

38th CEOS WGCV Plenary Hosted by NOAA/NCEP College Park, MD, USA 29 Sept. - 3 Oct. 2014

Agency Report

from the Federal Scientific Institutes (FSIs) and Programmes

under the Authority of the

BELGIAN FEDERAL SCIENCE POLICY OFFICE (BelSPO)

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Contributors

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- 1. Reference solar spectrum (UV to IR)
- 2. Land/Ocean EO missions
- 3. Atmospheric composition EO missions
- 4. Reference validation measurements
- 5. QA/Validation systems for AC



1. Reference Solar Spectrum

(from UV to IR)

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ISS / COLUMBUS SOLAR



- Three instruments covering solar spectral irradiance from 17 nm to 100 µm (99% of solar energy)
 - <u>SOLSPEC</u> (SOLar SPECtral Irradiance measurements): 180 nm 3000 nm; developed by CNRS (France) in partnership with <u>BIRA-IASB</u> (Belgium) and LSW (Germany)
 - SOVIM (SOlar Variable and Irradiance Monitor): near-UV, visible and thermal (200 nm - 100 μm); developed by PMOD/WRC (Davos, Switzerland) with one instrument's radiometers provided by <u>IRM-KMI</u> (Belgium)
 - <u>SOL-ACES</u> (SOLar Auto-Calibrating Extreme UV/UV Spectrophotometers): EUV/UV; developed by IPM (Germany)

Facility Support Centre: Belgian USOC hosted by <u>BIRA-IASB</u>

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ISS SOLSPEC REFERENCE SOLAR SPECTRUM











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ISS SOLSPEC REFERENCE SOLAR SPECTRUM Calibration







2. Land/Ocean EO Missions

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PROBA Series EO and Solar

QinetiQ Space nv

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- PROBA = ESA's 'PROject for OnBoard Autonomy'
- Small satellites for technology demonstrations; prime contractor Qinetic Space, Belgium
- <u>PROBA-1</u>: launched October 2001; EO sensors still operating; transferred to ESA's Earth Observation Directorate
- <u>PROBA-2</u>: 1st ESA space weather mission dedicated to Sun observation, launched Nov. 2, 2009; 4 Belgian and CZ sensors
- <u>PROBA-V</u>: reduced-mass version of the SPOT-5 VEGETATION-2, launched 7 May 2013 from Kourou
- <u>PROBA-3</u>: double spacecraft to study solar corona while testing precise formation-flying techniques; launch 2016
- <u>Altius</u>: atmospheric limb mission for atmospheric composition

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VEGETATION



- PROBA-V: Reduced-mass version of the SPOT-5 VEGETATION
 - QinetiQ Space (Prime Contractor): Satellite platform
 - OIP Sensor Systems: VEGETATION instruments
 - VITO (PI): user segment, data processing chain
- Four spectral bands: BLUE, RED, NIR, SWIR
- Ground resolution: 100-180m nadir, 350-660m SWIR off-nadir
- Mission status:
 - Launched May 7, 2013; gap filler between SPOT-5 VGT and Sentinel-3
 - Dec. 2013 till May 31, 2014: tandem/harmonized operation with SPOT-5 VEGETATION
 - Permanent QA; radiometric and geometric calibration
 - Transition from SPOT-5 VEGETATION to PROBA-V on June 1, 2014
 - Final data products at 300 m to 1 km resolution

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QinetiQ Space

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OIP Sensor Systems









Algerian Abstract



What seems to be yellow paint streaks slicing through a collection of colors are actually the ridges of wind-blown sand that make up Erg Iguidi, one of the Saharan sand seas. Erg Iguidi is an area of constantly shifting sand dunes that extend from Algeria into northwestern Africa.

Left, the image acquired from ProbaV's central camera (100m resolution) on 24/05/2014 (Credit ESA-VITO 2014). Above the image captured from Landsat 7, an Earth-observing satellite managed by NASA and the U.S. Geological Survey (USGS). (Credit NASA's Goddard Space Flight Center/USGS

To download PROBA-V images, please visit www.vito-eodata.be and https://earth.esa.int/web/guest/pi-community/apply-for-data CEOS WGCV-38, College Park, Oct. 2014

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PROBA-V IOO m Workshop

November 19, 2014

BELSPO Offices, Brussels (BE)

Dear colleagues,

http://proba-v.vgt.vito.be

We hereby kindly inform you that on Wednesday **November 19, 2014** the **PROBA-V 100 m Workshop** will be organized **at the offices of the Belgian Science Policy Office** (BELSPO) in Brussels.

During this workshop we would like to examine the results of the performed studies with the PROBA-V 100 m images and discuss which would be the most appropriate 100 m product for your application(s).

In order to prepare the workshop, we would **like to ask you to complete a survey**. The **results will be presented and discussed during the workshop**. The survey will be sent via e-mail.

The complete programme and practical information on the venue can be found on the following pages.

- <u>http://proba-v.vgt.vito.be/content/workshop2014_programme</u>
- <u>http://proba-v.vgt.vito.be/content/workshop2014_venue</u>

We kindly ask you to confirm your participation by **registering online before October 10, 2014** at http://proba-v.vgt.vito.be/content/workshop2014 registration

Might you have any further questions about the 100 m images and/or the workshop, please do not hesitate to contact Bart Deronde (<u>bart.deronde@vito.be</u>, +32 14 33 68 21).

For practical information, you can contact Evelyn Stynen (evelyn.stynen@vito.be, +32 14 33 68 57).

Thank you very much for your cooperation and we hope to meet you in Brussels on November 19, 2014 and shape together the most wanted 100 m product.

On behalf of the PROBA-V Workshop organisers, Joost Vandenabeele (BELSPO) and Bart Deronde (VITO)





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Argentina – Belgium Cooperation





Constellation of two L-band SAR EO satellites for disaster management.



Orbit : 620 km, 97.9 deg., Sun-synchroneous, 6 days revisit time

Launch :SAOCOM-1A/-1B 2015 / 2016 SAOCOM-2A/-2B 2019 / 2020 Payload :

L-band polarimetric (HH-VV) SAR
Hyperspectral technological camera
High-sensitivity panchromatic camera

- Panchromatic camera

Parameters:

- Land: albedo, topography, soil moisture, vegetation, imagery
- Oceans: topography, currents, surface winds
- Snow and ice: ice sheet topography, snow cover/edge/depth, sea ice cover/edge/thickness

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3. Atmospheric Composition EO Missions



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ATMOSPHERIC COMPOSITION MISSIONS

Belgian involvement in:

- ERS-2 GOME (SAG, retrieval, Cal/Val)
- Meteor-3M SAGE-III (ST, retrieval, Cal/Val)
- SCISAT-1 ACE (Belgian imagers, SAG, retrieval, Cal/Val)
- Envisat SCIAMACHY (Co-PI, Belgian PMDs, SAG, retrieval, Cal/Val)
- Envisat GOMOS and MIPAS (SAG, retrieval, Cal/Val)
- EOS-Terra MOPITT (ST, retrieval, Cal/Val)
- EOS-Aura OMI (ST, retrieval, Cal/Val)
- MetOp-A/B GOME-2 and IASI (SAG, SAF, retrieval, Cal/Val)
- TANSO-GOSAT (TCCON, Cal/Val)
- OCO-2 (TCCON, Cal/Val)
- Sentinel 5 Precursor TROPOMI (MAG, retrieval, Cal/Val)
- Definition of future missions (MAGs, ACC, ORM...)
- Development of Altius (PI)

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Ozone Monitoring by GOME Type Sensors





Image courtesy BIRA-IASB, DLR, ESA, IFE/IUP/Bremen, and KNMI







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4. Reference Measurements for Satellite Validation



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Solar UV-Visible Irradiance Monitoring Network





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Solar UV-Visible Irradiance Monitoring Network



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Ground UV Radiation Data Availability

1. Spectral data (Global Solar Spectral Irradiance)

• Wavelength range : 280 -600 nm Field of view : 2 pi sr Period : since March 29, 1993

2. Broadband data

- UV-B meter (total) since February 2, 1995
- UV-B meter (diffuse) since July 16, 1996
- UV-A meter since May 11, 1995
- pyranometer since July 25, 1995

3. Filter radiometer data

- 10-Channels SPUV-10 since March 21, 1996
- 7-Channels UVMFR-7 since October 14, 1999
- 7-Channels MFR-7 since December 18, 2003
- 5-Channels GUV-551C since May 23, 1996
- 6-Channels GUV-2511 since June 3, 2005

4. Cloud measurements

- TSI(Total Sky Imager) since December 7, 1999
- CIR (Cloud Infrared Radiometer) since March 1, 2002

5. Meteorological measurements

- Eole 100/200 since May 27, 1997
- 6. Sunshine Duration
- SDM MS-093 since June 16, 2010





NETWORK FOR THE DETECTION OF ATMOSPHERIC COMPOSITION CHANGE





NDACC Sites



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NDACCO UV-Visible (MAX-)DOAS Spectrometers





Retrieved gases Ozone (O₃) Nitrogen dioxide (NO₂) Bromine monoxide (BrO) Chlorine dioxide (OClO) Formaldehyde (CH₂O) Glyoxal (CHOCHO) Sulfur dioxide (SO₂) CEOS WGCV-38, College Park, Oct. 2014





NDACC & TCCON FTIR Spectrometers

Direct greenhouse gases: Methane (CH_4) Nitrous oxide (N_2O) Ozone (O_3) Water Vapour (H_2O) Carbon Dioxide (CO_2)



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Other species: Carbon monoxide (CO) Ethane (C_2H_6) Hydrogen cyanide (HCN) Formaldehyde (CH₂O) Nitric acid (HNO₃) Hydrogen chloride (HCl) Hydrogen fluoride (HF) CFCs, HCFCs, HFCs





NDACC





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Belgian Maritime Data Centre (BMDC)



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PAN-EUROPEAN INFRASTRUCTURE FOR OCEAN & MARINE DATA MANAGEMENT

European Directory of Marine Environmental Data (EDMED)







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5. QA / Validation Systems for Atmospheric Composition



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EC FP7 NORS Project



<u>NORS</u>: Demonstration Network Of ground-based Remote Sensing Observations in support of the Copernicus Atmospheric Service (MACC-II) Nov. 1, 2011 to end November 2014

Objective:

To perform the required research and developments for optimizing the <u>NDACC</u> data for the purpose of supporting the quality assessments of the CAMS

⇒ Research part

To develop and implement a Web-based Validation Server of the MACC-II (CAMS) products using the NORS data products

⇒ Operational part

Integrated in MACC-III / Val from Aug. 2014 to end March 2015



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NORS Validation Server for Copernicus Atmosphere **1** Martine De

n Server

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CH4

NO2

PARAMETER

Special functions -Browse reports

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Product files -

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Reports Filter Octions CO-fkya-FTIR, [ALL]@[ALL]: 2013-11 ZID DOF Mean CO.MIXING.RATIO.VOLUME profiles MACC vs NORS

03	
MODEL TYPE	
fkya	6
fnyp	9
fsd7	10

Intercomparison Selection

INSTRUMENT TYPE	
FTIR	10
LIDAR	0
MWR	0
UVVIS.DOAS	6
UVVIS.DOAS.OFFAXIS	0
UVVIS.DOAS.ZENITH	0

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letwork of Remote Sensing

CEO.

Ground-Based Observations in support

of the Copernicus Atmospheric Service



http://nors-server.aeronomie.be	
GCV-37 presentation by M. De Mazièr	e

Filter Options	
LOCATION	
[ALL]	38
BERN	6
EUREKA	6
HAUTE.PROVENCE	6
IZANA	64
JUNGFRAUJOCH	22
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BIRA.IASB	(1)
CNRS.LATMOS	6
IUP	(1)
RIT	(77)





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NORS

Network of Remote Sensing Ground-Based Observations in support of the Copernicus Atmospheric Service



50⁺ abstracts and 100⁺ registrations !

You are here: Home > NORS/NDACC/GAW workshop > Program

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- Tioject
- = Partners
- Related Initiatives
- = Outreach
- Documents
- = NORS Validation server
- = NORS/NDACC/GAW workshop
 - Programme
 - Venue, Accomodation & Travel Information
 - Social Event
 - Attendance Fee & Other Costs
- Registration & Abstract Submission

Monday 3/11 - Wednesday 5/11 AM: NDACC Steering Committee Meeting - open to members only and upon invitation

Wednesday 5/11 PM - Friday 7/11 AM: NORS/NDACC/GAW Workshop - open

Friday 7/11 PM: NORS Final Review Meeting with Steering Committee - open to members of the NORS consortium only

Preliminary programme of the NORS/NDACC/GAW Workshop:

Session 1: Satellite applications and validation

Programme

Keynote talk by Claus Zehner (ESA - European Space Agency, Italy)

Session 2: Validation of Copernicus Atmosphere Service products

Keynote talk by Henk Eskes (KNMI - Royal Netherlands Meteorological Institute, Netherlands)

Session 3: Decadal time series for trend and climate studies

Keynote talk by Jean-Pascal van Ypersele (UCL - Université catholique de Louvain, IPCC Vice-chair, Belgium)

Session 4: Stratospheric Ozone and the Montreal Protocol

Keynote talk by Wolfgang Steinbrecht (DWD - Deutscher Wetterdienst, Germany)

Session 5: Aerosols, Clouds, and Trace Gases (incl. Greenhouse Gases)

Keynote talk by Gelsomina Pappalardo (CNR - Consiglio Nazionale delle Ricerche, Italy)





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NORS

PERSPECTIVES FOR NORS



- NORS/NDACC/GAW Workshop Nov. 5-7, 2014, in Brussels.
- Peer-reviewed papers in preparation.
- NORS continues in MACC-III at a funding level that only permits maintenance of the 'routine' validation activity, <u>without funding for validation data</u> (NDACC).
- Space Agencies and Copernicus should contribute to supporting the in-situ component they rely on for Cal/Val.
 <u>But:</u> Copernicus Atmosphere Monitoring Service foresees 'support to in-situ component' but it is limited to 1 personequivalent per network for QA of data stream... No support for data acquisition and analysis.





ONGOING / NEW ACTIVITIES

- QA4ECV (EC FP7 2014-2018): QA system for ECV production
- ACROSAT (Belspo/ProDEx 2014-2015): Metrology of data comparisons
- GAIA-CLIM (EC H2020 2015-2018): Gap Analysis for Integrated Atmospheric ECV CLImate Monitoring
 - Measurement characterization, comparison metrology, traceability
 - Virtual observatory, mapping of observational capabilities, gap analysis
- Balloon Aircore at Reunion Island (2015) for TCCON/OCO-2 calibration (vertical profile of CO_2 , CO and CH_4)
- CEOS ICal (ESA): + FTIR intercomparison campaign (2016)
- ESA Sentinel-5 Precursor TROPOMI Cal/Val AO: 4 networkbased projects + 1 modelling support project for S5p Cal/Val of O₃C, O₃P, NO₂, HCHO, CO and CH₄



Traceability of Validation Processing Chain

Illustration: Validation process for nadir backscatter UV ozone profiles (from MetOp-A GOME-2)

Keppens et al., AMTD 2014



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Traceability of Validation Processing Chain



* u_{S} , u_{C} and u_{R} for satellite, comparison, and reference units, respectively,

** Regridding only, or regridding including function smoothing (Gaussian, triangular, others), Regridding possibly by summation for sub-columns.

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THANK YOU !

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