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SEEDS - Sentinel EO-based Emission and Deposition Service

SEEDS
Sentinel EO-based Emission and Deposition Service

SEEDS 2nd GA and Stakeholder Engagement Meeting

30-31st March 2023

NILU
Koninklijk Nederlands Meteorologisch Instituut
Ministerie van Infrastructuur en Waters
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SEEDS

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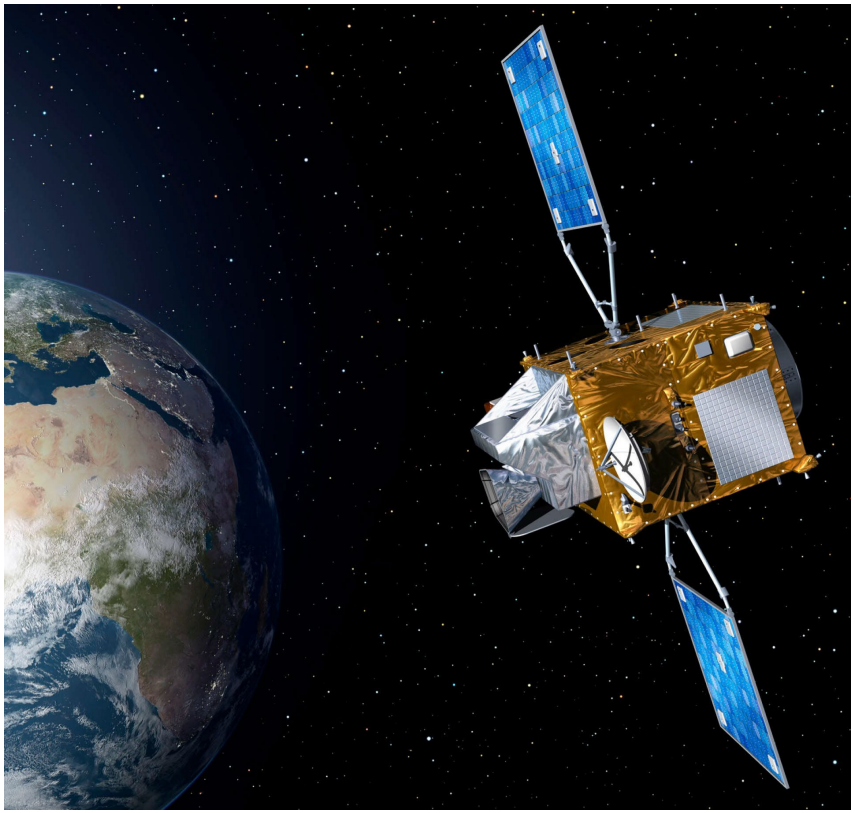


- The SEEDS project goal is to develop several top-down (satellite) inversion techniques to estimate European emissions of NOx, NH3, VOC, improve deposition flux modelling and develop advanced data assimilation techniques.
- The project is developing techniques that may eventually become part of the Copernicus Atmosphere Service (CAMS).
- SEEDS is now entering its third and final year and we have begun to compile a significant number of datasets in our portal for further evaluation.

Sentinel 5P & Preparation for Sentinel 4

SEEDS – New Products

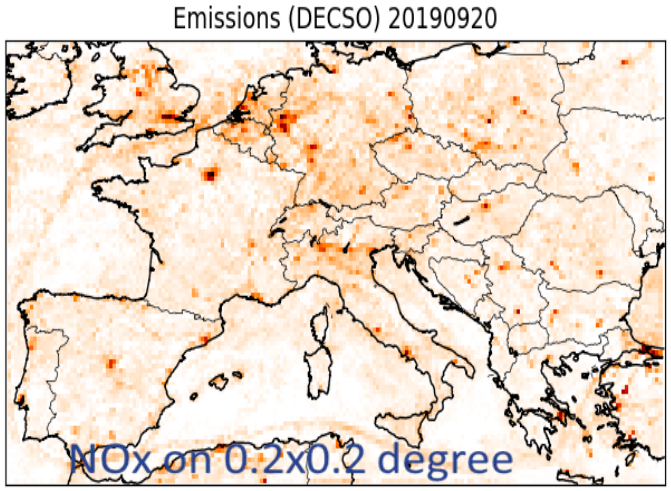
I. Anthropogenic emissions

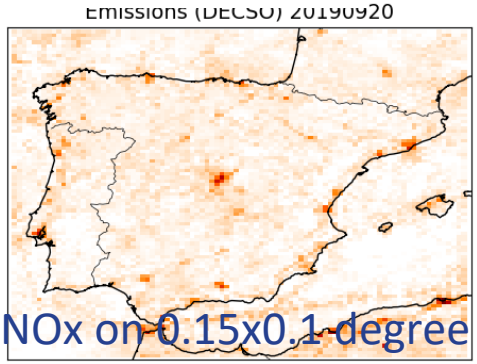
SEEDS uses inverse modelling to produce up-to-date high-resolution estimates of NOx, NH_3 and biomass burning emissions.

- **NOx** - 2019-2022 Monthly anthropogenic NOx emissions at up to 5 km resolution
- **NH_3** - 2019-2022 Monthly NH_3 emissions with 20 km resolution
- **Fires** - 2018-2022 Monthly biomass burning emissions at up to 10 km resolution

SEEDS – New Products

I. Anthropogenic emissions





- **NOx** Sentinel-5P TROPOMI observations and the inverse model DECSO (Daily Emission estimation Constrained by Satellite Observations).
- **Ammonia (NH_3)** DECSO model applied to IASI or CrIS observations.
- **Biomass burning (Fires)** via HCHO observations of S-5P TROPOMI using an adjoint of MAGRITTE model.

SEEDS – New Products

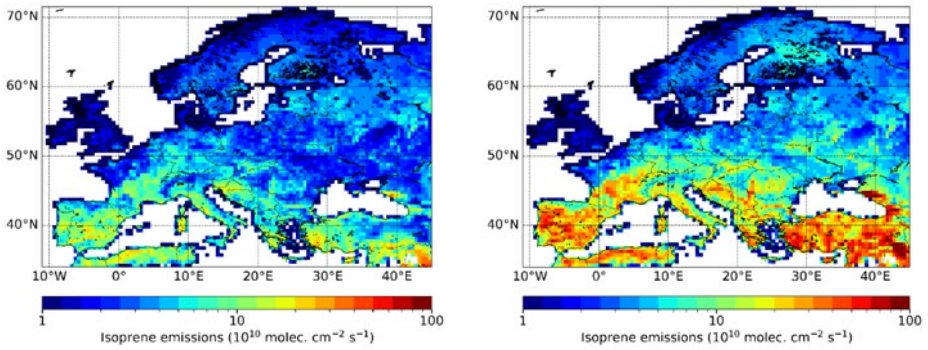
II. Biogenic emissions

SEEDS combines top-down inverse monitoring approach with high-resolution land-surface models to provide enhanced resolution biogenic emission products from satellite observations

- **Soil NOx** - 2019-2022 Agricultural soil NOx emissions at up to 5 km resolution
- **BVOC** -2019-2022 Top-down and bottom-up estimates of Biogenic Organic Compounds with 10 km resolution

SEEDS – New Products

II. Biogenic emissions



Isoprene emission maps of Europe before (left) and after (right) inversion

- Soil NOx emissions are derived from the DECSO inverse model and Sentinel 5P observations. This is a new product of SEEDS currently not available in CAMS.
- Top-down BVOCs flux estimates are inferred based on the MAGRITTE v1.1 regional atmospheric chemistry-transport model and Sentinel-5P TROPOMI data of formaldehyde columns.
- Bottom-up BVOCs are based on the MEGAN code linked to SURFEX land surface model

SEEDS – New Products

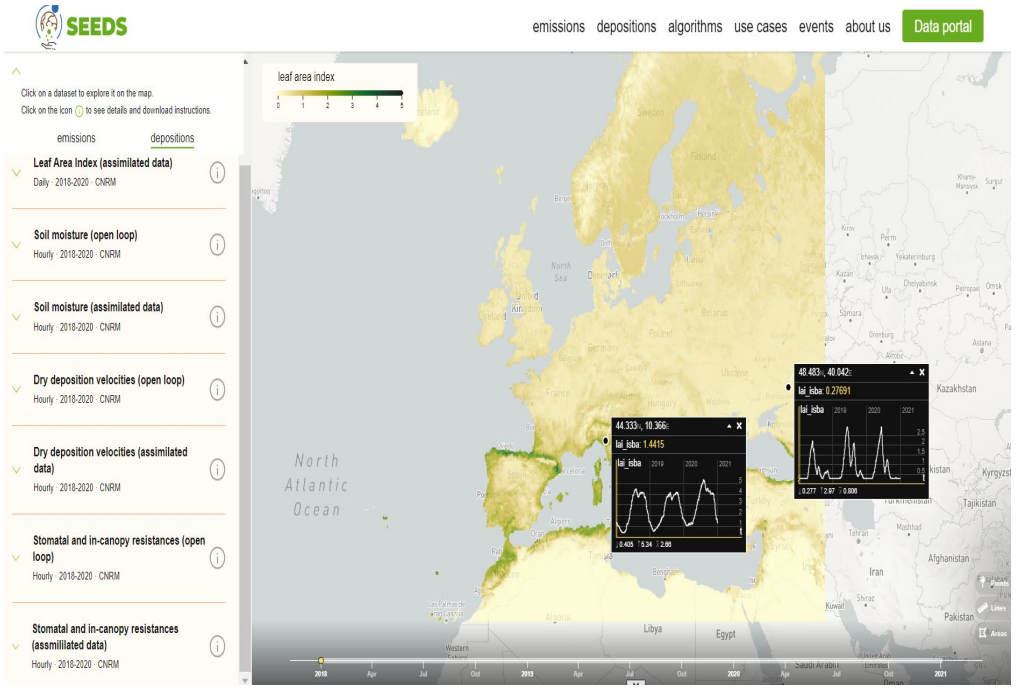
III. Land surface and deposition

SEEDS offers EO-based estimates of soil moisture, vegetation variables, and deposition fluxes based on a coupled atmosphere-land-vegetation approach for direct use in precision agriculture applications.

- **LAI** - 2018-2022 Leaf area index data sets at 10 km spatial resolution
- **Soil Moisture** - 2018-2022 Soil moisture datasets at 10 km spatial resolution
- **Deposition** - 2018-2022 Deposition fluxes and diagnostics (e.g., stomatal resistance) for ozone and nitrogen at 10 km spatial resolution

SEEDS – New Products

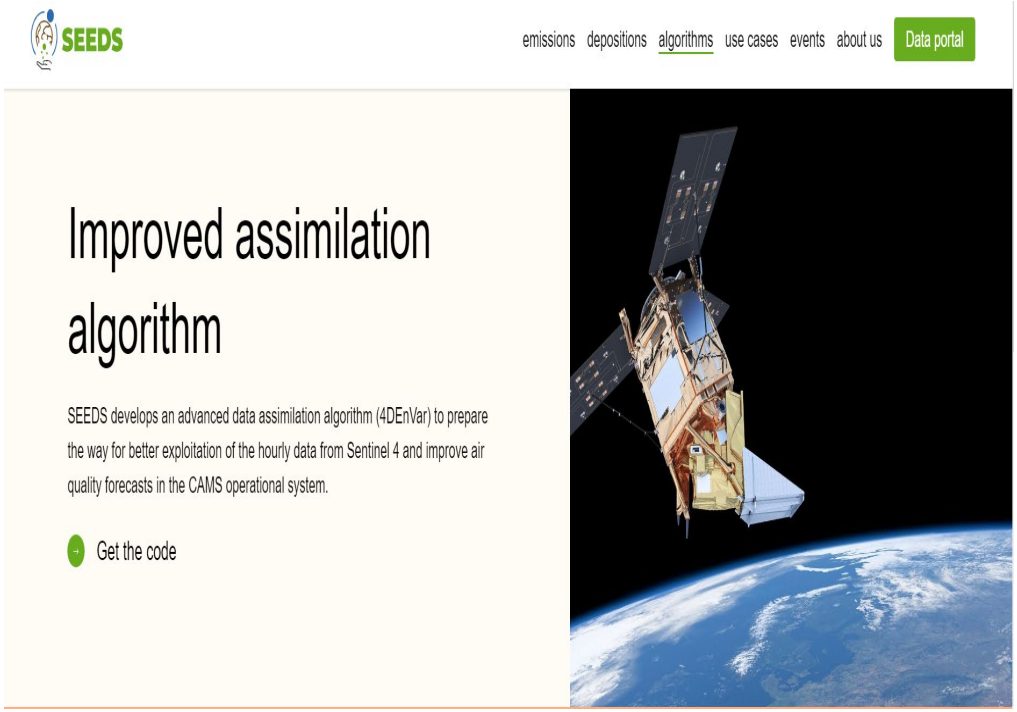
III. Land surface and deposition



- **Soil moisture** products are derived from the SURFEX_LDAS_MONDE model combined with EO data the ASCAT-Metop series, in 10km resolution
- **LAI** products using the SURFEX_LDAS_MONDE combined PROBA-V and ASCAT satellite observations, also in 10km resolution.
- **Deposition fluxes** are linked to the land-surface SURFEX_LDAS_MONDE and produced based on the EMEP dry deposition scheme implemented in the MOCAGE model.

SEEDS – New Products

IV. Advanced data assimilation algorithm



SEEDS develops an advanced data assimilation algorithm (4DEnVar) to prepare the way for better exploitation of the hourly data from Sentinel 4 and improve air quality forecasts in the CAMS operational system

- **Open-source code** with the 4DEnVAr algorithm for use by a wide range of researchers and scientific experts.

SEEDS – Demonstration

V. Improved CAMS products

The project is developing techniques that may eventually become part of the Copernicus Atmosphere Service (CAMS).

The added-value of the SEEDS emission and deposition products is demonstrated though their capabilities to improve the current CAMS operational type chain to prepare further production and use in downstream applications.

The capabilities of

- SEEDS up-to date emission data
- SEEDS deposition and land surface data
- SEEDS 4DEnVar DA algorithm
- the combined SEEDS methods and data

to **improve current CAMS regional forecasting products** will be systematically evaluated in a part of the CAMS production chain

SEEDS – Demonstration

V. Improved CAMS products

- The performance of the new SEEDS emission and deposition products and the 4DEnVar algorithm are to be assessed individually and collectively against existing CAMS air-quality forecast and analyses.
- The basis of the evaluation is the MOCAGE modelling chain that is currently operational in the CAMS production system.
- The focus is on forecasting results for ozone, NO_2, PM10 and PM2.5 as they represent the most critical air quality species and the ones that are chemically related to the new emission products.

SEEDS – Demonstration

VI. Stakeholder engagement

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Explore the possibilities

Agriculture and forestry

SEEDS products on soil moisture and leaf area index can support environmental management practices in precision agriculture while the SEEDS deposition products for ozone and nitrogen can inform control options for eutrophication and crop yield damage.

Urban planning

SEEDS products for urban planning include both anthropogenic and biogenic emissions products as well as improved air pollution forecast of NOx, ozone and PM that can support local administrations in cities develop sustainable zero-pollution city plans.

Industry

SEEDS anthropogenic emission products can be used by industry (metallurgy, cement, energy, oil and gas production sectors) as independent and scientifically sound data to validate monthly emissions from space.

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SEEDS – Demonstration

VI. Stakeholder engagement

2nd SEEDS General Assembly and Stakeholder Engagement Meeting

30-31 March 2022 Barcelona / Online

Join us in Barcelona for this hybrid meeting where you can learn more about the status of SEEDS products and help us envisage ways to test them. The first day from 10:00 to 17:00 focuses on SEEDS emissions products. The second day, from 9:00 to 13:00 focuses on data for agriculture services. The meeting is open to all interested.

Sentinel EO-based Emission and Deposition Service

SEEDS General Assembly and Stakeholder Engagement Meeting

30th – 31st March 2023

Hybrid meeting in Barcelona, Spain - Final Agenda

Thursday 30th March (10:00-17:00) - SEEDS emission products

10:00 - 10:15 SEEDS project: Main achievements so far (Leonor Tarrason, NILU)

Block 1 : Industrial emissions

10:15 – 10:35 Experiences of use of EPRTR and expectation on SEEDS (Chris Dore, AETHER)

10:35 – 10:50 Use of Satellite data for NOx point sources (Henk Eskes, KMNI)

10:50 – 11:10 SEEDS NOx emissions from industrial plants (Ronald Van der A, KNMI)

11:00 – 11:30 Evaluation of industrial emissions at EEA using satellite data (F. Antognazza, EEA)

11:30 -12:00 Common discussion on perspectives for use of satellite point source NOx

12:00-12:30 Coffee Break

Block 2 : Fire Emissions

12:30 – 12:45 Main uses of Biomass burning products in CAMS (Mark Parrington, ECMWF)

12:45 – 13:00 Fire emissions in SEEDS (Jenny Stavrakou, BIRA_IASB)

13:00 – 13:30 Common Discussion

13:30 - 15:00 Lunch break

Block 3 – Emissions in cities

15:00 – 15:15 SEEDS NOx emissions in cities (Ronald Van der A, KMNI)

15:15 – 15:30 Lessons learnt from Catalonian emissions in cooperation with SEEDS (Marc Guevara, BSC)

15:30 – 15:45 SEEDS VOCs in cities and links to ozone (Glenn Michael Oomen, BIRA_IASB)

15:45 – 16:00 Air quality in the Metropolitan area of Barcelona and expectations on satellite-based emissions (Eva Español, AMB)

16:00 – 16:30 Common discussion on perspectives of use of satellite data for city emissions

16:30 – 16:45 Summary and perspectives on SEEDS emission products

17:00 City visit and dinner

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SEEDS General Assembly and Stakeholder Engagement Meeting

30th – 31st March 2023

Hybrid meeting in Barcelona - Final Agenda

Friday 31st March (09:00-13:00) – SEEDS surface fluxes

09:00 – 09:20 CAMS expectations on SEEDS science and products (Vincent-Henri Peuch, ECMWF)

Block 4 : Agricultural emissions

09:20 – 09:35 SEEDS NH3 emissions (Jieying Ding, KNMI)

09:35 – 09:50 SEEDS Soil Biogenic of NOx (Ronald van der A, KNMI)

09:50 – 10:15 Common discussion on agricultural emissions

10:15 – 10:30 Coffee Break

Block 5 : Deposition fluxes and yields

10:30 – 10:45 SEEDS Nitrogen and Ozone dry depositions (Paul Hamer, NILU)

10:45 – 11:00 Applications of EO products as a resource in agricultural management (Victor Altes, ULeida)

11:00 - 11:30 Added value of deposition products to CAMS (Joaquin Arteta , MeteoFrance)

11:30 – 12:00 Common discussion on deposition fluxes

Block 6 : Physical information on SM and LAI

12:00 -12:15 SEEDS Soil Moisture and LAI products (Jean-Christophe Calvet, CNRM)

12:15 -12:30 Irrigation management based on satellite observations (Pere Quintana, ObservEbre)

12:30 – 12:45 Common discussion and perspectives on surface fluxes

12:45 – 13:00 Summary and perspectives on SEEDS surface flux products

SEEDS – Stakeholder engagement

VI. Stakeholder engagement

Join at
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SEEDS Consortium team

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NILU - L. Tarrason, P. D. Hamer

KNMI - H. Eskes, R. van der A, J. Ding

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CERFACS - E. Emili, P. Piacentini

MF-CNRM - J. Arteta, J.-C. Calvet, N. Frebourg, V. Marécal

ISAT – Lobelia Earth - J. Calvin, P. Moreno, A. Naranjo

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Thank you

https://seedsproject.eu

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