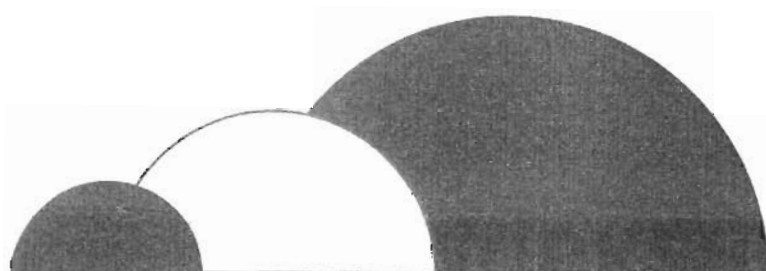


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# *Epitome*



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# **F I S T**

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**Key terms:** Tyrrhenian Sea; Dissolved Organic Carbon; Dissolved Oxygen; Nutrient

Dissolved organic carbon, dissolve oxygen and nutrients were measured, during three cruises, in the Southern Tyrrhenian Sea in the framework of VECTOR project. The cruises were carried out in November 2006, February and April 2007. The very high stability of the water column in the Tyrrhenian Sea is clear visible from vertical profiles of salinity, potential temperature and dissolved oxygen. In November a marked thermocline of about 5°C (from 19°C to 14°C) was observed at a depth of 50 m, while in February it became very weak (only 1.5°C). Dissolved oxygen exhibited a typical vertical distribution with a sub-surface maxima of about 240 µM and a minimum (180 µM) at 500 m. This oxygen minimum was observed in the core of the Levantine Intermediate Water (LIW), in correspondence to the salinity maximum. Inorganic nitrogen and silicate showed very low values in the surface layer, and a sharp increase with depth below 100 m, to reach their maximum from 2000 m to the bottom. In the first two cruises dissolved oxygen and nutrients showed concentrations and vertical profiles very similar, with the exception of the surface layer (0-100 m), in which a higher extent of variability was observed. The stability of water column and the occurrence of the thermocline have a clear influence on DOC vertical profiles. DOC showed a vertical trend similar to those observed in oceanic waters, with higher values at surface and a decreasing till a minimum (40 µM) at 400 m. Below 400 m no significant variations were visible. These trends were observed in all the stations of the section. The most significant difference in DOC trends, observed between the first two cruises, was at surface. Between 0 and 50 m, DOC showed values of 58±2 µM in November and of 49±1 µM in February. The occurrence of a more marked thermocline in November than in February, may allow the accumulation of semi-labile DOC in the mixed layer, this may be consumed or transported at higher depths whit the breakeven of the thermocline. In general, in the deep layer, DOC showed concentrations significantly lower than those reported in other Mediterranean regions. The minor extent of winter convection in this area, with a consequent absence of DOC transport at depth can explain this behavior.

Correlation between DOC, DO and nutrients will be also investigated to better understand DOM dynamics and carbon fluxes in the deep waters of this region. Finally the assessment of stoichiometric ratio between DOC, DO and nutrients will be studied in order to give information about mineralization processes.

## W10-149 Poster Sclavo, Mauro

10.1474/Epitome.02.0149.Geoitalia2007

### THE EVALUATION OF THE LONG TERM WAVE CONDITIONS - A COMBINED USE OF BUOY, MODEL AND SATELLITE DATA

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**Key terms:** long term wave conditions; satellite data; calibration of the model data

Long time series of meteorological and oceanographic parameters, in particular wind and waves, are required for many obvious purposes. These range from the assessment of climatology to the more immediate needs of oceanographic and coastal engineering. These time series are particularly required for the determination of long term trends associated to the much discussed climate change. Objective measurements, extended over long periods of time, are probably the best way to check the local effects of what is happening at the global level.

Historically three objective sources of data are available in the sea: buoys and platforms, satellites, and numerical models. No one succeeds in providing the accurate and distributed data requested for a sufficiently long period. Our aim is to describe how such a result can be obtained for an inner sea, like the Mediterranean Sea, making use of the information from the different available sources. In particular, we focus on the calibration of the model data making use of satellite data

The parameters we consider in this work are wind and waves. The complicated geometry and orography of the Mediterranean, and in particular the Adriatic, Sea make rather difficult for a meteorological model to reproduce with the required accuracy the distribution of the wind fields into the basin. In particular we have verified a substantial underestimate of the wind speeds. The underestimate depends on the resolution of the model, so it is larger for the global, operational models. Expectably this leads to a substantial underestimate of the derived modelled wave heights.

On the other hand modelled wave heights are the most continuous and detailed source of data, because buoys, as accurate as they are, are few and not capable to properly describe the spatially highly variable wave fields that characterise the Italian peninsula. The solution is to perform an extensive comparison between the available buoy, model (ECMWF) and altimeter data. The buoys are used to check the performance of the altimeter as wave measurements, in particular in coastal areas. This has indicated that the wave altimeter data are good enough in the Mediterranean Sea for our present purposes.

The following step is to intercompare corresponding model and satellite data. This requires various interpolations. In fact the model data are available at six hour intervals at the grid points, while the satellite data vary in space and time. Therefore the model data need to be interpolated, in space and time, to evaluate the co-located corresponding model data. The overall purpose is to derive, after a suitable intercomparison and correction place by place, the calibrated long term time series at the grid points. These can then be used to derive extended statistics, both as general distributions, and as one- and two-dimensional local distributions.

Once these statistics are available, they can be used as boundary conditions for local high resolution modelling. This can be done at various stages of sophistication. First we can use a third generation wave model, e.g. Swan to derive the wave conditions in the whole considered area. Nesting can then be used to focus with higher resolution on a specific spot. Finally an advanced sophisticated coastal circulation model can be fully coupled to the wave model to obtain a realistic estimate of the coastal conditions, both as waves and current.

## W10-150 Orale Sclavo, Mauro

10.1474/Epitome.02.0150.Geoitalia2007

### WAVE CLIMATE AND EXTREME EVENTS IN THE ITALIAN SEAS

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**Key terms:** climate; weather parameters; italian seas

Climate is defined by the type, frequency and intensity of weather events. Average values of specific weather parameters over fixed time intervals provide an information about the mean status of the atmosphere, the soil and the sea during those intervals. The occurrence and severity of extremes might become relevant as their mean frequency increases monotonically over a period like it happens during the few last decades. Anthropogenic climate change has the potential to alter the prevalence and the impact of extremes such as heat waves, storms, floods and droughts. This study focuses on the relevance that the extreme weather events have in modifying past evolutions and future scenarios of the Italian coasts and seas. Precisely, this work makes use of widely recommended methods for the statistical analysis of extreme waves. The current level of understanding in this field, allows to: select wave datasets of independent and identically-distributed (*idd*) data; identify the best fit to the data distribution; evaluate, from the distribution, the extreme waves values and return periods ( $T_r$ ).

Waves are treated as parameters being characterized by the value of two properties: their incoming direction and their significant height. Important information about the relevance of potentially occurring extreme events at the return period  $T_r$  is provided by the mean and cumulative persistence of the extreme waves over a fixed threshold. Two methods are principally used for this study, one uses the *idd* data as the result of a selection of *largest r-annual events* (normally  $r \approx 5$ ), the other obtain the *idd* data by keeping only the *peaks-over-threshold*. The two methods are based on different choices and both apply to a 42-years length time-series (part of the ERA40 reanalysis from 1957 to 2002) of wave data. The first method optimizes the level of data independence within the selected dataset, but dramatically reduces the number of elements (larger statistical errors), the second increases the dataset size (smaller statistical errors), but also increases the autocorrelation coefficient of the data.

The statistical analysis of the entire and the independent wave-dataset as well as a comparison of the return period and values by utilizing the two different method are presented here.

## W10-151 Poster Socal, Giorgio

10.1474/Epitome.02.0151.Geoitalia2007

### PHYTOPLANKTON SEASONAL PATTERNS FROM PLURIANNUAL TIME SERIES IN A HIGHLY VARIABLE COASTAL ECOSYSTEM (NORTHERN ADRIATIC SEA)

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**Key terms:** Phytoplankton; Long Term Ecological Research; Northern Adriatic

The broad variability of marine environment conditions, occurring as a consequence of meteo-climatic forcing and anthropogenic pressure, might induce changes of the plankton community structure at a wide range of time scales. Phytoplankton appears very sensitive to climatic changes and could be used as a proxy of the variations occurring in the environment. The overall complexity of coastal ecosystems and the remarkable interannual variability of environmental factors, make multiannual series of data a powerful tool for a reliable reconstruction of the plankton seasonal cycles and of their driving factors. The phytoplankton studies in the Northern Adriatic Sea (a shallow, eutrophic, coastal basin) started more than 20 years ago but, in the last 10 years, the investigations have become more intensive, both in space and time. The ecological monitoring activities carried out in this ecosystem permit, from one side, to define the short-term (monthly, seasonal) and interannual phytoplankton variability, and, from the other, to understand the time scales of the processes that control and modulate the variability of the hydrochemical features (temperature, salinity, nutrients) of the area. A clear trend of increasing water temperature, related to the eastern Mediterranean climatic transient, has been evidenced in the whole Northern Adriatic basin, starting from the late eighties. The long-term studies on the phytoplankton allowed the elucidation of the seasonal pattern of biomass and the description of the seasonal variations of the prevalent phytoplankton species, so that a sort of "calendar of plankton" could be defined. The availability of a wide array of ecological parameters and the joint efforts of different researchers and institutions working in this coastal ecosystem, entitled the Northern Adriatic Sea to enter the International Long Term Ecological Research network (ILTER) as a fundamental site for marine studies on long-term series.

## W10-152 Orale Tedesco, Letizia

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### A 1-D SEA ICE THERMODYNAMIC MODEL FOR STUDIES OF SEA ICE BIOGEOCHEMISTRY

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**Key terms:** Sea ice model; Sea ice ecosystem; Biogeochemistry model

A 1-dimensional thermodynamic model capable of simulating seasonal changes of ice, snow ice, superimposed ice and ice thicknesses has been developed. Particular attention has been paid to reproduce the snow ice formation when

heavy snow loads cause sea water flooding at the ice-snow interface, and the superimposed ice formation when melted snow re-freezes at the snow-ice interface under positive temperature gradient within snow and ice. Following Semtner 0-layer model, the sea ice system consists of one layer of ice and one layer of snow on top. If the ice draft exceeds the ice thickness, snow ice formation is initiated. Snow density and compaction are changed accordingly and a new isostatic equilibrium is formulated. No seawater mass is added and snow is compressed to an amount of new snow ice equal to the initial depression below the water line. If melted snow re-freezes under freezing conditions, superimposed ice formation is also initiated by transforming a fraction of snow, depending on snow properties, in superimposed ice. Snow ice and superimposed ice play important roles, not only because they change the snow properties and the consequent rate of the ice growth, but also because they create suitable habitats for sea ice algae, bringing nutrients where the light is a minor limiting factor. Micro algae find a larger access to nutrients and more stable environmental conditions in the last centimeters of the ice sheet, but are often limited by thick snow covers that prevent sufficient light to penetrate. As a first testbed application in data-rich areas, the model has been implemented in the Baltic Sea and validated in four different stations (Ajos, Kummelgrund, Jussaro, Kotka) against observations provided by the Ice Service at the Finnish Institute of Marine Research. Atmospheric forcing data are from the ECMWF-ERA 40 Reanalysis. Other geophysical properties, such as salinity, density and brines characteristics have been recently included, since they are closely related to the physiological and ecological response of sea ice algae. A coupled version with BFM (Biogeochemical Flux Model) is currently under development. The BFM represents the biogeochemical processes of pelagic ecosystem emphasizing the flows of the major biogeochemical elements from the (in)organic pelagic pools through the food web as a function of organisms' demand and trophic relationships. Sea ice ecosystem is still poorly understood, due to sparse observations and complexity of the interactions between environmental factors and ice biota. Ecosystem models can be thus a valuable tool to better understand the processes that control the dynamics of the sea ice algal community, its contribution to the total primary production in relation to its phytoplankton counterpart, its fate after being released in the water column, and its contribution to the global carbon cycle. The coupled model can be further coupled with a 1-dimensional turbulence model to better resolve the oceanic fluxes and mixing/stratification processes. In the future it will further be extended with a dynamic model of ice growth for 3-dimensional simulations.

## W10-153 Orale Tassarolo, Chiara

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### A CASE STUDY OF THE CORRELATION BETWEEN STEEP AND NARROW MARGIN WITH THE DEVELOPMENT OF FLUVIAL STRUCTURES: THE IONIAN CALABRIAN AREA

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*Key terms:* Ionian Calabrian Margin; basins and shelf morphology; seafloor topography

The Calabrian Ionian margin represents a particular geo-structural setting for the development of an original fluvial system, peculiar for this own area. Structural movements, correlated to the opening of the Tirrenian sea, have encouraged a rapid and important uplift of the area localized in the frontal part of the arc in translation, determining quite high relief inland, and a narrow and less well developed shelf offshore.

In association to this structural setting, the particular climate regime of this area, characterized by seasonal, very intense and sporadic meteorological events, point up to the development of short but steep rivers, with a medium extension in basins area and responsible for an intense and active mass transport to the shelf and the upper slope: the called Fiumara. This kind of rivers have also been responsible for the development of erosional structure, even wide and deep, localized offshore.

On the base of this assumption, in the framework of Vector Project (line Vulcost), five (four in the original project) rivers (Fiumara Torbido, Allaro, Amusa, Precanti, Novito) have been selected to point out the correlation between these peculiar fluvial frameworks and the interrelate generation of two very wide systems of canyon, on the shelf and beyond it: the Caulonia and the Marina di Gioiosa Canyons.

A Multibeam (Seabed 8160) and Sub-bottom Profiler (GeoChirp II) survey collected in 2006, and a subsequent study of the Morphological and stratigraphic characteristics of the area, in association to an elaboration and evaluation of data of the basins onshore, have enabled to point out a preliminary characterization of the geo-morphological peculiarities of the selected area.

This study has been developed considering in that way the relation between the typology of margin, the kind of hydrographic basins developed, the sedimentary and erosive processes in act, and the correlated progress of marine structures offshore, in the aim of an evaluation of the coastal zone modification and evolution.

## W10-154 Poster Tosi, Luigi

10.1474/Epitome.02.0154.Geoitalia2007

### COULD SALT WATER INTRUSION AND LAND SUBSIDENCE TRIGGER SOIL DESERTIFICATION IN THE CATCHMENT SOUTH OF THE VENICE LAGOON (ITALY)-

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*Key terms:* saltwater intrusion; land subsidence; soil desertification; Venice

### Lagoon; Bacchiglione-Brenta river mouth

The catchment south of the Venice Lagoon is threatened by shallow aquifer salinization and land subsidence. Although the area is not experiencing everywhere saline contamination and high sinking rates, a very serious situation has been brought to light in a large portion of the coastal farmland. The salt water contamination, recently investigated within a series of research projects, i.e. ISES, BRENTA, Co.Ri.La. 3.10-3.16, extends up to 20 km inland from the coast (Carbognin and Tosi, 2003; Rizzetto et al., 2003; Carbognin et al., 2005, 2005b). The depth of the fresh/salt-water interface varies from 1 to 30 m below the ground level and exhibits a significant, mainly seasonal, time variation. The dynamics of the soil salinization process is especially sensitive to changes in river (Brenta, Bacchiglione, Adige, Gorzone) discharges, in groundwater and channel levels regulated by a number of pumping stations of the reclamation network, and in weather conditions.

At the same time an ongoing land subsidence with rates varying from few mm/yr to cm/yr affects the southern lagoon margin and the nearby watershed (Tosi et al., 2000; Teatini et al., 2007). The settlement of these territories is mainly due to natural consolidation (Teatini et al., 2005) and geochemical subsidence, i.e. peat oxidation promoted by farming activities (Gambolati et al., 2005).

Salt water intrusion and land subsidence combined with significant dry seasons expose this area to the potential soil desertification. The combined effect of both processes is producing an alarming social and environmental impact on the south Venice coastland, also in relation to the expected global climate change.

### Acknowledgements

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## W10-155 Poster Tramontana, Mario

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### GEOMORPHIC EVOLUTION OF WAVE-CUT CLIFFS AT THE NORTHERN MARCHE RIVER MOUTHS

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*Key terms:* Wave-cut cliffs; Coastal evolution; River mouth; Northern Marche

The north Marche coast reach between Gabicce and Senigallia is characterised by a relatively continuous coastal plain at places narrowed or interrupted by rocky cliffs (i.e. San Bartolo and Ardizio, north and south of Pesaro respectively). The seafloor is constituted by soft sediment of various grain size (from sand to mud) except for the seafloor off San Bartolo cliff, where a wide, still active rocky wave-cut bench occurs. The coastal plain merges into the terminal sectors of the major fluvial plains and also encloses the downstream reaches of minor streams debouching directly into the sea. Two important morphologic features characterise the coastal plain: (i) the coastal plain ends landwards against either the base of hill-slopes straightened by marine erosion or rocky paleo-cliffs; (ii) the coastal plain is locally stepped by a minor discontinuous wave-cut cliff cutting late Quaternary gravels and sands. Such wave-cut cliff is a distinctive landform occurring close to the major river mouths; elsewhere, this landform appears only in some areas, in particular at the mouth of minor streams draining directly into the sea (e.g. Ponte Sasso, Fosso Sejore). Indeed, the wave-cut cliff is clearly connected with river mouths. It is well-formed, with sharp profiles and heights reaching 5-8 m at the Metauro and Cesano river mouths; it is recognisable at the Foglia and Misa river mouths as well, nonetheless here it is less defined displaying smoothed profiles and heights not exceeding 2-3 m. This landform is associated with late Pleistocene-early Holocene coastal fans, built up in conditions of relatively low sea-level and likely related with cold climate stages (Dryas). Such chronological attribution is supported by some radiocarbon datings spanning from 10,700±95 to 10,880±95 yr B.P.

The fans grew seaward for some kilometres off the modern shoreline, while the fan apexes are found as far as 5-10 km upstream the modern river mouths. The higher the fan relief, the greater the gravel supply from the drainage basin and, in turn, the gravel availability was a function of the amount in the drainage basin of resistant rock outcrops. The eustatic sea level rise accounts for the erosional removing of a large part of the downstream portions of the coastal fans; only the apex areas, extended within the river valleys, have been