Prof. Arnon Karnieli

The Remote Sensing Laboratory
Department of Solar Energy and Environmental Physics
Jacob Blaustein Institutes for Desert Research
Ben-Gurion University of the Negev
Sede-Boker Campus 8499000, ISRAEL
Tel: +972-8-6596855
Mobile: +972-52-8795925

פרופ' ארנון קרניאלי

המעבדה לחישה מרחוק
המחלקה לאנרגיה סולרית ופיסיקה של הסביבה
המכונים לחקר המדבר ע"ש יעקב בלאושטיין
אוניברסיטת בן-גוריון בנגב
קמפוס שדה-בוקר 8499000
טלפון: 08-6596855 נייד: 052-8795925
מייל: karnieli@bgu.ac.il
https://karnieli-rsl.com/

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Re: VENµS periodic news No. 33

1. VENµS updates

1.1 VENµS Mission 5 (VM5)

In June 2022, VENµS started its new mission, termed VENµS Mission 5 (VM5). This mission includes 119 scientific and calibration sites worldwide with 12 spectral bands (as before) but at 4 m resolution. Several of the sites are observed every day, and others every other day. Over Israel, there are 24 tiles, 21x21 km each, organized in four strips labeled N, M, C, and B (Fig. 1). The exact tile location can also be observed using the following Google Earth link: Real_VM5_footprint_v3.kmz . The revisit time of the strips is two days. Strips N and C are observed on a specific day, while M and B on the following day. The updated VENµS web portal for downloading the images is still under construction and will be ready soon.

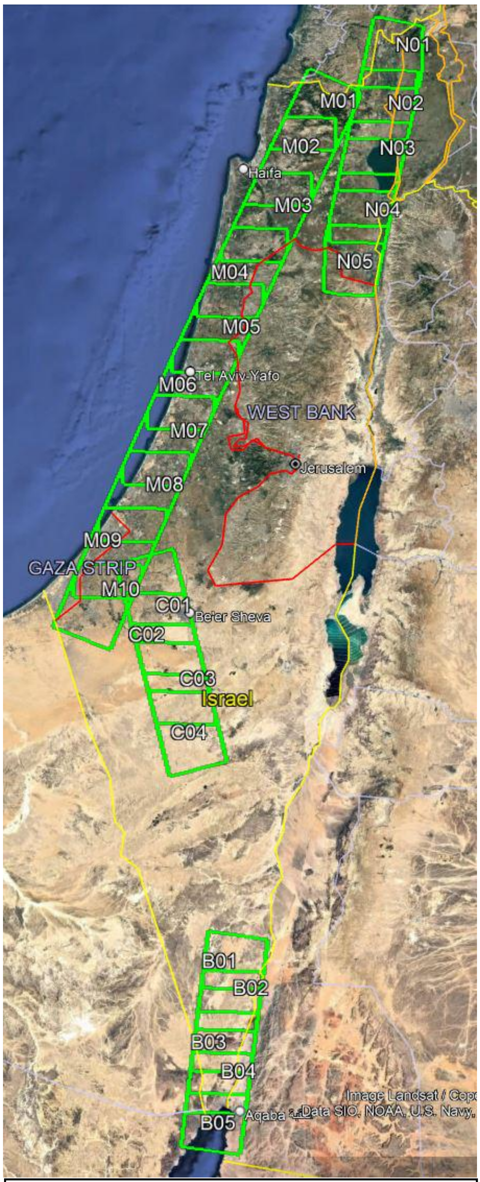

Fig. 1 VENµS strips and tiles over Israel during VM5.

Currently, only L1 products are available. However, atmospheric correction can be performed by using the ATCOR or 6S programs. Note that for doing atmospheric correction, one can use the 5 Aeronet stations, locating across the country (i.e., Eilat, Sede Boker, Rehovot, Tel Aviv, Haifa, and Kiryat Shemona). Link to the Aeronet portal: https://aeronet.gsfc.nasa.gov/

1.2 VM1 updates

We have just terminated the reprocessing to Collection 4 of all the VENµS VM1 data.

The L2/L3 products for all the 27 tiles, from Nov. 2017 to the end of Oct. 2020, are now in 5 m spatial resolution.

2. Feature papers

2.1 Coastal morphology from space: A showcase of monitoring the topography-bathymetry continuum

Bergsma, E.W.J., Almar, R., Rolland, A., Binet, R., Brodie, K.L., & Bak, A.S. (2021). Coastal morphology from space: A showcase of monitoring the topography-bathymetry continuum. *Remote Sensing of Environment*, 261. DOI:10.1016/j.rse.2021.112469

Abstract: With a large part of the world's population residing in coastal areas, and largely depending on the coastal environment, monitoring natural and human-induced coastal changes are paramount to understand the dynamic and vulnerability of these coastal systems/communities. To understand changes in coastal areas, e.g. environmental and social resilience to environmental change, local measurements are inadequate. Such large-scale issues can only be addressed with perhaps less accurate but large scale measurements from space. Considering vulnerability or exposure to coastal flooding, both the bathymetry (underwater) and topography (above water) are vital boundary conditions to understand and accurately estimate impacts on short (storms) and long (inter-seasonal) time-scales. In this work, we estimate the coastal bathymetry and topography with the optical VENμS satellite for every single overpass at the Field Research Facility of the US Army Corps of Engineers at Duck, NC. The experimental VENμS satellite enables estimation of the topography and bathymetry by two repetitive identical images with a small time-lag. This capability proofs to result in topographies with a few meters accuracy and the bathymetry estimation is at best a few decimetres accurate. As a base for future Earth Observation missions such as Landsat or Sentinel 2, VENμS shows that higher resolution imagery (5 m), repetitive bands and a revisit time of only 2 days, enables unprecedented land/sea monitoring.

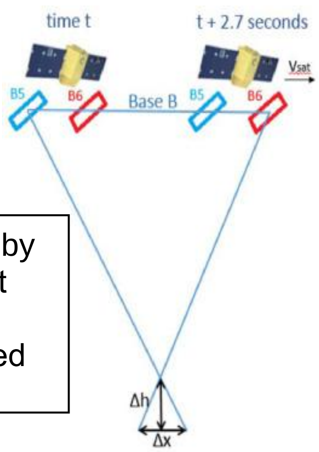

Fig. 2. Illustration of the stereoscopic capability provided by the VENμS satellite. By collecting two images that look at the same scene but at a different angle a Digital Surface Model can be calculated (Δh) through correlation of shifted (Δx) ground tie-points.

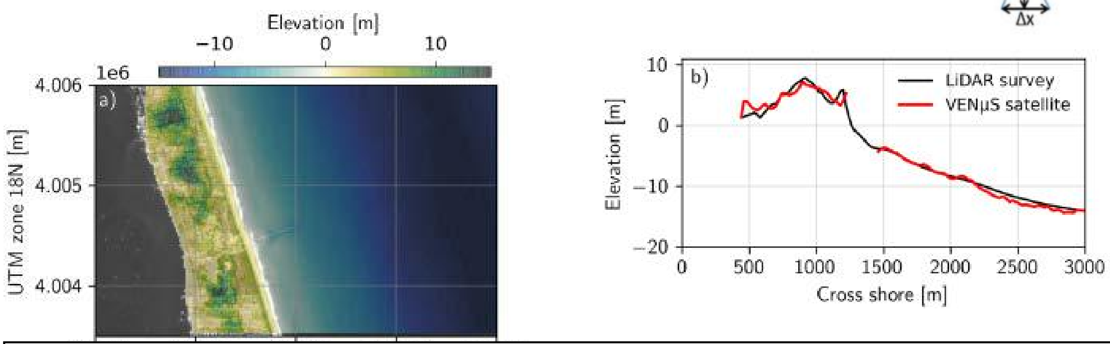

Fig. 3. Spaceborne coastal continuum. a) presents the airborne LiDAR measurements covering land and sea in the vicinity of the FRF at Duck overlayed on top of a Venus image. b) shows the alongshore average profile of the LiDAR survey in black and superimposed the VENμS derived topography and bathymetry in red.

For more details, contact Erwin W.J.Bergsma (erwin.bergsma@cnes.fr)

2.2 Estimation of aboveground biomass production using an unmanned aerial vehicle (UAV) and VENμS satellite imagery in Mediterranean and semiarid rangelands

Adar, S., Sternberg, M., Paz-Kagan, T., Henkin, Z., Dovrat, G., Zaady, E. and Argaman, E. (2022). Estimation of aboveground biomass production using an unmanned aerial vehicle (UAV) and VENμS satellite imagery in Mediterranean and semiarid rangelands. *Remote Sensing Applications-Society and Environment*. 26, 100753. https://doi.org/10.1016/j.rsase.2022.100753

Abstract: Rangeland management requires frequent and accurate estimation of aboveground vegetation biomass (AGB) as a proxy of forage production. However, traditional methods for AGB measurement are time-consuming and only provide a low number of spatiotemporal measurements. Newly developed remote sensing platforms such as UAVs and new generation satellites allow unprecedented large-scale and frequent monitoring of rangeland vegetation that is typically produced in marginal lands characterized by high surface heterogeneity. This study used high-resolution UAV data and the new multi-spectral VENμS satellite to monitor AGB production for two consecutive years in a Mediterranean and semiarid grassland rangeland in Israel. We then studied the effects of grazing intensity and precipitation along the growing season on AGB. Data were collected from two long-term ecological research sites with plots under controlled grazing pressures (i.e., no grazing, moderate, and intensive grazing). We used high-spatial-resolution UAV imagery for land cover classification in order to mask different levels of mixed pixels in the VENμS satellite images along the growing season. A support vector regression model (SVM) for satellite-based AGB estimation was developed using more than 600 ground-truth AGB measurements collected during 2019–2020. The effect of the percentage cover for mixed pixel removal was examined. The results showed an improvement in the prediction model by 35% and reduced the RMSE by half for the support vector machine regression model's best prediction. The best AGB prediction results were achieved by including satellite pixels with over 50% vegetation cover. For the first time in Eastern Mediterranean rangelands, our study illustrates the benefits of high-integrated remote sensing data (i.e., satellite and UAV) for generating more accurate AGB estimations even in highly heterogeneous ecosystems in terms of surface cover. Such an approach can provide crucial and better information for sustainable rangeland management under varying spatiotemporal and climatic conditions.

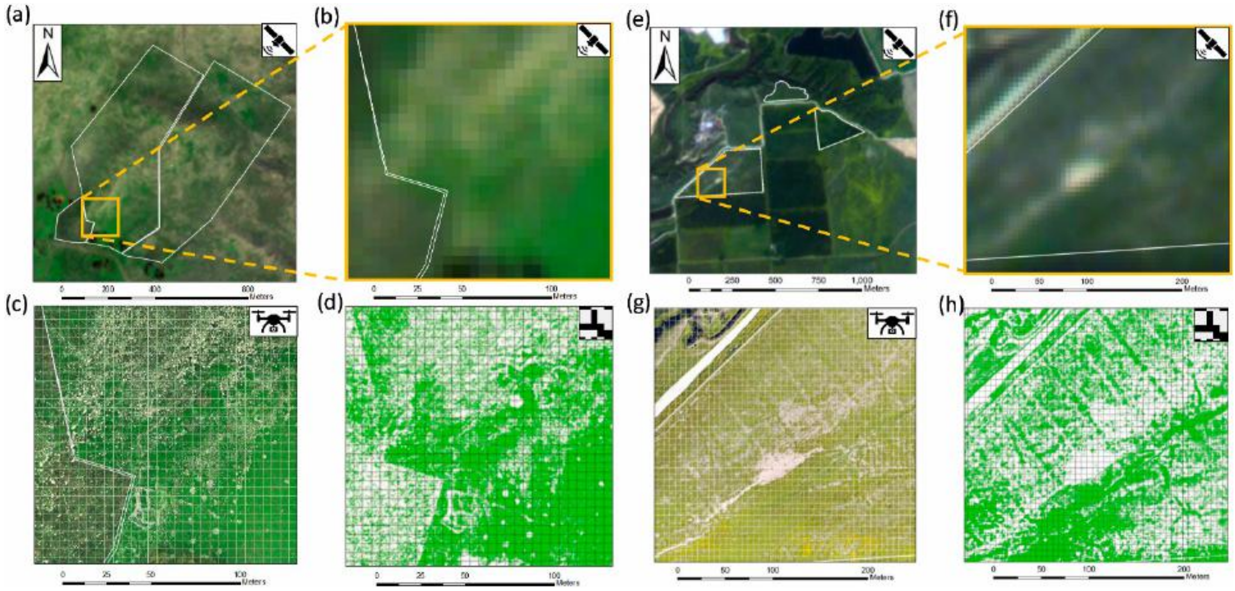

Fig. 4. A VENµS image showing the study plots Karei Deshe (a) and Migda (e); (b) and (f): enlarged sections of these respective images (5.3 m pixel-1); (c) and (g): UAV orthomosaic (~2 cm pixel-1) of the respective areas with the superimposed VENµS pixel grid; (d) and (h): vegetation mask (shown in green) based on orthomosaic classification, enabling selective selection of VENµS pixels by vegetation cover calculated in the subpixel. Both sites exhibit spatial patchiness of vegetation.

For more details, contact Eli Argaman (Eliar@moag.gov.il)

2.3 Analysis of the damage caused to KKL forests by the March 2020 windstorm

Silver M., Vanunu A.Y., Dor-Haim, S., Shachak, M. and Karnieli, A. (2021) Analysis of the damage caused to KKL forests by the March 2020 windstorm. *Forest*, 21. (In Hebrew with English abstract. Available online: https://www.kkl.org.il/files/forest_and_environment/yaar_21/yaar21_damage_estimation.pdf

Abstract: During the rainstorm of March 11-12, 2020, unusual wind caused heavy damage to the KKL-JNF forests, which manifested itself in the breaking and uprooting of many trees throughout the Lakhish area and south to the entrance to Be'er Sheva. This study deals with an extreme event that is expected to occur more frequently in our region as part of climate change. The project focuses on the Amatsiya and Shaharia forests, where most of the damage was concentrated. Following the storm, KKL-JNF wardens conducted a ground and aerial survey to inspect, map, and photograph the areas where the trees had fallen. At the same time, scientists at Ben-Gurion University's Remote Sensing Laboratory at the Sde Boker Campus analyzed the event using drone photographs, LiDAR, satellite images, meteorological data, and planting date data. The findings in the Amatsiya Forest show agreement between the wind direction during the night of the storm and the direction of the fall. However, no significant correlation was found between tree density, topographic aspect, slope, and the number of trees that fell. The probable explanation for the extent of the damage in the Amatsiya Forest is, apparently, a combination of strong winds on the night of the storm with high soil moisture due to the heavy rains that fell in the area in January, February, and March. In the Shaharia forest, on the other hand, there was agreement

between the number of trees that fell and the slope aspects. Therefore, it can be concluded that in Shaharia, more trees fell on southeast-facing slopes and in areas with sparse tree density. Our conclusion is that remote sensing methods using drones, LiDAR, and satellite imagery (VENµS) can effectively map storm damage and accurately characterize spatial variables associated with damaged trees. A combination of topographic and meteorological data made it possible to assess the factors that caused these damages. Moreover, the study results show that from now on, the wind storm factor should be considered when monitoring forest systems managed by KKL-JNF.

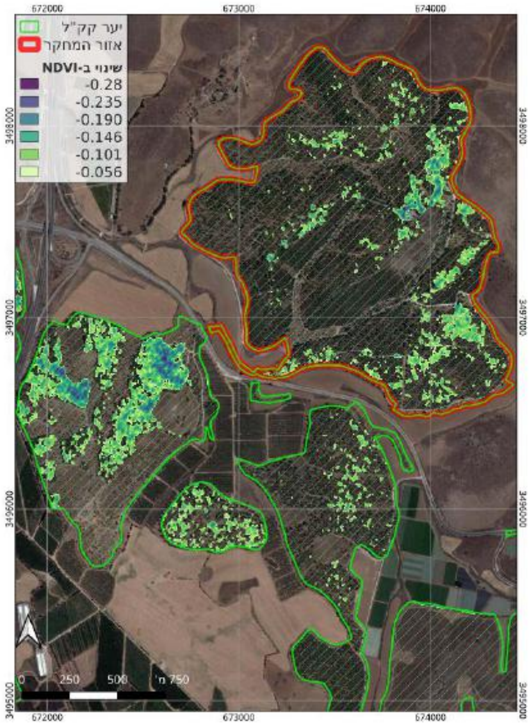

Fig. 5. Areas of windstorm damage in the Shaharia Forest were obtained from changes of VENµS-derived NDVI between Summer 2019 and Summer 2020.

For more details, contact Micha Silver (silverm@post.bgu.ac.il).

3. Previous VENµS Newsletters

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

4. Unsubscribe

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Best regards,

Manuel and Arnon

Ben Gurion University