GEOSS Support for Decision-Making in the Coastal Zone: Managing and Mitigating the Impacts of Human Activities and Natural Hazards in the Coastal Zone

A series of regional GEO Workshops organized by the GEO Coastal Zone Community of Practice and the IGOS Coastal Theme in partnership with GOOS and GTOS

WORKSHOP 1

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

June 9-13, 2008

Athens, Greece

Observing System Requirements for Managing & Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Sandy Coasts & Cliffs Group

Definition(s)

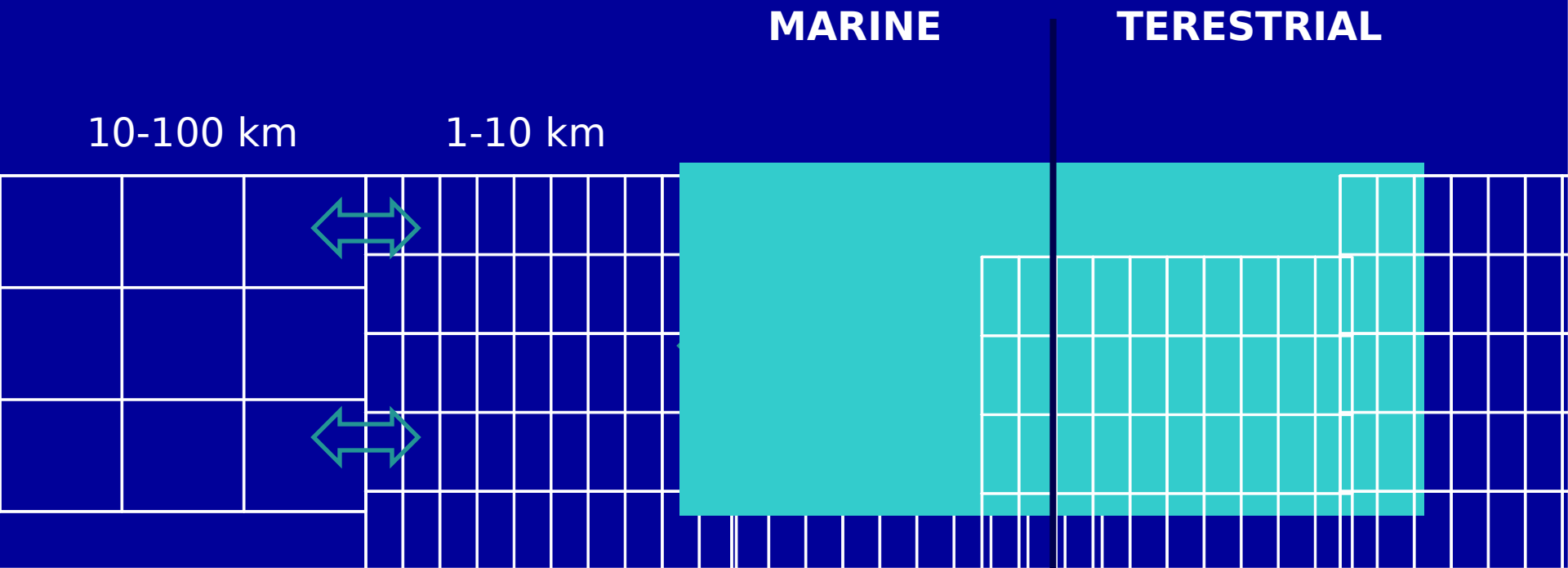
Group	***Characteristics of the Environment***			
Sandy Coasts & Cliffs	High(er) Salinities	High(er) elevations	Narrow(er) shelf – deeper water	Further away from sediment sources
Deltas & Lagoon Systems	Fresh water discharges / Lower salinities	Low(er) elevations, higher susceptibility to inundation	Shallow waters	Close to sedimentary supply
	Potentially Important Processes			
	Ecosystem	Inundation	Effect of open ocean processes	Effect of terrestrial sources in erosion

…Requirements for Managing & Mitigating…

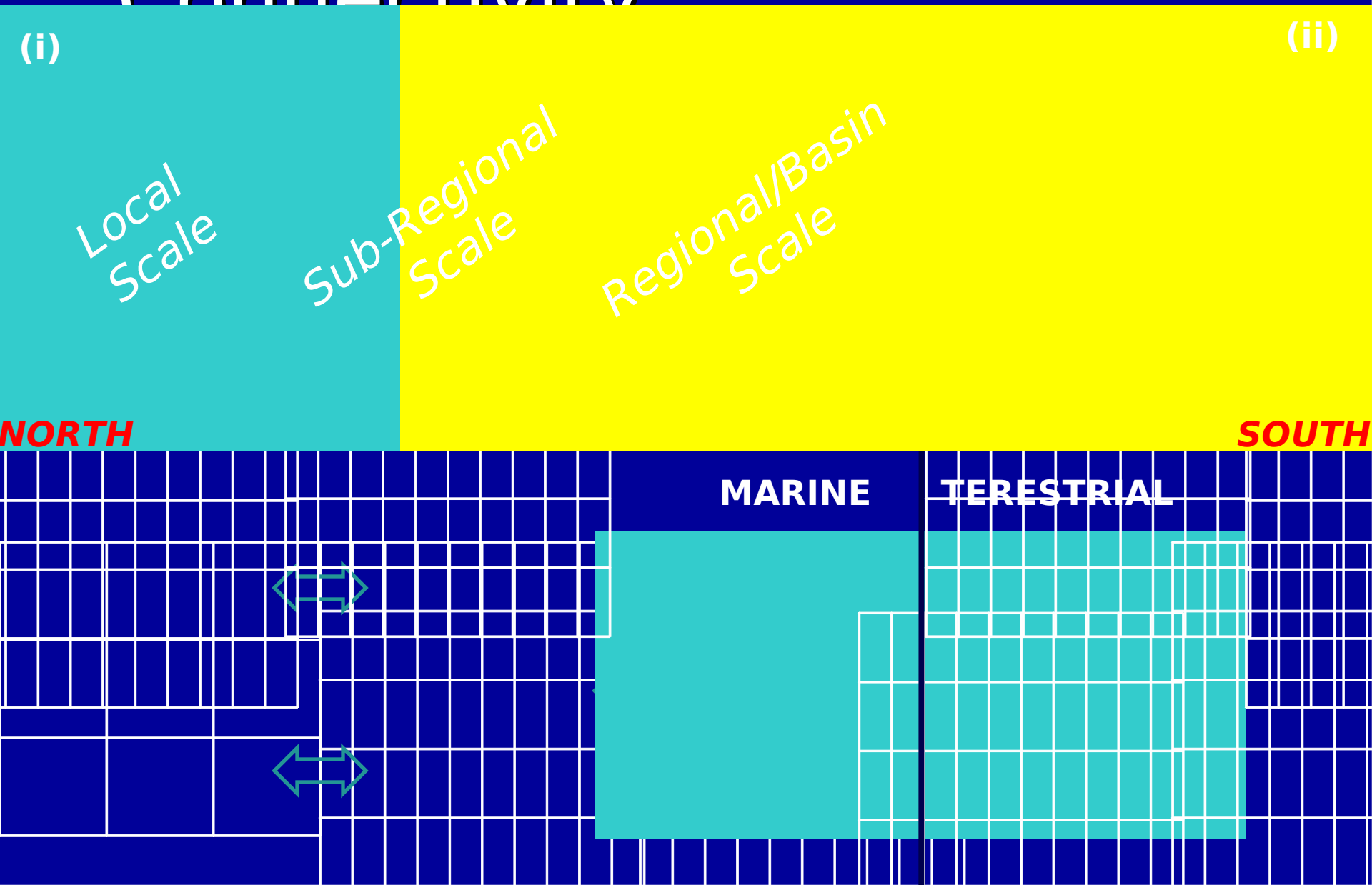
- Define the management & mitigation activities that could benefit from “Observing Systems”.
- Identify existing data/procedures already contributing to management & mitigation activities.
  - Two categories of “stakeholders”:
    - Policy makers (long-term development plans, facilitating the development of “directives” and/or “regulations”).
    - Regulation enforcers / mitigation

Temporal / Spatial Resolution

- Long-term processes
- Short-term processes



North / South Rim Connectivity



Long-Term Issues (1/2)

- Sea Level Rise and its “dynamic” effect must be assessed.
  - Current studies and effects are based on the “static” approach solution. Dynamic processes (e.g., waves, sediment transport) will change coastal morphology, bathymetry and thus will have potentially different implications.

- Climate change and its implication on nearshore processes under both current and future sea levels.

Long-Term Issues (2/2)

- Major projects altering physical environment and their impacts on the Med.
  - Enlargement (widening & deepening) of Suez Canal will lead to changes of flux of water masses and potentially contribute to the introduction of new species with unknown effects to fisheries and ecosystems.
- Quality of the Med. marine environment.

Medium-Term Issues

- Provide accurate climatologies on forcing to be used as design criteria for coastal engineering projects and coastal development.
  - Examples: (i) nearshore wave climate for harbor designs (e.g., seiche); (ii) coastline evolution trends toward an equilibrium state for sustainable development of coastal zone;
- Establish baselines utilizing existing data



Short-Term Processes (nearshore / inner-shelf circulation)

- Water quality issues, urban run-off from impermeable surfaces and beach closures.
- Transport and fate of oil spills entering the nearshore.
- Disruptive oscillations in Ports/Harbors and Semi-enclosed bays (Seiches due to atmospheric and/or incident wave forcing).
- Extreme events (surges, tsunamis, etc).

Short- and Long-Term Ecosystem Analysis

- Nutrient loading (terrestrial input)
- Development of HABs
- Hypoxic/Anoxic conditions
- Habitat Alteration
- Current state and trends of marine resources

Scale Integration

$$Long\text{-}Term = \int Short\text{-}term \cdot dt$$

Development of both long- and short-term strategies, requires the definition of a baseline used to define “anomalies” or “deviations” to trigger alarm signals

REQUIREMENTS

- Development of climatologies require consistency and continuity in measurements.
- Sampling at temporal scales able to discriminate between natural oscillations and deviations.
- Adoption and strict adherence of common, internationally accepted standards on QA/QC of data & data formats.
- Interoperability of systems / data exchange.
- Easy access to historical and real-time data.

GAPS

- Gap in development stages and preparedness at various countries (in-situ monitoring systems including, e.g., coast tide gauges)
- Bathymetry and topography data, although the basis for the majority of processes is of dubious accuracy, storm inundation scales in some instances are comparable to uncertainty in bathymetry.
- High resolution gravitometry data is required for the Mediterranean region to make data assimilation of satellite altimetry better for the region.
- Ecosystem models require various levels of data (physical parameters, bio-geochemical etc). Gap in data types/resolution to assimilate in such models.
- Lack of real-time river runoffs.
- Gap in routine habitat-related data collection
- Coupling of terrestrial and marine models
- Coupling of bio-physical and socio-economic sciences

Recommendations

- Select parameters to be observed that can benefit in the long-term.
- Plan for the sustainability of the measurement program
- Advocate for the development of future technologies able to overcome some of the current limitations.
- Establish baselines
- Use visualization/tools based on the requirements of end users – flexibility – iterative process

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Issue

Knowledge Gap

Observing systems (data/products – knowledge, resolution and continuity gaps)
Data management, modeling, and integration
Prediction, scenarios, and decision-support

Outcomes, Products

Action Items & Schedule

Pilot/Demonstration Project and/or GEO Workplan Item

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Issue (Basin-Scale)

Climate Change and its "Dynamic" Impact on Nearshore Processes under both current and future (up to year 2100) conditions

Knowledge Gap

Future conditions (winds, atmospheric pressure, precipitation,) at scales from basin to regional to local

Observing systems

Gaps in in-situ observations in the southern Med.

Gaps exist in satellite based altimetry and scatterometry, and gravitometry (global gap?)

Gaps in knowledge of exchanges among the adjacent basins and seas

Data management, modeling, and integration

QA/QC

Metadata (Nadia)

Coupling of atmospheric and ocean models (this is a global gap)

Coupling of hydrologic and ocean/atmos models at Med scale

Linking basin-scale, regional & local models (regional likely missing in the south)

Prediction, scenarios, and decision-support

Model consistency, compatibility

Need baseline of existing conditions and scenario-based assesments

Outcomes, Products

Climatologies and scenarios

Action Items & Schedule

Pilot/Demonstration Project and/or GEO Workplan Item

Generate climatology and scenarios for IPCC (and other) predictions (potential user: EEA) in forms useful for the ICAM community

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Issue (Local and Regional Scale)

Inundation, Erosion and Shoreline Change

Knowledge Gap

"Dynamic" response of coastal regions (including physical and socio-economic) to inundation and changes in forcing, and human activities.

Observing systems

Gaps in in-situ water level at the land boundary

Gaps in shallow water wave gauges everywhere (Buoys, ADCPs, HF Radar)

Gaps in and/or limited access to higher resolution bathymetry, topography and waterline position data (to meter or better resolution)

Gaps in river discharge and loadings

Gaps in land cover and land use maps

Gaps in Sediment characteristics

Data management, modeling, and integration

Access to and integration of higher resolution bathymetry, topography, land cover, land use, and waterline position data

Dune and cliff erosion

Coupling of nearshore atmospheric and ocean models (this is a global gap)

Coupling of terrestrial hydrologic and ocean/atmos models

Linking basin-scale, regional & local models (regional likely missing in the south)

Prediction, scenarios, and decision-support

Outcomes, Products

Parameter fields per above

Dynamics-based inundation forecast (GIS-based maps) for short-term (events) and long-term (water level changes)

Risk assessment/maps of Inundation, Erosion and Shoreline Change

Update design criteria for coastal engineering projects and coastal development to include both climate change-associated as well as tsunami impacts

Action Items & Schedule

Pilot/Demonstration Project and/or GEO Workplan Item

"OPENMED" interoperability project

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Issue (Basin Scale)

Current state and trends of the quality of the Mediterranean marine environment

Knowledge Gap

Present and future conditions of the ecosystem at scales from basin to regional to local

Observing systems

- Gaps in in-situ observations, especially in the southern Med.
- Gaps exist in satellite based ocean color including merged products
- Gaps exist in in-situ bio-optical data throughout the coastal Med
- Gaps exist in land cover data (satellite and in-situ) throughout the coastal Med

Data management, modeling, and integration

- Coupling of ecosystem and hydrodynamic models; coupling with terrestrial hydrologic and atmospheric models
- Linking basin-scale, regional & local models (regional likely missing in the south)
- Process full-resolution MERIS data for the all Med coastal regions
- "Migrate" and refine basin scale to regional
- Linkages with watersheds and adjacent basins, especially loadings

Prediction, scenarios, and decision-support

Outcomes, Products

Action Items & Schedule

Pilot/Demonstration Project and/or GEO Workplan Item

Assessments, Forecasts and Scenarios (e.g., biodiversity, water quality, and fisheries) under IPCC (and other) predictions (potential user: EEA), in forms useful for use in ICAM

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Issue (Local and Regional Scale)

Nutrient loading (terrestrial input), Development of HABs, Hypoxic/Anoxic conditions

Habitat Alteration and water quality

Knowledge Gap

Inadequate knowledge of present and future coastal ecosystems

Observing systems

- Gaps in biogeochemical and ecological in-situ observations
- Gaps exist in satellite based ocean color including merged products, regional algorithms and product suites in coastal/case 2 waters
- Gaps exist in in-situ bio-optical data throughout the coastal Med
- Gaps exist in land cover data (satellite and in-situ) throughout the coastal Med

Data management, modeling, and integration

- "migrate" and refine regional scale to local
- Coupling of ecosystem and hydrodynamic models; coupling with terrestrial hydrologic and atmospheric models
- Linking basin-scale, regional & local models (regional likely missing in the south)
- Process ocean color data to full-resolution (incl MERIS and MODIS data) for all Med coastal regions
- Linkages with watersheds and adjacent basins, especially loadings

Prediction, scenarios, and decision-support

Outcomes, Products

- Validated land (coastal) habitat maps

Action Items & Schedule

Pilot/Demonstration Project and/or GEO Workplan Item

- Analog of "OPENMED" for water quality and ecology
- Water quality pilot projects/tie-in with GEO remote sensing water quality efforts

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

1. Short-term (immediate) action items
    1. CZCP Med (Kostas, Yannis, Nadia, Paul, Hans Dahlin)
    2. Develop an informational document for wide-spread distribution
    3. S. Med workshop (Hans-Peter, Jimmy, Mahmoud, Benrekta): planning ASAP; schedule TBD
    4. Mediterranean Interoperability demonstration projects
        1. Oceanic, atmospheric parameters (Hans-Peter, Michael B, Antonio, Eleni, Yannis, Kosta, Dov?, Nadia)
            1. Deep water to coast
            2. Move quickly to products
            3. Identify areas most amenable to Phase 2 pilot projects
        2. Ecology parameters (Paul, Mark Dowell, Andy, Francois, Eleni F.)
            1. Deep water to coast
            2. Move quickly to products
            3. Identify areas most amenable to Phase 2 pilot projects
        3. Land cover mapping (per Bob)
            1. Dry land and nearshore marine habitat
            2. Land use
            3. Distinguish between actively monitored

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Issue
Habitat Alteration
Knowledge Gap
Dynamic response of coastal region to inundation

Observing systems
- access to/higher res bathymetry and topography data
- river flow

Data management, modeling, and integration
- nearshore wave transformation and sediment transport

Prediction, scenarios, and decision-support

Outcomes, Products

Action Items & Schedule

Pilot/Demonstration Project and/or GEO Workplan Item


MELMARINA
مشروع رصد ونمذجة
البحيرات الساحلية
Monitoring and modelling coastal lagoons:
Making management tools for aquatic resources in North Africa


Systematic Observations of Land and Ocean


GTOS
Terrestrial Carbon Observations
Terrestrial Networks
Climate Observations (TOPC)
Central and Eastern Europe
Land Dynamics (GOFC/GOLD)
Southern Africa
Terrestrial Coastal Environments (C-GTOS)
Net Primary Productivity


ReCoMap
INDIAN OCEAN


Western Indian Ocean
WIOMSA
Marine Science Association


GOOS
Global Ocean Observing System


GHRSST-PP


GGOS
http://www.ggos.org


MERSEA


chloroGIN
Chlorophyll Global Integrated Network


myOcean


MOON


GODAE
Global Ocean Data Assimilation Experiment

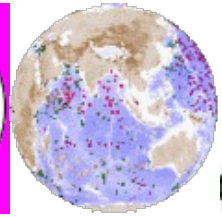

BCLME
Benguela Current Large Marine Ecosystem Programme


iCCG
International
Ocean Colour
Coordinating Group


MedWet


ILTER
International
Long Term
Ecological
Research


Argo

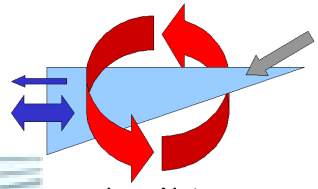



LOICZ


Ramsar


DITTY


DINAS
COAST


LaguNet
www.dsa.unipr.it/lagunet

DevCoCast


SEDAC
socioeconomic data and applications center


CENSUS
OF MARINE LIFE


GLOBCOLOUR

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Specific objectives of *this* Workshop

- Compare scientifically sound scenarios for time-space extent of coastal inundation and storm surge in the coastal zone and for impacts of coastal flooding on coastal
  - infrastructure,
  - human health risks (exposure to waterborne pathogens),
  - ecosystems (e.g., water quality, habitats, biodiversity), and
  - living resources (organisms and habitats).

- Assess current observing system capacities for providing the data and information required to assess changes in susceptibility (risk and resilience) both temporally (annual to decadal scales) and spatially (100 meter to 1 kilometer resolution).

- Increase awareness among coastal planners and managers of geospatial patterns of susceptibility and causes of changes in susceptibility, both short term (e.g., coastal engineering) and long term (e.g., changes in sea level).

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

- **Build on and extend previous efforts and specify data and information requirements of the Integrated Coastal Area Management (ICAM) community in developing nations, particularly longer-term planners, policy makers, researchers and educators.**

- **Discuss and prioritize data and information gaps. Identify the challenges to filling these gaps, as well as the emerging decision-making approaches and model-based solutions.**

- **Facilitate linkage of space-based observations, and land and ocean in situ measurements and models with studies focusing on the impacts of human activities, coastal development and urbanization on susceptibility to coastal inundation, and human and ecosystem health.**

- **Initiate planning for a COastal Data Assimilation System pilot project (CODAS) and Integrated Coastal Decision Support System (ICoDSS) for data acquisition, analysis, modeling and integration**

Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region

Deliverables:

- **Geospatial maps of risk and resilience with 1 km resolution for the Mediterranean region.**

- **Guidelines (best practices) for assessing risk and changes in risk for coastal planners and managers.**

- **Observing system requirements for the provision of data and information needed to quantify changes in susceptibility on appropriate time and space scales.**

- **Pilot project designs, implementation of which will increase operational capabilities for the sustained provision of data and information on environmental changes across the land-sea interface that affect risk.**