DRAFT

Report of the GEO Coastal Zone Community of Practice (CZCP) Workshop "Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region"

9-13 June 2008
National Observatory of Athens
Athens, Greece

Organized by the GEO CZCP and the IGOS Coastal Theme in partnership with GOOS, GTOS, the GEO Secretariat and the Greek GEO Office

INTRODUCTION

The following report describes the findings and recommendations of the first of a series of regional workshops organized by the GEO Coastal Zone Community of Practice and the IGOS Coastal Theme in partnership with GOOS and GTOS. The overall title of the series is "GEOSS Support for Decision-Making in the Coastal Zone: Managing and Mitigating the Impacts of Human Activities and Natural Hazards in the Coastal Zone". The first of these regional workshops, "**Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region**", was held at the National Observatory of Athens, Athens, Greece, on 9-13 June 2008. The Workshop program and the list of participants is attached as Appendices A and B, respectively. The presentations are available at: http://www.greekgeo.noa.gr/geoworkshop1/index.html

We here describe the aims of the 1st CZCP Regional Workshop, the findings and recommendations.

RATIONALE FOR THE WORKSHOP SERIES

Increases in coastal urban population and impacts of land-use practices in coastal catchments and floodplains have led to rapid and accelerating changes in sediment supplies and increases in nutrient, pollutant and pathogen loadings to coastal waters. These pose serious risks to human health and overall well being and the capacity of ecosystems to support products and services critical to the survival and well being of human populations, in developed and developing nations alike. Risks are increasing and are likely to be compounded by global climate change and associated impacts, e.g., sea level rise. High and immediate priorities for GEOSS are improved forecasts of global to local sea-level rise and associated increases in coastal inundation that may be exacerbated by increases in the frequency of extreme weather. Detecting, predicting, assessing and managing the interplay of coastal urbanization and global climate change are critical to the sustainability of healthy ecosystems and the products and services they provide to human populations.

Approaches for carrying out these tasks will necessarily differ from country to country in view of the multiplicity of tools, policies, measures, standards and resources employed for monitoring, assessing and managing risk within the coastal zone. Nonetheless, there remains an urgent need to promote integrated, multidisciplinary and multi-sector coastal and ocean management at the regional level in ways that leverage, support, and enhance the capacity of individual coastal States in developing effective coastal zone policies, robust response mechanisms and risk mitigation strategies.

GOALS AND OBJECTIVES FOR THE WORKSHOP SERIES

Under the auspices of the Global Earth Observing System of Systems (GEOSS), and with a primary focus on the needs of developing nations, the GEO Coastal Zone Community of Practice (CZCP) is conducting this series of regional workshops to provide an end-to-end forum for data providers and users to identify observing system requirements (from observations to modeling) and decision-making tools needed to

manage and mitigate the impacts of coastal inundation, storm surge and human activities on coastal communities and ecosystems. As a step toward achieving these goals, this series of workshops aims to:

- Foster communication between land-oriented and sea-oriented communities of scientists, environmental managers, policy makers and other users. Historically, observation efforts within the marine aquatic and terrestrial spheres have been largely separate. A major goal of the CZCP is to aid in establishing an integration of these efforts.
- Specify data and information requirements of the Integrated Coastal Area Management (ICAM) community, including the first responder and mitigation communities, the regulatory community, longer-term planners, policy makers, researchers and educators. ICAM user interests represent a spectrum of scales from local to global with information needs from near-real time to multi-decadal.
- 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 sustained programs that will provide data and information needed to:
    - Assess changes in susceptibility (risk and resilience) to coastal inundation and storm surge in high risk regions and
    - Assess and forecast impacts on human health risks, the state of coastal ecosystems and the living resources they support.
- Initiate planning for Coastal Data Assimilation System (CODAS) pilot projects and corresponding Integrated Coastal Decision Support Systems (ICoDSS) for data acquisition, analysis, modeling and integration to support improved decision-making across the land-sea interface in two or more target regions. A key goal of this planning process will be to strengthen the institutional capacities of developing countries and to promote international joint observation and research, through improved surface-based monitoring and increased use of satellite data, and the creation and dissemination of technical and scientific knowledge.
- Promote the end-to-end goals of coastal observing systems by fostering improved linkages between data providers and end-users, and facilitating the transition from Data to Products to Information to Knowledge.

EXPECTED OUTCOMES OF THE WORKSHOP SERIES

Potential activities and products resulting from the series of Workshops include:

- Improved use of the database of monitoring sites and networks for Coastal GOOS and Coastal GTOS, i.e. TEMS (http://www.fao.org/gtos/tems/index.jsp), for coastal observing systems through registration of programs and sites.
- Formal partnerships and linkages among the various programs represented at the Workshops.
- Development of land-sea data assimilation schemes, building towards an integrated COastal Data Assimilation System (CODAS) prototype with

operational nowcasting & forecasting (short & long term) capabilities to support users.

- Development of standardized user interface tools (e.g, GIS) and integrated decision support systems for coastal management – that is, an Integrated Coastal Decision Support System (ICoDSS) - that can be used for short-term decisions as well as long-term planning

HERITAGE OF THE WORKSHOP SERIES

The IGOS Coastal Theme Report was approved by the IGOS Partners in November 2004, and published in January 2006[1], with coastal observing coordination and implementation activities ongoing since 2005. The Coastal Theme Report has provided the foundation in developing a *Coastal Zone Community of Practice* (CZCP) to address user needs under the auspices of the GEO User Interface Committee (UIC).

The CZCP is a user-driven community of stakeholders, the purpose of which is to develop a strategy for engaging user groups across the land-sea interface in the development of those elements of the GOOS and GTOS that are required to provide and integrate data on terrestrial, freshwater, marine and atmospheric systems that converge in the coastal zone. Its specific objectives are to:

1. Engage data providers and users in the specification of requirements for *in situ* and remote observations
2. Evaluate current and projected observation capabilities against these requirements, and identify gaps, redundancies and activities that need to be strengthened;
3. Promote the development of workshops and "proof of concept" pilot projects;
4. Promote development or strengthening of networks of institutions globally, regionally, and across Communities of Practice (CPs) that contribute to and benefit from GEOSS to achieve the mutual goals of GOOS and GTOS.

The CZCP employs a regional approach to engage users and potential users through GOOS Regional Alliances (GRAs) and regional activities of GTOS.

This series of workshops complements and builds upon other GEO activities, including the GEO Inland and Nearshore Coastal Water Quality Remote Sensing Workshop held March 2007 in Geneva and other workshops that focus on improving the skill of forecasts of coastal inundation and storm surge; here we focus on predicting, managing and mitigating their impacts through more effective coastal zone management.

[1] ***IGOS. A Coastal Theme for the IGOS Partnership — For the Monitoring of our Environment from Space and from Earth. Paris, UNESCO 2006. 60 pp. (IOC Information document No. 1220).***
See: www.igospartners.org/docs/theme_reports/IGOS%20COASTAL%20REPORT%20midrez.pdf

GOALS AND OBJECTIVES FOR WORKSHOP I:
"*Observing System Requirements for Managing and Mitigating the Impacts of Human Activities and Coastal Inundation in the Mediterranean Region*"

The first regional workshop of the series focused on the specific coastal observing needs, challenges and capabilities in the Mediterranean region. This region was chosen as the site for the first workshop because the variations in needs and capabilities among the different countries in the Mediterranean make it a small-scale analog of the present global situation, wherein large differences exist from nation to nation (and region to region) in terms of both susceptibility (risk and resilience) to coastal hazards and capacity for effective coastal zone management. During the planning for the workshop, it was envisioned that coastal inundation would be the "glue" that allows treatment of all of the issues mentioned in the prospectus of the Workshop series (above). Human activities and their impact on susceptibility to coastal flooding is a key issue, likewise associated impacts on ecosystem health and productivity. Specific objectives of the Mediterranean workshop included:

- Comparison of 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).
- Assessment of present 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).
- Determination of observing system requirements for the provision of data and information needed to quantify changes in susceptibility on appropriate time and space scales.
- Promotion of an increased 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).
- 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 susceptibility.

WORKSHOP FORMAT

The Workshop was conducted over a period of 5 days, with the first day devoted to discussion of the goals and objectives of the meeting, and a review of representative local (Greek) activities in coastal observations, decision support systems, and integrated coastal area management (ICAM). Days 2 through 4 consisted of a series of breakout sessions and plenary discussions building towards the stated goals and objectives, as follows:

1. Identify priority issues to be addressed through sustained observations, data management and operational modeling in the context of the following four areas of concern.
    a. Quantitative indicators of risk and resilience of coastal populations to coastal inundation and storm surge;
    b. Impacts of coastal inundation and storm surge on coastal infrastructure;
    c. Impacts of coastal inundation on coastal ecosystems;
    d. Impacts of coastal inundation on living resources
2. Observing system requirements for the provision of data and information in support of decision making. Focus on an observing and decision-support system that addresses the high-priority gaps, including:
    a. Observing systems
    b. Data management, modeling, and integration
    c. Prediction, scenarios, and decision-support
3. Observing system requirements for Integrated Coastal Area Management: Human Use, Public Health, Environmental Protection, & Resource Management in the Context of Global Climate Change. Set the stage for focused discussions on the design of the pilot CODAS and ICoDSS projects.

These issues were discussed in breakout sessions that were roughly divided according to geomorphological/societal regions of the Mediterranean, with two parallel sessions addressing:

- River Deltas and Coastal Lagoons
- Sandy Coastlines and Cliffs

These groups were by no means mutually exclusive and the groups were free to consider a broad range of topics and issues.

The final day (Day 5) consisted of discussions of next steps in terms of carrying out the recommendations of the Workshop, as well as preliminary planning for the second workshop, to be conducted in Africa.

SUMMARY OF WORKSHOP FINDINGS

In general, the offshore marine observing system is in good condition and needs continued support and enhancement. Coastal marine and terrestrial observing systems have the added complication of the need for more involvement and control by individual States. Therefore, the needs are more varied among States and in particular between the northern and southern rims of the Mediterranean. More extensive capacity building and coordination of activities are needed, especially in the southern rim countries.

Priority Issues

1. Existing North-South differences in observational capabilities in the Mediterranean hinder progress in the development of a basin-wide observing and decision support system that can address the range of threats to coastal populations, infrastructure, ecosystems, and living resources. Obstacles to enhancing the capabilities in the Southern Mediterranean include gaps in information related to:

- decision making
- priority issues in the Southern Mediterranean countries including NGOs
- operational responsibilities
- data availability
- current capabilities
- national programs for ICZM and coastal observations/research
- international relations (data exchange)
- capacity building issues/awareness

2. There is a need for enhanced risk awareness, based on scientific hazard and vulnerability assessment.

With respect to hazards, this assessment must include:

- *Seismic (Sources, Historical records)*
- *Sea level (Tsunamis, Surges, SLR)*
- *Meteorological data*
- *Coastal Topography/Bathymetry (DEMs)*
- *Coastal Morphology/Typology (Monitoring Coastal Change)*
- *Existing Defences*
- *Anthropogenic forcing and modifications/alterations*

With respect to vulnerability, this assessment must include

- Social
  - *Population distribution* (LULC, nightlights, CIESIN GPW)
- Economic
  - *LULC and LUCC (Accuracy, Validation)*
- Environmental
  - *Habitats, pollution, Sensitive areas /ecosystems (improve monitoring & temporal resolution)*
- Institutional

This effort must examine feedbacks (positive/negative), and should enable the development of scenarios (derived from hazard & vulnerability data) and tools (e.g. DIVA) toward enhanced risk awareness.

3. There is a need for enhanced Land Cover / Land Use & Digital Elevation Maps. These maps are essential to the treatment of:

- Risk and vulnerability assessment
- Urbanization impacts
- Natural resource (esp. wetland) protection and adaptation

Issues with respect to existing resources include the fact that although remotely-sensed data/imagery and related resources are numerous, the compatibility of imagery, classifications and analyses remain a challenge. In addition, the provision of regional information generally has a lag of several years, and so has minimal utility in up-to-date risk assessment analyses. Gaps in observing system derived information needed to address this issue include:

- Inventory of imagery and extracted land cover class information
- Establish compatibility of classifications & standardization
- Establish compatible information bases for north and south rims (coming soon – GlobeCover 2 and Globe Corine????)
- Validate remotely-sensed information with in-situ measurements in selected sites
- Infer ecosystem functions, services, condition, stressors and potential for change from combined (remote and in-situ information) for selected sites
- Infer functions, etc. for broader coastal landscape.
- Minimize the lags in data on human dimensions and demographics and foster improved modeling for nowcasting and forecasting of them.

4. There is a need to assess the "***dynamic***" impact of climate change on near-shore processes under both current and future (up to year 2100) conditions. Knowledge gaps include future conditions (winds, atmospheric pressure, precipitation,) at scales from basin to regional to local. Gaps in observations needed to address this issue include:

- In-situ observations in the southern Mediterranean
- Satellite based altimetry, scatterometry, and gravimetry
- Knowledge of exchanges among the adjacent basins and seas
- Data management, modeling, and integration
- QA/QC
- Metadata
- Coupling of atmospheric and ocean models
- Coupling of hydrologic and ocean/atmosphere models at basin scale
- Linking basin-scale, regional & local models (regional likely missing in the south)
- Prediction, scenarios, and decision-support
- Model consistency, compatibility
- Baseline of existing conditions and scenario-based assessments

5. There is a need to assess the "***dynamic***" impacts of climate change on inundation, erosion and shoreline change. Present studies and analyses are based on a "***static***"

approach, often focusing on inundation levels. These assessments are important for decision-support and need to be supported by extended Earth observations. However, dynamic processes (e.g., waves, sediment transport) will change coastal morphology and bathymetry, and thus will have potentially different implications. Effective analyses must include physical and socio-economic responses to inundation and to changes in forcing, as well as human activities. Gaps in observations needed to address this issue include:

- In-situ water level at the land boundary
- Shallow water wave gauges everywhere (Buoys, ADCPs, HF Radar)
- Higher resolution bathymetry, topography and waterline position data (to meter or better resolution)
- River discharge and loadings
- Land cover and land use maps
- Up-to-date human demographic and socio-economic information
- Sediment characteristics
- Dune and cliff erosion rates
- Coupling of nearshore atmospheric and ocean models
- Coupling of terrestrial hydrologic and ocean/atmospheric models
- Linking basin-scale, regional & local models (regional likely missing in the south)

6. There is a need to assess the current state and trends of the quality of the Mediterranean marine environment. Gaps in observations needed to address this issue include:

- In-situ observations, especially in the southern Mediterranean
- Satellite based ocean color including merged products
- In-situ bio-optical data throughout the coastal Mediterranean
- Land cover data (satellite and in-situ) throughout the coastal Mediterranean
- 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 all Mediterranean coastal regions
    - "Migrate" and refine basin scale to regional
- Linkages with watersheds and adjacent basins, especially loadings

7. There is a need to assess nutrient loading (terrestrial input), development of HABs, hypoxic/anoxic conditions, habitat alteration and water quality. Knowledge of existing and likely future coastal ecosystem states is inadequate. Gaps in observations needed to address this issue include:

- Biogeochemical and ecological in-situ observations
- Satellite based ocean color including merged products, regional algorithms and product suites in coastal/case 2 waters of suitable space and time resolution

- In-situ bio-optical data throughout the coastal Mediterranean
- Land cover data (satellite and in-situ) throughout the coastal Mediterranean
- Up-to-date human demographic and socio-economic information
- 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 (including MERIS and MODIS data) for all Mediterranean coastal regions
- Linkages with watersheds and adjacent basins, especially loadings

Recommendations/Action Items

Recommendation 1: Develop a Pilot Project to address and promote the minimization of the North-South differences in observational capabilities in the Mediterranean.

Action Item 1:
Prepare an informal document that summarizes the data and information presently available in the Southern Mediterranean coastal region, initially using Egypt as a template/example.
Responsible Persons: Dr. Mahmoud Ahmed (NARSS, Egypt), with assistance from Dr. Lahuaria Benrekta nee Boukheddimi, Professor Adegoke, Professor Plag.
Schedule: by November 2008

Action Item 2: Organize a Southern Mediterranean workshop to develop plans towards a pilot project in the region. The workshop goal will be the identification of the cross-boundary/regional priority issues that could be the basis for a pilot project involving most of the Southern Mediterranean countries, and that could be addressed in a proposal to, e.g, the EU, AID, GEF, UNEP, FAO, IOC. The workshop will be held in a Southern Mediterranean Country, most likely Egypt. Other details:

- Workshop will review the relevant conditions in the Southern Mediterranean Countries
- Participation by experts nominated through the GEO delegations (Members or Participating Organizations)
- Participation of experts from other regions (NMC, GEO-UIC, USA)
- Official presentation of the new protocol for ICZM of the Barcelona Convention

Note: GEO-Egypt and/or NARSS, Egypt could be a host for this workshop
Responsible Persons: GEO in coordination with CZCP & relevant organizations. Dr. Mahmoud Ahmed (NARSS, Egypt), with assistance from Professor Adegoke, Professor Plag, Professor Bruno, and Dr. DiGiacomo.
Schedule: late 2008 or early 2009

Recommendation 2: Develop and facilitate improved basin-wide observation capabilities to provide:

- In-situ water level at the land boundary
- Shallow water wave characteristics
- Higher resolution bathymetry, topography and waterline position data (to meter or better resolution)
- River discharge and loadings with links to human dimensions
- Sediment characteristics
- Dune and cliff erosion rates

Develop the capability for dynamics-based inundation forecasting for both short-term events and long-term water level changes. Use this capability to produce scenario-based

risk assessment tools (e.g., maps) of inundation, erosion, and shoreline change. This capability should also be used to update design criteria for coastal engineering projects and coastal development to include both climate change-associated as well as tsunami impacts. This effort will require the coupling of nearshore atmospheric and ocean models; and terrestrial hydrologic and ocean/atmospheric models, as well as linkages between basin-scale, regional & local models.

Action Item 1: recommend for inclusion in GEO Workplan.
Responsible Persons: ?????
Schedule: ?????

Action Item 2: Develop an "OPENMED" interoperability project to facilitate and demonstrate the capability of providing basin-wide, real-time ocean and weather observations in the Mediterranean. Pattern this after the OpenIOOS demonstration project (see http://www.openioos.org/); and build on existing cooperative programs, including MedGOOS (see http://www.medgoos.net/). This site will be located on the new CZCP website. The initial parameters to be disseminated will be ocean surface salinity and temperature. This effort will assist in the identification of the locations of follow-on Pilot Projects.
Responsible Persons: Professor Michael Bruno, Professor Yannis Krestenitis, Professor Kostas Nittis, Professor Nadia Pinardi, Dr. Hans Dahlin, Dr. Paul DiGiacomo, Professor Hans-Peter Plag
Schedule: launch before end of December, 2008

Recommendation 3: Develop and facilitate improved basin-wide observation capabilities to provide:

- Biogeochemical and ecological in-situ observations
- Satellite based ocean color including merged products, regional algorithms and product suites in coastal/case 2 waters
- In-situ bio-optical data
- Validated coastal habitat maps
- Linkages with watersheds and adjacent basins, especially loadings
- Tie-in with GEO remote sensing water quality efforts

This effort will require the coupling of ecosystem and hydrodynamic models; coupling with terrestrial hydrologic and atmospheric models, as well as linkages between basin-scale, regional & local models.

Action Item 1: recommend for inclusion in GEO Workplan.
Responsible Persons: Professor Robert Christian, others ??
Schedule: ?????

Action Item 2: Develop an "OPENMED" interoperability project to facilitate and demonstrate the capability of providing basin-wide, real-time observations of water quality and ecology parameters in the Mediterranean. Pattern this after the OpenIOOS demonstration project (see http://www.openioos.org/); and build on existing cooperative

programs, including MedGOOS (see http://www.medgoos.net/). This site will be located on the new CZCP website. The initial parameters to be disseminated are still to be determined. This effort will assist in the identification of the locations of follow-on Pilot Projects.
Responsible Persons: Professor Michael Bruno, Professor Yannis Krestenitis, Professor Kostas Nittis, Professor Nadia Pinardi, Dr. Hans Dahlin, Dr. Paul DiGiacomo, Professor Hans-Peter Plag
Schedule: launch before end of December, 2008

Recommendation 4: Existing Land Cover/Land Use maps will be updated and standardized for more effective use by the Integrated Coastal Area Management (ICAM) community.

Action Item 1:
Engage contacts regarding GEO landcover workplan, EEA, and UNSDI to address bridges and standards in the coastal zone (land & sea).
Responsible Persons: Dr. Françoise Breton, Dr. Eleni Fitoka, Professor Robert Christian
Schedule: October, 2008

Action Item 2:
Prepare proposal for FP7 call regarding coastal issues fostering relevant in-situ and remote-sensing products. Dr. Breton will provide a short prospectus at the end of June for N-S rim activities; potential link to second proposal on southern rim with RFP in November.
Responsible Persons: Dr. Francoise Breton, Dr. Eleni Fitoka, Professor Robert Christian, Dr. Andrianos Retalis, Mr. Antonio Bonaduce, Professor Nadia Pinardi, Professor Athanasios Vafeidis
Schedule: January 2009

Recommendation 5: Develop climatologies and forcing scenarios for future (up to year 2100) conditions, including winds, atmospheric pressure, precipitation at scales from local to basin-wide.

Action Item: recommend for inclusion in GEO Workplan.
Responsible Persons: recommended: Piero Lionello
Schedule: ?????

Recommendation 6: Develop proposal to initiate more effective use of information analyses to support risk & vulnerability assessments in the Mediterranean

Action Item: Identify status of existing tools and data to be linked to FP7 proposal.
Responsible Persons: Professor Athanasios Vafeidis, Dr. Russell Arthurton, Mr. Antonio Bonaduce, Professor Nadia Pinardi

Schedule: Initial, 2-page overview before end of September, 2008 with analysis from FP7 grant

Recommendation 7: Form a CZCP Mediterranean
Responsible Persons: Professor Yannis Krestenitis, Professor Kostas Nittis, Professor Nadia Pinardi, Dr. Hans Dahlin, Dr. Paul DiGiacomo
Schedule: Immediate

Recommendation 8: Develop basin-wide capability to perform ecological and water quality Assessments, Forecasts and Scenarios (e.g., biodiversity, water quality, and fisheries) under conditions provided by IPCC (and other) predictions (potential user: EEA), in forms useful for use in ICAM
Action Item:????

APPENDIX A

Program of Workshop June 9-13, 2008, Athens, Greece

Monday, 9 June

14:30 - 15:30 Registration and Coffee
15:30 - 16:00 Welcome
Professor Christos Zerefos, President of NOA, President of Mariolopoulio – Kanagineio Foundation, Co-host of the Workshop

16:00 - 16:45 GEO Presentations
Dr. Michael Rast, GEO Secretariat
Professor Michael Bruno, Stevens Institute of Technology - Co-Chair

16:45 - 17:00 Presentations on Greek activities (Greek GEO office introduces)
Greek GEO Office –V. Tritakis; E. Christia

17:00 - 17:20 BREAK
17:20 - 17:40 Professor Christos Anagnostou – HCMR: ***Introduction to Coastal Research in Greece***
17:40 - 18:00 Dr. Kostas Nittis, HCMR: ***Operational Marine Monitoring and Forecasting***
18:00 - 18:20 Professor Yannis N. Krestenitis, Aristotele University of Thessaloniki: ***Extreme sea level variability and coastal inundation***
18:20 - 18:40 Dr. Nikolaos Sifakis, C. Kontoes, I. Keramotsoglou, NOA: ***Decision support in prevention, crisis management and damage assessment in flood sensitive areas***
18:40 - 19:00 Dr. Eleni Fitoka, EKBY: ***Coastal wetland ecosystems & the Mediterranean Wetland Initiative (MedWet)***
19:00 - 19:20 Dr. E. Koutrakis & G. Sylaios, Fisheries Research Institute: ***ICZM and Coastal Monitoring systems for coastal erosion study: The experience gained from Beach Med-e***
20:00 - RECEPTION

Tuesday, 10 June

08:00 - 09:00 Registration and Coffee
09:00 - 09:15 Bruno, Plag, Christia: ***Workshop Goals, Organization and Deliverables***
09:15 - 11:15 (each talk 20 minutes)

Professor Hans-Peter Plag, University of Nevada, Reno and Co-Chair: ***Geophysical Dynamics of the Coastal Zone in the Mediterranean on Annual to Decadal Scales***

Professor Anastasios Vafeidis, Institute of Geography, Christian-Albrechts University, Kiel : ***Spatially explicit assessment of coastal vulnerability - The DIVA-Med tool***

Dr. Christos Anagnostou, HCMR: ***Towards Integrated Coastal Zone Management***

Professor Nadia Pinardi, INGV, and Mediterranean Operational Oceanography Network: ***Observing and Prediction Systems in the Mediterranean Region: Ocean***

Professor Robert Christian, East Carolina University, and LOICZ: ***Observing and Prediction Systems in the Mediterranean Region: Transitional Waters and Land***

Dr. Mark Dowell: ***Space-Based Monitoting in Support of Environmental Assessment at Synoptic Scales***

11:15 - 11:45 BREAK

11:45 - 12:15 Professor Robert Christian, East Carolina University: ***Results of Gap Analysis***
12:15 - 12:30 Dr. Russell Arthurton, IOC: ***Decision-making tools in support of ICAM – the case of marine-related hazards***
12:30 - 12:45 Bruno, Plag & Christia: ***Charge to the afternoon break-out sessions*****: Main goal is to define/identify/specify priority issues in decision support to be addressed through sustained observations, data management and operational modeling. Most likely, priorities will depend on regional characteristics (e.g., river deltas, Adriatic, Riviera, etc.). Identify questions to be answered by the groups. One question will be to identify four to five high priority issues to be addressed.**

12:45 - 14:00 LUNCH

14:00 - 17:30 Breakout Sessions A:
Identify priority issues to be addressed through sustained observations, data management and operational modeling in the context of the following four areas of concern.

1. Quantitative indicators of risk and resilience of coastal populations to coastal inundation and storm surge;
2. Impacts of coastal inundation and storm surge on coastal infrastructure
3. Impacts of coastal inundation on coastal ecosystems
4. Impacts of coastal inundation on living resources

Each group will examine the issues from the perspective of different geomorphological/societal regions of the Mediterranean: 1. River Deltas and Coastal Lagoons; and 2. Sandy Coastlines and Cliffs.

Wednesday, 11 June

08:00 - 09:00 Registration and Coffee
09:00 - 12:00 Plenary session
Working Group reports
Discussion
Charge to Working Groups for Breakout Sessions B: Observing system requirements for the provision of data and information in support of decision making (based on results for Session A).

12:00 - 14:30 LUNCH and Breakout Sessions B
Focus on an observing and decision-support system that addresses the high-priority gaps.

- **Observing systems**
- **Data management, modeling, and integration**
- **Prediction, scenarios, and decision-support**

14:30 - Trip to Sounio and DINNER

Thursday, 12 June

08:00 - 09:00 Registration and Coffee
09:00 - 12:30 Plenary Session
Working Group reports
Discussion
Charge to Working Groups for Breakout Sessions C: Data and information requirements for Integrated Coastal Zone Management: Human Use, Public Health, Environmental Protection, & Resource Management in the Context of Global Climate Change (Integrate results from Session B, formulated as questions)

12:30 - 14:00 LUNCH

14:00 - 17:30 Working Groups
Main topic will be:
Observing system requirements for Integrated Coastal Area Management

Friday, 13 June

08:00 - 09:00 Registration and Coffee
09:00 - 11:30 Plenary session
Working Group reports
Discussion
Executive Summary of results and next steps (including completion of workshop report and production of deliverables).

APPENDIX B

List of Participants

Robert Christian	East Carolina University - USA	christiannr@ecu.edu
Michael Bruno	Co-Chair, Stevens Institute of Technology USA	Michael.Bruno@stevens.edu
Hans-Peter Plag	Co-Chair, University of Nevada Reno USA	hpplag@unr.edu
Jimmy Adegoke	University of Missouri-Kansas City USA	adegokej@umkc.edu
Mahmoud Ahmed	National Authority for Remote Sensing and Space Sciences, NARSS Cairo Egypt	mahahmed_narss@yahoo.com
Eleni Christia	Greek GEO Office	elchris@email.edunet.gr
Hans Dahlin	EuroGOOS Office, SMHI Sweden	hans.dahlin@smhi.se
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