

WINDLAB KNOWLEDGE AND DATA HUB

WHY WINDLAB? AN OPEN HUB FOR WIND RESEARCH AND INNOVATION

The **WindLab Knowledge and Data Hub** is an open platform designed to support data management, sharing and reuse in wind energy research. Developed within the **MERIDIONAL** project and co-created with **AIRE** and **FLOW**, it enables data-driven research on wind inflow, wake turbulence, wind farms and turbines.

WindLab provides a central access point where these datasets can be stored, documented and accessed in a structured way. A core principle of WindLab is the adoption of the **FAIR data principles** – making data Findable, Accessible, Interoperable and Reusable whenever possible. By lowering barriers to data access and reuse, the platform supports **reproducibility, transparency and knowledge transfer across the wind energy research ecosystem**.



WindLab
Knowledge & Data Hub

WHO IS WINDLAB FOR?



Academic researchers and scientists in wind energy



Engineers working on wind farm and turbine modelling



Developers of simulation, optimisation and analysis tools



Collaborators across research and industry

HOW WINDLAB IS BUILT: THE DIGITAL INFRASTRUCTURE

WindLab is deployed and maintained by **HLRS (High-Performance Computing Center Stuttgart)** and benefits from its **HPC (High-Performance Computing) and data storage infrastructure**, ensuring reliability and scalability.

The platform is built using **CKAN**, a widely adopted open-source data management system. CKAN was selected for its strong support of FAIR data principles, structured dataset publication and fine grained access control.

An **open access policy** applies. Dataset owners can decide whether data is public or restricted, allowing both open science and controlled access workflows.

WindLab is
accessible at

<https://windlab.hlrs.de/>



HOW WINDLAB IS BUILT: METADATA

Metadata refers to structured information that describes data, enabling its effective management and use across different contexts and disciplines.

WindLab uses structured metadata to **describe dataset content, origin and scientific context**, which is essential for ensuring that datasets remain understandable, discoverable and reusable over time.

In the context of wind energy research, high-quality metadata is crucial for interpreting datasets related to simulation settings, boundary conditions, models, assumptions and computational parameters.

Within MERIDIONAL, **descriptive and domain-specific metadata standards were analysed and selected** to best support wind energy applications.

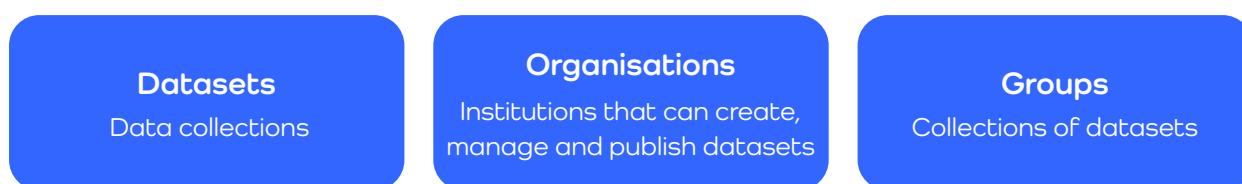
WindLab implements these standards through custom metadata templates. These templates enforce mandatory fields, support validation and ensure consistency across datasets. The MERIDIONAL metadata template, developed using this approach, **allows dataset providers to clearly document key attributes** while ensuring consistency across datasets.

WindLab provides metadata harvesting capabilities that enable the aggregation and presentation of metadata from external repositories. The tools developed support the discovery of wind energy research datasets on the Zenodo research data repository and display their corresponding metadata within the platform.

USING WINDLAB: WEB INTERFACE

The web interface is the main entry point to the WindLab platform. It provides a user-friendly graphical environment for browsing and managing data. The home page features a central search box that allows users to query datasets using keywords and metadata fields. The search and filtering functions enable users to quickly identify relevant datasets based on technical characteristics, project affiliation or data type.

Content within WindLab is organised around:



Datasets can be designated as public or private. Uploading data requires user registration and appropriate permissions.

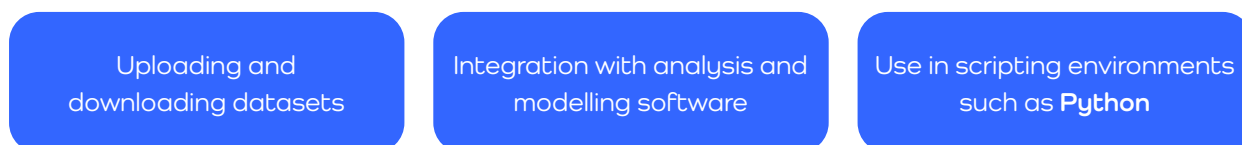
When uploading data, users have to:

- Upload the dataset (either as a file or via a public link).
- Complete the associated metadata template, including mandatory fields.
- Define access conditions and visibility.

USING WINDLAB: API

For advanced users, the **API** provides a powerful alternative to the web interface. Unlike the web interface, designed for human interaction, the API enables **machine-to-machine communication**, allowing WindLab to be integrated directly into modelling, simulation and analysis pipelines. This is particularly relevant for users working with large datasets or automated workflows.

The API supports:



The API has been tested using Python and is compatible with established wind energy tools, such as **TOPFARM** and **TopDesign**. This allows WindLab to be embedded directly into existing research pipelines.

WINDLAB SUSTAINABILITY

Long-term sustainability is ensured through **institutional hosting and a governance model**. Storage capacity is scalable and can be extended.

Researchers and industrial stakeholders benefit from improved discoverability of domain-specific datasets and standardised metadata structures, facilitating data reuse and reproducible research.

WindLab strengthens the European research and innovation ecosystem by promoting FAIR data practices, enabling cross-sector collaboration, and reducing fragmentation of wind energy data resources.



Find us on    **MERIDIONAL EU**

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