Federica Benassi

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PROFILE

PhD student in Ocean Sciences with a strong background in Physics and Data Science. My research focuses on integrating machine learning with oceanography to understand and predict physical and biogeochemical processes. I am developing data-driven tools for two main lines of investigation:

- 1. satellite-based detection and quantification of lateral carbon export from coastal upwelling systems using unsupervised clustering of (sub)mesoscale filamentary structure;
- 2. wave forecasting on unstructured meshes using Graph Neural Networks trained on multi-source ocean-atmosphere data.

EDUCATION

 PhD student in Future Earth, Climate Change and Societal Challenges Nov 2023 - present University of Bologna and Euro-Mediterranean Center on Climate Change Bologna, Italy • Supervisors: Ivan Federico, Lorenzo Mentaschi, Nadia Pinardi Thesis: Artificial intelligence for oceanographic interdisciplinary modelling · Focus: GNN-based wave modeling and satellite-based carbon flux estimations across the shelf break M.Sc. Degree in Physics of the Earth System Sep 2021 - Oct 2023 University of Bologna Bologna, Italy Final mark: 110/110 cum laude (GPA: 4.0) Thesis title: Estimating the export of biomass across the shelf break via AI applied to satellite images Developed unsupervised clustering methods for filament detection and POC export estimation in Eastern Boundary Upwelling Systems

B.Sc. Degree in Physics

- University of Modena and Reggio Emilia
- Final mark: 110/110 cum laude (GPA: 3.5)
- Thesis title: Computational study of electronic and optical properties of Dibenzoterrilene

RESEARCH EXPERIENCE

Visiting Master's student

Alfred Wegener Institute for Polar and Marine Research Member of the PhytoOptics Group, Physical Oceanography Section

 Designed and tested a clustering pipeline to identify and track filaments linked to lateral carbon export in satellite imagery

TEACHING AND OUTREACH

COMPASS School Lecturer

University of the Philippines Diliman

Quezon City, Philippines Delivered a 2-hour lecture and practical lab on unsupervised learning for pattern recognition in marine productivity datasets in the Philippines' shelf

Virtual Lab on Ocean Acidification (High School Program)

University of Bologna

 Prepared an interactive Google Colab laboratory for data processing and visualization in Python, focused on sea surface temperature and pH using the Mediterranean Sea Reanalysis dataset

Python Basics Course (Master's Students)

University of Bologna

 Prepared and taught an 8-lectures introductory course on Python for students in the Science of Climate Master's program

PUBLICATIONS

Benassi, F., Pinardi, N., Siedlecki, S., Mentaschi, L., Bianconcini, S., & Federico, I. (2025). Shelf water carbon [1] export from the Atlantic and Pacific Eastern Boundary Upwelling Systems: A satellite-based estimation. Submitted to Geophysical Research Letters.

Apr - Jun 2023

Sep 2017 - Sep 2020

Modena, Italy

Bremerhaven, Germany

Apr - May 2024 Bologna, Italy

1-7 Mar 2025

Mar - May 2023

Bologna, Italy

CONFERENCES, SEMINARS AND WORKSHOPS

- [P.3] F. Benassi, N. Pinardi, S. Siedlecki, L. Mentaschi, S. Bianconcini, I. Federico. Shelf water carbon export from the Atlantic and Pacific Eastern Boundary Upwelling Systems: a satellite-based estimation. EGU General Assembly 2025 (Vienna, Austria, 29 Apr 2025)
- [P.2] F. Benassi, N. Pinardi, L. Mentaschi, I. Federico, S. Bianconcini, S. Siedlecki. Shelf water carbon export from the Atlantic and Pacific Eastern Boundary Upwelling Systems. CoastPredict General Assembly (Lecce, Italy, 6 Feb 2025)
- [P.1] F. Benassi, N. Pinardi, L. Mentaschi, I. Federico, S. Bianconcini. Estimating the lateral export of biomass across the shelf break via an unsupervised learning framework applied to satellite images.

ESA-ECMWF Workshop on Machine Learning for Earth System Observation and Prediction (Frascati, Italy, 7 May 2024)

[0.1] F. Benassi, N. Pinardi, S. Bianconcini, A. Bracher. Estimating the export of biomass across the shelf break via Al applied to satellite images. EUMETSAT Meteorological Satellite Conference (Malmo, Sweden, 12 Sep 2023)

CODING SKILLS

- **Python (advanced):** data visualization (Matplotlib, Seaborn, Cartopy); data manipulation (Pandas, Xarray); scientific computing (NumPy, SciPy); machine and deep learning (Scikit-learn, Keras, PyTorch)
- R (intermediate)
- Bash (intermediate)

TEXT PRODUCTION SKILLS

- LaTeX (intermediate)
- Office package (intermediate)

LANGUAGES

- Italian: native speaker
- English: proficient user (overall IELTS score 7.5, C1)
- French: basic user (A2)

HONORS AND AWARDS

Best Master's Thesis Award

Dept. of Physics and Astronomy, University of Bologna

• Awarded as part of a departmental call recognizing the best theses among on-time MSc graduates during 2023

Bologna, 5 May 2025

Foto Benessi