owemes Offshore Wind and other marine renewable Energy in Mediterranean and European Seas

The pool of *Italian* skills on off-shore wind

A survey on Italian research eco-system on FOW &c

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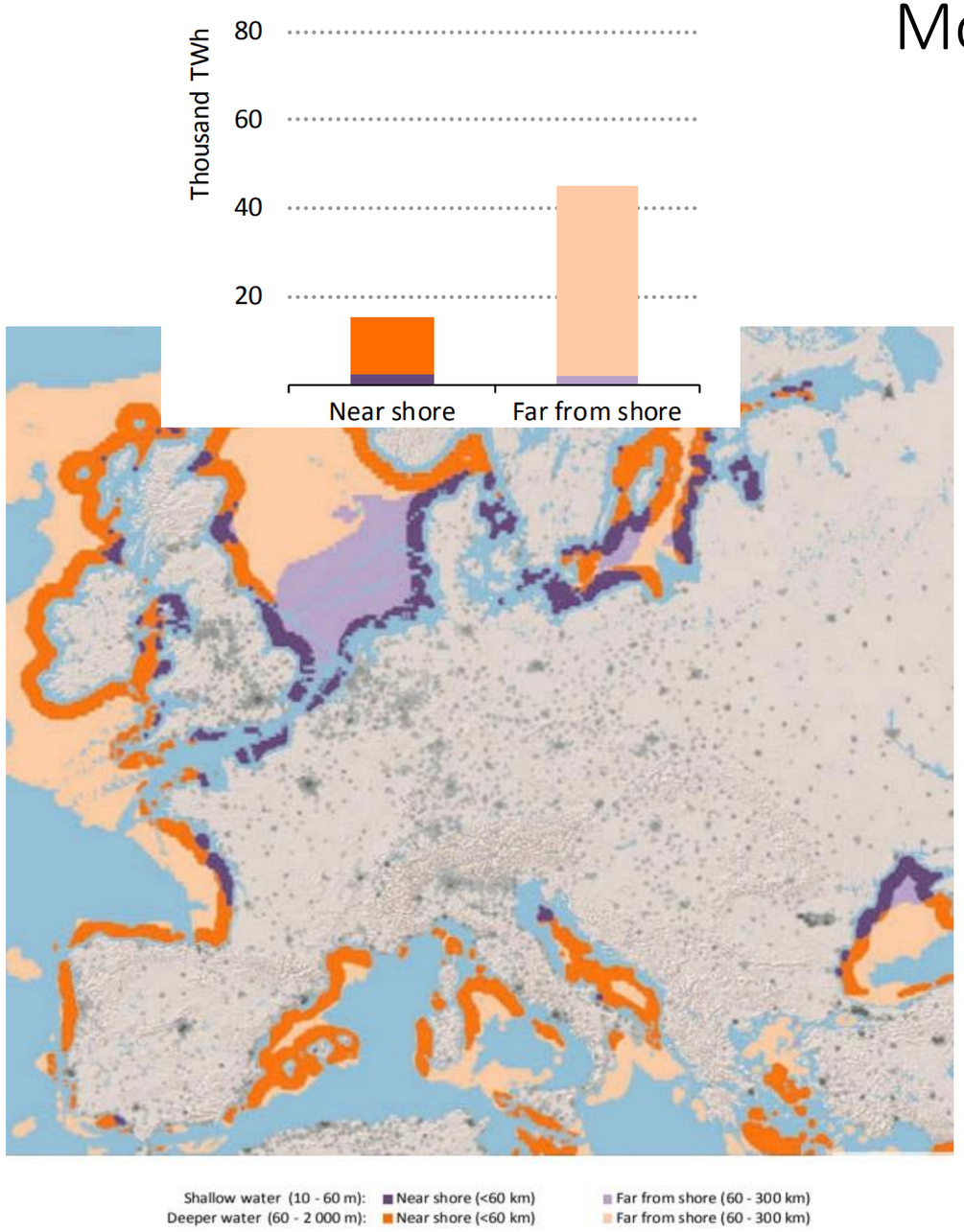
Motivations



- Secondo il GWEC*, l'Italia è il terzo mercato per potenziale di eolico galleggiante nel mondo

- Secondo il Politecnico di Torino, il potenziale di eolico offshore galleggiante in Italia è pari a:

o Capacità: 207,3 GW (x 3,4 la capacità installata di FER nel 2022)

o Generazione: 540,8 TWh/a (pari a 1,7 volte la domanda di elettricità nel 2022)

- La maggior parte del potenziale di eolico offshore galleggiante concentrato in Sicilia e in Sardegna

Motivations

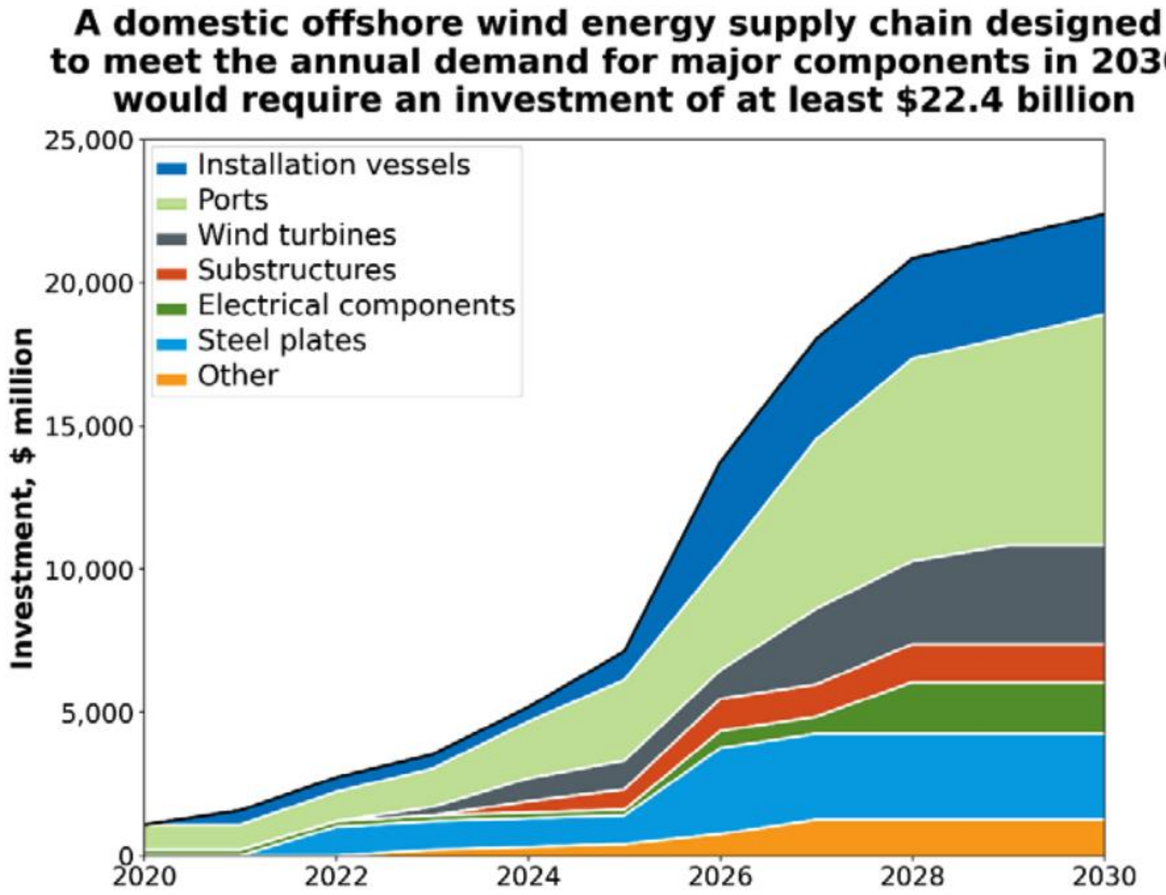


Figure ES2. Cumulative investment over time in the major components of a domestic offshore wind energy supply chain.

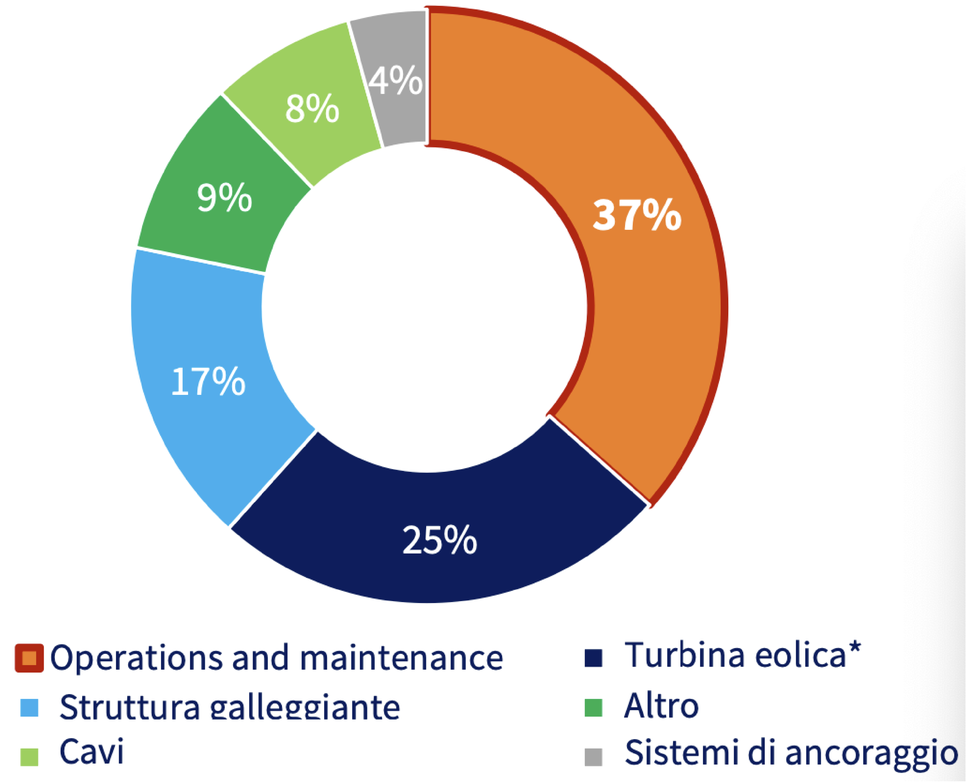
Fonte: A Supply Chain Road Map for Offshore Wind Energy in the United States, NREL, 2023

Motivations

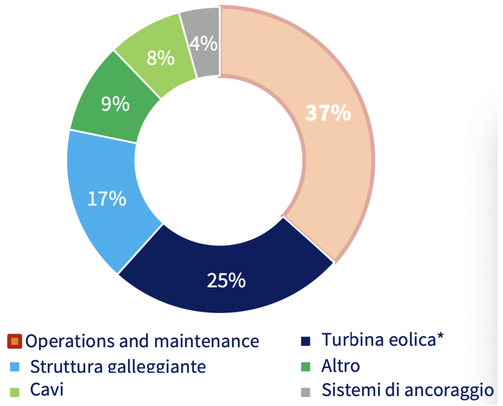
Leadership *value chain* italiana

- produzione di acciaio, che potrebbe essere il materiale dominante per le piattaforme galleggianti
- prima per valore della produzione di strutture in ferro e acciaio
- prima nella produzione di navi e imbarcazioni, cruciali durante la fase di installazione e O&M delle turbine galleggianti
- (leadership nel settore di tecnologie e servizi off-shore derivata dal mondo Oil&Gas)
- *Assenza di OEM turbine eoliche di grande taglia*

Costo totale di un parco eolico *offshore* galleggiante per categoria (valori %), 2023



Fonte: The European House - Ambrosetti su BVG Associates, Catapult, Offshore Renewable Energy, The Crown Estate, Crown Estate of Scotland e Floating Offshore Wind Centre of Excellence, 2023



Wind Implementation Working Group

Target 3 – Wind manufacturing capacity

New proposal: **At least 2GW of wind manufacturing capacity added per year in the IWG Wind members' countries**, supported by the implementation of R&I projects* that will add manufacturing capacity at the national level **(automation, optimisation of manufacturing processes, optimisation of materials use, logistics, supply-chain etc.)**

In line with the Net Zero Industry Act and the EU target of 36GW / year of deployed capacity.

Target 4 – Recycling

New proposal: **Each Member States dedicates R&D budget to materials recovery technologies** including recycling and **critical raw materials**.

In line with the Critical Raw Materials Act and the EU target of recycling capacity.

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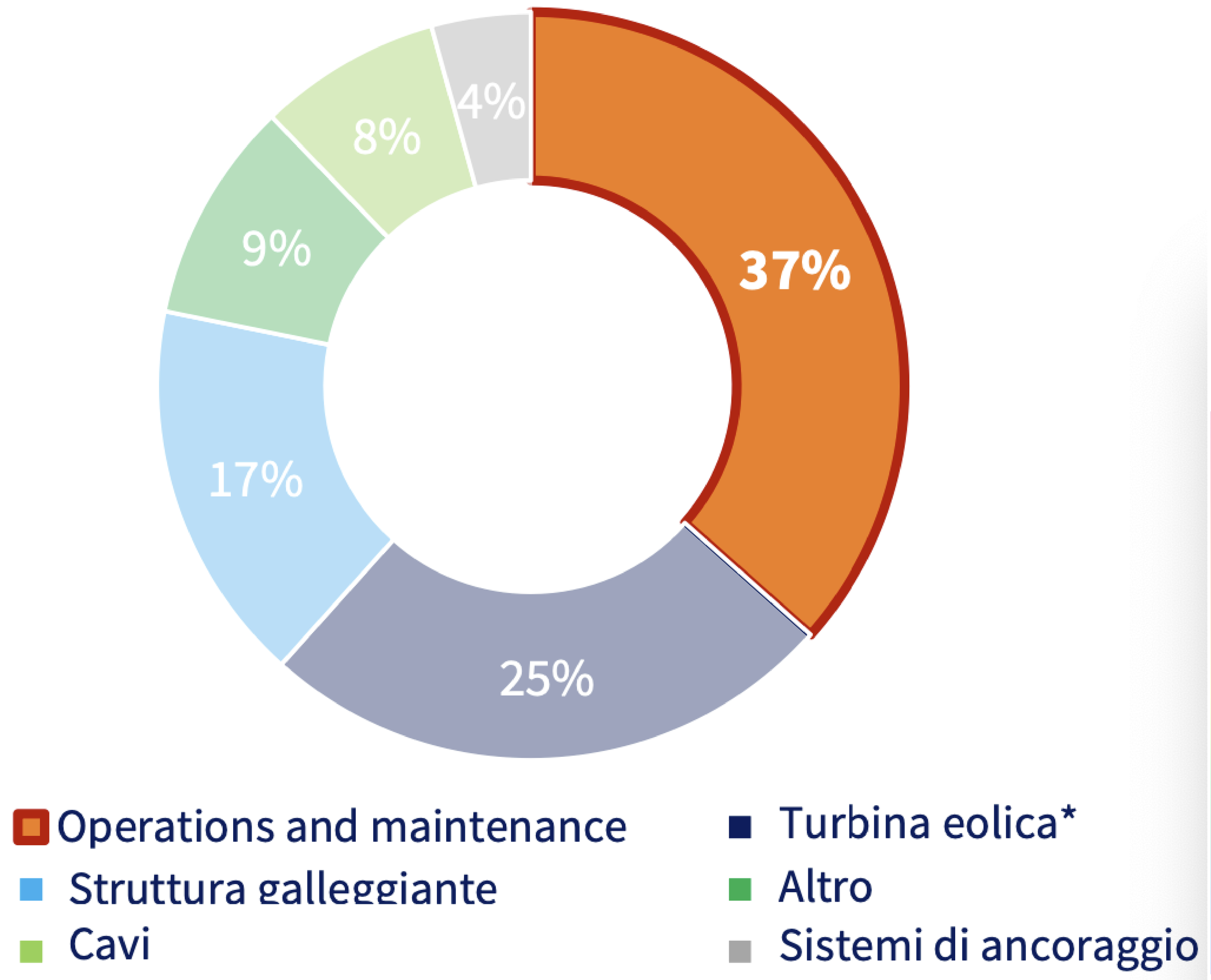
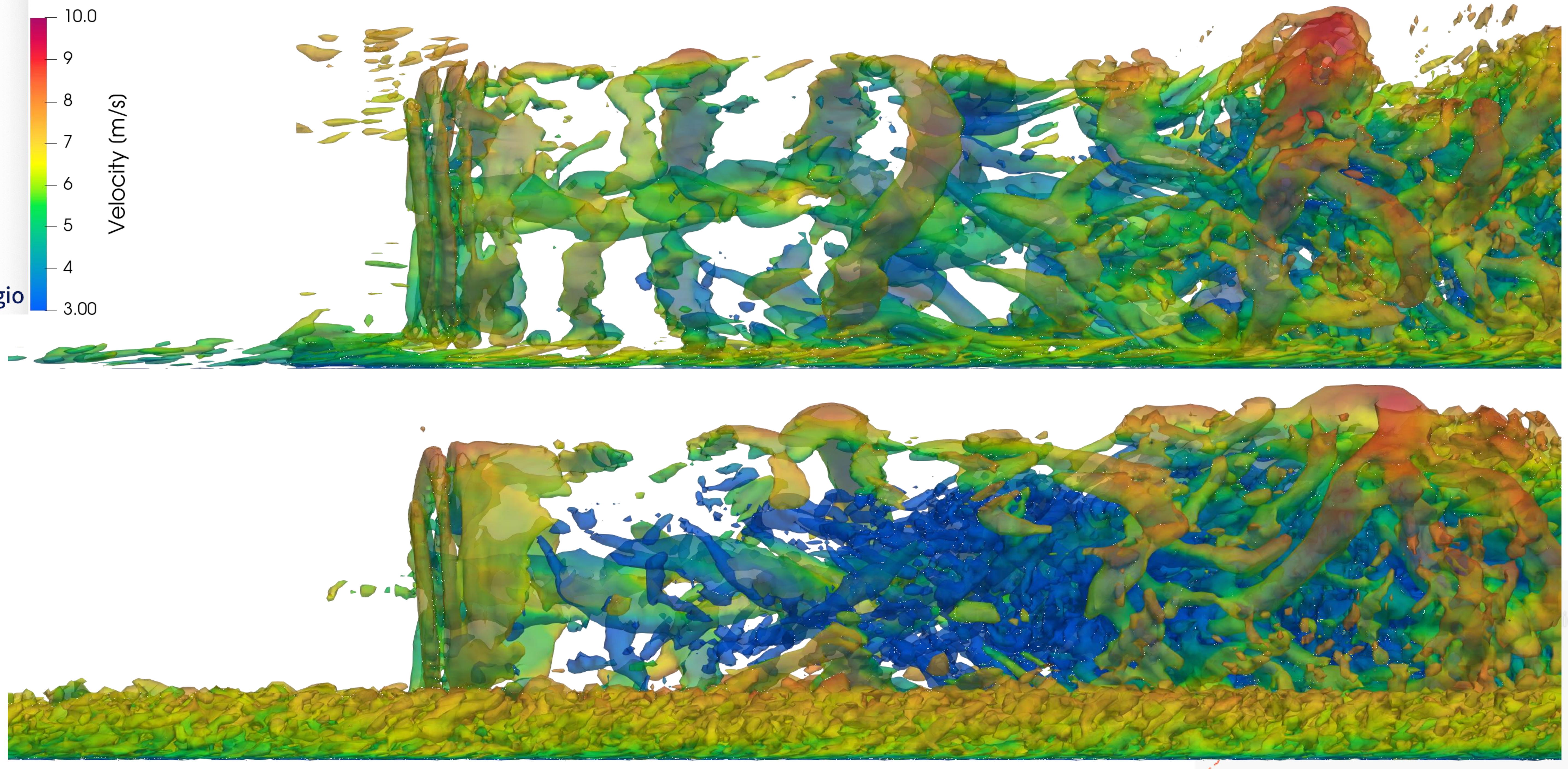
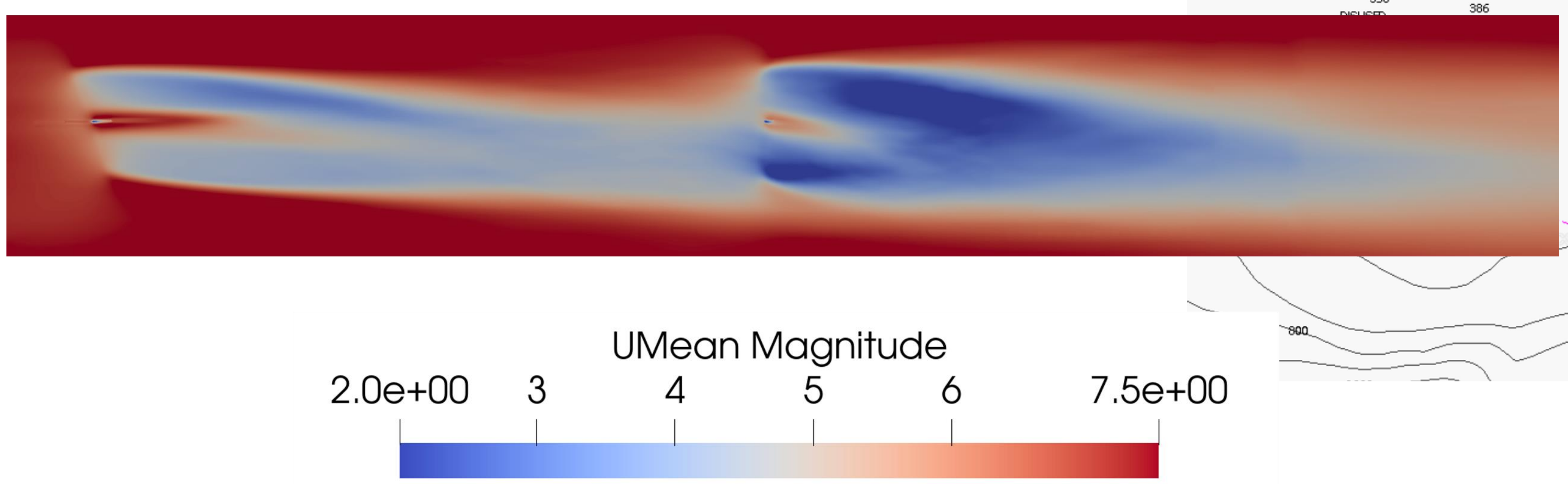
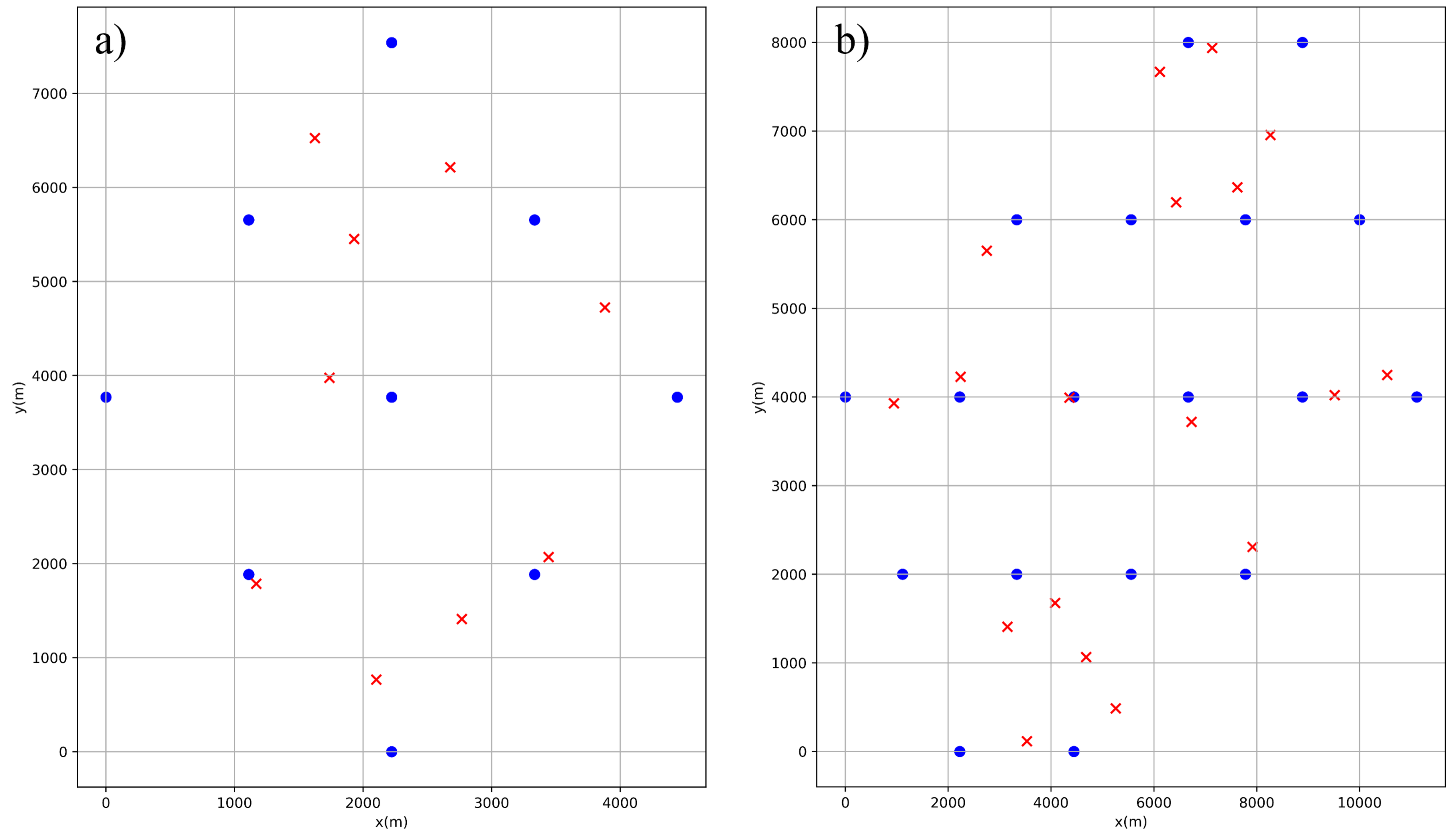
Challenges

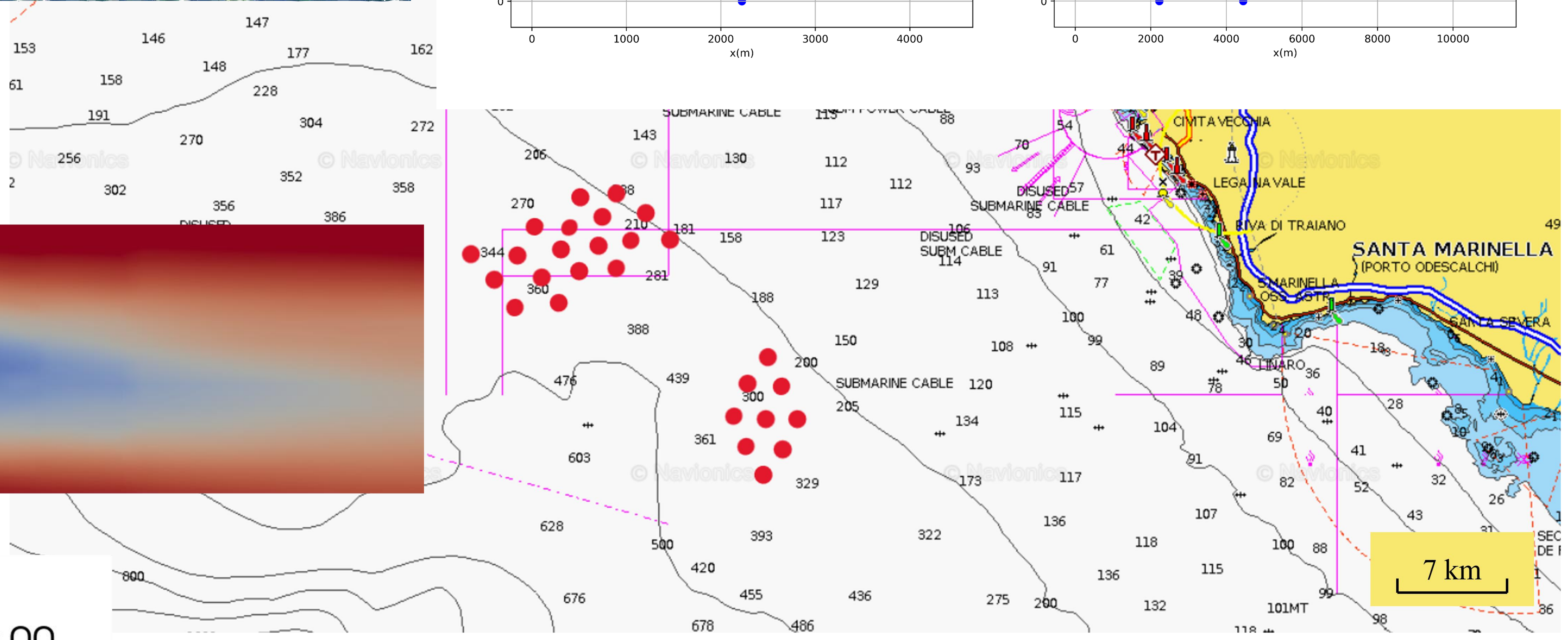






Ottimizzazione di un parco eolico offshore al largo di Civitavecchia: dal micro-siting al controllo dell'imbardata, De Girolamo et al., 2023





The pool of *Italian* skills on off-shore wind

Rationale

Objectives

- **Map** the **research ecosystem** on FOWT in Italy (wrt Europe)
- Estimate strenght of collaborative effort among **Institution**

- **Assess** the R&D quality
  - **publications** on indexed journals&conferences
  - **patents** in collaboration with italian universities
  - funded **peer-reviewed projects** with italian partners on FOWT

Survey criteria

Methodology design

- **Database selection** (Scopus, G-patents, Cordis, &c)
- **Queries** (title,abstact, keywords, affilitation, &c)
- **Filtering criteria** (n. collaborations, n. papers, &c)
- **Visualization** (histograms, graphs…)

Search & *discover*

Database search

- Apply queries
- Data export

Filter

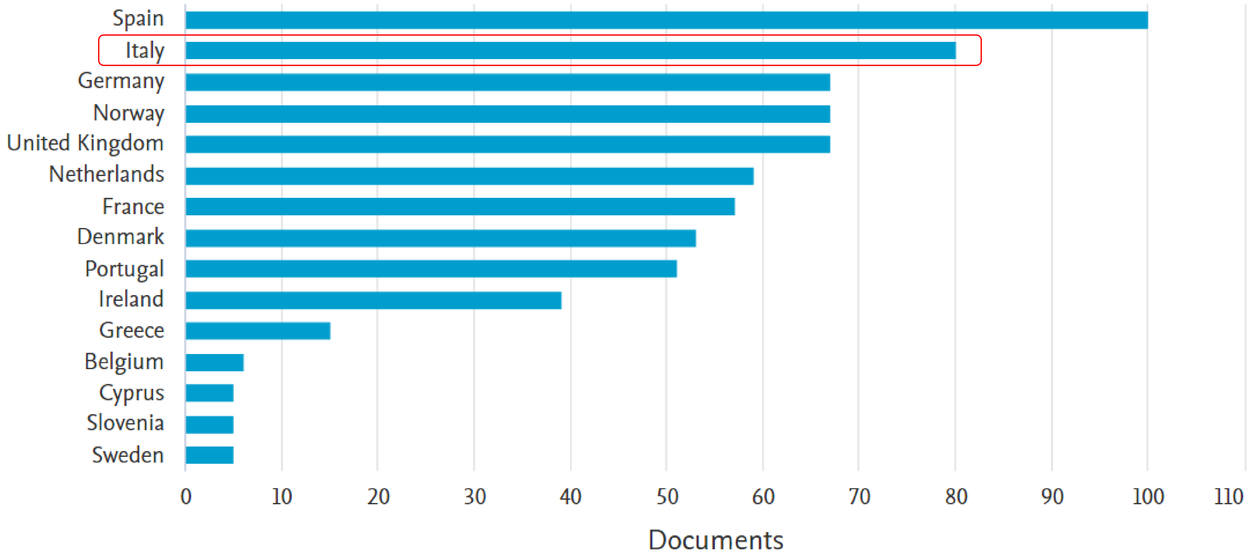
- Apply filter criteria

Visualization

- Check **readability**
- Check **representiveness**

SCOPUS search

Title: “off-shore&floating&wind” and “affiliation EU”



SCOPUS search

Keywords: “off-shore floating wind”, “2001-2023”&”Italian affiliations”

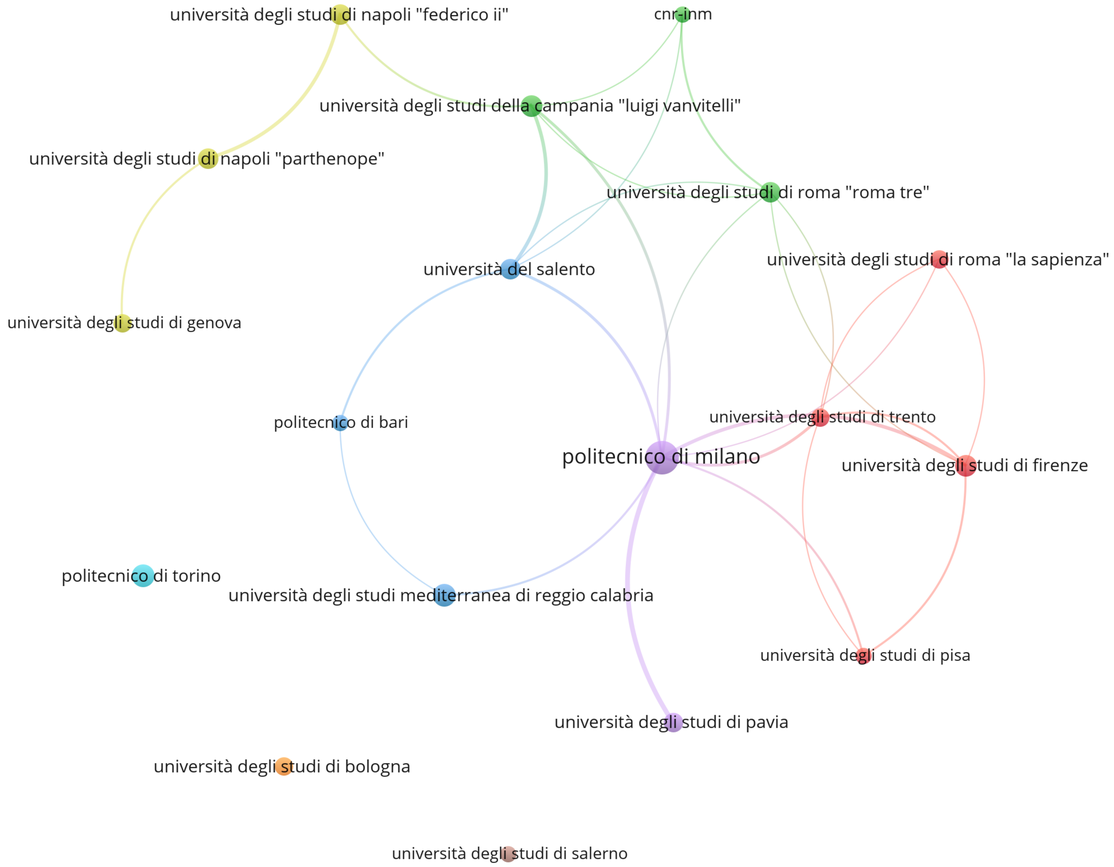
Results

145 papers from 39 universities and research institutions

nodes, 18 institutions with at least 3 published papers

arcs drawn to illustrate collaborative works

Rem. collaborations w international partners aren’t shown



International Energy Agency

The number of Italian participants in the IEA Wind TCP Tasks has increased significantly (*2021, Italy participated in tasks 11, 25, 30, 34, 41, 47, 48, and 49)*

Task 30
Offshore Code Comparison Collaboration, Continuation, with Correlation and uncertainty

Task 41
Enabling Wind to Contribute to a Distributed Energy Future

Task 47
TURBulent Inflow Innovative Aerodynamics (TURBINIA)

Patents

https://patents.google.com
Search terms: “floating”&”offshore”&”wind” and “country:IT” and “year: since 2000”

Floating structure for wind turbines, O Me R Officine Riunite S.r.l., 2006

Joint for modular wind blade and modular wind blade comprising said joint, Castorrini A, Corsini A, Rispoli F, Sciulli F, 2014

Support tower, particularly for a wind turbine, Micoperi Energia S.r.l., 2015

Infrastructura flotante en alta mar para explotar la energia eolica, Kite Gen Research S.r.l. et al., 2015

Rigid oscillation damping and control system for floating systems, in particular for offshore wind systems, Università degli Studi Mediterranea di Reggio Calabria, 2019

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Peer-reviewed projects

Database: CORDIS & other EU databases

Search terms: “floating”&”offshore”& “wind” 36 projects in Europe (2 with Italian partners)

POWERED (2011-2015)
IPA Crossborder 2007-2013 Programme
Project of Offshore Wind Energy: Research, Experimentation and Development
Università Politecnica delle Marche – Regione Marche

CoCoNet (2012-2016)
FP7 project (European Commission, CROS)
Towards COast to COast NETworks of marine protected areas coupled with sea-based wind energy potential.
CNR - ISMAR
CoNISMa (Consorzio Nazionale Interuniv Scienze del Mare)
COISPA Tecnologia e Ricerca

SEAFLOWER (2021-2024)
Horizon 2020 project
Support the development of floating solutions from the geotechnical standpoint, contributing towards overcoming some of the current technical barriers of wind energy exploitation in deep waters
Università degli Studi di Bologna

FLOATECH (2021-2024)
Horizon 2020 project
“Offshore wind basic science and balance of plant”
Università degli Studi di Firenze, Università di Napoli Federico II
Seapower, Saipem

Database: TETHYS

Search terms: ”offshore”
18 projects World (1 with Italian partners)

MORE-EST Platform (2010-2019)
RES is a web platform that supports maritime stakeholders in the exploitation of wave energy resource
Politecnico di Torino

Next Gen-EU (2022-2024) projects
e.g. PE NEST
“Spoke 2 – Offshore energy”
Politecnico di Bari, Politecnico di Milano, Politecnico di Torino, Sapienza Roma, Univ Cagliari, Napoli Federico II, CNR INM *et al.*

ICSC
Centro Nazionale di Ricerca in HPC, Big Data and Quantum Computing

NEST
NETWORK FOR ENERGY SUSTAINABLE TRANSITION

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NEST – Network 4 Energy Sustainable Transition

SPOKE 2 - ENERGY HARVESTING & OFF-SHORE RENEWABLES

LEADER	POLIBA
CO-LEADER	UNICA
Steering Committee - R&D Participants	POLIBA, UNICA, POLITO, POLIMI, UNIROMA1, UNINA, CNR
Other partecipants	UNICAL - UNIVAQ

Objectives

- Develop demonstration Offshore wind projects, suitable for the Mediterranean area
- Fill the gap from pilot-plant to demonstration project for wave/currents energy converters
- Improve the power-take-off performance by means of advanced technologies (blade morphing, and adaptive geometries)
- Develop the concept of integrated infrastructure exploiting the potential of combined wind/wave energy production and/or wave attenuation
- Develop new design for geothermal energy uses in buildings and agriculture and energy storage
- Develop and testing of novel devices for energy harvesting and conservation

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Systems for optimizing annual energy production from wind turbines based on reducing aerodynamic interference between machines and environmental derating

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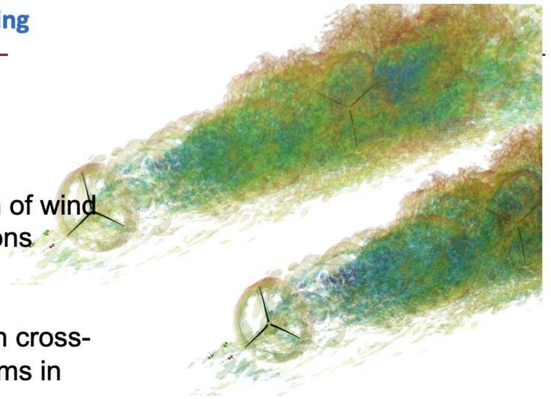
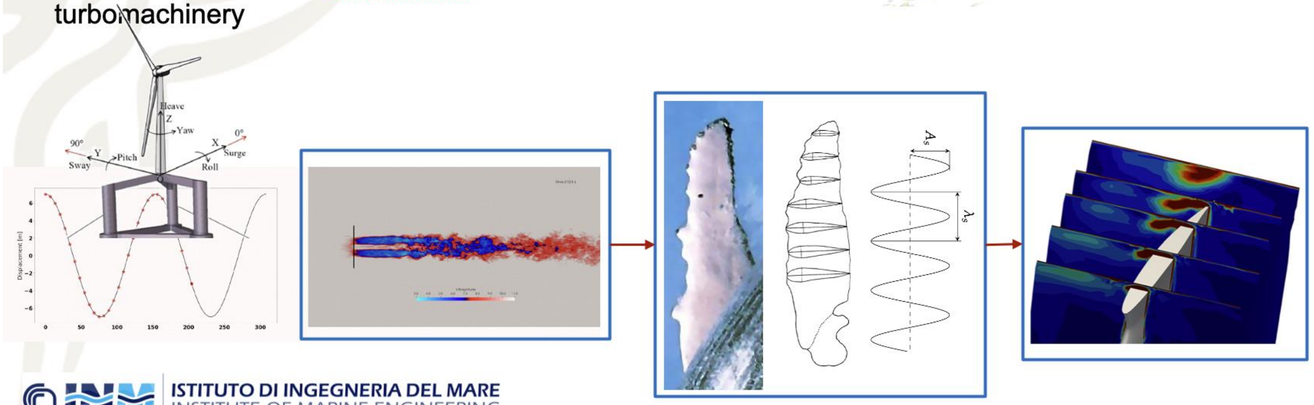


Activity I: passive systems for wake effect reduction

- Development of reliable CFD methods for simulation of wind turbines wakes, wake-rotor & wave-turbine interactions

- Verification of new blade refitting strategies based on cross-fertilization of passive *bio-inspired* flow control systems in turbomachinery

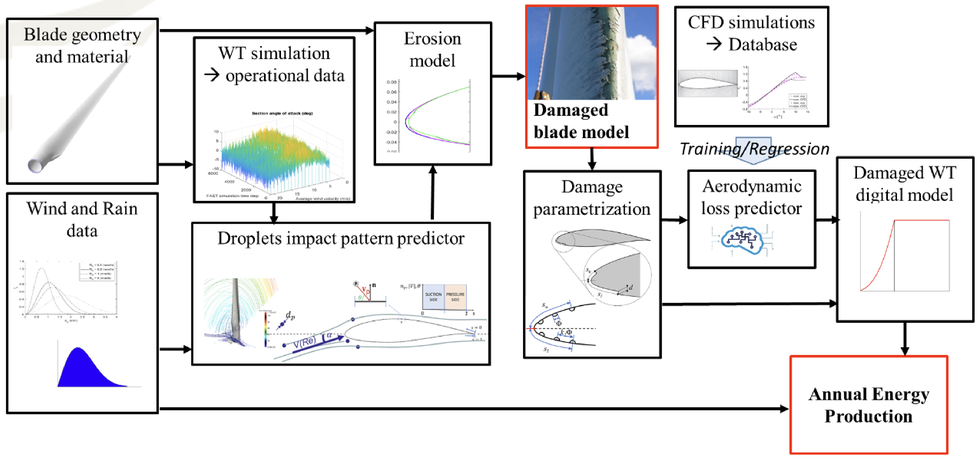


ISTITUTO DI INGEGNERIA DEL MARE
INSTITUTE OF MARINE ENGINEERING

Systems for optimizing annual energy production from wind turbines based on reducing aerodynamic interference between machines and environmental derating

Activity II: Damage and energy loss prediction systems and Development of integrated simulation tools for fast and reliable prediction of:

- Erosion damage progression on the blades
- Impact of leading edge erosion damages on wind turbine performance and energy production



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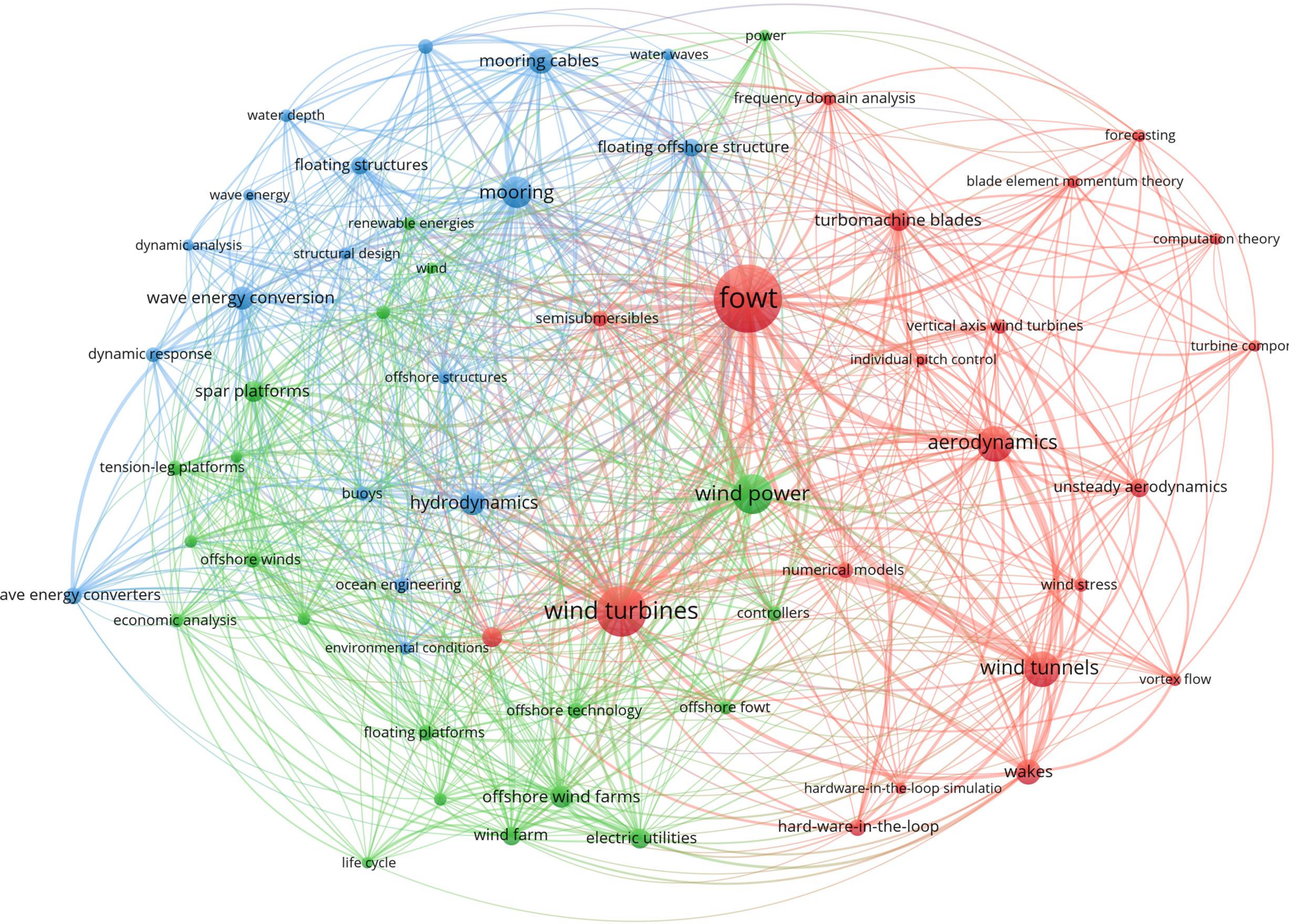
Concluding remarks, research keywords



Method: Density-based clustering
Database: Keywords from Scopus queries

Results: 3 clusters

red – aero studies on WT blade and components

green – system and operation tecno-economic analyses

blu – floater, mooring and wave-WT interactions

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