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פרופ' ארנון קרניאלי

המעבדה לחישה מרחוק
המחלקה לאנרגיה סולרית ופיסיקה של הסביבה
המכונים לחקר המדבר ע"ש יעקב בלאושטיין
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June 7, 2021

Dear colleagues,

Re: VENµS periodic news – June 07, 2021

1. VENµS updates

1.1 Collection 4 - reprocessing of old VENµS images

We have just terminated to reprocess the L2 products for tiles W11 and W12 (entire VM1). In order to have the current status of the reprocessing to collection 4, please connect to the website. A popup will give you all the relevant information. Do not hesitate to contact us with any questions, please.

1.2 Cyberattack on Ben Gurion University

We on track again! Due to technical issues since January, the VENµS website was unavailable from outside the university network. We are glad to inform you that the website is now accessible. Thank you for your patience.

2. ISA-Volcani agreement

The Israel Space Agency (ISA) recently signed an agreement with the Agricultural Research Organization - Volcani Center. Volcani's scientists will help commercial companies that provide satellite-based services to farmers to use VENµS images. The agreement holds for historical and near-real-time images. The farmers will receive the VENµS products at no cost.

For more information contact: Dr. Yafit Cohen, e-mail: yafitush@volcani.agri.gov.il ; Tel.: 972-3-9683596

3. Feature papers

More than 40 VENμS-related papers have been published so far in scientific journals!

3.1 Impact of the number of dates and their sampling on a NDVI time series reconstruction methodology to monitor urban trees with VENμS satellite

Granero-Belinchon, C., Adeline, K., Briottet, X. (2021) Impact of the number of dates and their sampling on a NDVI time series reconstruction methodology to monitor urban trees with VENμS satellite. *International Journal of Applied Earth Observation and Geoinformation*, **95**, 102257. DOI: 10.1016/j.jag.2020.102257

Abstract: This article studies the influence of the number of satellite remote sensing acquisition dates and their sampling on the performance of a time series reconstruction method developed in Granero-Belinchon et al. 2020. This method initially aimed at monitoring urban London plane (Platanus x acerifolia) trees, and was tested with Sentinel-2 imagery at spatial resolutions of 10 and 20 m and a temporal revisit of 5 days. Due to its higher revisit frequency of 2 days while having a similar spatial resolution of 10 m, VENμS imagery was consequently used in the present article to fulfill with the purpose of this study. The strategy relies on the building of different acquisition date configurations based on the VENμS time series by considering uniform and non-uniform samplings and with a total number of acquisitions ranging from 45 to 14. Thus, the aim of the article is to examine the number of annual acquisitions needed to describe properly a vegetation phenological cycle and the impact of the annual sampling of these acquisitions on the final reconstructed time series. To this end, this study was carried out by using the widely used Normalized Difference Vegetation Index (NDVI). Results showed that on one hand, applied on an acquisition configuration composed of at least 18 uniformly sampled dates throughout the year, this reconstruction methodology is able to describe correctly the annual NDVI dynamics but leads to inaccuracies in the description of intra-annual ones. Nevertheless, these intra-annual descriptions are improved with the increase of the number of acquisitions. On the other hand, strongly non-uniform acquisition date samplings lead to inaccurate descriptions of the under sampled time periods but correct descriptions of the rest of the time series curve. The study case is London planes located in Toulouse (France) with 45 cloud-free Ven mu s images during the year 2019. Finally, this work emphasizes the main limitations of the studied reconstruction methodology when few acquisitions or very non-uniform acquisition date samplings are available and thus the identification of borderline cases in future applications and other study cases.

For more information, contact: Carlos Granero-Belinchon, e-mail: carlos.granero-belinchon@imt-atlantique.fr

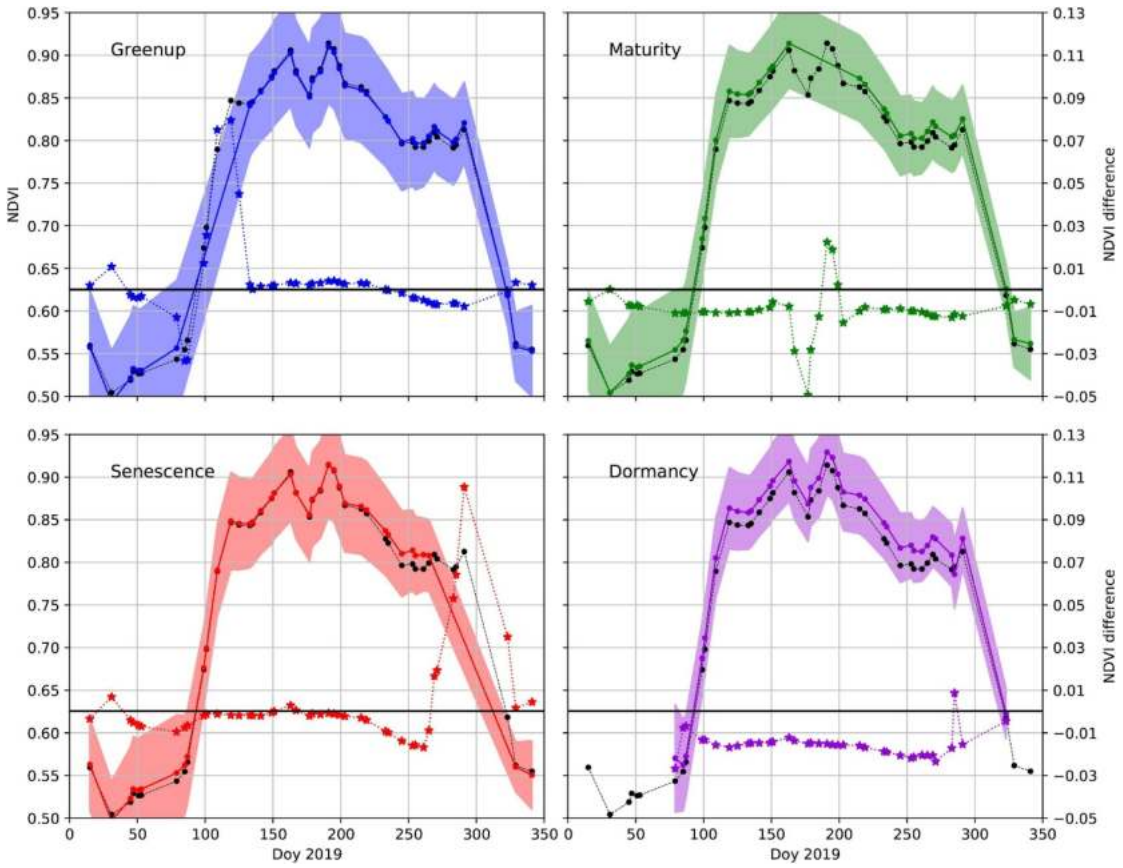

Figure 1: *2019 VEMµS NDVI reconstructed time series without Greenup dates in blue, Maturity dates in green, Senescence dates in red and Dormancy dates in purple. The NDVI standard deviation is indicated with shaded areas. Reference NDVI reconstructed time series is plotted in black for comparison and the difference between this reference and the undersampled reconstructed NDVI time series is plotted in dashed colour line.*

3.2 Estimating processing tomato water consumption, leaf area index, and height using Sentinel-2 and VENµS Imagery

Kaplan G., Fine L., Lukyanov, V., Manivasagam, V.S., Malachy, N., Tanny, J., Rozenstein, O. (2021) Estimating processing tomato water consumption, leaf area index, and height using Sentinel-2 and VENµS Imagery. *Remote Sensing*. **13**, 1046. DOI: 10.3390/rs13061046

Abstract: Crop monitoring throughout the growing season is key for optimized agricultural production. Satellite remote sensing is a useful tool for estimating crop variables, yet continuous high spatial resolution earth observations are often interrupted by clouds. This paper demonstrates overcoming this limitation by combining observations from two public-domain spaceborne optical sensors. Ground measurements were conducted in the Hula Valley, Israel, over four growing seasons to monitor the development of processing

tomato. These measurements included continuous water consumption measurements using an eddy-covariance tower from which the crop coefficient (K_c) was calculated and measurements of Leaf Area Index (LAI) and crop height. Satellite imagery acquired by Sentinel-2 and VENμS was used to derive vegetation indices and model K_c, LAI, and crop height. The conjoint use of Sentinel-2 and VEN mu S imagery facilitated accurate estimation of K_c (R^2 = 0.82, RMSE = 0.09), LAI (R2 = 0.79, RMSE = 1.2), and crop height (R^2 = 0.81, RMSE = 7 cm). Additionally, our empirical models for LAI estimation were found to perform better than the SNAP biophysical processor (R^2 = 0.53, RMSE = 2.3). Accordingly, Sentinel-2 and VENμS imagery was demonstrated to be a viable tool for agricultural monitoring.

For more information, contact: Offer Rozenstein, e-mail: offerr@volcani.agri.gov.il

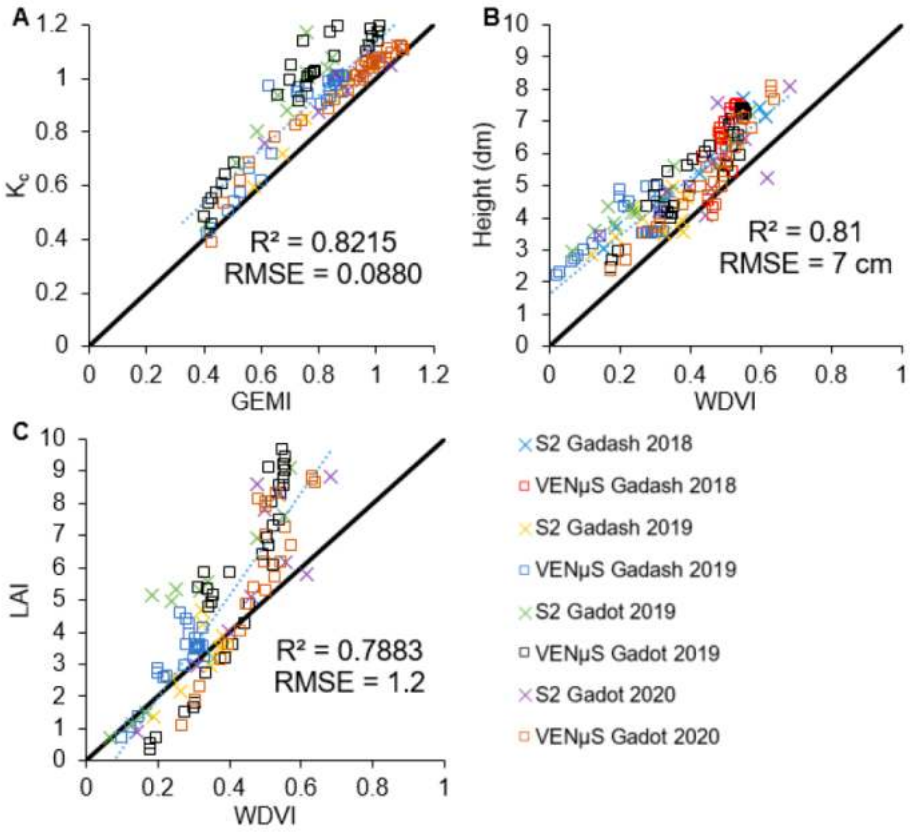

Figure 2: *Vegetation Index linear regression models based on Sentinel-2 and VENμS imagery: (A) Kc–GEMI Sentinel-2 and non-transformed VENμS images acquired during three processing tomato growing seasons; (B) Vegetation height (dm)–WDVI Vegetation Index regression model based on Sentinel-2 and transformed VENμS images acquired during four processing tomato growing seasons; (C) Vegetation LAI–WDVI Vegetation Index regression model based on Sentinel-2 and transformed VENμS images acquired during three processing tomato growing seasons.*

3.3 The impacts of spatial resolution, viewing angle, and spectral vegetation indices on the quantification of woody Mediterranean species seasonality using remote sensing

Elbaz, S., Sheffer, E., Lensky, I.M. and Levin, M. (2021). The impacts of spatial resolution, viewing angle, and spectral vegetation indices on the quantification of woody Mediterranean species seasonality using remote sensing. *Remote Sensing*. **13**, 1958. https://doi.org/10.3390/rs13101958

Abstract: Discriminating between woody plant species using a single image is not straightforward due to similarity in their spectral signatures, and limitations in the spatial resolution of many sensors. Seasonal changes in vegetation indices can potentially improve vegetation mapping; however, for mapping at the individual species level, very high spatial resolution is needed. In this study we examined the ability of the Israel/French satellite of VENμS and other sensors with higher spatial resolutions, for identifying woody Mediterranean species, based on the seasonal patterns of vegetation indices (VIs). For the study area, we chose a site with natural and highly heterogeneous vegetation in the Judean Mountains (Israel), which well represents the Mediterranean maquis vegetation of the region. We used three sensors from which the indices were derived: a consumer grade ground-based camera (weekly images at VIS-NIR; six VIs; 547 individual plants), UAV imagery (11 images, five bands, seven VIs) resampled to 14, 30, 125, and 500 cm to simulate the spatial resolutions available from some satellites, and VENμS Level 1 product (with a nominal spatial resolution of 5.3 m at nadir; seven VIs; 1551 individual plants). The various sensors described seasonal changes in the species' VIs at different levels of success. Strong correlations between the near-surface sensors for a given VI and species mostly persisted for all spatial resolutions ≤125 cm. The UAV ExG index presented high correlations with the ground camera data in most species (pixel size ≤125 cm; 9 of 12 species with $R \geq 0.85$;$p < 0.001$), and high classification accuracies (pixel size ≤30 cm; 8 species with >70%), demonstrating the possibility for detailed species mapping from space. The seasonal dynamics of the species obtained from VENμS demonstrated the dominant role of ephemeral herbaceous vegetation on the signal recorded by the sensor. The low variance between the species as observed from VENμS may be explained by its coarse spatial resolution (effective ground spatial resolution of 7.5) and its non-nadir viewing angle (29.7º) over the study area. However, considering the challenging characteristics of the research site, it may be that using a VENμS type sensor (with a spatial resolution of ~1 m) from a nadir point of view and in more homogeneous and dense areas would allow for detailed mapping of Mediterranean species based on their seasonality.

For more information, contact: email: shelly.elbaz@mail.huji.ac.il; Tel.: +972-5228-47331.

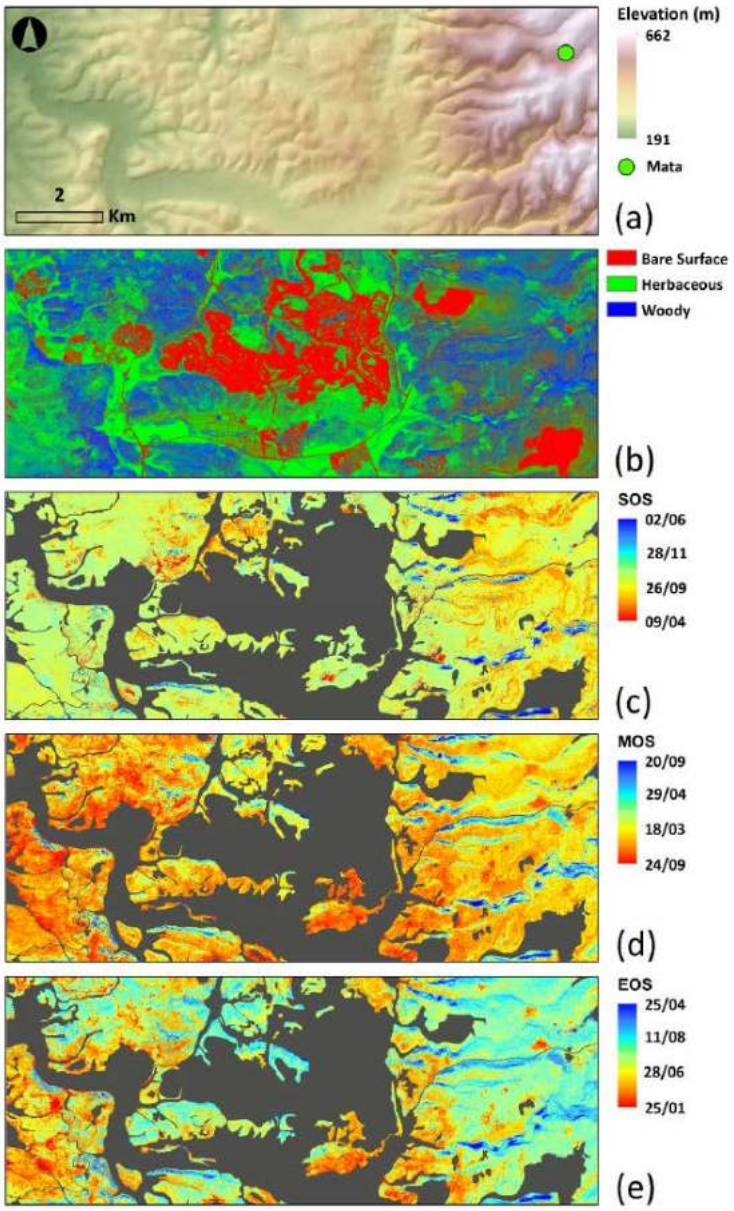

Figure 3. *VENμS processed study area; (a) the location of Mata over the elevation base map. (b) bare surface, woody vegetation and herbaceous vegetation components. (c–e) a pixel-based analysis of phenological indices—start of season (SOS), maximum of season (MOS), and end of season (EOS), computed by TimeSat 3.3 software, for the time period between October 2018 and September 2019, using 62 cloud-free VENμS images. Grey areas represent urban, bare surface and agricultural land uses, which were masked out and not included in our analysis.*

4. Special issue in Remote Sensing – call for papers

New deadline for manuscript submissions: 31 December 2021

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

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

5. Previous VENμS Newsletters

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

6. 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