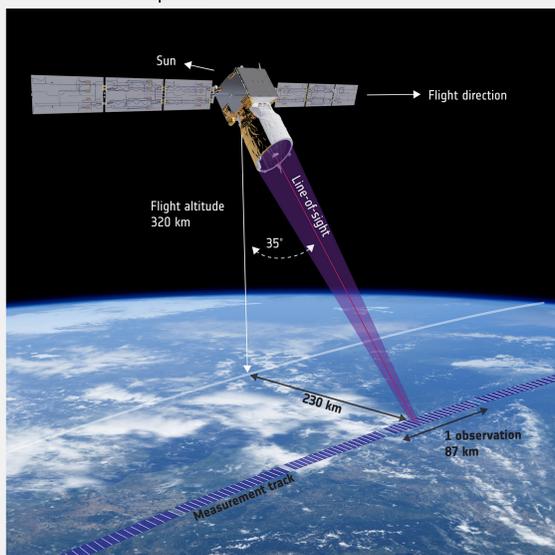


Abstract

VirES is a Virtual workspace for Earth-observation Scientists, a service provided by the European Space Agency (ESA). VirES has firstly been established for ESA's magnetic field mission Swarm as "VirES for Swarm" [1] and has been extended to ESA's atmospheric dynamics mission Aeolus, which was launched in August 2018. The service is developed by the Austrian IT company EOX in strong collaboration with missions' scientists. VirES is a web-based service (<https://aeolus.services>) that enables scientists to discover, visualize, select and download data of Earth-observation (EO) missions through an easy to operate graphical user interface. "VirES for Aeolus" [2] will provide access to Aeolus L1B, L2A, L2B, L2C products and auxiliary data. The first version 1.0 passed acceptance tests in April 2018 and developments towards Version 1.2 are in progress. The service is planned to be accessible for public use as soon as the mission's phase E1 is completed and first data products are released by ESA.

The Aeolus Mission

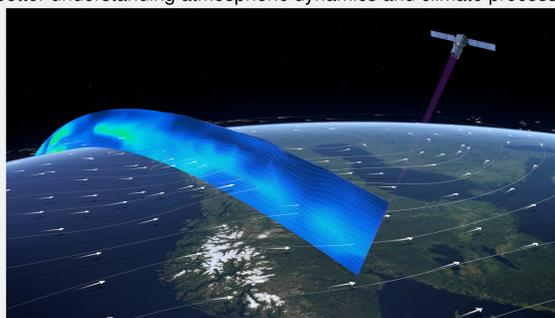
- ▶ Part of ESA's Earth Explorer program
- ▶ Instrument: ALADIN (Atmospheric LAsER Doppler INstrument)
- ▶ Orbit: 320 km, polar, sun synchronous
- ▶ Launch: August 22, 2018 from Kourou, French Guiana
- ▶ First wind lidar in space!



The wind is observed orthogonal to the satellite ground-track, pointing 35° off-nadir.

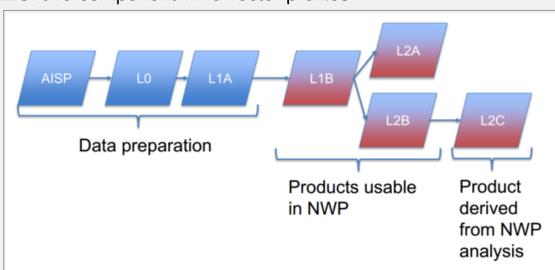
Mission Objectives

- Global measurements of wind profiles for
- ▶ improving numerical weather prediction (NWP)
 - ▶ better understanding atmospheric dynamics and climate processes



Aeolus Data Products

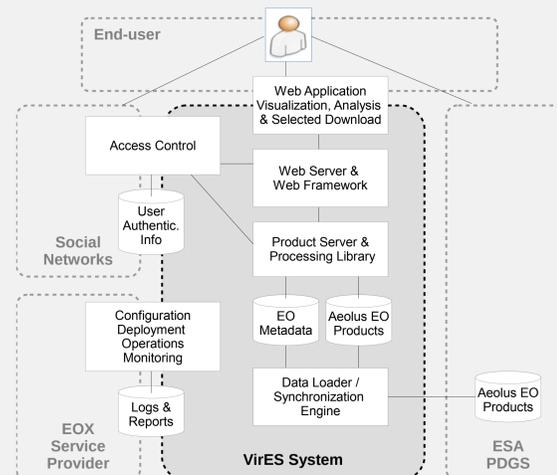
- ▶ AISP: Annotated Instrument Source Packages
- ▶ L0: time-ordered source packet streams
- ▶ L1A: geo-referenced measurement data
- ▶ L1B: horizontal line-of-sight (HLOS) wind profiles
- ▶ L2A: aerosol and cloud layer information
- ▶ L2B: consolidated HLOS wind profiles
- ▶ L2C: two-component wind vector profiles



VirES for Aeolus covers L1B, L2A, L2B, L2C and the most important auxiliary data products (AUX MRC, AUX RRC, AUX ISR, AUX ZWC, AUX MET)

VirES-Aeolus System Architecture

The following diagram shows the high-level architecture of the VirES system as well as the main relationships with the major components identified within and outside of the system's perimeter.

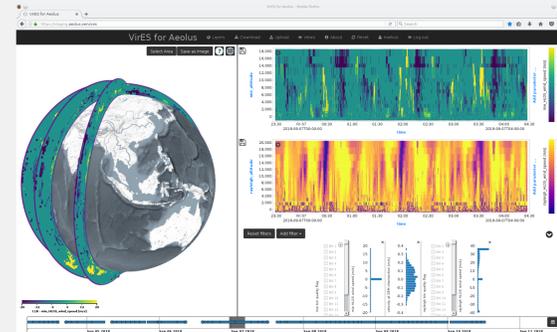


This architecture provides the following main functions:

- ▶ Visualization and analysis tools for Aeolus EO products including visual filtering and data download.
- ▶ User access control including a sign-up procedure and authenticated by the VirES System based on an account that a user owns in one of the social networks Facebook, Google, LinkedIn, or Twitter. Alternatively, the user can choose that a "native" account in VirES is created.
- ▶ Loading and holding a complete and continuously synchronized set of Aeolus EO products copied from the official Aeolus Data Dissemination Facility (ADDF) in ESA's Payload Data Ground Segment (PDGS).
- ▶ Supporting procedures and functions for configuration, deployment, operations, monitoring and reporting in order to enable the service provider EOX to manage the system during all phases of the lifecycle.

Graphical User Interface

The graphical user interface (GUI) is accessible through various internet browsers (Internet Explorer, Edge, Firefox, Chrome, Safari, Opera, mobile browsers).

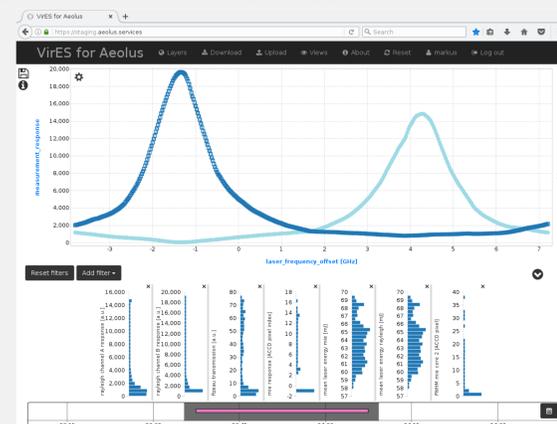


The GUI is composed of a menu bar on top and three widgets:

- ▶ At the bottom there is the time slider widget where the user selects the time range of the data to be analyzed.
- ▶ On the left hand side the VirES globe widget provides a three-dimensional visualization of the selected data corresponding to its latitude, longitude and altitude. In the screenshot we see the measurement data as vertical curtains.
- ▶ Right of the globe widget there is the VirES analytics panel widget.

Analytics Panel

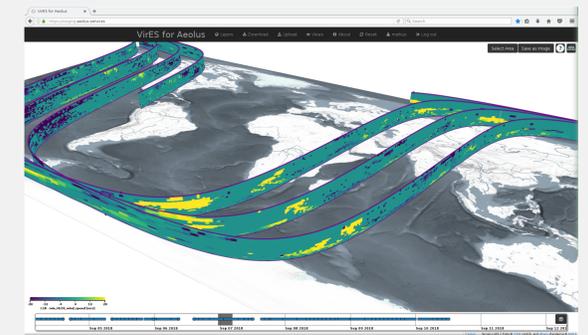
The analytics panel is composed of one or two scatterplot panels on top and multi-parameter histogram displays at the bottom. These are used as visual feedback and filter tools.



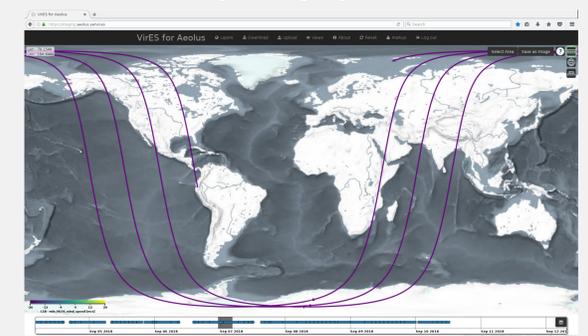
In the screenshots above ISR (internal spectral registration) auxiliary data is displayed.

Globe Widget

Cartographic displays can be shown using different views: 3D globe, 2.5D "Columbus" map or 2D map.

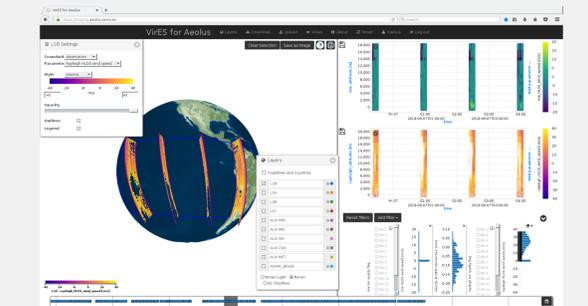


Users can interactively zoom and pan the map/globe, and in the 2.5D and 3D cases change viewing angles.



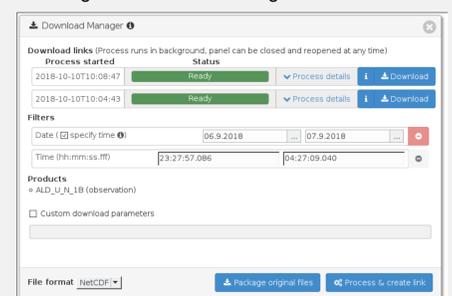
Data Selection

The GUI allows to combine selection by time, geolocation and parameter range. A spatio-temporal selection made by using the time slider and the globe widget takes also effect in the analytics panel. In the opposite direction filters set along any of the histogram axes are influencing what is displayed in the globe widget.



Data Download

Graphical data displayed in the globe widget and in the analytics panel can be saved as PNG images. Selected numerical data can be downloaded as NetCDF files together with the original Aeolus product files using the download manager.



Access

VirES for Aeolus will be available via <https://aeolus.services>

References

- [1] Pedrosa, D. S., Triebnig, G.: Visual Analysis of SWARM and Geomagnetic Model Data. Proceedings Living Planet Symposium 2016, ESA SP-740, 2016.
 [2] Costa, G., Reitebuch, O., Triebnig, G.: Aeolus VirES Tool. ADM-Aeolus CAL/VAL Rehearsal Workshop, Toulouse, France, 2017.

Acknowledgements

Contributions of Jos de Kloe, Gert-Jan Marseille (both KNMI) and Michael Rennie (ECMWF) are gratefully acknowledged.