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Appendix 5: Coastal Environments

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The issue:

Latin America and the Caribbean (LAC) have a strong relationship with the coastal environment and there is increasing demand for the subdivision, use and development of coastal space and resources. The complex nature of the coastal environment means that managing the effects of coastal hazards is challenging.

The coastal zone is one of the most dynamic natural systems because there the hydrosphere, the lithosphere and the atmosphere meet and interact, forming interconnected systems. Coastal ecosystems are complex entities consisting of living beings, the physical environment they inhabit, and the interactions within and between these two components. Coastal zones comprise many habitats, all of which have been highly modified over millennia by human activities. As a consequence of the last statements, many of these ecosystems has been considered for marine protected areas trough the Americas, not only for their natural richness, but also because they has been recognize of great economic value.

Coasts are of great ecological and socioeconomic importance. They sustain economies and provide livelihoods through fisheries, ports, tourism, and other industries like their recent consideration for clean ways of power generation. They also provide ecosystem services such as providing food, regulating atmospheric composition and cycling of nutrients and water. These areas have been centers of human settlement since the dawn of civilization, and also have cultural and aesthetic value.

Coastal ecosystems are among the most productive because they are enriched by land-based nutrients and nutrients that well up into the coastal waters from deeper levels of the ocean. As a consequence, they are repositories of biological diversity and provide a wide range of goods and services. Coastlines are among the most populated regions. A number of major cities are located in coastal areas and residential development in coastal areas is rapidly occurring with, in many cases, little future proofing for coastal hazards. Coastal oceans are the most fished, the most modified, and the most subject to natural and industrial disasters.

Loss and degradation of coastal zone ecosystems are affected by direct and indirect drivers and stressors, most of them of anthropogenic origin. The main indirect drivers and stressors

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are: population expansion and increased demands for resources; distribution of wealth and social inequalities; policy failure; market failure and/or distortions; globalization; and poor development model. Direct drivers and stressors are: loss, fragmentation, and degradation of habitats; overexploitation of resources; pollution; introduction of alien invasive species; and climate change and variability, which interacts with the previous factors listed, in many cases reinforcing their impacts.

Both direct and indirect drivers and stressors are agents of global change. They do not operate singly but form an interacting and often synergistic complex. Some of the most dramatic observed and/or predicted consequences of their action are: changes in species distribution, organism metabolism and ecological processes such as productivity and species interactions; changes in ocean chemistry, eutrophication, acidification, hypoxia; rising sea level; chronic erosion and contamination; shifts in weather patterns and greater spreading of exotic species. While the pressures along the coastal zone increase, the challenge of the Integrated Coastal Management remains difficult to accomplish. One of the most important needs to achieve the goal is the availability, communication and proper use of scientific information and here is where the role of ocean/climate services becomes fundamental.

Particular monitoring and research needs in view of effective climate services for Latin America and the Caribbean:

Research is required in a number of specific areas to address the different users' requirements, and issues in each geographic region of LAC.

Observation and monitoring of the climate system in the LAC region is very deficient and in many cases inexistent. Large efforts should be done in this sense, including not only observation and monitoring of meteorological/oceanographic variables but also of the state of coastal ecosystems.

Some proposed research priorities for a regional climate research agenda that emerged during the WCRP-LAC meeting include:

- Inter basins influence on ENSO impacts (Pacific- Atlantic);
- Decadal modulation of ENSO local effects and the role of other sources of variability like Pacific Decadal Oscillation (PDO) and Atlantic Decadal Oscillation (AMO);
- Role of the Eastern Pacific in ENSO diversity;
- Convective processes in the Eastern Pacific and ENSO;
- The thermocline feedback in the eastern Pacific;
- Extreme events prediction and early alarm systems of climate hazards?;
- Impacts of climate variability and change on extreme events.

Finally, the inclusion of socioeconomic issues on the research agenda is a very important aspect and a need for the region.

Strengths and weaknesses:

The principal strengths to progress towards the development of Ocean-Climate services in the LAC region detected during the WCRP-LAC meeting are:

- Capacities in terms of human resources to carry out research on the subject.
- Experience of many institutions of the region in the provision of some services.
- Interest and will of many institutions of the region to expand the range and improve the quality of services provided.
- Commitment of the local scientific community with the issue.
- The existence of regional mechanisms and frameworks to develop research subjects beyond the national level.

Nevertheless a number of weaknesses were also noted:

- The number of trained professionals and students in topics related to oceanography is generally smaller than the needs in most of the region.
- The capabilities developed by research centers and universities are not always exploited by local services due to either lack/failures in communication or joint projects.
- Even though some institutions are providing services, there is a need to progress in the development of standardized methodologies for producing forecasts and climate products.
- The resources of many institutions providing services are limited to the routine tasks and only a small portion of their budget is allocated for research and capacity building.
- Essential interaction between disciplines is rather modest and in some cases inexistent.
- Science information is not being communicated properly to the coastal environment end users and policy developers and managers; science information is frequently not available or not in a form that its usage can be effective.
- Climate predictions are not always translated to the probable climate impacts, making information useless to end users.
- Inability of the scientific community to communicate the inherent uncertainty of climatic products.
- Overlapping of projects and initiatives which split financial resources and the adequate response of end beneficiaries.

Conclusions and proposed actions

The condition of coastal environments in LAC is a perfect example of the urgent need to coordinate efforts and get a serious dialogue and commitment between the research community and the operational agencies.

A great challenge for LAC region is to understand how we can exploit coastal resources within environmental and biological constraints, to ensure enduring access to them through informed regulation, management and utilization. This requires not only the production of scientific information but also its communication to end users, becoming a task that demands the

participation of several actors with diverse capabilities. The issue is complicated because the application of science must involve more than just providing information on the state of the coastal environment, identifying indicators for assessing environmental change or developing mechanisms for monitoring and predicting the effect of policy and management options. Information must also inform the analysis of issues, help the user to ask the right questions and then provide signposts to where appropriate data can be found.

The WCRP-LAC meeting showed that there are already established capacities in LAC to think that the development of climate services is possible, although there are some shortcomings and needs. Improvements and progress on scientific research and observation networks and monitoring of the coastal environment, so as changes in the management of operational agencies are required. Increased participation of specialists in social sciences seems to be also a fundamental need to improve the communication of scientific results and their inherent uncertainty, that because the problems identified are of inter, multi and trans-disciplinary nature.

Some important aspects that were mentioned during the meeting were:

- To move towards a definition of Ocean-Climate services by considering specific users (and stakeholders?) demands, and main issues in each geographic region of LAC: Pacific, Caribbean and Atlantic coast.
- To establish specific roles of the components of the Ocean-Climate services for the coastal zones including the mechanisms for their interaction: data monitoring and processing, research, modeling, forecast, information and decision support systems, vulnerability assessments, risk management and policy making (support for help in the protection process support?).
- To ensure coordinated efforts among the global, regional and national programs which really contribute to the sustainability of coastal zones in Latin America.
- (Dudas: mencionar aquí el asegurarse el gestionar fuentes de financiamiento para ayudar con la investigación de aspectos oceanográficos y costeros? Promover los programas académicos de grado y posgrado en temas costeros y oceánicos, es decir marinos, en las líneas de investigación mencionadas? Intercambio de académicos y estudiantil?)

The following actions to foster synergy with ongoing international projects and panels were also proposed:

- To agree the necessary arrangements to establish a Regional CLIVAR Panel, working group or task force for LAC to define the regional research agenda, taking in account the outcomes of the WCRP-LAC Conference.
- To develop a road map for the inclusion of the marine component in the GFCS with focus on LAC.
- To request a regional meeting with GOOS, JCOMM (IOC-WMO) where the agreed research agenda for LAC be presented and coordinated.
- To request to Future Earth and UNEP-PROVIA, information about their plans and activities related to coastal and marine issues for LAC.