IH cantabria

INSTITUTO DE HIDRÁULICA AMBIENTAL
UNIVERSIDAD DE CANTABRIA

MVOTMA
Ministerio de Vivienda
Ordenamiento Territorial
y Medio Ambiente

CTCN
CLIMATE TECHNOLOGY CENTRE & NETWORK

DEVELOPMENT OF TECHNOLOGICAL TOOLS TO EVALUATE THE IMPACTS OF AND VULNERABILITY AND ADAPTATION TO CLIMATE CHANGE IN URUGUAY'S COASTAL ZONE

D1.1: DOCUMENT SUMMARIZING OTHER COUNTRIES EXPERIENCES OF DETERMINING THE THREATS TO, AND EXPOSURE AND SENSITIVITY OF SEA COAST

FUNDACION INSTITUTO DE HIDRÁULICA AMBIENTAL DE CANTABRIA
UC UNIVERSIDAD DE CANTABRIA

ACTIVITY 1: REVIEW INTERNATIONAL EXPERIENCES AND PROPOSE THE MARINE DYNAMIC VARIABLES TO BE USED FOR COASTAL ZONE MANAGEMENT

ACTIVITY 1.1. REVIEW INTERNATIONAL EXPERIENCES

This activity aims to provide extensive and detailed input based on existing experiences at the regional and the local scale in determining threats, exposure and vulnerability of sea coasts. The review carried out includes guidelines and recommendations for risk assessment methodologies from different institutions, and some of the most relevant projects on studying climate change-induced impacts and risks.

Some of the most relevant *guidance documents* to date on climate change and risk disaster assessment are listed and described below.

1. Technologies for Adaptation to Climate Change

   United Nations Framework Convention on Climate Change (UNFCCC), 2006

   Download link:

   http://unfccc.int/resource/docs/publications/tech_for_adaptation_06.pdf

   https://www.cbd.int/doc/case-studies/tttc/tttc-unfccc-en.pdf

The publication Technologies for Adaptation to Climate Change summarizes and illustrates conclusions of a review of adaptation technologies and assesses their possibilities in five sectors: coastal zones, water resources, agriculture, public health and infrastructure, serving as a brief introduction to the principles and methods of adaptation and the practical steps that can be taken to put them into practice. The extended document aims to provide (i) an overview of the current knowledge and understanding of adaptation to climate change, (ii) a framework for assessing technologies for adaptation to climate change, (iii) the process of technology development and transfer as relevant to adaptation to climate change, (iv) examples of important technologies for adaptation together with case studies, and (v) a discussion of implications for climate policy.

2. Guide to the Vulnerability Reduction Assessment

   United Nations Development Programme (UNDP), 2008

   Download link:

   https://europa.eu/capacity4dev/public-environment-climate/document/guide-vulnerability-reduction-assessment-undp

The Guide to the Vulnerability Reduction Assessment (VRA) is a form of participatory impact assessment used in the UNDP Community-Based Adaptation programming that focuses on community perceptions of vulnerability to climate change and capacity to adapt. The VRA is comprised of four indicators associated with a set of perception-based questions, which aggregate to serve as an index of adaptive capacity. The process is structured in four steps. The first step corresponds to the assessment of the current vulnerability and the indicator used is the vulnerability of the

livelihood/welfare to existing climate change and/or climate variability. Once the present context of variability is discussed, the second step consists of assessing future climate risks. The vulnerability of livelihood/welfare to developing climate change risks is used on this occasion to relate to "likely" risks. In order to qualify the former indicator, and focus on the needs of the community to successfully adapt, the third step is about formulating an adaptation strategy. An indicator to identify policy and practical barriers links project outputs to their respective outcomes in vulnerability reduction. Finally, the last step aims to continue the adaptation process. In that event, the indicator used is the ability and willingness of the community to continue to manage climate change risks, which includes considerations of project sustainability.

3. Caribbean Risk Management Guidelines for Climate Change Adaptation Decision Making
   Caribbean Community Secretariat, 2008

   Download link:

   http://dms.caribbeanclimate.bz/M-Files/openfile.aspx?objtype=0&docid=2879.

The Caribbean Risk Management Guidelines for Climate Change Adaptation Decision Making aims to provide a risk management framework to guide the decision-making process related to the identification and implementation of appropriate climate variability and climate change adaptation options for the Caribbean. The risk management process is divided into the following six steps:

I. Getting started. This step captures the administrative process and identifies the specific problem(s)/hazard(s) and the associated risks. Specifically, the following sectors were considered to be at risk: human settlements, tourism, agriculture and food security, water, health, insurance, infrastructure, ecosystems.

II. Analysis of the climate variability or climate change hazard. The concerning hazards are identified and then, risk scenarios are developed or expanded to show the types of losses or impacts that could occur as a result of exposure to the hazard.

III. Risk estimation. This step involves estimating the frequency (or probability) and severity of the impact of climate variability and climate change risk scenarios developed in the previous step.

IV. Risk evaluation. Risks are examined in terms of costs, benefits and acceptability, considering the needs, issues and concerns of stakeholders. Risks are rank from "least severe" to "most severe" from the analyses completed earlier, and the perceptions of the stakeholders.

V. Adaptation, risk control and financing. This step produces strategies that will result in all risk issues and concerns considered in the process, becoming acceptable.

VI. Implementation and monitoring. The aim of this step is twofold: to guide the actions to be taken to reduce vulnerability to present day climate variability and projected climate change, and to monitor and evaluate the implementation process.

4. Shaping Climate-Resilient Development: A Framework for Decision-making

   Economics and Climate Adaptation Group, 2009

Download link:

https://www.google.es/url?sa=t&rct=j&q=&esrc=s&source=web&cd=1&cad=rja&uact=8&ved=0ahUKEwjsz6OA6JDWAhXG1xoKHYuVDKAQFggrMAA&url=http%3A%2F%2Fccsl.iccip.net%2Fclimate_resilient.pdf&usg=AFQjCNFjhB0w_9AqiRU5zpQLwF01Lfb-fg

The aim of Shaping Climate-Resilient Development: A Framework for Decision-making is to provide decision-makers with a systematic way of answering climate-related loss questions. Focusing specifically on the economic aspects of adaptation, it outlines a fact-based risk management approach that national and local leaders can use to understand the impact of climate on their economies and identify actions to minimize that impact at the lowest cost to society. The report is structured in three main blocks:

I. Designing a systematic approach to climate adaptation. A quantitative decision-making framework is built around two sets of tools: tools to quantify a location's "total climate risk", and the cost-benefit discipline to evaluate a selection of feasible and applicable measures to adapt to the expected risk. The methodology is applied it in eight on-the-ground cases and tested against a sample of climate hazards, economic impacts, and development stages. The assessments undertaken in these test cases were built on broad metrics of climate-related economic loss, such as GDP, asset value, and agricultural production, and in most cases did not attempt to calculate the additional social and environmental costs of climate impacts.

II. Towards solutions: findings from the test cases. Based on the test cases, (i) plausible scenarios on which to base decision-making can be built to account for the possible effects of global warming on local weather patterns; (ii) significant value is at risk; (iii) a portfolio of cost-effective measures can be put together to address a large part of the identified risk; and (iv) the cases reinforced the view that adaptation measures are in many cases also effective steps to strengthen economic development – especially in developing countries.

III. Taking climate-resilient development forward. Lessons learnt on how decision-makers can best assess and address the climate risk facing their economies and societies.

5. Climate, Risk and Business

International Finance Corporation (IFC), 2010

Download link:

http://www.ifc.org/wps/wcm/connect/09deed804a830d0f85e6ff551f5e606b/ClimateRisk_Business.pdf?MOD=AJPERES

The Climate, Risk and Business entails a set of pilot climate risk assessment studies that aim to test and begin to develop methods for evaluating climate risks to the private sector and to identify appropriate adaptation responses. The studies use a risk-based approach in which risk is a function of two dimensions: the probability of a hazard and the magnitude of its consequence. The framework developed sets out eight stages: (i) identify problems and objectives; (ii) establish decision-making criteria; (iii) assess risk; (iv) identify options; (v) appraise options; (vi) make decisions; (vii) implement

decisions; and (viii) monitor. Data on observed and future climatic conditions are required to provide a view of "baseline" climatic conditions against which future climate change impacts could be assessed, and to identify any trends in the observed records. In general terms, all the studies aim to provide a holistic approach by analyzing risks to the technical/operational, environmental, social and financial performance of the investments.

6. Climate, Environment, and Disaster Risk Reduction Integration Guidance

   Swiss Agency for Development and Cooperation, 2010

   Download link:

   https://www.dfae.admin.ch/content/dam/deza/en/documents/publikationen/Diverses/221231-accroissement-partI_EN.pdf

The Climate, Environment, and Disaster Risk Reduction Integration Guidance (CEDRIG) is an approach to provide support in analyzing whether existing and planned cooperation strategies, programmes and projects are at risk from disasters emanating from climate variability, climate change, environmental degradation and/or tectonic activities, as well as whether they have an impact on greenhouse gas (GHG) emissions and/or the environment. This guidance is structured in two main parts:

- Part I: outlines the rationale and framework, and provides the user with procedural information about the approach, key definitions and explanations as well as supporting materials.
- Part II: contains the practical handbook. This is the core part of the guidance through the process of how to screen and assess whether strategies, programmes or projects are at significant risk.

The scope and depth of the CEDRIG can be adapted to reflect specific needs and constraints. A modular approach provides for an initial basic analysis of the relevance of climate change, environmental degradation and/or natural hazards (Module 1, Risk and Impact Screening) and if necessary a more in-depth assessment in a second step (Module 2, Detailed Assessment at Strategic and Programmatic Level; or Module 3, Detailed Assessment at Project Level). As such only strategies, programmes or projects assessed to be at risk from disasters or posing an impact on GHG emissions and/or the environment need to run through a detailed assessment. It consists of an assessment of risks and impacts, identification of adaptation and risk reduction options as well as mitigation options, selection of options, and definition of monitoring and evaluation indicators.

7. Technologies for Climate Change Adaptation – Coastal Erosion and Flooding

   Global Environment Facility (GEF) and United Nations Environment Program (UNEP), 2010

   Download link:

   http://www.tech-action.org/-/media/Sites/Uneprisoe/Publications%20(Pdfs)/TNA%20Guidebooks/TNA_Guidebook_AdaptationCoastalErosionFlooding.ashx?la=da

Technologies for Climate Change Adaptation – Coastal Erosion and Flooding is intended to be a practical tool for use by coastal zone managers in developing countries. The aim is to provide best practice guidance and assist these managers in assessing their evolving adaptation needs and help them to prepare action plans for adapting to climate change in the coastal zone. The guidebook is structured in the following 6 chapters:

- Chapter 1 Introduction: describes the reasons for developing this guidebook and the target audience that comprises.
- Chapter 2 Background: summarizes the main physical and societal impacts of climate change on coastal zones, as determined by previous studies, including the review of the Intergovernmental Panel on Climate Change (IPCC) Fourth Assessment Report. There are a range of climate change impacts and resulting impacts in coastal areas.
- Chapter 3 Adaptation Approaches, Options and Practices: focuses on the process of adaptation and on typologies of adaptation approaches.
- Chapter 4 Adaptation, Technologies and Practices: thirteen adaptation technologies to adapt to erosion and flooding hazards in coastal areas are described. They are grouped under the three adaptation approaches of (i) protect; (ii) accommodate; and (iii) retreat. For each adaptation technology, several aspects are considered, including specific details, its advantages and disadvantages, knowledge and capacity building requirements, approximate costs and opportunities and barriers to implementation. This includes relevant case study examples, normally from the developing world, supplemented by developed world examples where appropriate. Additionally, the knowledge and capacity building requirements and monitoring technologies are considered and contrasted across all 13 adaptation technologies.
- Chapter 5 Prioritization of Technologies and Practices: addresses the issue of decision analysis, or deciding how to identify the most appropriate technology for a specific situation. This includes discussion of relevant decision-making frameworks, including cost-benefit analysis, cost-effectiveness analysis and multi-criteria analysis.
- Chapter 6 Conclusions: provides a synthesis of the key findings and recommendations related to the use of adaptation technologies in the coastal zone.

8. Climate Proofing for Development: Adapting to Climate Change, Reducing Risk

   Deutsche Gesellsschaft für Internationale Zusammenarbeit, 2011

   Download link:

   http://www.preventionweb.net/files/globalplatform/entry_bg_paper~giz2011climateproofing.pdf

The Climate Proofing for Development: Adapting to Climate Change, Reducing Risk is designed to support the integration of climate change impacts as well as awareness of the challenges and opportunities of climate change in development planning on various levels - national, sectoral, local and project. The study comprises four sections. The Introduction describes the main elements of

Climate Proofing for Development. Following this, Part A introduces the methodology of the approach, while Part B presents examples of possible use at different levels, including best practices. Part C presents some lessons learnt from the Climate Proofing for Development approach. The Climate Proofing for Development approach contains four main steps:

I. Preparation: climate information - especially on current and future climatic trends (e.g. sea level rise, reduced water availability, etc.) is gathered and compiled in a user-friendly way. These so-called exposure units can include productive sectors (e.g. agriculture), policy aspects (e.g. energy production policy), geographic areas (e.g. coastal zones, dry lands or mountain regions) or a specific target group (e.g. farmers).

II. Analysis: analysis of the biophysical and socio-economic effects of climatic trends on each exposure unit and develop probable chains of effects for climate change. Following the chain of effect, the bio-physical effects lead to socio-economic effects such as reduced employment opportunities or loss of income.

III. Options for action: for the most significant effects defined previously, options for action are developed to reduce the effects of climate change and to make use of the opportunities presented by climate change wherever possible. Instruments such as cost-benefit analyses support the selection of options for action and are deployed according to the specific possibilities. Co-benefits are also taken into account.

IV. Integration: this step aims to integrate the selected options for action into planning documents and the monitoring and evaluation processes.

9. Climate Change Data and Risk Assessment Methodologies for the Caribbean

   Inter-American Development Bank (IDB), 2014

   Download link:

   https://publications.iadb.org/bitstream/handle/11319/6453/Climate%20Change%20Data%20and%20Risk%20Assessment%20Methodologies%20for%20the%20Caribbean.pdf

The Climate Change Data and Risk Assessment Methodologies for the Caribbean provide a step-wise process to assess disaster and climate change risks and identify tools and methodologies to support the risk assessment process specific to the Caribbean region. The risk assessment process focuses on the direct and indirect risks to projects from sea level rise, hurricanes (including storm surge), and flooding (both coastal and riverine) because these hazards are considered to pose the greatest threat to the Caribbean region. The approach is structured as a tiered process following four steps:

- Step 1: screening for climate and climate change risk to determine whether further climate change related analysis is necessary.
- Step 2: definition of the assessment parameters. This includes defining the site and planning horizons and identifying and gathering relevant data to better understand what type of vulnerability assessment will be conducted.
- Step 3: assessment of climate and climate change risk and identification of the risk

management strategies. Conduction of a basic vulnerability or detailed risk assessment to identify how susceptible the project is to climate and climate change hazards (such as sea level rise, hurricanes, flooding, and drought). Identification of strategies to address identified risks, vulnerabilities, or impacts.

- Step 4: implementation, monitoring and reporting. Implementation of climate and climate change risk management strategies. Evaluation of the effectiveness and efficiency of the measures implemented.

10. Coastal Adaptation Strategies Handbook

    U.S. Department of the Interior, National Park Service, 2016

    Download link:

    https://www.nps.gov/subjects/climatechange/upload/CASH_FINAL_Document_111016.pdf

The Coastal Adaptation Strategies Handbook summarizes the current state of the National Park Services (NPS) regarding climate adaptation and key approaches currently in practice or considered for climate change adaptation in coastal areas in order to guide adaptation planning in coastal parks. The report is structured in 9 main chapters:

- Chapter 1 Introduction: defines the purpose of the document, describes the terminology to be used and provides a brief summary of the contents.
- Chapter 2 Policy: tackles the challenging questions on when the National Park Service can intervene.
- Chapter 3 Planning: outlines the NPS planning framework and emerging work with scenario planning and climate-smart strategies.
- Chapter 4 Natural Resources: focuses on the natural resources of the dynamic coastal zone. It includes an overview of science and tools to support adaptation (many of which are applicable to other resources), and a discussion of how to handle uncertainty.
- Chapter 5 Cultural Resources: focuses on cultural resources such as archeological sites, historic and prehistoric buildings and structures, cultural landscapes, museum collections, and the environments and places that support traditional and indigenous lifeways (ethnographic resources).
- Chapter 6 Facility Management: covers the work of the Sustainable Operations and Climate Change Program along with facility management and transportation programs that are challenged with managing assets in low-lying areas exposed to coastal hazards.
- Chapter 7 Communication and education: provides examples of interpretive products, training, and communication strategies.
- Chapter 8 Protecting Infrastructure, Costs and Impacts: features practical coastal infrastructure information including cost per unit length of constructed features (including seawalls, beach nourishment, and nature-based features).

- Chapter 9: Lessons learned from Hurricane Sandy: includes a case study of Hurricane Sandy response and recovery strategies including changes to infrastructure.

The handbook highlights processes, tools and examples that are applicable to many types of NPS plans and decisions. The level of detail varies by topic depending on the state of research and practice in that field.

11. Impacts, vulnerabilities and adaptation of Brazilian coastal cities to climate change

    Brazilian Panel of Climate Change (BPCC)

    Download link:

    http://www.portalodm.com.br/dnfile/639-impacto--vulnerabilidade-e-adaptacao-das-cidades-costeiras-brasileiras-as-mudancas-climaticas-03-10-2017/pdf/publicacoes/1/impacto--vulnerabilidade-e-adaptacao-das-cidades-costeiras-brasileiras-as-mudancas-climaticas.pdf

The study Impacts, vulnerability and adaptation of Brazilian coastal cities to climate change presents a review of the state of the current knowledge related to impact assessment, vulnerability analysis and the design and implementation of adaptation options in the face of climate change. In addition, it provides guidance for the development of adaptation strategies and includes practical examples from medium and large cities along the Brazilian coast.

The report contains the following information: (i) analysis of the vulnerability of Brazilian coastal cities to the potential impacts of sea-level rise and extreme weather events; (ii) adaptation alternatives in coastal cities based on both infrastructure and natural solutions; (iii) recommendations for adaptation policies; and (iv) case studies of medium and large coastal cities located in different regions of Brazil where adaptation measures have been implemented.

12. Practical Guide for Adaptation to Climate Change in Panamanian Pacific Coastal Marine Areas

    United Nations Development Programme (UNDP)

    Download link:

    http://www.miambiente.gob.pa/manglares/index.php

The Practical Guide for Adaptation to Climate Change in the Marine Coastal Areas of the Panamanian Pacific is intended to help formulate a series of measures to make the way in which coastal communities plan their development safer and more sustainable. Furthermore, such measures should strengthen the resilience of these communities to the current climate – variability and extremes – in order to enable them to adapt to global climate change.

The guide has been developed to be consulted and used directly by those interested in the planning and implementation of their activities. To optimize results and learning, it is recommended that the exercises be conducted with the support of a facilitator with experience in adaptation in marine-coastal zones. The objective of this guide is expected to be achieved once the following 3 steps are completed:

- Step 1: Know the risk conditions of the Coastal Marine Zone: climatic and non-climatic factors to consider.
- Step 2: Identify the Environmental Services that allow us to adapt to climate change and minimize global warming.
- Step 3: Formulate Strategies, Plans and Measures for adaptation based on ecosystems and that at the same time help in the capture of Greenhouse Gases (GHG).

13. CoastAdapt

    National Climate Change Adaptation Research Facility (NCCARF) and Australian Government, 2017

    Download link:

    https://coastadapt.com.au/

The CoastAdapt project features a number of resources drawn together from researchers and all levels of government to boost capacity when it comes to managing the risks from climate change that cannot be avoided, including projected sea-level rise maps, information on undertaking risk assessments and creating a community of practice. CoastAdapt provides a three-level risk assessment process of increasing depth and resource requirement:

- A first-pass risk screening allows users to conduct a desk-top study and screen their climate change-related exposure using readily available datasets. A qualitative process that can be carried out without detailed local data and provides guidance on whether a more detailed second- or third-level assessment is required.
- A second-pass risk assessment takes a standard risk-based approach using national data, local information and expert knowledge. It uses national data products and relevant local information from any previous studies and reports, and supports the user to identify how climate change may compound existing risks or create new ones, and advises on whether a more detailed third-level assessment is required.
- A third pass (detailed) risk assessment process allows users to further investigate short-listed risks. It should be used where detailed modelling or hazard studies are required for a complex project (or site) before implementation or investment decision-making and provides support to prioritize strategies and action.

Table 1 summarizes the above-mentioned guidance documents.

SOURCE	DATA AND METHODS		
	THREATS	EXPOSURE	VULNERABILITY
Technologies for Adaptation to Climate Change UNFCCC, 2006	Climate-related hazards	Coastal zones, water resources, agriculture, public health and infrastructure	Related to the degree of climate change; social, economic and environmental conditions and; and existing management practices in a system or sector
A Guide to the Vulnerability Reduction Assessment UNDP, 2008	Climate change and/or climate variability	-	Indicators based on a corresponding set of perception-based questions
Caribbean Risk Management Guidelines for Climate Change Adaptation Decision Making Caribbean Community Secretariat, 2008	Climate change and/or climate variability	Hotels, water demand, and water infrastructure and resources	Social, economic and environmental factors rank from very low to extreme
Shaping Climate-Resilient Development: A Framework for Decision-making Economics and Climate Adaptation Group, 2009	Climate-related hazards	GDP, assets and agriculture production	Economic factors and development stages
Climate Risk and Business: Practical Methods for Assessing Risk IFC, 2010	Climate change and/or climate variability	Assets, activities and resources	Sensitivities and risk attitude
Climate, Environment, and Disaster Risk Reduction Integration Guidance Swiss Agency for Development and Cooperation, 2010	Climate change and/or climate variability, environmental degradation and tectonic activity	Population, property, agriculture, infrastructure water systems and sanitation	Poverty and other non-climatic stressors, and response capacity
Technologies for Climate Change Adaptation – Coastal Erosion and Flooding GEF and UNEP, 2010	Climate change, including climate variability and extremes	Buildings and infrastructure	Degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes
Climate Proofing for Development: Adapting to Climate Change, Reducing Risk	Climate-related hazards	Productive sectors, policy aspects, geographic areas and/or specific	Biophysical and socioeconomic effects

SOURCE	DATA AND METHODS		
	THREATS	EXPOSURE	VULNERABILITY
Deutsche Gesellsschaft für Internationale Zusammenarbeit, 2011		target groups	
Climate Change Data and Risk Assessment Methodologies for the Caribbean IDB, 2014	Disaster and climate-related hazards	Degree of climate stress upon a particular unit analysis (physical environment)	Degree of susceptibility and coping capacity
Coastal Adaptation Strategies Handbook U.S. Department of the Interior, National Park Service, 2016	Climate change, including climate variability and extremes	Resources, assets and processes	Degree to which a resource, asset or process is susceptible to adverse effects of climate change, including climate variability and extremes
Impacts, vulnerability and adaptation of Brazilian coastal cities to climate change BPCC, 2016	Climate change and extreme weather events	Population and anthropogenic activities (tourism, fishery and aquiculture, services, commerce, industry, agriculture, public health and ecosystem conservation)	Degree of susceptibility and coping capacity
Practical Guide for Adaptation to Climate Change in Panamanian Pacific Coastal Marine Areas UNDP, 2017	Climate change, including climate variability and extremes	Population, infrastructure, productive sectors, natural areas and ecosystems	Lack of present and future capacity and resources to deal with impacts
CoastAdapt NCCARF and Australian Government, 2017	Disaster and climate-related hazards	Areas, systems and assets	Degree of capacity to accommodate changes in climate at minimum disruption or cost, and deal with impacts

Table 1: Guidelines on climate change and risk disaster assessment

In the light of the foregoing, it can be concluded that although threats are mostly related to climate change, climate variability and extremes, these may also include other non-climate related hazards such as tectonic activity. Regarding how exposure is characterized, most documents consider assets, activities and resources whether more generally in terms coastal zones and water resources, or in the shape of specific sectors, for example population, property, agriculture and infrastructure. The way vulnerability is addressed, however, widely varies among the revised guidance documents. While some relate vulnerability to the susceptibility of exposure to adverse effects (i.e., threats) and coping capacity; others go beyond that and differentiate between social, economic, environmental, and even biophysical and management aspects in a system or sector. On the other hand, vulnerability metrics include indicators based on perception-based questions, qualitative valuations and risk attitude.

Additionally, some interesting *projects* on climate change and risk disaster assessment found in literature are listed and described below.

1. Regional Study of Climate Change effects on the coast of Latin America and the Caribbean

   Economic Commission for Latin America and the Caribbean, 2012

   Download link:

   http://www.cepal.org/en/topics/climate-change/effects-climate-change-coasts-latin-america-and-caribbean

The Regional Study of Climate Change effects on the coast of Latin America and the Caribbean is amongst the most relevant projects on climate change impacts and risks developed regionally in Latin America and the Caribbean (LAC). The project is structured in four documents (i) Dynamics, trends and climate variability in LAC; (ii) Vulnerability and exposure of the LAC coast to climate change; (iii) Climate change impacts in the LAC coast; and (iv) Climate change risk assessment in the LAC coast. Additionally, it provides an auxiliary theoretical document, a methodological guide and a web viewer where the results are available. Climate change effects are assessed in beaches, estuaries, dune systems and maritime structures. A broad number of climate variables including met-ocean (e.g., mean sea-level, salinity, sea surface temperature, air temperature and wind) and coastal (e.g., waves, storm surge and astronomical tide) dynamics are considered. The main impacts analyzed are coastal flooding, beach erosion, operability and reliability of ports, and coral bleaching. The assessment of exposure and vulnerability, and therefore risks, takes into account data related to topography, land use, protected areas, population, GDP, coral reefs, tourism and infrastructures.

2. UK Climate Change Risk Assessment 2012

   Defra, 2012

   Download link:

   https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/584281/uk-climate-change-risk-assess-2017.pdf

The UK Climate Change Risk Assessment 2012 reviews the evidence for over 700 potential impacts of climate change in a UK context. Detailed analysis is undertaken for over 100 of these impacts across 11 key sectors (i.e., agriculture, ecosystem services, built environment, industry, energy, floods and erosion, forestry, health, fisheries, transport and water), on the basis of their likelihood, the scale of their potential consequences and the urgency with which action may be needed to address them. A plausible range of climate change scenarios is used in the analysis, where some aspects of socio-economic change (e.g. population growth) are also taken into consideration. Risks are categorized as low, medium or high based on their economic, social and environmental consequences. The project results are organized in a number of summary, technical and final reports according to the sectors considered.

3. The Effects of Climate Change in the Netherlands

   PBL Netherlands Environmental Assessment Agency, 2012

   Download link:

   http://www.pbl.nl/sites/default/files/cms/publicaties/PBL_2013_The%20effects%20of%20climate%20change%20in%20the%20Netherlands_957.pdf

The policy study entitled The Effects of Climate Change in the Netherlands analyzes observed and possible future effects of climate change on flood safety, water availability and water quality, ecosystems and biodiversity, agriculture, and public health. The study provides an update on the observed and projected climate change in the Netherlands based on the latest scientific understanding. It mainly focuses on air temperature, precipitation, wind and sea-level rise, and pays special attention to climate and weather extremes, because these determine many of the risks involved. The analysis is summarized in a report and organized in 8 chapters, which include a review of policy response and adaptation in the Netherlands.

4. Assessing the Costs of Climate Change and Adaptation in South Asia

   Asian Development Bank, 2014

   Download link:

   http://www.preventionweb.net/files/38999_assessingcostsclimatechangeandadapt.pdf

The study Assessing the Costs of Climate Change and Adaptation in South Asia examines the economic costs associated with the impacts of climate change and the cost and benefits of adaptation in Bangladesh, Bhutan, India, the Maldives, Nepal, and Sri Lanka. This aims to (i) assess the biophysical impacts of climate change in the region, including individual country impacts, (ii) estimate the total economic loss to the countries in the region by 2100 taking into account the different scenarios and impacts projected across vulnerable sectors, and (iii) estimate the magnitude of funding for adaptation measures required to avert such potential losses. The analysis is based on a three-step modeling approach: (i) regional climate modeling (ii) physical impact assessment, and (iii) economic assessment (using the integrated assessment model and the computable general equilibrium model). The climate variables used are sea-level rise, storm surge, temperature and precipitation; and the sectors covered

entail agriculture, terrestrial ecosystems, water, marine and coastal resources (except Bhutan and Nepal), health, and energy.

5. Generation and integration of historical climate data bases and climate change projections for coastal risk management in Santa Catarina state (Brasil)

   Economic Commission for Latin America and the Caribbean, 2015

   Download link:

   http://www.cepal.org/en

The Generation and integration of historical climate data bases and climate change projections for coastal risk management in Santa Catarina state (Brasil) project aims at generating historical databases of wind, waves, and sea level at high resolution in Santa Catarina state using numerical models. Changes in marine dynamics are calculated for different climate change scenarios, giving particular emphasis to extreme events, climate variability and long-term trends. Besides, an historical reconstruction of river flow is carried out for extreme events of precipitation in the river Itajaí. Using all the dynamics provided (i.e., waves, storm surge, astronomical tide, sea-level rise and river flow), a methodology for the analysis of flooding at high resolution is developed and applied in the coastal stretch between Bombinhas to Armacao, including Itapema, Balneario Camboriú and Itajai.

6. Climate Change Knowledge Portal (CCKP) Beta

   The World Bank Group, 2016

   Download link:

   http://sdwebx.worldbank.org/climateportal/

The Climate Change Knowledge Portal (CCKP) Beta is a central hub of information, data and reports about climate change around the world. The aim of the portal is to provide development practitioners with a resource to explore, evaluate, synthesize, and learn about climate related vulnerabilities and risks at multiple levels of detail. The CCKP contains environmental, disaster risk, and socio-economic datasets, and consists of spatially referenced data visualized on a Google Maps interface. Some examples are: World Bank and external datasets related to agriculture; water runoff projections; natural disasters; socioeconomic statistics; and low carbon growth studies, among others. Vulnerability is described as socioeconomic indicators that include data on population, agriculture production and human nutrition. The portal provides the ability to compare different datasets within different regions and countries.

7. CLIMATE-ADAPT

   European Commission (DG CLIMA, IES, ETC/CCA) and European Environment Agency (EEA), 2016

   Download link:

   http://climate-adapt.eea.europa.eu/data-and-downloads#b_start=0

The CLIMATE-ADAPT project aims to support Europe in adapting to climate change. It is an initiative of the European Commission and helps users to access and share data and information on: expected climate changes in Europe; current and future vulnerability of regions and sectors; EU, national and transnational adaptation strategies and actions; adaptation case studies and potential adaptation options; tools that support adaptation planning. The information is organized under the following entry points:

- Adaptation information (Observations and scenarios, Vulnerabilities and risks, Adaptation measures, National adaptation strategies, Research projects)
- EU sector policies (Agriculture and forestry, Biodiversity, Coastal areas, Disaster risk reduction, Financial, Health, Infrastructure, Marine and fisheries, Water management)
- Transnational regions, Countries and Urban areas
- Tools (Adaptation Support Tool, Case Study Search Tool, Map Viewer)

The Observations and scenarios section provides access to information on observations and scenarios for the atmosphere, cryosphere, water systems, oceans, the terrestrial biosphere and urban areas and health. A set of vulnerability indicators that include distribution and abundance of animal species, river flow drought, soil moisture, precipitation extremes, forest fires, river floods, coastal floods, and health are used to analyze the expected impacts, risks and adaptive capacity to each policy sector to the effects of climate change.

8. U.S. Climate Resilience Toolkit

   U.S. Global Change Research Program (USGCRP), 2016

   Download link:

   https://toolkit.climate.gov/steps-to-resilience/explore-hazards

   https://toolkit.climate.gov/steps-to-resilience/assess-vulnerability-risks

The U.S. Climate Resilience Toolkit is a website designed to help people find and use tools, information, and subject matter expertise to build climate resilience. The project sets out five steps to resilience: explore hazards, assess vulnerability and risks, investigate options, prioritize and plan, and take action. Prepared spreadsheets aim at providing support to implement a resilient-building project. Although the impacts considered are heavy precipitation events, heat waves, coastal flooding, and erosion, this list can be enlarged by the user when necessary. Exposure is characterized through key assets and resources (e.g., buildings and infrastructures), and both vulnerability and risk are assessed in a qualitative manner (i.e., low, medium, high). Users can also explore case studies in Alaska and the Artic, Hawaii and Pacific Islands, and the Northeast of the U.S.

Table 2 summarizes the above-mentioned projects.

SOURCE	DATA AND METHODS		
	THREATS	EXPOSURE	VULNERABILITY
Regional Study of Climate Change effects on the coast of Latin America and the Caribbean Economic Commission for Latin America and the Caribbean, 2012	Wind, pressure, waves, storm surge, astronomical tide, sea-level rise, salinity, sea surface temperature, air temperature	Population, land use, protected areas and ecosystems, tourism, infrastructures and GDP	Vulnerability functions for the natural and socioeconomic systems
UK Climate Change Risk Assessment 2012 Defra, 2012	Air temperature, precipitation, water level and sea-level rise	Agriculture, ecosystem services, built environment, industry, energy, floods and erosion, forestry, health, fisheries, transport and water	
The Effects of Climate Change in the Netherlands PBL Netherlands Environmental Assessment Agency, 2012	Air temperature, precipitation, wind and sea-level rise	Food safety, water availability and quality, ecosystems and biodiversity, agriculture and public health	
Assessing the costs of climate change and adaptation in South Asia Asian Development Bank, 2014	Temperature, precipitation, storm surge, sea-level rise	Agriculture, water, energy, forestry, coastal and marine resources, and human health	Socioeconomic (e.g., poverty, insecurity, education, etc.) and environmental (e.g., pollution, deforestation, etc.) factors
Generation and integration of historical climate data bases and climate change projections for coastal risk management in Santa Catarina state (Brasil) Economic Commission for Latin America and the Caribbean, 2015	Wind, waves, storm surge, astronomical tide, sea-level rise and river flow	Physical environment	
Climate Change Knowledge Portal (CCKP) Beta The World Bank Group, 2016	Temperature, precipitation and runoff	Population, agriculture production and human nutrition	
CLIMATE-ADAPT European Commission (DG CLIMA, IES, ETC/CCA) and European Environment Agency (EEA), 2016	Temperature, precipitation, ice and snow cover, river flow, sea surface temperature, storms and sea-level rise	Distribution and abundance of animal species, river flow drought, soil moisture, precipitation extremes, forest fires, river floods, and floods and health	
U.S. Climate Resilience Toolkit USGCRP, 2016	Precipitation, waves and sea-level rise	Assets and resources	Qualitative-based approach

Table 2 Projects on climate change and risk disaster assessment

In the light of the above, it can be concluded that threat, exposure and vulnerability are fully characterized only in the case risk estimates are provided; otherwise, threats and data on exposure are combined to derive exposure to a given impact (e.g., flooding). Threats are represented by met-oceanic and hydrological variables such as wind, pressure, waves, storm surge, astronomical tide, sea-level rise, salinity, sea surface temperature, ice and snow cover, air temperature, precipitation, and runoff, which either in isolation or combined give rise to impacts. Most of the revised projects characterize exposure through strategic sectors which are related to the socioeconomic system, to the physical system or to both. These sectors include population, agriculture, fishery, tourism, transport and infrastructures, but also ecosystems and animal species. On the other hand, few projects consider vulnerability specifically, and even less use vulnerability functions.