climatic changes may increase the water stress imposed on these lands. Recent observations demonstrate positive relations between geodiversity—expressed

by the degree of soil stoniness—and SMC in the upper soil layers. This suggests that areas of high geodiversity can potentially provide a haven for plant survival under water scarcity conditions. The objective of this study was to assess the effect of geodiversity on the dynamics of SMC in semiarid environments, which so far has not been fully investigated. The optical trapezoid model (OPTRAM) applied to six-year time series data (November 2013–July 2018), obtained from LANDSAT 8 and highly correlated with field measurements (R^2 = 0.96), shows here that the SMC in hillslopes with high geodiversity is consistently greater than that in hillslopes with low geodiversity. During winter periods (December–March), the difference between the two hillslope types was ~7%, while during summer periods (June–September) it reduced to ~4%. By using the high-resolution spectral-spatiotemporal VENμS data, we further studied the geodiversity mechanism during summertime, and at a smaller spatial scale. The VENμS-based Crop Water Content Index (CWCI) was compared with the OPTRAM measurements (R^2 = 0.71). The Augmented Dickey–Fuller test showed that water loss in the high-geodiversity areas during summers was very small (*p*-value > 0.1). Furthermore, the biocrust index based on the VENμS data showed that biological crust activity in the high geodiversity hillslopes during summers is high and almost stationary (ADF *p*-value > 0.1). We suggest that the mechanism responsible for the high SMC in the high-geodiversity areas may be related to lower evaporation rates in the dry season and high runoff rates in the wet season, both of which are the combined result of the greater presence of developed biocrusts and stoniness in the areas of higher geodiversity.

For more information, contact: Hezi Yizhaq hezi.yizhaq1@gmail.com



VENμS-derived Crop Water Content Index (CWCI) for the study area.



VENμS-derived Crust Index (CI) for the study area.

5. Feature paper

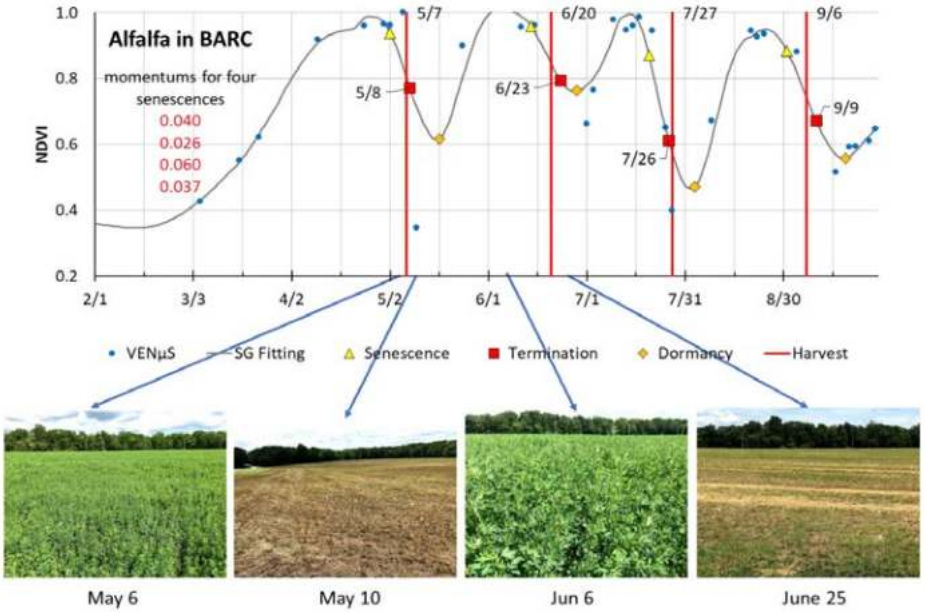
Detecting Cover Crop End-Of-Season Using VENμS and Sentinel-2 Satellite Imagery

Gao, F., Anderson, M.C. and Hively, D. (2020) Detecting Cover Crop End-Of-Season Using VENμS and Sentinel-2 Satellite Imagery. *Remote Sensing*, 12, 3390. doi:10.3390/rs12213524

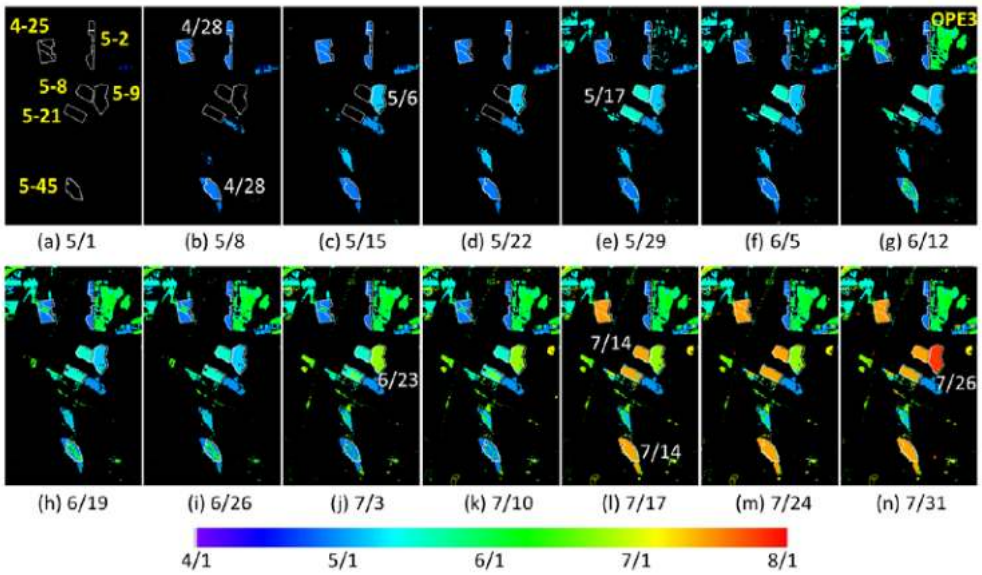
Abstract: Cover crops are planted during the off-season to protect the soil and improve watershed management. The ability to map cover crop termination dates over agricultural landscapes is essential for quantifying conservation practice implementation, and enabling estimation of biomass accumulation during the active cover period. Remote sensing detection of end-of-season (termination) for cover crops has been limited by the lack of high spatial and temporal resolution observations and methods. In this paper, a new within-season termination (WIST) algorithm was developed to map cover crop termination dates using the Vegetation and Environment monitoring New Micro Satellite (VENμS) imagery (5 m, 2 days revisit). The WIST algorithm first detects the downward trend (senescent period) in the Normalized Difference Vegetation Index (NDVI) time-series and then refines the estimate to the two dates with the most rapid rate of decrease in NDVI during the senescent period. The WIST algorithm was assessed using farm operation records for experimental fields at the Beltsville Agricultural Research Center (BARC). The crop termination dates extracted from VENμS and Sentinel-2 time-series in 2019 and 2020 were compared to the recorded termination operation dates. The results show that the termination dates detected from the VENμS time-series (aggregated to 10 m) agree with the recorded harvest

dates with a mean absolute difference of 2 days and uncertainty of 4 days. The operational Sentinel-2 time-series (10 m, 4–5 days revisit) also detected termination dates at BARC but had 7% missing and 10% false detections due to less frequent temporal observations. Near-real-time simulation using the VENμS time-series shows that the average lag times of termination detection are about 4 days for VENμS and 8 days for Sentinel-2, not including satellite data latency. The study demonstrates the potential for operational mapping of cover crop termination using high temporal and spatial resolution remote sensing data.

For more information, contact: feng.gao@usda.gov; Tel.: +1-301-504-6576.



Four terminations were detected for an alfalfa pixel using the VENμS NDVI time-series in 2019.



Cover crop termination maps from the 14-weekly near-real-time simulations ((a–n), ending dates below subfigures) using VENμS images.

6. Special issue in Remote Sensing – call for papers

Consider submitting an article to the special issue of the Remote Sensing journal: "VENμS Image Processing Techniques and Applications". https://www.mdpi.com/journal/remotesensing/special_issues/Venus

Deadline for manuscript submissions: 31 December 2020

Accepted papers will be published continuously in the journal (as soon as accepted) and will be listed together on the special issue website.

7. Previous VENμS Newsletters

Previous VENμS Newsletters along with more information about VENμS can be read in the following link: https://karnieli-rsl.com/newsletters

8. Unsubscribe

If you wish to unsubscribe from the future VENμS Newsletters, write an e-mail to karnieli@bgu.ac.il.

Best regards,

Manuel and Arnon

Ben Gurion University