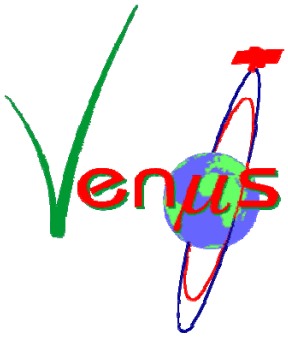


VENμS:
Joint Israeli – French Micro-Spacecraft for Earth Observation Mission

VENμS

Vegetation and Environment monitoring on a New Micro Satellite

Research Announcement

Outline proposal due: June 26, 2006

Full proposal due: September 15, 2006

Centre National d'Etudes Spatiales – France

Israeli Space Agency - Israel

04 June 2006

CONTENT

1 Introduction

CNES, the French space agency, and ISA, the Israel space agency, are soliciting research proposals for the use of Venμs earth observation data.

The Venμs program is jointly developed, manufactured and operated by CNES and ISA. It consists of two missions:

- a Scientific Mission which goal is to operate a super spectral camera for land environment monitoring.
- a Technological Mission that aims at qualifying an Israeli electric propulsion technology (IHET) and to demonstrate its mission enhancement capabilities.

Only the Scientific Mission is part of this Research Announcement

The satellite is planned to be launched by early 2009, and the scientific mission should last at least two years.

Venμs unique features will be to acquire high resolution, multi-spectral images every two days with constant view angles over about 50 sites of interest all around the world. Venμs is aimed at demonstrating the relevance of such observation capabilities in the framework of the European Global Monitoring for Environment and Security Program (the "GMES Program").

The main scientific objectives of the Venμs mission are to contribute to the study of land surfaces. Examples of research topics are:

- retrieval of land surface biophysical variables
- monitoring and modeling of land surface functioning under the influence of environmental factors (climate, topography, soils etc.) and of human activities;
- development and validation of natural and cultivated ecosystem functioning models, improvement of carbon cycle models;
- research on theoretical and practical methods for scale transfer, i.e. up and downscaling;
- validation of products derived from the data of medium to low spatial resolution sensors;

Venμs data could also prove useful for coastal zones and inland waters studies.

Scientific mission requirements have been provided by CESBIO (Gérard. DEDIEU, French PI), Ben Gurion University of the Negev (Arnon KARNIELI, Israeli PI) and CNES (Hervé JEANJEAN and Olivier HAGOLLE).

The selection of the 50 sites that will be imaged every two days by Venμs is the subject of this

Research Announcement.

Participation as a Venμs Co-Investigator (Co-PI) is open to researchers from educational institutions, research institutes, government institutions, and any other non-profit organizations. Partners associated to the proposal under the Co-PI responsibility can belong to any type of organization, including private and commercial companies.

Proposals for this VENμS Research Announcement are submitted in a two-stage procedure: first a short outline proposal is to be submitted. If this outline proposal is successful, proposers will be invited to submit a full proposal. Applicants may submit outline proposal any time before June 26th, 2006. Co-ordinators of successful outline proposals will be invited to submit a full proposal by a deadline specified in the invitation letter, tentatively set to September 15th, 2006.

Although Venμs is primarily designed for land studies, a proposal may address any topic of earth sciences over land, atmosphere or ocean, provided it satisfies the above criteria. Proposed research can for example deal with:

- validation of Venμs data products
- improvement of Venμs products, for example algorithms for atmospheric correction, cloud screening, time compositing
- scientific research
- applied research

It is expected that about 50 sites will be acquired by Venμs, the purpose of this Research Announcement being to select them. Therefore, the main advantages of being selected as a Co-PI are to have the proposed site(s) included among the 50 Venμs sites and to be associated to the community of Venμs' users. In addition, the Co-PI will be given the first priority for delivery of level 1 to 3 data. Other scientific users will be given access after a delay of three months.
Funds for Co-PIs are not available under this research announcement.

2 Summary of the Venμs mission and products

2.1 Mission

The satellite will fly in a near polar sun-synchronic orbit at 720 km height, leading to a 2-days revisit period. The Venμs camera will provide a ground resolution of 5.3 m over a 27 km swath. The whole system will be able to be tilted up to 30 degree along and across track. The mission will have the capability to observe each selected site under a constant view angle every two days. The system will cross the equator at around 10:30 AM.

The satellite will carry a super-spectral camera characterized by 12 narrow spectral bands (B1 – B12).

Bands	Central Wavelength *(μm)*	Bandwidth (nm)	Main Driver
B1	0.420	25	Atmospheric correction
B2	0.443	40	Aerosols, clouds
B3	0.490	20	Atmospheric corrections
B4	0.555	20	Land
B5	0.638	24	Land
B6	0.638	24	DEM, image quality
B7	0.672	16	Land
B8	0.702	16	Land
B9	0.742	16	Land
B10	0.782	16	Land
B11	0.865	20	Land
B12	0.910	20	water vapor

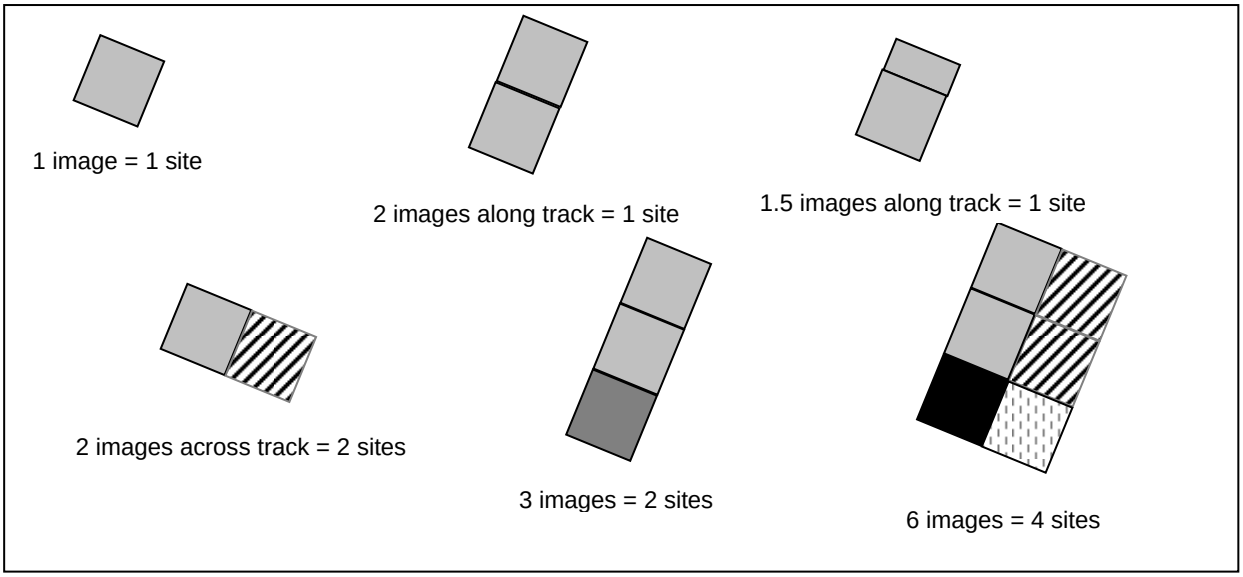
2.2 Products

At the camera level, each spectral line of an image is made of 5200 pixels. At nadir, the field of view is 27 km with a ground resolution of 5.3 m, but the SNR requirements are only met at 10.6 m. When image with oblique viewing is acquired, the ground resolution decreases a little and the field of view increases.

The following definitions apply in the rest of the text:

An **image** corresponds to the acquisition of 5200 rows by 5200 pixels in the twelve spectral bands. At nadir, it corresponds to an area on ground of approximately 27x27km. This is the minimal product size that will be delivered to the users.

The baseline definition of a **site** is: "an area on the Earth covered by one to two along track contiguous images". A site corresponds to 5200x5200 to 5200x10400 pixels in the focal plane (i.e the number of lines can be any number between 5200 and 10400). Therefore, the minimum size of a site is 27x27 km, the maximum size being 27x54 km at nadir.



However, this definition has to be extended to more complex situations since the same area can also be observed with different view angles, for example nadir, forward and backward viewing from the same orbit and/or from different orbits at high latitude. In that case, a site corresponds to several **acquisitions** of one to two images each with different view angles over the same area.

When a project requires images which departure from this definition of a site, several sites of one to two images have to be defined. This could occur in the following situations:

- More than two along track contiguous images are needed to cover the area of interest
- Two or more across track images are needed. In that case, the images are acquired with different viewing angles, possibly from different orbits.

In order to allow CNES and ISA to serve a large number of scientific investigations and due to the limits of the Venμs capabilities, the proponents are kindly requested to limit as far as possible their demand to the acquisition of one to two consecutive images from the same orbit. Best efforts will be done to satisfy more demanding requests, such as area larger than two contiguous images or acquisitions with different view angles. Such requests should rely on sound scientific justifications.

The three levels of products available to the selected Co-PIs are summarized in the table below.

Product level	Temporal characteristic	Content	Ground resolution
Level 1	single date and single viewing angle acquisition	Top of the Atmosphere reflectances, map projected (orthorectified image)	10 m
Level 2	single date and single viewing angle acquisition	Surface reflectances, map projected (orthorectified image)	10 m
Level 3	10 days time composites of single viewing angle acquisition	Surface reflectances, map projected (orthorectified image)	10 m

These products apply for sites that are for areas corresponding to acquisitions of 5200x5200 to 5200x10400 pixels of 5.3 m. Because of the resampling at 10 m, the number of lines and rows of the products themselves will be smaller than 5200x5200 (or 5200x10400), approximately by a factor of 2x2. Since the Venμs ground segment will only manage and deliver sites, the mosaicing of several sites to cover the project area of interest will have to be done by the proponents.

The main goal of Venμs scientific mission being to demonstrate the value of high resolution multitemporal measurements, it is expected that the baseline product for most proposals will be level 3 products, supplied to Co-PIs on a regular basis to monitor seasonal evolution of the surfaces with a ten days sampling. However, Levels 1 and 2 will be available upon request.

3 Data Distribution

3.1 Data Policy

For this RA, the data will be provided free of charge through the Internet to PIs who agree to the following.

Access to VENμS Scientific Mission data will be as follows:

3.1.1. VENμS Scientific Mission data are the property of CNES and are subject to the French and European Intellectual Property laws. The use of data is limited to scientific use or to research activities aiming at demonstrating the asset of VENμS data for the GMES Program.

3.1.2. CNES has the responsibility to make Scientific Mission data available free of charge -in a standard Data Format after calibration and validation- to the two main French and Israeli Principal Investigators (PIs), together with the selected Co-PIs from other countries. The aforementioned will be given the first priority for delivery of level 1 to 3 data. Other scientific users will be given access through the internet to level 1 to 3 data after a delay of three months.

3.1.3. Final results of the analysis of Scientific Mission data will be made available to the scientific community through publication in appropriate journals or other established

channels as soon as practicable and consistent with good scientific practice. In the event such reports or publications are copyrighted, CNES and ISA shall have a royalty-free right under the copyright to reproduce, distribute, and use such copyrighted work for their own purposes. Publications shall include a suitable acknowledgement of the services afforded by CNES and ISA.

3.1.4. All raw Scientific Mission data obtained from the VENμS Scientific Mission will be archived in an appropriate CNES centre for at least 10 years after completion of the VENμS Scientific Mission, unless otherwise agreed by CNES and ISA.

3.1.5. The Co-PI of a selected proposal is authorized to provide copies of the data to its partners listed in the proposal.

3.1.6. The Co-PI and their partners are not allowed to redistribute or to sell the data.

CNES and ISA shall not be liable for data loss, deterioration in data quality, or delay of data supply resulting from problems of Venμs or ground facilities, or for not providing Venμs data due to bad weather or matters beyond CNES and ISA control.

Other detailed conditions, such as the number of the images provided to the PIs, shall be determined on a case by case basis after review by CNES and ISA.

3.2 Data available before Venμs Launch

About 57 SPOT images acquired in 2002 during the ADAM (**A**ssimilation des **D**onnées par **A**gro-**M**odélisation) experiment in Romania are made available to Venμs Co-PIs, at no charge. Further information can be obtained on the following web site:

http://medias.obs-mip.fr/adam/index_en.html

In 2005-2006, Formosat-2[1] images are being acquired about every 3 days over an agricultural region located near Toulouse, France and every 4 days over a irrigated perimeter near Marrakech, Morocco, with constant observation angles, at 8 m resolution in 4 spectral bands. These images will also be available upon request.

All these SPOT and Formosat-2 data are geometrically and radiometrically corrected to allow multitemporal studies.

[1] http://www.nspo.org.tw/2005e/imagesell/SATproperty.htm and http://www.spotimage.fr/html/_54_944_.php

3.3 Data Distribution after Venμs Launch

It is expected that data distribution will start after the end of the commissioning phase, which is scheduled 3 months after launch. The distribution of Venμs products is not quasi real time, though best efforts will be done to shorten delays.

4 Funding

No funds will be provided to PIs.

5 Benefits and Responsibilities of PIs

5.1 Benefits

Co-PIs can request satellite data listed in section 2.2 at no cost.

5.2 Responsibilities

The selected scientific Co-PIs working over the study sites must provide an annual report of the results of their analysis to the main French and Israeli PIs. At least two international workshops (or symposiums) will be jointly organized by the Parties in order to present and share the results.

The Co-PIs are encouraged to participate in the kick-off meeting that will be held within six months after the launch of Venμs.

The Co-PIs will send to CNES and ISA a copy of any published article dealing with Venμs data.

In case pre-launch data (see §3.2) have been provided to the Co-PIs, a report on their use and on the results achieved will be due by the end of 2008.

6 Proposal Submission

6.1 General Conditions

Proposals for this VENμS Research Announcement must be submitted in a two-stage procedure: first a short outline proposal is submitted. If this outline proposal is successful, proposers are invited to submit a full proposal.

Outline proposal must be submitted by e-mail using the format defined in the annex E.
Applicants may submit outline proposal any time before June 26th, 2006. Proposals should not exceed 3 pages.

Full proposal: Co-ordinator of successful outline proposals will be invited to submit a full proposal by a deadline specified in the invitation letter, tentatively set to September 15th, 2006. The full proposal will be submitted by e-mail using the format defined in the annex F.
Full proposals should be as brief as possible, concentrating on substantive material. Proposals should not exceed 12 pages.

Proposals are not returned.

6.2 Where to Send Proposal

Please send outline proposal by e-mail before June 26, 2006 to Venus RA secretariat:

venussec@cnes.fr

Please also send a copy by e-mail to VENμS scientific PI's:

karnieli@bgu.ac.il.fr

and

gerard.dedieu@cesbio.cnes

6.3 Where ask for further information

Any question regarding this RA should be sent to:

Karnieli@bgu.ac.il
venusfaq@cnes.fr

Questions and answers of general interest will be sent to proposers registered through the outline proposal and will also be published on the Venus web sites:

http://www.bgu.ac.il/BIDR/research/phys/remote/03-Venus.htm
http://venus-mission.cnes.fr

7 Selection of Proposals

7.1 Evaluation and Selection Procedures

Proposals will be reviewed and evaluated by experts of the Scientific Committee assigned by CNES and ISA based on the evaluation criteria shown in §7.2. Final decisions on acceptance of

proposals will be made by CNES and ISA, taking into account the overall balance of different proposals and their resource requirements as well as the evaluation result. PIs will be notified of proposal acceptance by fall 2006.

7.2 Evaluation criteria

Outline proposal:

- Relevance of the proposal to demonstrate the usefulness of Venμs high resolution, multi-spectral and frequent revisit capabilities
- Technical feasibility of acquiring Venμs images other the requested site(s) within the research period.

Full proposal:

- Overall scientific, technical or social merit of the proposal or unique and innovative methods, approaches, or concepts demonstrated by the proposal.
- Relevance of the proposal to demonstrate the usefulness of Venμs high resolution, multi-spectral and frequent revisit capabilities.
- Relevance for the development of science and applications at the landscape, river basin or regional scales
- Applicant's existing capabilities, related experience, dedicated ground facilities and techniques for achieving the proposal objectives.
- Technical feasibility of acquiring Venμs images other the requested site(s) within the research period.

7.3 Follow-on Action

After applicants are notified of selection as a Co-PI, they are required to observe the terms and conditions of the projects including, but not limited to, data distribution and publications of results. CNES will send an agreement form to the selected PIs later. PIs should follow the procedures therein.

8 Cancellation and Postponement of RA

CNES and ISA reserve the right to cancel this RA upon notice delivered by CNES and ISA. CNES and ISA assume no liability for cancelling the RA, for postponing the RA schedule, or for anyone's failure to receive actual notice of cancellation.

9 Research Announcement Office

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10 APPENDIX A: CAMERA

The satellite will carry a super-spectral camera characterized by 12 narrow spectral bands (B1 – B12). The ground resolution at nadir is 5.3 m.

The table below presents the spectral bands and the required Signal to Noise Ratio

The set of bands includes 4 bands for atmospheric effects removal. The 638 nm band is duplicated with a difference in viewing angle of 1.5°. It is aimed at deriving Digital Elevation Models (DEMs) and image quality assessment. It will also be used to detect clouds using their altitude. Note that most Venμs spectral bands (B1 to B9) are also suited for water colour applications, in situations which do not require a very high SNR.

The column "Resolution" gives the resolution to which the Signal to Noise Ratio ("SNR at resolution") requirement applies, defined at the minimum radiance, Lmin. When the main driver is land observation, the SNR is around 100 for a 10.6 meters resolution. For spectral bands which primary use is it to characterize the atmosphere, SNR is given at 21.2 m.

Note that the multispectral images will be still provided with 10 m resolutions. The radiometric resolution for all bands is 10 bits.

Lmax is computed so that it is possible to monitor the absolute calibration over desert sites.

bands	L0 (μm)	Δl (nm)	L min (W/μ/m2/sr)	Lmax (W/μ/m2/sr)	Required Resolution (meters)	SNR for Lmin at resolution	SNR for Lmin at 5.3 m	Main Driver
B1	0.420	25	40	140	21.2	100	25	Atmospheric correction
B2	0.443	40	50	140	21.2	100	25	Aerosols, clouds
B3	0.490	20	30	160	21.2	100	25	Atmospheric corrections
B4	0.555	20	30	195	10.6	100	50	Land
B5	0.638	24	20	220	10.6	100	50	Land
B6	0.638	24	20	220	10.6	100	50	DEM, image quality
B7	0.672	16	20	234	10.6	90	45	Land
B8	0.702	16	15	218	10.6	110	55	Land
B9	0.742	16	20	204	10.6	110	55	Land
B10	0.782	16	30	197	10.6	110	55	Land
B11	0.865	20	30	173	10.6	100	50	Land
B12	0.910	20	30	127	21.2	100	25	water vapor

A brief summary of the interest of every band is given below.

B1, B2, and B3: These bands are sensitive to the scattering of light due to particles (aerosols) and molecules, those effects depend on the wavelength. They will allow estimating the turbidity (aerosols) of the atmosphere, which is then used to apply atmospheric correction. In addition, these bands are very efficient to detect clouds and cloud edges over land and water. This is important for automatic processing of image time series. Cloud screening and aerosol characterization do not require the use of full resolution data. Working with data averaged over 4x4 pixels or even more is sufficient. Therefore, the SNR at full resolution is lower than for the other bands.
Bands 1 or 2 in conjunction with bands 6 and 11 are useful for computing atmospheric resistant vegetation indices.

B4: This band is located in the green peak of vegetation and is useful to characterize vegetation status (LAI, chlorophyll).

B5: Vegetation chlorophyll absorption. Used with B11 to compute vegetation indices

B6: this band is a duplication of B5, and is implemented in the camera focal plane such as the difference of viewing angle is 1.5 degree.

The interests of the duplicated B5 band are:
- From the small stereoscopic effect it will be possible i) to generate a coarse DEM ii) to help to detect clouds by their altitudes.
- Having a duplicated band has proved to be very useful with Polder for image quality purposes.

B7, B8, B9, and B10: these red-edge bands are designed for detecting the blue shift of the red edge when vegetation is stressed. They can be useful for computing the chlorophyll index.

B11: near infrared band, e.g. for NDVI and other vegetation indices computation

B12: water vapour absorption, to help correcting absorption effects on other bands

11 APPENDIX B: PRODUCTS

11.1 Level 1

The main feature of Venμs products is the high frequency of the observations which is also the main driver of Venμs product definition. Since the basic use of Venμs data is done with multiple images at different dates, the basic level 1 products must be geometrically registered and radiometrically calibrated. As a result, the Venμs level 1 products will be equivalent to SPOT level 3 products (that does not follow the CEOS product level definitions).

The Venμs level 1 will thus provide:

- Geolocated top of atmosphere reflectances (possibility to use a different geographic projection for each site, but only one per site), with a subpixel (objective 3m) multi-date registration.
- A cloud mask at a coarse resolution

The level 1 geometric ground resolution is 10 m (TBC).

11.2 Level 2

For the level 2 products definition, two basic facts have been taken into account:

- The Venμs data set will have the following unique features: multi-temporal, high resolution products, with low directional effects. The algorithms to derive bio-physical variables from these data are far from being mature, and it is the aim of Venμs to help develop these algorithms.
- The Venμs data set is made of 50 different local data sets on 50 sites located around the world, there is no global data set.

For these reasons, it does not seem relevant to develop very complex inversion algorithms that will have to work on 50 very different sites with different vegetation characteristics and with different applications. At least for the first generation of Venμs products, it seems more relevant to limit the level 2 processing to what will be common to most applications: cloud screening and atmospheric corrections.

The Venμs level 2 products will provide:

- a fine cloud mask
- surface reflectance after atmospheric corrections for all spectral bands (still geolocated)
- confidence values
- maybe some vegetation indexes (TBC)

The level 2 geometric resolution is 10 m for the 1st generation at least (TBC)

11.3 Level 3

For the same reasons, the idea for level 3 products, is only a reduction of the data volume for

users : the aim is to deliver synthesis products that provide cloud free data (as far as possible) based on the level 2 data gathered during a short period (7 or 10 days, TBD).

The Venμs level 3 will provide the same variables as Level 2, every 7 or 10 days (TBD), maximising the number of cloud free pixels. Level 3 will be based on L2 data acquired under the same viewing angle.

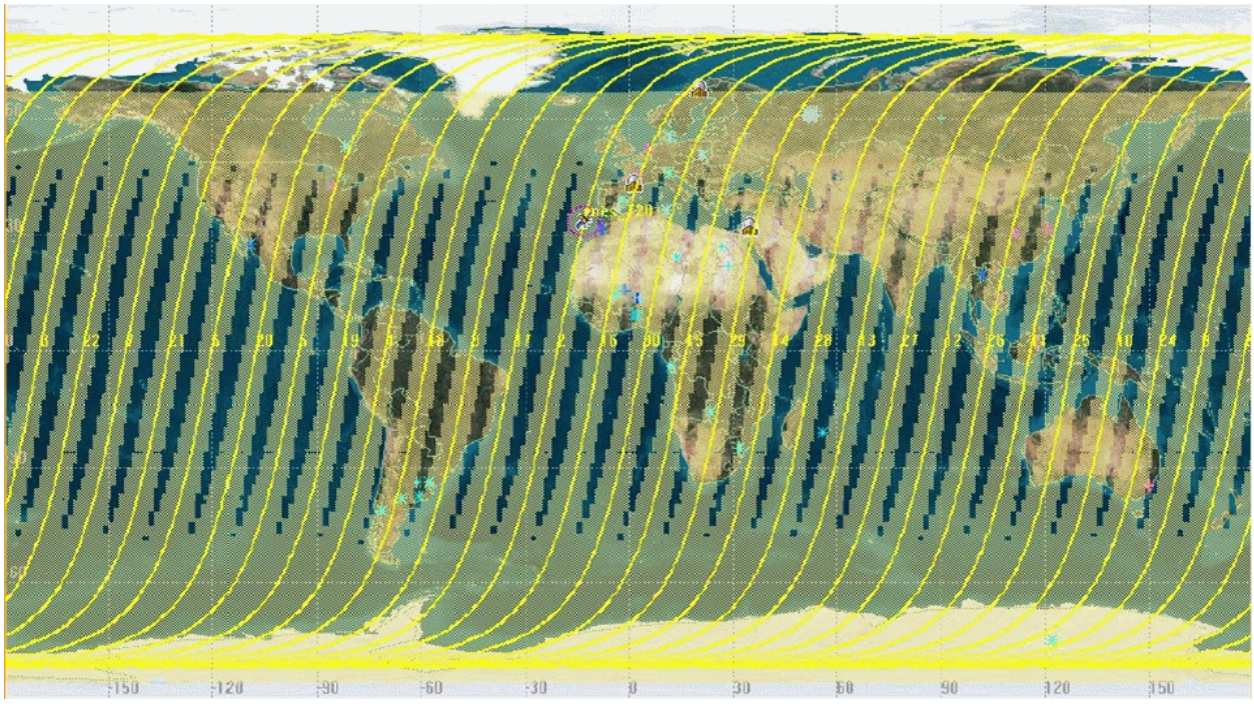
The level 3 geometric resolution is 10 m (for the 1st generation at least, TBC)

11.4 In-situ data

For operational reasons, it is not possible to incorporate in-situ data in the operational level 2 and 3 processing (such as aerosol measurements).

12 APPENDIX C: MISSION OPERATIONS

During the first two years and a half, i.e. during the so-called scientific mission (VM1), the satellite will fly in a near polar sun-synchronic orbit at 720 km height, leading to a 2-days revisit period. The inclination is about 98°, the local time of descending node is 10h30 am (TBC between 10h00 and 12h00). The ground track revisit time is 2 days.
The orbit will be controlled such as to maintain the local time of overpass at ±5 minutes.



Venμs scientific mission: orbits and areas which can be observed.

The scientific mission is expected to end about 33 months after launch (so-called VM1 period). At the end of this period, the Technological Mission will begin. The altitude of the spacecraft will be decreased from 720 km to about 410 km. The change of orbit will take about six months (VM2 period). The 410 km orbit will then be kept during one year, from about 38th month to 50th month after launch (VM3 period). Imaging operation is expected to continue during the technological mission. Due to orbit change, the swath will be reduced to about 15 km, while the ground resolution will increase to about 3m. This Research Announcement only deals with the VM1 period. Selection of the sites to be acquired during the VM3 period will be decided later.

13 APPENDIX D: Venμs reflectance time series : interest of constant observation angles

1. Introduction

The VENμS mission will provide:

1- high resolution images

2- observations every 2-days

3- in 12 narrow spectral bands ranging from 420 nm to 910 nm

4- with constant observation angles

This fourth feature is often omitted when Venμs project is described, but nonetheless this property of Venμs images is one key of the enhanced quality of Venμs time series. This short note aims at showing the great interest of constant observation angles for the quality of reflectance time series, thanks to a data-set acquired with FORMOSAT-2[2], a Taiwanese satellite that also acquires images with constant observation angles.

Usually, reflectance time series in the visible or near-infrared domain, such as those provided by high resolution satellites such as SPOT, or by wide field of view instruments, such as VEGETATION, MERIS or MODIS, are degraded by two geo-physical sources of noise : 1) directional effects, since the observed surface reflectances depend on solar and observation angles and 2) atmospheric effects, mainly because of aerosol scattering, difficult to correct because aerosol optical properties are highly variable and difficult to characterise

Thanks to the constant observation angles, directional effects will be minimized, since the only variation of observation and illumination geometry will be caused by the variations of solar elevation during the year. As a result, the directional effects variations will be quite slow with time, and moreover, when comparing data acquired at a one year interval, no directional effects will be observed.

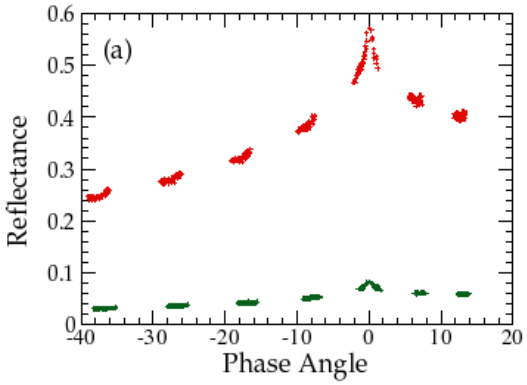


Fig 1. Examples of reflectance variations for a needle-leaf forest as a function of phase angle for POLDER near infra-red band (in red) and for red band (in green). Phase angle is the angular distance to the backscattering direction (when the pixel, the satellite and the sun are aligned). Reflectance variation can be greater than 100% if observation angles vary from day to day.

Furthermore, the quasi absence of directional effects can be used to enhance the atmospheric corrections. For this, we will use the following properties:

[2] http://www.nspo.org.tw/2005e/imagesell/SATproperty.htm and http://www.spotimage.fr/html/_54_944_.php

- aerosol optical properties vary quickly with time but slowly with location.
- reflectances vary quickly with location but slowly with time, when there are no directional effects.

In a few days period, the top of atmosphere reflectance variations are mainly caused by variations of aerosol optical properties, providing a way to estimate these properties. Such a method will be implemented in Venμs level 2 algorithms.

2. Example data-set with Formosat-2 data

To prepare Venμs algorithms, to promote the use of Venμs-like time series of images, and to train the future users of Venμs data, a data set partly similar to those of Venμs has been acquired thanks to FORMOSAT-2 satellite. FORMOSAT2 is a Taiwanese high resolution satellite (NSPO, distribution by SPOT-IMAGE) with the following features:

1- high resolution images (8m), field of view : 24 km
2- observations possible every day (not global)
3- 4 spectral bands (broader than Venμs) ranging from 490 to 850 nm
4- with constant observation angles

Images are being acquired every 3 days for a site in France, every 4 days for a site in Morocco. We are showing below a sequence of 12 images acquired during a 2 months period, between 2005-11-16 and 2006-02-16. The images displayed below are top of atmosphere reflectances, with a constant colour table defined below.

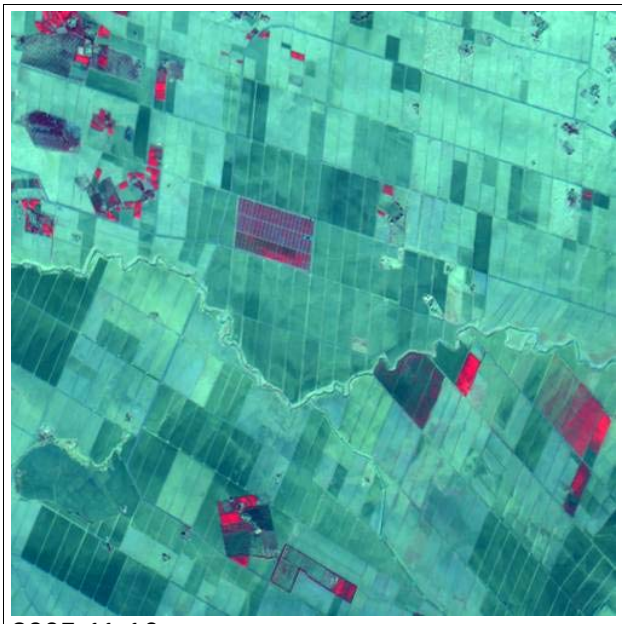
Red : 0-255	Near infrared band (B4) : 0.15-0.5
Green : 0-255	Red band (B3) : 0.06-0.28
Blue : 0-255	Blue band (B1) : 0.08-0.2

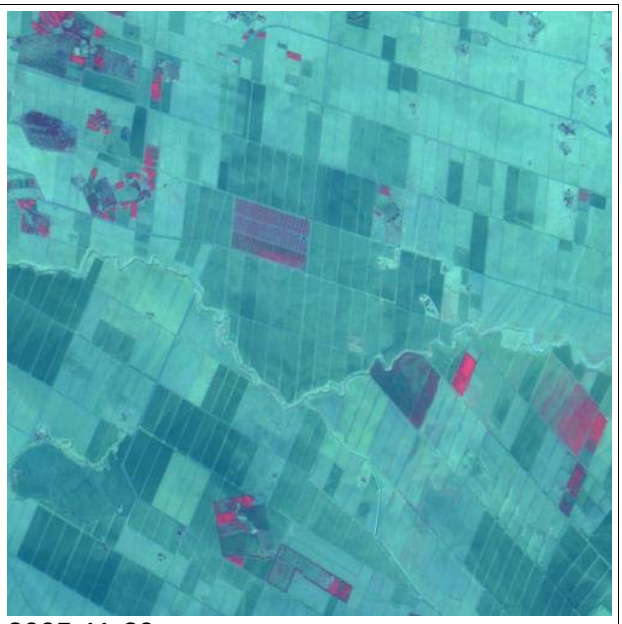
The first striking feature of this series of images is their similarity: except for a few accidents, all the images look the same. The accidents come from various phenomena:

- on 2005-11-20, the aerosol optical depth was higher than on the other days of this time-series (an AERONET sun photometer is available nearby the site). Venμs level-2 products will use the day-to-day variations of the atmospheric transparency, as well as the stability of reflectances, to invert the atmospheric aerosol content.
- on 2005-12-29 and 2006-01-18, the images were acquired after heavy rain events
- on 2006-02-16, some semi transparent clouds appear in the images, and the start of the growing season for vegetation is easily visible. The start of the growing season was already noticeable on many fields in the image of 2006-01-22.

Between the images acquired on 2005-11-16 and 2005-11-28, some much localised changes in reflectances can also be noticed. The reflectance of bare ground on some parcels suddenly

decreases. This change occurs because the parcel has been ploughed. Detecting the date of ploughing in this region is very important because wheat is sowed when the parcel is ploughed.


2005-11-16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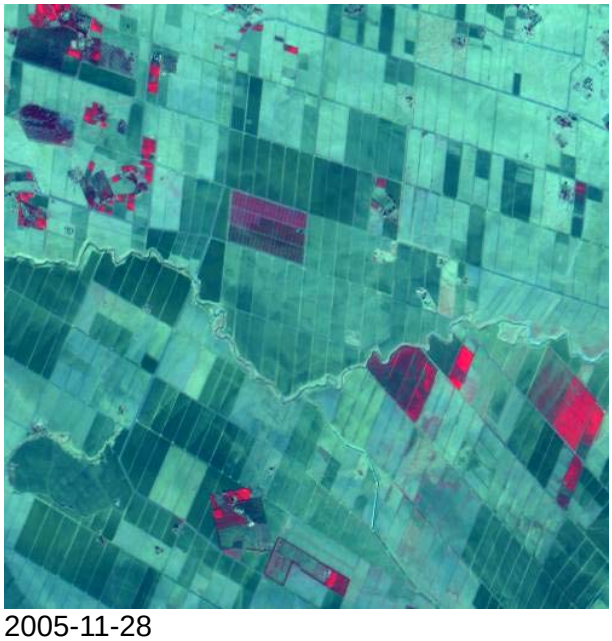
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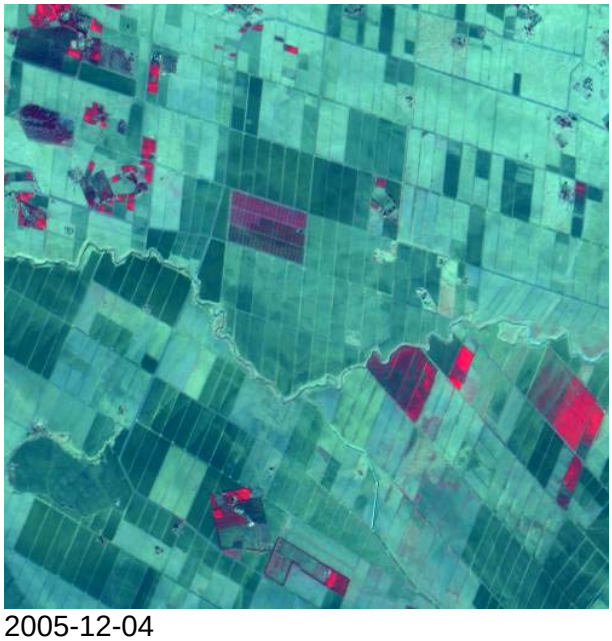
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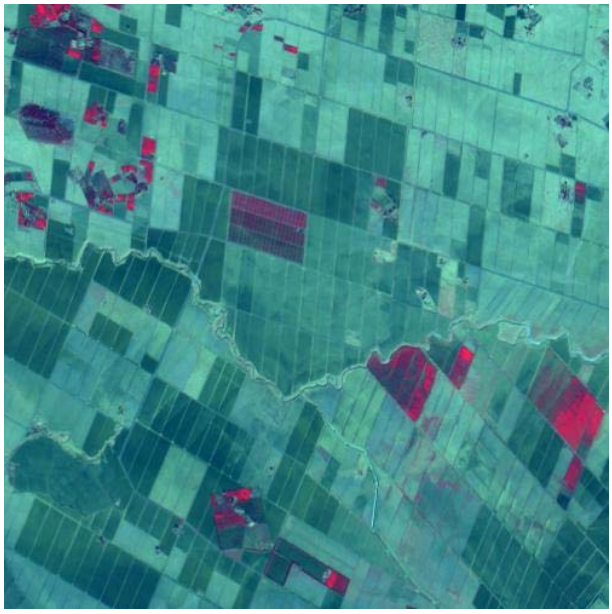
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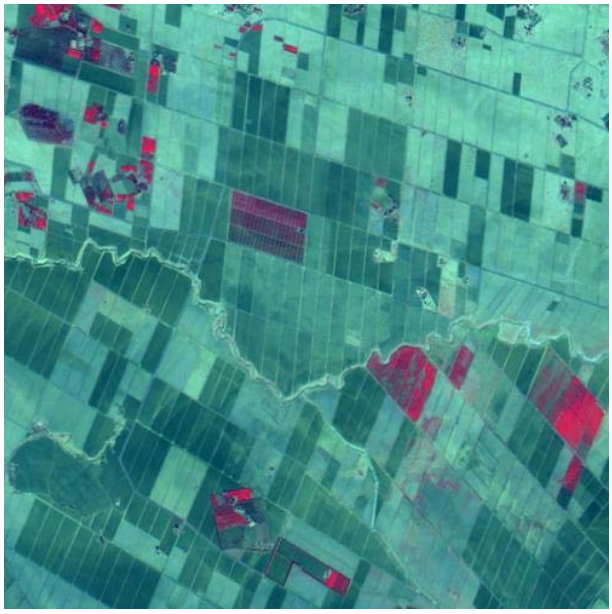
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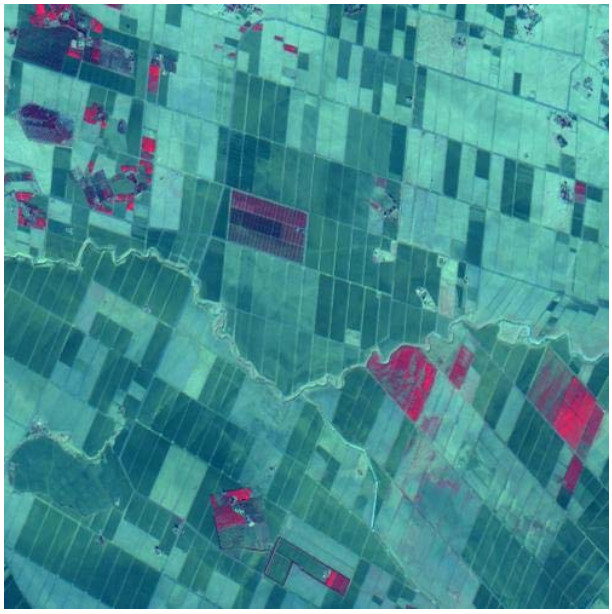
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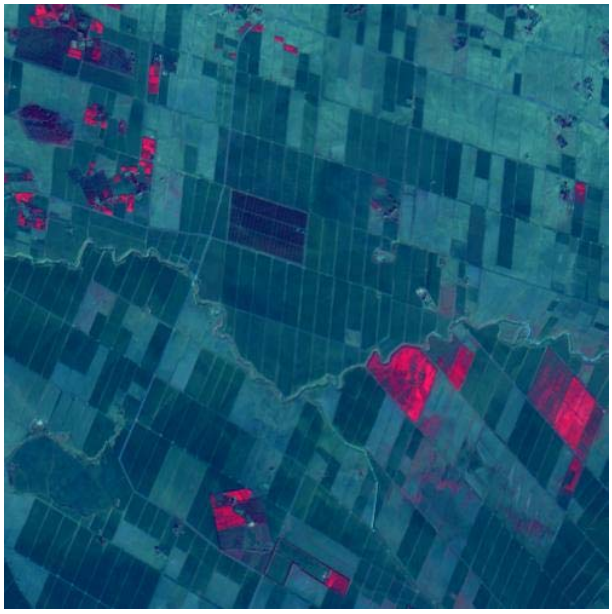
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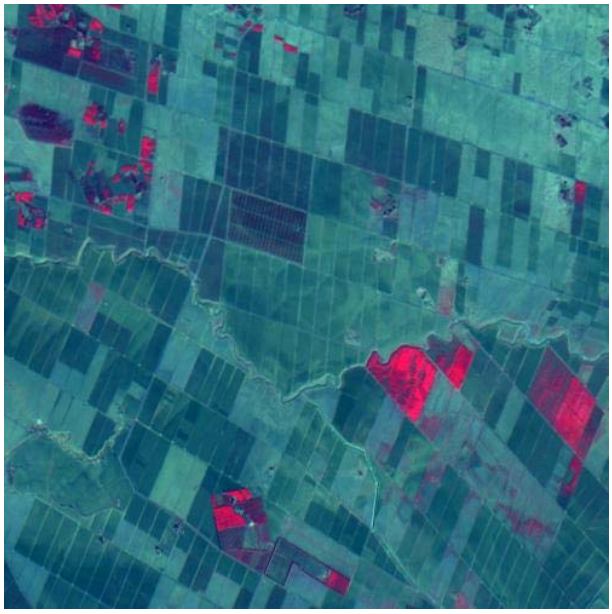

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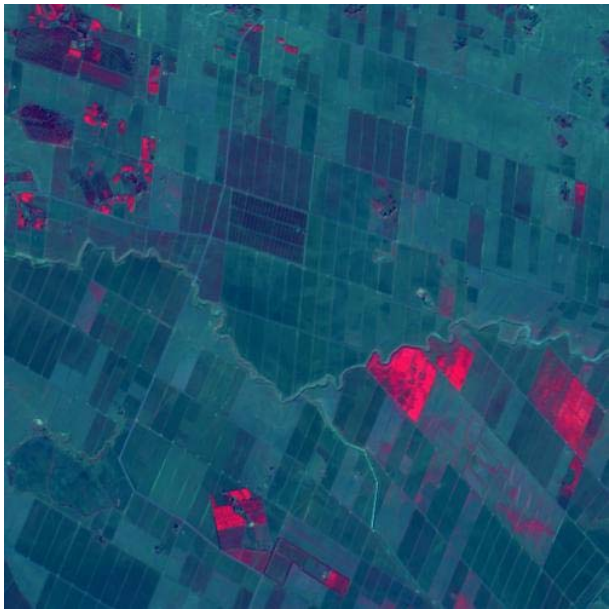

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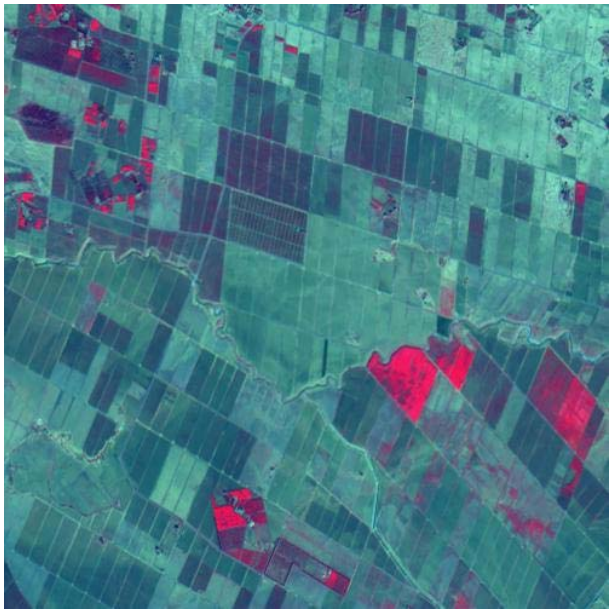

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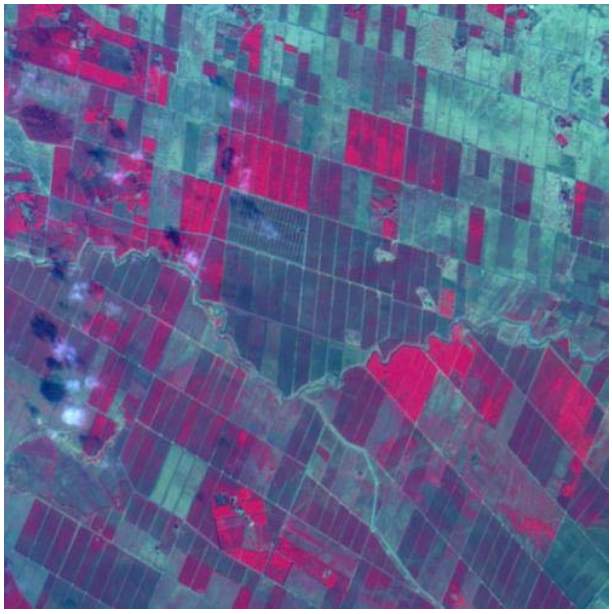

2006-02-16

It is possible to plot the reflectance of a given pixel as a function of time to have an idea of the future quality of Venμs time series. On Fig.3, one can note that the amount of noise on the time series is really low thanks to the quasi absence of directional effects. The higher reflectance values in the blue and red channels on November 20th are due to a higher optical thickness. The sudden drop of reflectances in all channels on December 12th is due to the ploughing of the field. The reflectance decrease in the green and red channels on December 29th is related to the heavy rain event, but it is less visible on ploughed fields than on fields that are not yet ploughed. Finally, on the last date, vegetation start is clearly visible thanks to the near-infrared reflectance.

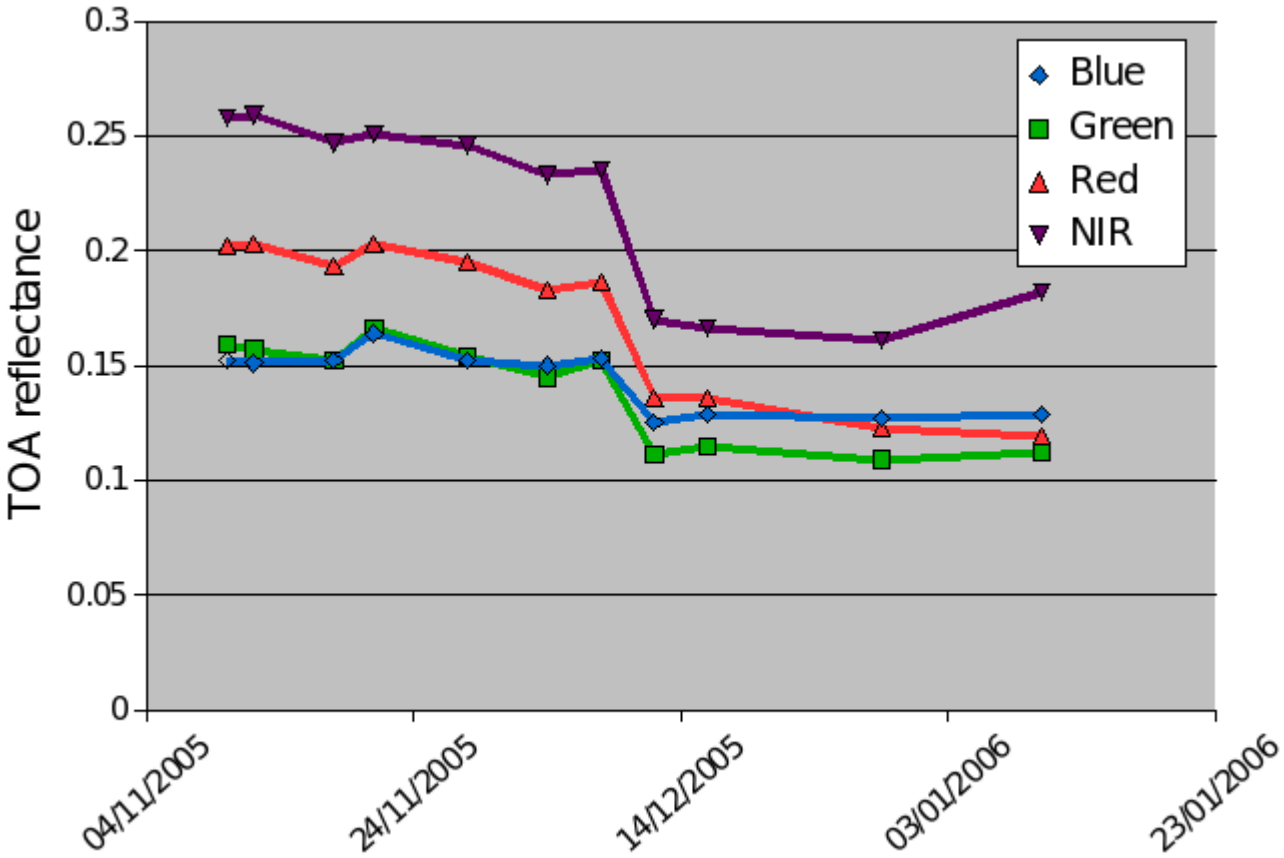

Fig 3 This figure shows the top of atmosphere variations of reflectance as a function of time for a ground pixel, for FORMOSAT four channels: blue, green, red, near-infra-red.

14 APPENDIX E: Outline Proposal Content and Application Form

Application form is available hereafter and can also be downloaded on the Venμs web sites:

http://www.bgu.ac.il/BIDR/research/phys/remote/03-Venus.htm

http://venus-mission.cnes.fr

All proposals should be type-written in English, Arial font, size of 11 points.
Each page must have a page number in the middle of the bottom and the name of the applicant in the upper right corner.

Please send outline proposal by e:mail before June 26, 2006, to the Venus RA secretariat:

Karnieli@bgu.ac.il
Or
venussec@cnes.fr

File format should be Adobe PDF (preferred), MS Word, or Rich Text File (RTF).

Please also send a copy by e:mail to VENμS scientific PI's :

karnieli@bgu.ac.il

and

gerard.dedieu@cesbio.cnes.fr

VENμS Research Announcement

Outline proposal

Proposal Title:

Acronym:

Principal Applicant:

Name, first name:

Official title:

Organization:

Department:

Address:

Country: E-mail:

Telephone: Facsimile:

Co-applicants:

Name	Organization	E-mail

Research Category (check one)

- ☐ Validation of Venμs data products
- ☐ Improvement of Venμs products (algorithms for atmospheric correction, cloud screening, time compositing...)
- ☐ Scientific research
- ☐ Applied research

Date and Signature of principal applicant:

Suggested content and length of an outline proposal

1) Cover page: previous page

2) Proposal outline (1 page):

2.1 Objectives

2.2 Approach

2.3 Ground experiment(s), in situ measurements

2.4 Anticipated use of Venμs data

3) Data Requirements (1 page). If several sites are requested, please provide the information for every site

3.1 Site Name:

3.2 Country:

3.2 Land cover type

3.3 Geographical coordinates (in decimal degrees)

Latitude and longitude of the center of the site:

Latitude and longitude of the four corners:

North-West Corner		North-East Corner		South-East Corner		South-East Corner	
Latitude	Longitude	Latitude	Longitude	Latitude	Longitude	Latitude	Longitude

It is recalled that a site is an area on the Earth covered by one to two along track contiguous images. The minimum size of a site is 27x27 km, the maximum size being 27x54 km at nadir. A site can also be observed with different view angles, for example nadir, forward and backward viewing from the same orbit and/or from different orbits at high latitudes. In that case, a site corresponds to several acquisitions of one to two images each with different view angles over the same area.

4) Periods of acquisitions (1/2 page)

The site will be observed every two days, with similar viewing angles, during these periods, unless a different requirement is given.

Please indicate the beginning and end of observations period for each year, from 2009 to 2011

5) Specific requests (1/2 page)

For example, request for different view angles, complex imaging requirements. Please provide enough details to explain your needs.

15 APPENDIX F: Full Proposal Content and Application Form

Application form is available hereafter and can also be downloaded on the Venμs web sites:

http://www.bgu.ac.il/BIDR/research/phys/remote/03-Venus.htm
http://venus-mission.cnes.fr

All proposals should be type-written in English, Arial font, size of 11 points.
File format should be Adobe PDF (preferred), MS Word, or Rich Text File (RTF).
Each page must have a page number in the middle of the bottom and the name of the applicant in the upper right corner.

VENμS Research Announcement

Full proposal

Proposal Title:

Acronym:

Principal Applicant:

Name, first name:

Official title:

Organization:

Department:

Address:

Country: E-mail:

Telephone: Facsimile:

Co-applicants:

Name	Organization	E-mail

Research Category (check one)

- ☐ Validation of Venμs data products
- ☐ Improvement of Venμs products (algorithms for atmospheric correction, cloud screening, time compositing...)
- ☐ Scientific research
- ☐ Applied research

Date and Signature of principal applicant:

Suggested content and length of a proposal

Cover page: previous page

Abstract of the Proposal (300 words)

Background and Objective (~ 1 page)

(Scientific and/or technological objectives of the project and brief state of the art)

Approach and methodology (~ 5 pages)

Algorithms to be used

Ground experiment(s), in situ measurements

Anticipated use of Venμs data

Anticipated results (~ 1 page)

Work calendar (Gantt diagram)

Project management (~ 2 pages)

An introduction should explain the structure of the project management. The plan must for each type of activity be broken down into workpackages (WPs) which should follow the logical phases of the project, and include management of the project and assessment of progress and results

The consortium and project resources (~ 2 page)

- brief biography of the PI
- list of scientists involved, with their affiliation and address
- list of relevant articles published by the partners
- available technical facilities
- any other relevant information

Details of Data Requirements

See table next page

Data Requirements (One form per site)

A site is an area on the Earth covered by one to two along track contiguous images. The minimum size of a site is 27x27 km, the maximum size being 27x54 km at nadir. A site can also be observed with different view angles, for example nadir, forward and backward viewing from the same orbit and/or from different orbits at high latitudes. In that case, a site corresponds to several acquisitions of one to two images each with different view angles over the same area.

Site Name:

Country:

Land cover type:

Geographical coordinates (in decimal degrees)

North-West Corner		North-East Corner		South-East Corner		South-East Corner	
Latitude	**Longitude**	**Latitude**	**Longitude**	**Latitude**	**Longitude**	**Latitude**	**Longitude**

Periods of acquisitions:

The site will be observed every two days, with similar viewing angles, during these periods, unless a different requirement is given.

	2009		2010		2011	
	beginning	**end**	**beginning**	**End**	**beginning**	**End**
Period requested to achieve the whole objectives of the proposal						
Minimum period to obtain worthwhile results*						

** Due to technical or acquisition programming constraints, the acquisition of the whole requested period might appear not feasible. To anticipate such limitations, please indicate the minimum period for acquisition that is still of interest for your investigation (for example, the minimum period could correspond to summer crop cycle, while the whole period also encompasses winter crop cycle). Best efforts will be done to cover the whole requested period.*

Estimated number of images:

Specific requests (e.g. different view angles, complex imaging requirements). Please provide enough details to explain your needs, possibly on separate sheets: