Newsletter from EVDC   **August 2017**

EVDC - ESA Atmospheric Validation Data Centre

The ESA Atmospheric Validation Data Centre (EVDC) is the official ESA repository for validation and campaign datasets.

EVDC is built to assist the scientific community with the archival and exchange of correlative data for validation of satellite instrument atmospheric composition products and provides the final archive for the data. EVDC builds on the previous ENVISAT Cal/Val database system in operation at NILU since the early 2000s, and includes tools for extraction, conversion and archival of a large amount of EO data.

The objective of the current ESA funded project lead by Skytek [1] with the partnership of NILU [2] and ICHEC [3], is to provide an online information system that supports users in managing and exploiting campaign datasets for Earth Observation missions and applications. The EVDC will provide access to satellite data subsets for specific missions over user-defined areas; in particular the system is in preparation for the upcoming atmospheric composition/dynamic missions Sentinel-5P and ADM-Aeolus. (https://earth.esa.int/web/guest/missions/esa-future-missions/sentinel-5P) (http://www.esa.int/Our_Activities/Observing_the_Earth/Aeolus/Introducing_Aeolus) Having both Cal/Val data and satellite products in a centralized system will greatly increase the possibility of validating missions over long time series and will improve

understanding of the behavior of sensors during the entire mission.

The EVDC database helps as a tool to monitor the quality and availability of the data provided and it aims to support field campaigns over various seasons and locations. The portal can be easily expanded to support new campaigns and satellite missions. EVDC offers easy access to a wide range of user support and advice to data managers on how to archive data and what variables they should store.

Data exchange with the EVDC is regulated by a protocol with the aim to ensure data ownership, to prevent re-distribution to third parties and to protect intellectual properties.

The Atmospheric Cal/Val data

The EVDC contains a large variety of data used for validation of the satellite atmospheric composition products from campaigns, in-situ ground-based measurements, aircraft, balloons and, in general, from a wide range of stations and measurements principles. It offers, moreover, the access to other Cal/Val datasets by the mirroring of specific databases (e.g. NDACC [4], ACTRIS [5]) and the provision of the ECMWF data for daily updated global gridded meteorological parameters. The EVDC portal also includes several tools supporting the user in terms of data query, data upload/download, format conversion (GEOMS [6] conversion routines) and for production of ECMWF parameter's maps.

The New EVDC Portal

EVDC has recently been upgraded, and is available at: http://evdc.esa.int/

The new EVDC portal is built on the previous versions of EVDC, a database which many of our users are familiar with. New features are introduced in the portal and old systems are upgraded and improved, in order to make it more user friendly and to meet the needs for newly required functionality.

The new EVDC web portal is based on a high scalable Django web application deployed on Amazon Web Service AWS [6]. The main upgrades with respect to the previous portal consist of an improved data access and query performance for the Cal/Val database, the new Search Satellite Data page for accessing the Satellite Archive, and the inclusion of a new feature: the Orbit Predictor and Overpass Tool (OPOT).

Read more below to explore the portals services and tools.
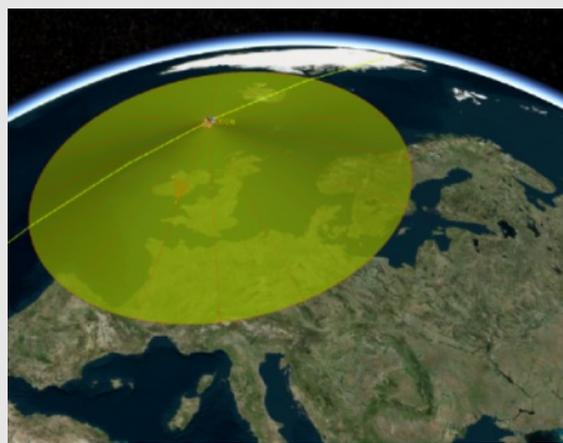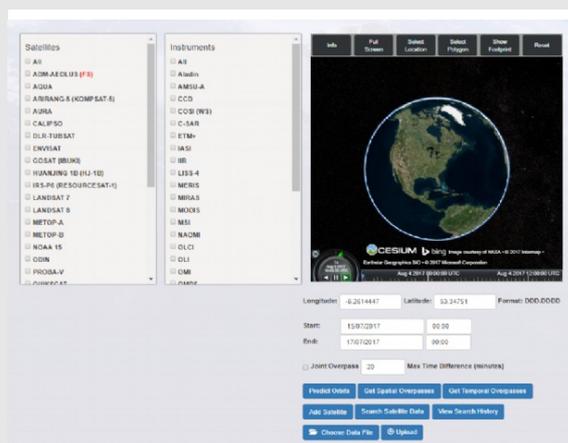
New feature in EVDC:
Orbit Predictor and Overpass Tool

The OPOT is a new tool that allows users to specify an area of the Earth's surface and a time window, select a list of satellites, and apply a query to verify if and when the satellite will perform observations in this region, matching, for example, specific ground based measurement observations.

The OPOT takes input for satellite's orbit in the form of TLEs (Two-Line Element set) and exploits the Simplified General Perturbation Model (SGP4)[8] to predict and store the future orbits.

An overpass occurs when the field of view of a satellite's instrument passes over an area of interest (AOI). Users can search for overpasses by satellite or instrument, as well as for joint overpasses between two satellites. They can then download the data for further analysis or upload previous queries. The tool also allows the planning campaigns for future missions, by simulating the TLEs for satellites not yet launched when their orbital characteristics are available.

The OPOT interface allows the user to specify query parameters such as satellites, instruments, date and time, while the 3D globe viewer can be used to specify the location (single point or a polygonal AOI) and to display the resulting overpasses

Test it out on http://evdc.esa.int/orbit/

New feature in EVDC:
Satellite Element

Beyond the Cal/Val data, the EVDC will provide access to satellite Level-1 and Level-2 products for specific missions over user-defined areas, this will greatly increase the possibility of understanding the behavior of the on-board instruments over long time series by allowing their validation against versus ground-based measurements. With this aim, a specific task of the project is dedicated to the deployment of infrastructure to download, archive and make available the satellite products for specific missions. This data store infrastructure, handled by ICHEC, is a Simple Storage Service (S3) implemented using the OpenStack Object Storage (Swift) technology [7]

Users will log onto the Satellite Element, discover requested Granules and Collections, and be presented with the relevant URIs on the EVDC web page. A dedicated storage system for the EVDC data is hosted by ICHEC in Ireland and currently stores Sentinel-3 data for a number of validation locations in France, Ireland, Italy, and Namibia, as a part of a pilot demonstration study. Once launched, the Sentinel-5P and ADM-AEOLUS data will be made available through the same interface.

Explore the Search Satellite Data at http://evdc.esa.int/search/satellite/
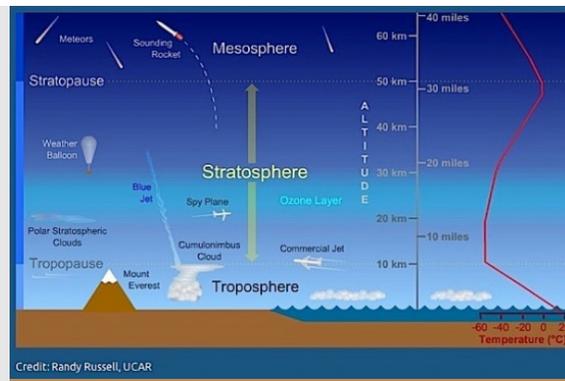
GEOMS format

In order to ensure harmony between specifications and reporting of data/metadata EVDC exploits the GEOMS – Generic Earth Observation Metadata Standard for all correlative data in the archive.

GEOMS is a EO metadata standard, developed in collaboration with ESA, NASA and NDACC. It is utilised for archiving data from ground based networks and for the validation of ESA and NASA satellite data.

The GEOMS documentation is found at
http://evdc.esa.int/documentation/geoms/

Campaigns

The following is an example of currently available campaign data: In preparation for the Sentinel5-P/TROPOMI (currently scheduled for launch in September 2017) data characterization and validation activities, a dedicated inter-comparison campaign (CINDI-2) for Max-DOAS instruments has been carried out in September 2016 in Cabauw, The Netherlands. The data from this campaign will be used apart from scientific purposes to initialize and characterize a set of Fiducial Reference Measurements for Ground-Based DOAS Air-Quality Observations (FRM4DOAS) [9] network of MAX-DOAS instruments.

Updated search functionalities

The Cal/Val data access, in terms of query, upload and download has been strongly improved. The new implementation is based on an Object Relation Mapping (ORM) layer, which abstracts away any database specific details, allowing the focus to remain on the underling information held within the database.

To search for data, from campaigns or from other data archives, go to the "Search Cal/Val Data" page http://evdc.esa.int/search/. Here, a detailed search for Variables, Locations and Instruments can be performed. The remaining fields are updated after each selection, in order to allow only valid combinations of search options.

All data in EVDC can be listed, but depending on the individual rights of each campaign, download access may be restricted. Information on how to get access to restricted data is found under "Contact Us" below.

Metadata harvesting and sharing

EVDC is connected to other data archives through data harvesting technologies.

Currently, Atmospheric EO and Cal/Val data are available from multiple sources and data archives across the world, there is no so-called "one-stop-shop" for search of data. In order to facilitate simpler and faster search methods for the users, EVDC is now setting up harvesting methods for sharing metadata between data archives from a number of national and international projects and programs.

There is a growing interest in using Cal/Val data, particularly in connection with the new Sentinel missions and other upcoming satellites, as well as in Copernicus and related initiatives. Through metadata sharing, EVDC aims to encourage cooperation between the various data archives, promote open data policy and strengthen collaboration throughout EO disciplines in the best possible way.

Metadata sharing leads to

- Data available to more users
- Larger contribution rate in publications
- Proper acknowledgements and more visibility
- Data can be understood and interpreted by any user

The OAI-PMH technique and "behind-the-scenes" information is provided in detail at our web portal.

To register your archive in this initiative and to set up the required protocols, please contact the EVDC team (see below). Our database management team will help you getting started and provides front line support for setting up harvester services.

Upcoming events

Launch of Sentinel-5 Precursor from Plesetsk (RU) September 2017.

Second Sentinel-5 Precursor Validation Team Meeting February 2018, ESTEC, Noordwijk

References

[1] Skytek http://www.skytek.com/; info@skytek.com

[2] NILU Norwegian Institute for Air Research http://www.nilu.no/; nadirteam@nilu.no.

[3] ICHEC Irish Centre for High-End Computing https://www.ichec.ie/

[4] NDACC Network for the Detection of Atmospheric Composition Change http://www.ndsc.ncep.noaa.gov/

[5] ACTRIS Aerosols,Clouds, and Trace gases Research InfraStructure network http://www.actris.eu/

[6] Django web framework documentation https://www.djangoproject.com/

[7] Solr documentations http://lucene.apache.org/solr/

[8] Models for Propagation of NORAD Element Sets. F. R. Hoots R. L. Roehrich 1980. https://www.celestrak.com/NORAD/documentation/spacetrk.pdf

[9] FRM4DOAS https://earth.esa.int/web/sppa/activities/frm

Acknowledgements

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