



AVIATION TWIN TRANSITION CLUSTER

A E U R O P E A N I N I T I A T I V E F O R A S U S T A I N A B L E F U T U R E

RefMap Clustering Event 2025

Advancing Sustainable Aviation & Urban Air Mobility

RefMAP Platform

Dr. Sotirios Xydis

Assistant Professor School of ECE, National Technical University of Athens (NTUA)
Senior Researcher of Institute of Communication and Computer Systems (ICCS)



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Reducing Environmental Footprint through transformative Multi-scale Aviation Planning



RefMap will create a **digital service** that optimises flight trajectories on **both micro and macro levels**.

By using environmental data, such as wind, noise, CO2 and non-CO2 emissions, **RefMap's analytics platform** will help **Airlines and Unmanned Aerial Systems** make more eco-friendly decisions.





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The Goal: RefMap Platform



Funded by
the European Union

RefMap Dashboard

Large scale tools

Small scale tools

Climate Impact

Large Scale

Analyze and visualize the environmental impact of projects or activities.

LAUNCH

DOCUMENTATION

Emissions

Large Scale

Calculate and monitor greenhouse gas and pollutant emissions for large-scale operations or infrastructure.

LAUNCH

DOCUMENTATION

Atmospheric Pollution

Large Scale

Assess air quality and model the dispersion of atmospheric pollutants over wide areas.

LAUNCH

DOCUMENTATION



Path Optimization

Large Scale

Optimize transportation or logistics routes for efficiency, cost, and environmental impact.

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DOCUMENTATION

Noise Assessment

Small Scale

Evaluate and map noise levels for small sites, buildings, or local environments.

LAUNCH

DOCUMENTATION

Wind Assessment

Small Scale

Analyze wind patterns and potential for small-scale wind energy or site planning.

LAUNCH

DOCUMENTATION

Hidden Challenges

**RefMAP Platform
Analyses**

User Interface Design

Workload Diversity

Big Data Analytics

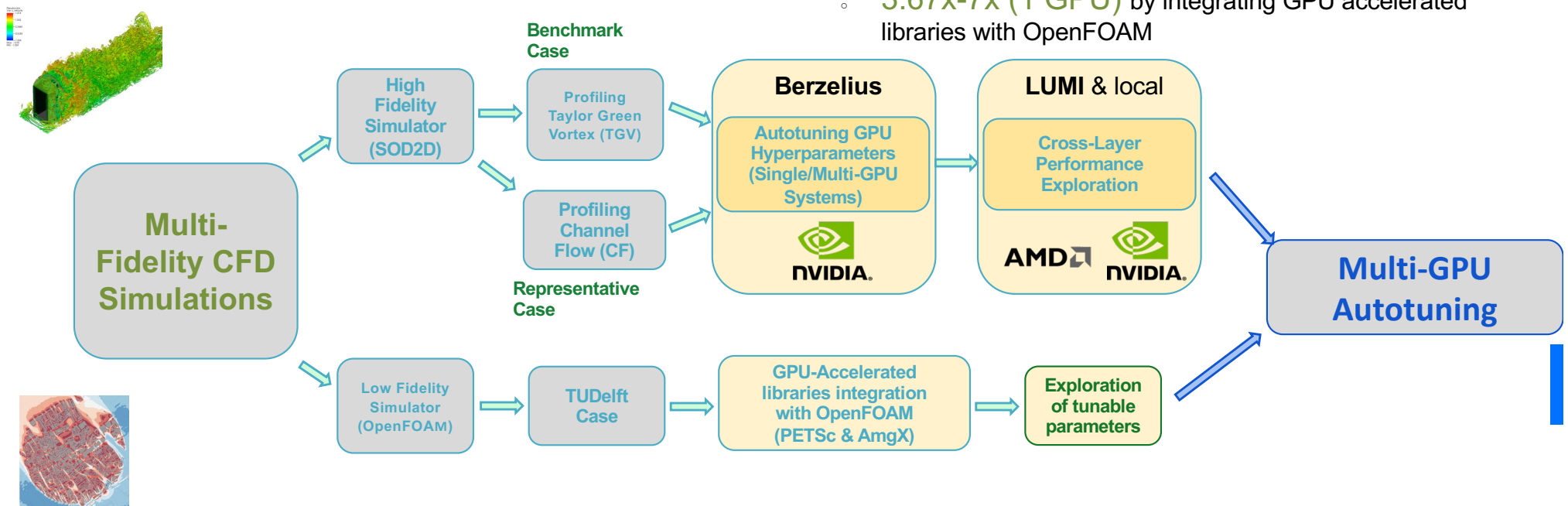
High Performance Computing

Objectives

- Optimize **CFD simulations**
- Leverage **multi-GPU systems**
- Develop **auto-tuning** techniques
- Perform **cross-vendor**, precision and **optimization** performance analyses
- Provide more data, of higher quality, for Airflow Surrogate model training

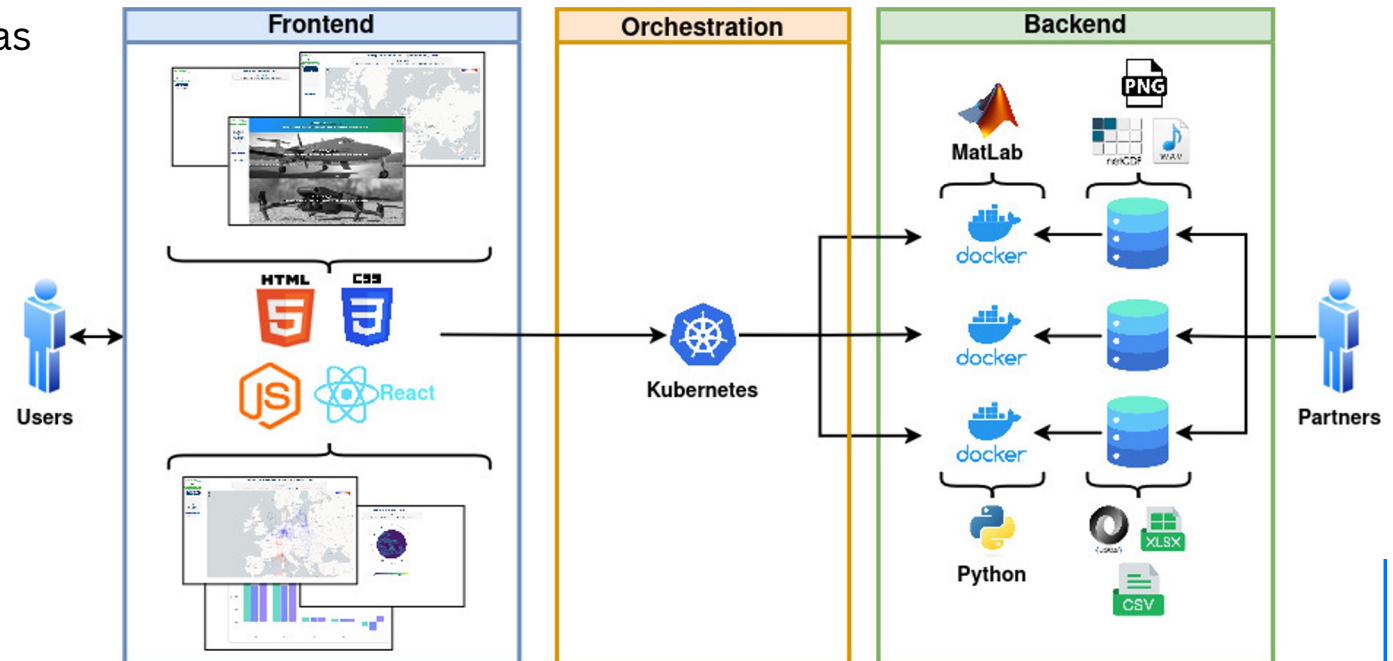
Main Achievements

- High Fidelity:**
 - Autotuning:
 - TGV case: 1.1-6x, depending on configuration
 - CF case: 1.07-1.2x, depending on configuration
 - Optimization range: **Up to 3.96x** in cross-layer analysis
- Low Fidelity Simulations:**
 - 3.67x-7x (1 GPU)** by integrating GPU accelerated libraries with OpenFOAM



- **Front-end**
 - Lightweight tasks (UI)
- **Back-end**
 - Computation intensive tasks as micro-services (analytics, visualizations, data mgnt)
- **Containerization**
 - Technologies Packaging
 - Ease of deployment
 - Tools/Runtime variability
- **Orchestration**
 - On-demand scalability
 - Cloud readiness
 - Develop once – deploy everywhere
 - Tools/Runtime variability

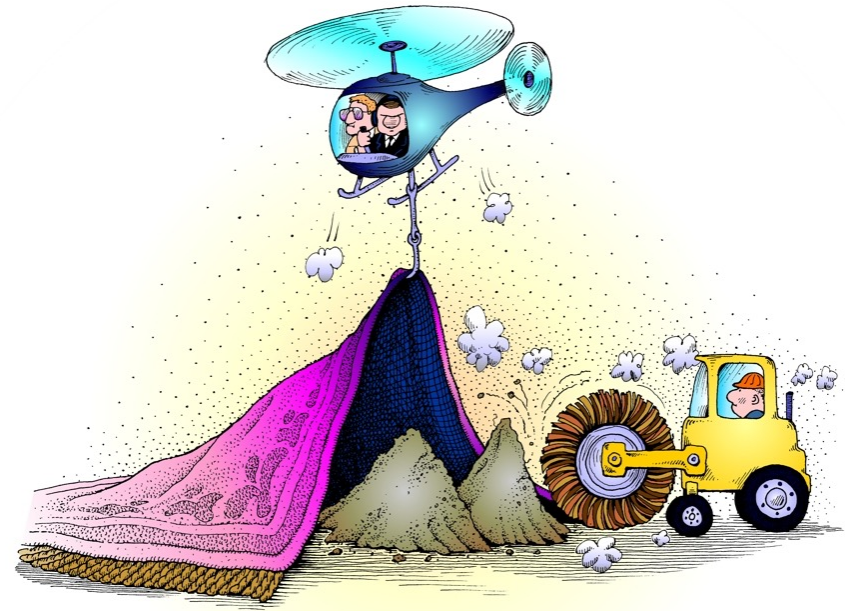
Hierarchical SW Stack



- **Minimal User Interaction** with RefMAP platform is constrained around only the following 3 aspects

- ✓ Tool specific documentation
- ✓ Informative Visualizations
- ✓ Expressive filters

Sweep “complexity” under the rug



Climate Impact Tool

Date
2022-01-01

Data Type
CO₂

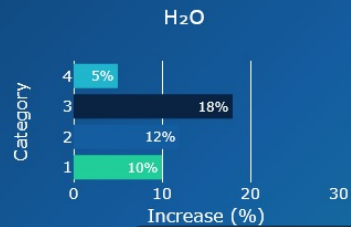
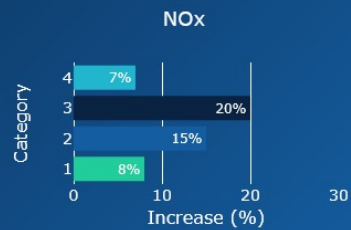
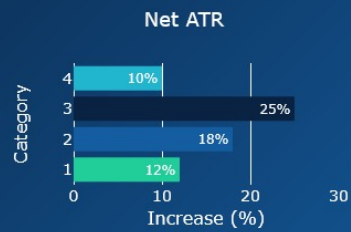
Scale
Local

Cost
Low

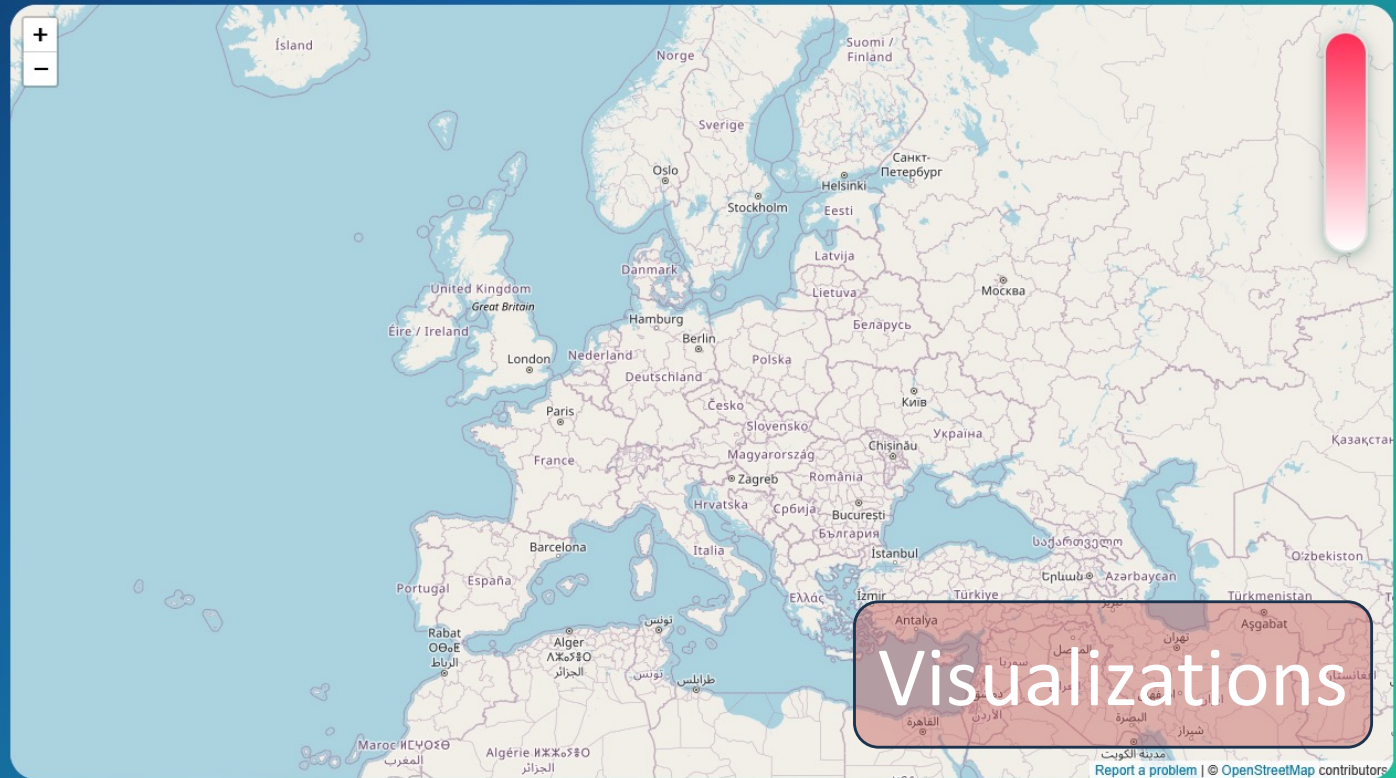
Flight Level
Ground

Time
Morning

Filters



Metrics





Wind Assessment Tool



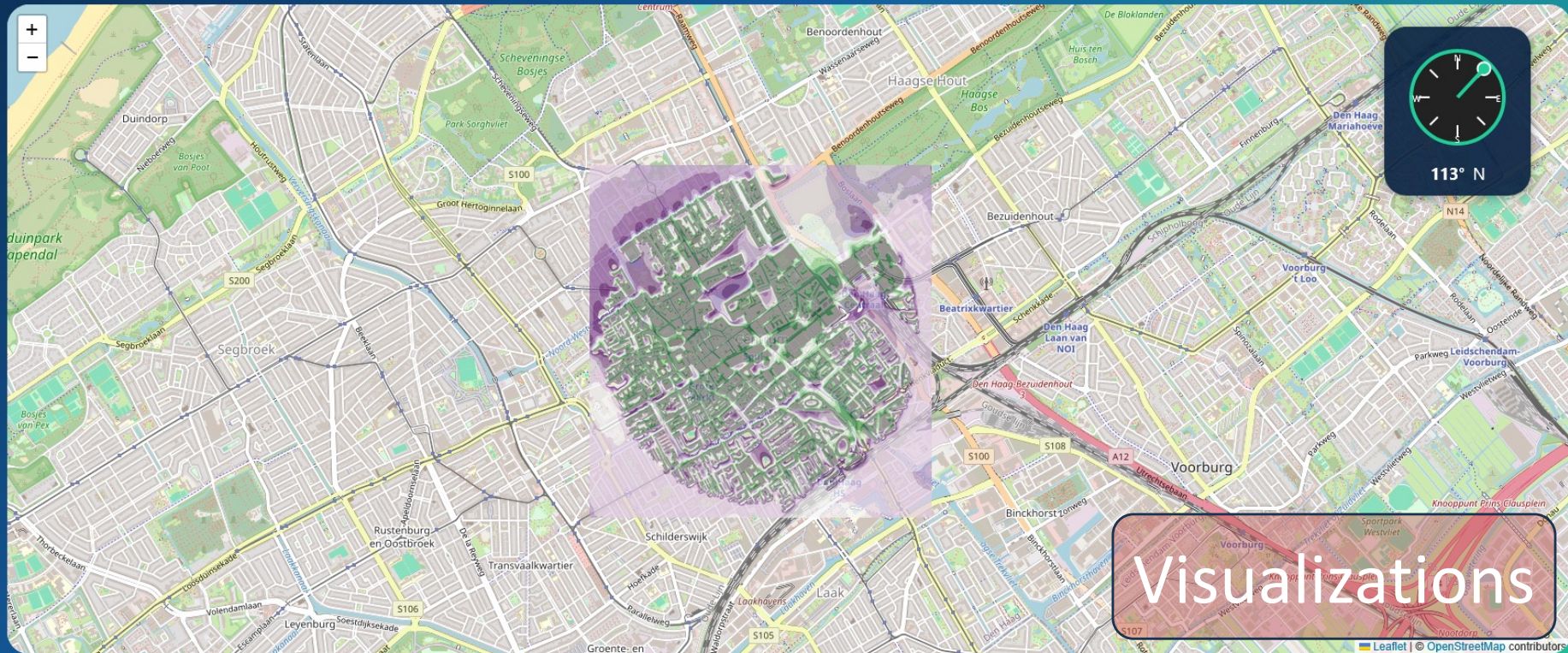
LoD
lod1p2

City
denhaag

Parameter
TKE

Altitude
10

Filters



Visualizations

**thank you
for your attention!**

Contact info: sxydis@microlab.ntua.gr

Microprocessors and `Digital Systems
Laboratory: www.microlab.ntua.gr



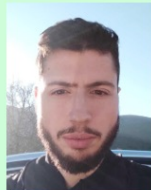
G. Anagnostopoulos
PhD Student



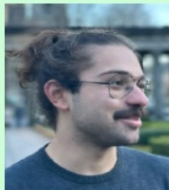
K. Iliakis
Postdoc Researcher



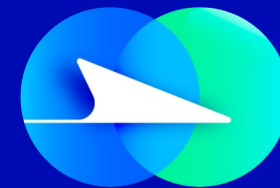
P.-E. Eleftherakis
PhD Student



A. Kapetanakis
Research Associate



**Q&A /
Closing**





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