



Corso di Dottorato di Ricerca in Scienze della Vita e dell'Ambiente - Ciclo XXXVI

Response of phytoplankton communities to a changing Adriatic Sea: the over 30 yrs story of a LTER marine area.

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Introduction

Phytoplankton community dynamics are considered as a key indicator to detect changes in the marine ecosystems as they show a rapid turnover, and they are directly related to the abiotic parameters. The Northern Adriatic Sea, represents one of the most productive areas of the Mediterranean Sea, due to the shallow depth and high riverine inputs. The objective of my PhD research is to evaluate the changes in terms of physico-chemical parameters, and abundance and composition of phytoplankton communities in the northern Adriatic Sea, related to meteorological and hydrological variations, and to anthropogenic pressures. Furthermore, the aim is also to depict a detailed information on the community structure and composition of phytoplankton community in terms of both abundances and significant taxa, the main constraints affecting their trends and the effects of extreme climate events.

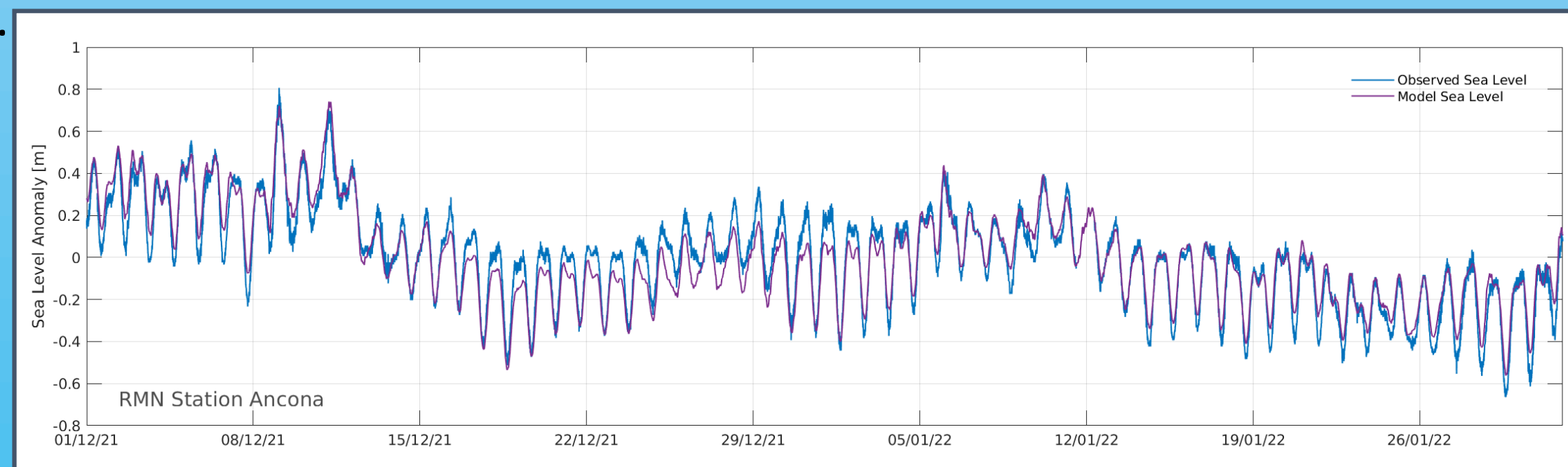
Keywords: long term ecological research; phytoplankton; big data; meteorological and anthropogenic effect

Part 1: validation of an oceanographic model

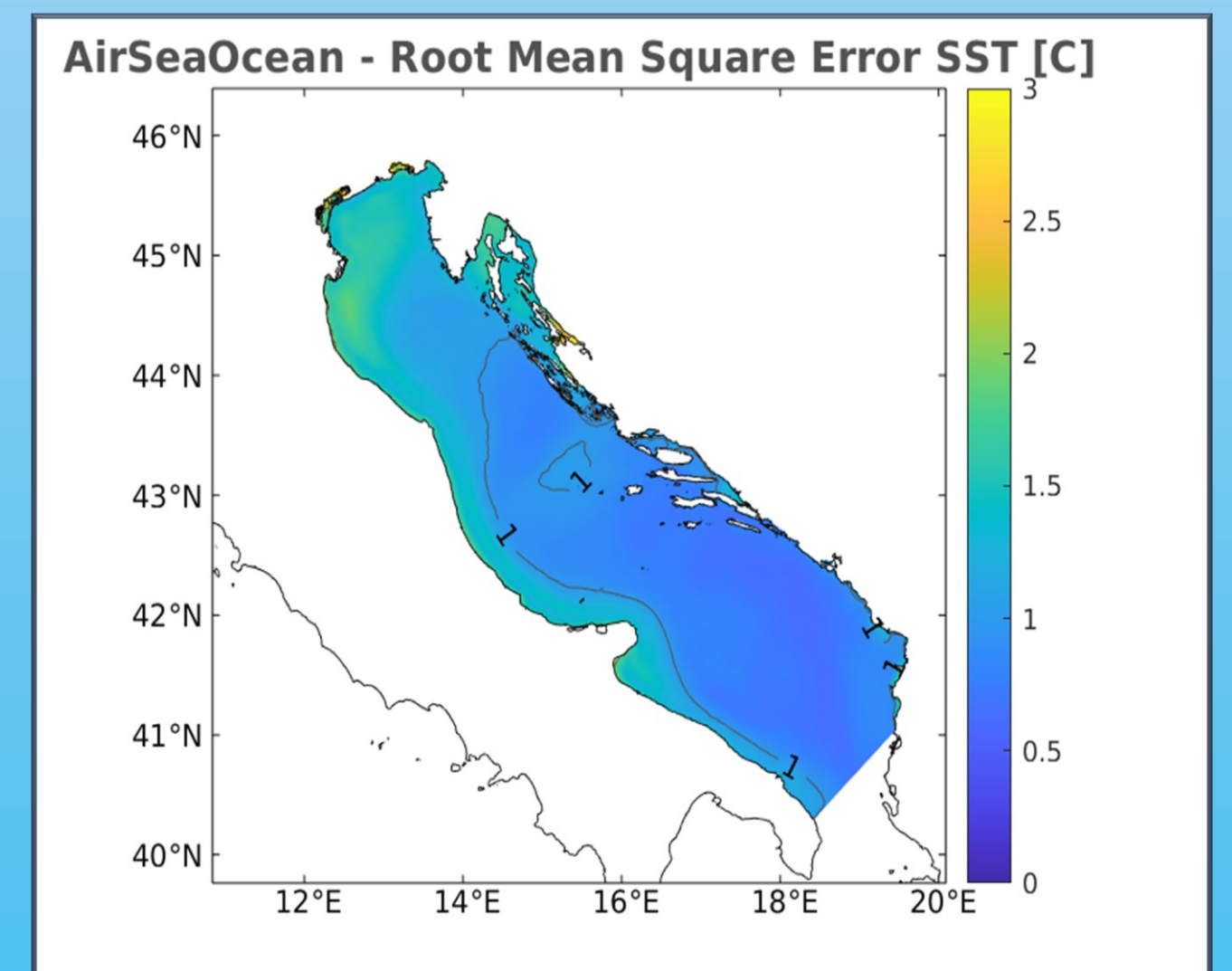
The aim of this study was to validate a coupled oceanographic model covering the Adriatic Sea. The validation was done for the Regional Ocean Modeling System (ROMS) for the hydrodynamics and the Simulating WAVes Nearshore model (SWAN) for the waves, that are part of the Coupled Ocean-Atmosphere-Wave-Sediment Transport modeling system (COAWST).

Model performance was assessed for several variables (temperature, salinity, sea surface height, ocean current speed) comparing model data with observational data from in situ measurements (2018-2019 period) and with data from models that were already validated. RMSE (Root Mean Square Error), BIAS and Pattern Correlation Coefficient were applied to statistically validate the comparison.

Preliminary results showed that the coupled model (ROMS and SWAN) is able to reproduce the observational data. In this way, data from the model will be able to be used in the same way of observational data, such as for the study of the relationships between phytoplankton and oceanographic conditions.



Comparison between observed (blue) and modeled (violet) sea level anomaly in the RMN Ancona Station (December 2021-January 2022)



Root Mean Square Error performed on satellite and modeled Sea Surface Temperature

Part 2: phytoplankton indicators for GES

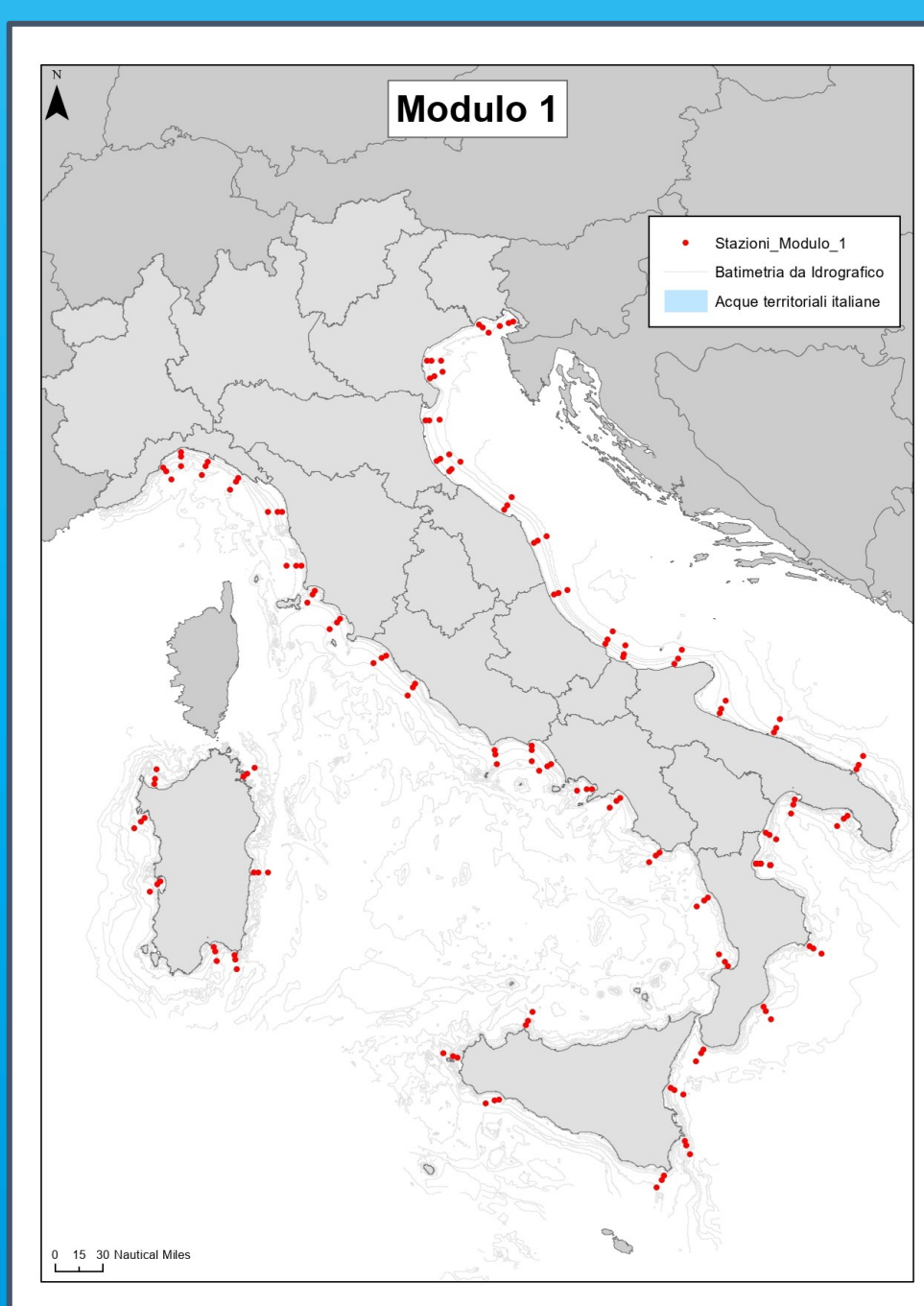
The aim of this study was to test the efficiency of indicators for the assessment of the Good Environmental Status in the pelagic habitats in the framework of the Marine Strategy based on of phytoplankton Mediterranean data, which is an optimal case study to test the efficiency (at regional scale) due to its heterogeneity and biogeographic differences. Data of phytoplankton were collected from ARPAs along all the Italian coasts since 2015 to 2020.

Traditional biodiversity indexes (e.g. Shannon diversity index and Pielou's evenness) were combined with non-traditional ones (Rao index), multivariate statistical approaches (e.g. NMDS).

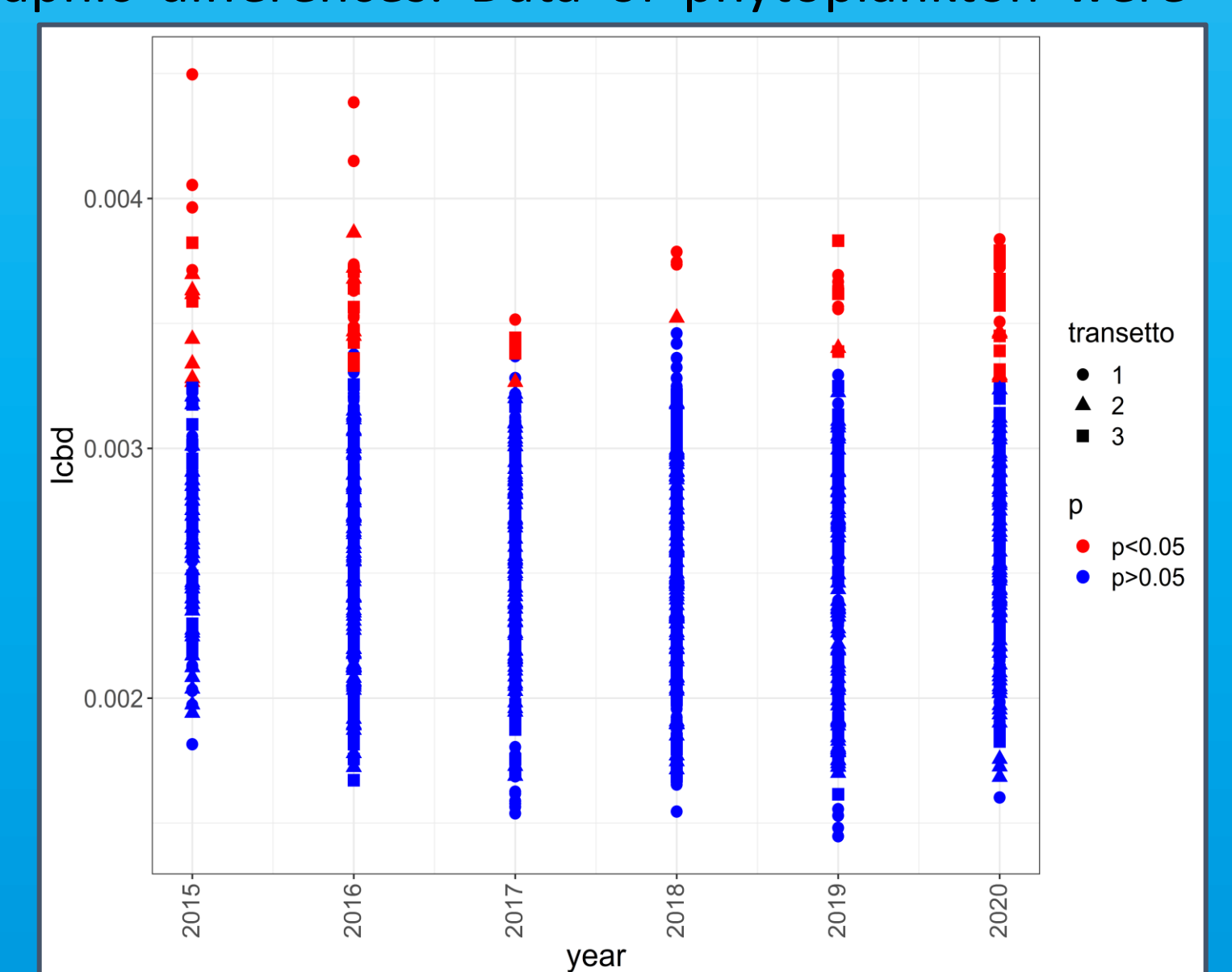
Temporal changes were studied using the Local Contributions to Beta Diversity index (LCBD; a beta diversity measure) and the Importance Value Index (IVI) highlighting important changes in time-space and revealing potential phytoplankton genus responsible for the modification in the community structure.

Phytoplankton and zooplankton data, collected from the same periods and regions, will be combined to look for a plankton life form indicator.

This study will give information on the applicability of many indicators in the environmental assessment on a regional scale.



Map of the study areas



Local Beta Diversity along different transects in the Emilia Romagna region (2015-2020)

Part 3: Work in progress

- (i) The study of the phytoplankton community using metabarcoding approach and comparing the results with those obtained by microscopy.
- (ii) Effects of extreme climate events, such as heatwaves, droughts and floods, on phytoplankton community.
- (iii) Sequencing and identification of still unknown sequences for metabarcoding in the new diatom species *Nitzschia gobbii*.

Publications

- (i) Accoroni et al., 2023. *Harmful algae*, accepted.
- (ii) Neri et al., 2023. *Biologia Marina Mediterranea*, 27 (1): 75
- (iii) Neri et al., 2023. *Estuarine, Coastal and Shelf Science* 282, 108224
- (iv) Accoroni et al., 2022 *Journal of Marine Science and Engineering* 10(10), 1402
- (v) Neri et al., 2022 *Continental Shelf Research* 242, 104746

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