

# Re-thinking coastal adaptation strategy: from SLR to land risks—Can the water policy fill the coastal strategy vacuum? The case of Morocco

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## 1 Introduction

Since the first Intergovernmental Panel on Climate Change (IPCC) report, the scientific community has agreed that sea-level rise (SLR) is the most important threat to coastal zones. Due to ocean thermal expansion and the loss of land-based ice because of increased melting, the sea level has risen at a rate of about 1.7 mm/year (Bindoff et al. 2007). The projected rise from 1990 to 2100 is 9–88 cm with a mid estimate from 48 cm (Nicholls and Lowe 2004, p. 229). Even though there are always uncertainties about this phenomenon, SLR could completely annihilate some coastal zones, especially in the small islands and the low coasts (McLean et al. 2001).

In Morocco, in the eastern part of the Mediterranean coast, “scenarios for future sea-level rise range from 200 to 860 mm, with a “best estimate” of 490 mm” (Snoussi et al. 2008, p. 206). The impact of the SLR will induce the loss of 24–59 % of this coastal zone and will have severe impacts on residential and recreational activities, agriculture and natural ecosystems. Those aspects are not well documented in Morocco and economic analysis is still needed in order to evaluate how SLR is affecting coastal ecosystem services (see the following).

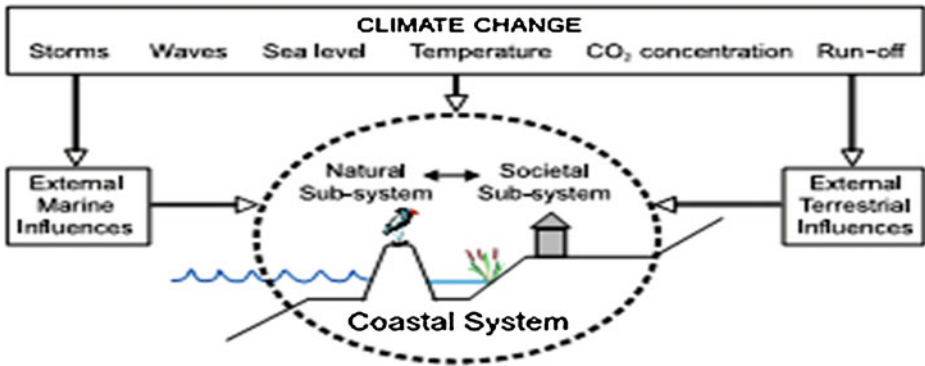
The issue is that a great number of persons are living in coastal zones which are also vulnerable ecosystems (wetlands, coral reef). This phenomenon is not specific to Morocco: “Humanity is preferentially concentrated in the coastal zones of the world. At least 200 million people were estimated to live in the coastal flood plain (below the 1 in 1000 yr storm surge) in 1990. This is likely to increase to at least 600 million people by 2100 (6 % of global population) as coastal populations are presently growing at twice the rate of global population increase (WCC’93 1994)” (Nicholls and Mimura 1998).

Consequently, the SLR is the most analysed climate change impact on coastal zone by the scientific community. However, even the IPCC recognizes that SLR is not the major problem facing the coastal zone. For IPCC, this zone is, indeed, submitted to several kinds of risks (Fig. 1). In its last report, the IPCC announced: “the issue of sea-level rise still dominates the literature on coastal areas and climate change” (IPCC, Nicholls et al. 2007,

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**Fig. 1** Climate change and the coastal system. Source: IPCC (Nicholls et al. 2007, chapter 6, p. 318

chapter 6, p. 318). In Morocco, it is estimated, that the SLR “has to be one of the main impacts of climate change” (Snoussi et al. 2008).

This paper will try to explain, on one hand, how and why coastal adaptation is being considered in a narrow approach by focusing only on the marine risks rather than also terrestrial ones, and what are the consequences of such an approach for Morocco. On the other hand, it will propose a framework for a new global coastal adaptation policy connected with water strategy. Indeed, the Moroccan water strategy could offer interesting perspectives to the future coastal adaptation policy.

To this end, this paper links scientific literature on coastal and water policies at international and national levels to the domestic laws and to the institutional Moroccan framework. It is also based on Moroccan coastal adaptation studies carried out in the Mediterranean coast.

## 2 The coastal adaptation strategy focuses on adaptation to SLR

The problem of SLR is automatically linked to climate change risk in the coastal zone. Many studies, national strategies and guidelines confirm this idea. For example, *UNEP Handbook Methodology* (UNEP 1998) “establishes a generic framework for thinking about and responding to the problems of sea level rise and climate change” (Feenstra et al. 1998, Klein and Nicholls 1998). In the same way, Dynamic Interactive Vulnerability Assessment (DIVA) is a tool created in 2004 by the EU-funded DINAS-COAST Consortium for integrated assessment of coastal zones and is specifically designed to explore the vulnerability of coastal areas to SLR.

In the Green Paper *Adapting to climate change in Europe: options for EU action*, it is underscored that “The most vulnerable areas in Europe are (...) coastal zones due to sea level rise combined with increased risks for storms” (Commission of the European Communities 2007, p. 5).

Influenced by this trend to associate SLR as the exclusive climate change threat to the coastal zone, Morocco also focuses in its two national communications to the United Nations Framework Convention on Climate Change (UNFCCC) on the need to adopt a coastal adaptation policy, which would take into account the phenomenon of the SLR. Adaptation, in the context of climate change, means the “adjustments in ecological socio-

economic systems in response to actual or expected climate stimuli, their effects or impacts”. Adaptation can be anticipatory or proactive, autonomous or planned (<http://www.ipcc.ch>).

The concept of adaptation in its wide meaning is commonly used in coastal management. Indeed, adaptive management is one of the important Integrated Coastal Zone Management (ICZM) principles. It “encompass the idea that the non-linear nature of ecosystems warranted a flexible management approach through learning from operational management experience as an ongoing, adaptive and experimental process”. Berkes and Folke integrate social dimensions to this concept (Duxbury and Dickinson 2007, p. 326).

The Climate Plan elaborated in November 2009, specifies that the coastal bill “should allow the application of an integrated management to the coastal zones and their adaptation to the sea level rise” (Secrétariat d’Etat auprès du Ministère de l’Energie, des Mines, de l’Eau et de l’Environnement, chargé de l’Eau et de l’Environnement 2009). It reiterates the famous strategies recommended by the IPCC, in order to counter SLR: protection, accommodation and retreat (Tol et al. 2008, p. 235).

- “Protect” means to reduce the risk of the event by decreasing its probability of occurrence. In a coastal zone, we can use hard or soft structures to protect (dikes, rock, breakwaters, etc.).
- “Retreat” means to reduce the risk of the event by limiting its potential effects. Setbacks are a good example of retreat.
- “Accommodate” means to increase society’s ability to cope with the effects of the event by acquiring elevating equipment, compensating property losses, etc.

This greater interest for SLR could be explained by the sectoral approach that is still predominant both in science, and in law and policy. The issue of marine pollution from land-based sources illustrates this reality. Indeed, there is no universal legal binding rules in this issue,<sup>1</sup> which is at best considered as a national problem to be dealt with by domestic law. In fact, only regional conventions are applied to marine pollution from land-based sources. The terrestrial threat to the coastal zone is not considered as the most important either in science, or in policy making. The reason is doubtfully due to greater marine threats compared to land threats. There are not clear statistics for land threats due to climate change, to the coastal zones, as is the case for the SLR. The literature on this issue is less targeted to the coastal zone than that on SLR; it follows a sector-based logic (water, nature, floods, etc.) which seems to exclude the coastal zone (IPCC, 2007, chap 6). Perhaps, recalling the ICZM principles is a way to put coastal adaptation into a holistic approach that could take into account the variety of risks present. Indeed, IPCC announces that “ICZM is widely recognised and promoted as the *most appropriate process to deal with climate change, sea-level rise* and other current and long-term coastal challenges” (IPCC, Nicholls et al. 2007, chapter 6, p. 340).

In all cases, focusing on SLR is not taking into account adaptation and vulnerability factors. Vulnerability indicates “the degree to which a system is susceptible to, or unable to cope with, *adverse effects of climate change, including climate variability and extremes*. Vulnerability is a function of the character, magnitude, and rate of climate variation to which a system is exposed, its sensitivity, and its adaptive capacity”.

<sup>1</sup> Except the United Nations Convention on Law of the Sea which establishes general rules regarding this issue. The universal rules on marine pollution from land-based sources are *soft law* rules: Global Programme of Action for the Protection of the Marine Environment from Land-Based Activities, UNEP(OCA)/LBA/IG.2/6-5 December 1995

In fact, “impacts of climate change will not affect all the regions (...) and not in the same way or with the same intensity. Within the region, there are several key factors that determine the range and severity of impacts including the characteristics of:

- Natural systems;
- Socio-economic systems
- Government systems (...)” (Travers et al. 2010).

One can thus consider that focusing on SLR in coastal adaptation policy increases coastal vulnerability, as there are no specific tools for addressing other climate risks on the coastal zone. Indeed, the notion of coastal vulnerability is linked with institutional, economic, political and institutional factors (Magnan 2009).

Furthering this idea, adaptive capacity is defined in words that are not limited to specific risk like SLR. It is defined as: “the ability of a system to adjust to climate change (including climate variability and extremes), to moderate potential damages, to take advantage of opportunities, or to cope with the consequences” (IPCC 2001).

In fact, coastal zones offer important ecosystem services (Barbier et al. 2012) which can be hindered both by SLR and by land risks (floods, water shortage, pollution...). This issue is not yet documented in Morocco by economic studies. However, a local study estimates that environment degradation on the Mediterranean Moroccan coastal zone is about 131–616 millions dirham per year which corresponds to 3.78–4.71 of the GDP of this area (METAP 2006). This study evaluates also the costs of beach recreational services to 8 million dirham (0.23 of the GDP). In addition, it tries to include coastal ecosystem services that do not have an economic value (provided by wetlands and forests, METAP 2006, p. 36). Even if the study does not focus on climate issues, it constitutes a basis for coastal ecosystem services assessment in Morocco and it demonstrates that those ecosystem services can be constrained by a wide range of risks.

Indeed, experience has shown that coastal threats linked to climate change are not to be restricted solely to SLR. In Morocco, recent rivers’ floods threatened coastal zone. In fact, under the suggestive title: “Local democracy did not resist floods” (Maroc Hebdo 1996) the article of a Moroccan newspaper summarizes the failure of the local administration to handle effects of nature. Floods came from abundant precipitation causing the flooding of rivers. Scientific literature in Morocco asserts that floods are probably due to climate change and climate variability (Bouaicha and Benabdelfadel 2010).

The problem of water shortage, in addition, is particularly relevant for coastal communities not only due to salt intrusion, but also because coastal zones are the most urbanized areas. For example, the *oulja* which are low lands dedicated to agriculture, localized in the coastal zones (especially in the Atlantic Moroccan coasts) have to face both SLR and floods from river basins. They should also confront water scarcity and pollution, issues dealt with by the Water Department and not by the Department of Coasts (which does not exist).

Indeed, traditionally, SLR is related to the Ministry of Equipment, Ministry of Fisheries and the Department of the Environment, which are not exactly the same actors involved in water policy.

The problem of SLR must be integrated into a global policy that takes into account the whole coastal zone. In Morocco, the water policy should be the framework under which this holistic approach could be undertaken notably because there is a coastal policy vacuum (Table 1).

**Table 1** Comparisons between water law and “coastal law” in Morocco

Water policy	“Coastal policy”
Intentional management <sup>a</sup>	“Effective” management <sup>b</sup>
Specific law	No specific law
Intergrated approach	Sectoral approach
Ecosystem approach (water territories)	No legal definition of coastal zone
Decentralization (“bottom up” approach) 7 regional basin agencies	Attributions of local authorities are unclear
Traditional climate component	Adaptation policy vacuum

<sup>a</sup>“The strategic intervention “asymmetrical” of an actor specialized to change the others, dialogue among the actors for a common change” (personal translation; Mermet et al. 2005)

<sup>b</sup>Means the opposite of intentional or voluntary management

### 3 The coastal policy vacuum in Morocco, a constraint or an opportunity for a global coastal adaptation policy?

Morocco does not have a coastal strategy (Idllalène 2009); however, the Department of the Environment has sketched global guidelines for such a strategy.<sup>2</sup> However, its two reports are more recommendations than a real governmental policy. Coastal zones have no special law, nor a special institution to manage them and are subject to different actors like the Department of Equipment, the Department of Tourism, the Department of Fisheries, the Department of Water and Forests, etc. Local governments do not have clear authority over the coastal zone. For example, we do not know what is the extent to which municipalities (*communes*) can intervene at sea. The role of central government is predominant. The bottom up approach is constrained by many issues like the weakness of resources, the insufficiency of attributions, and the limitation of the field of action (Tables 2 and 3).

Adaptation is thus challenging the Moroccan actors in coastal zones. Form a legal point of view; it is difficult indeed to adapt something that does not exist. Coastal zones have no legal status in Morocco. Adaptation requires that the coastal zone should have special actors (local and central), special laws that define the responsibilities and attributions, special management policy, etc. In fact, adaptation is just adding new dimension to the coastal management strategy. In Klein et al. (1999), we can see in their figure that the coastal management process can integrate adaptation (Fig. 2).

It is possible to consider that the lack of coastal management policy in Morocco, is a real opportunity for adaptation strategy. It is thus important that this strategy goes beyond the narrow approach proposed by most scientific literature about coastal adaptation, focusing only on SLR.

### 4 For a global approach to coastal adaptation: integrate the water policy

The links between risks associated to SLR and other risks (water stress, inundations, etc.) are not well established by coastal adaptation policies. In Morocco, the water strategy can offer a framework for dealing with climate risks other than SLR. This strategy should be combined

<sup>2</sup> Especially the strategy elaborated with the contribution of MedWetCoast project (Cellule du littoral 2005).

**Table 2** Actors interacting in coastal zones in Morocco (government)

National public authorities	Jurisdiction		
	Management and control		Environment
Depart. of Equipment	National harbor's strategy	Beach (interior waters and sand) control sanitation	Marine public domain <sup>a</sup> management (Authorizations of exploitation, control, marine pollution prevention...) National Emergency Plan (marine oil spill incidents) <sup>b</sup>
Depart. of Fisheries (and National Agency on Aquaculture Development)	Marine public domain management (maritime part) Authorization of exploitation (for fish farming)	Fisheries plans (ex. <i>Halieutis</i> )	Conservation of marine resources National Emergency Plan (Marine oil spill incidents)
Depart. of Water, Forests, Soil Conservation and Desertification	Forest management (including maritime sand dunes) Management of marine protected areas	Control and repression	Conservation of sand dunes (with vegetation) other than those of marine public domain Conservation of biodiversity (focal point of CBD convention)
Depart. of the Merchant Navy	Sea traffic monitoring	Port state control	National Emergency Plan (marine oil spill incidents) Conservation of marine environment (sea water)
Depart. of Tourism	Azur Plan (2020 Vision) (investment project for the creation of beach resorts)		"2020 Vision" contains a "sustainable development" component Part of environmental assessment commissions
Royal Navy	Control at sea (including public domaine)	Coordinator of the National Emergency Plan	National Emergency Plan (marine oil spill incidents)
Depart. of Environment		Control of the application of environmental law	Coordination of national environmental strategy
Superior Council on Water and Climate (Conseil Supérieur de l'Eau et du Climat)	General orientations of the water strategy	Examine the national climate strategy and its impacts on water resources	
River basin agencies	Examines plans regarding the utilization of water (Plans directeurs de l'utilisation de l'eau)		Water conservation

<sup>a</sup> Marine public domain (domaine public maritime) is defined by the law on public domain (July 1, 1914) as: "The bank of the sea until the limit of the highest tides, as well as a zone of 6 meters measured from this limit, natural harbours, ports, harbours and their dependences, lighthouses, lamps, beacons and generally all the works intended for the lighting and for the marking of coasts and their dependences". Dahir of July 1st, 1914 on public domain, Official Bulletin No. 89, July 10, 1914

<sup>b</sup> Parliament of Morocco (1996)

**Table 3** Actors interacting in coastal zones in Morocco (local authorities)

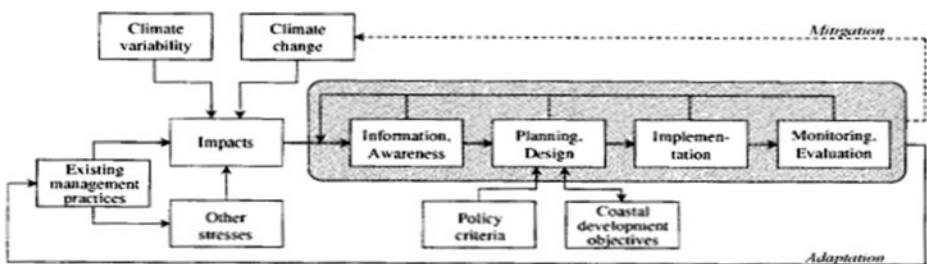
	Jurisdiction	
	Management	Environment
Communes (municipalities)	Urbanisation (autorizations, control) Authorizations of marine public domain occupations	Cleaning beaches Control of sand exploitation Environmental jurisdiction (forest, beaches, monuments...)
Regions	Regional scheme for territorial management Contribution to integrated management of river basin water's plan (Plan directeur d'aménagement intégrée des eaux du bassin hydraulique)	General environmental attributions
Provinces and prefectures (decentralized level)	Local coordinator of National Emergency Plan Can order destruction of construction in cases of not respecting urban law	General environmental attributions

with the future coastal policy in order to have an integrated coastal adaptation framework taking into account both maritime risks and land risks.

The first step: integrate adaptation into ICZM.

Integrate land risk into the strategy of coastal adaptation requires ICZM policy which constitutes the preliminary foundation of adaptation. ICZM means “a dynamic process for the sustainable management and use of coastal zones, taking into account at the same time the fragility of coastal ecosystems and landscapes, the diversity of activities and uses, their interactions, the maritime orientation of certain activities and uses and *their impact on both the marine and land parts*” (article 2-f of the Madrid Protocol on ICZM in the Mediterranean). Integration refers to the relationship between sciences dealing with coastal management, interactions between marine and land coastal components, institutional coordination between stakeholders involved in coastal zones and population participation in the process of coastal management (Cicin-Sain et al. 1998).

The link between ICZM and the adaptation of coastal zones is established by several international legal texts especially by chapter 17 of Agenda 21 of the United Nations Conference on Environment and Development (UNCED 1992), by the UNFCCC, and by the Protocol of Madrid on ICZM (2008). The UNFCC for example, announces that "all



**Fig. 2** Conceptual framework showing the iterative steps involved in coastal adaptation to climate variability and change. Source: Klein et al. 1999

Parties, taking into account their common but differentiated responsibilities and their specific national and regional development priorities, objectives and circumstances, shall (...) cooperate in preparing for adaptation to the impacts of climate change; develop and elaborate appropriate and integrated plans for coastal zone management, water resources and agriculture, and for the protection and rehabilitation of areas, particularly in Africa, affected by drought and desertification, as well as floods" (article 4-e). Adaptation calls one to take into account the time horizon to counter the predictable effects of climate change. The two strategies (ICZM and adaptation) have, indeed, the same objectives and the same tools (Billé and Rochette 2008). Yet in 1994, the IPCC considered ICZM to be the best framework for coastal adaptation (Bower et al. 1994).

Taipei's guidelines also had the objective to help countries set up strategies of ICZM that are focused on climate change risks (Cicin-Sain et al. 1999). The last IPCC report is dedicated to this idea by declaring that "Climate change therefore *reinforces the desirability of managing coasts in an integrated manner*" (Nicholls et al. 2007, p. 317). We can thus consider that the climate change policy is an opportunity for Moroccan coastal zones which could benefit from this policy to build an ICZM.

However, the climate change policy in Morocco is essentially centred on mitigation rather than on adaptation (Idlallène 2011). Coastal adaptation could benefit from the water strategy, as well as combining it with mitigation and coastal management. A spatial planning approach is the best way to guaranty both mitigation and adaptation in order to avoid tradeoffs (Biesbroak et al. 2009). Since "there is already a prominent role for spatial planning in adaptive measures, for example, in water management" (Biesbroak et al. 2009), coastal adaptation will benefit from the water policy.

The second step: bridging the gaps between coastal management, coastal adaptation and water policy

In line with the ecosystem approach (Forst 2009), coastal management must be widened to the whole river basin. In this way, it could integrate all the coastal threats due to climate change, and even other risks (erosion, climate variations). To this end, "within these basins, integrated measures are developed to combine water management objectives with, for example, nature conservation and land use planning" (Biesbroak et al. 2009). The ecosystem approach is recognized by the coastal bill and by the marine fisheries bill. Morocco adhered also to this approach through international legal agreements, which it has ratified.<sup>3</sup>

The integration of coastal adaptation into the global framework of the river basin will enhance the benefits gained from the water policy already in place. This policy, which is relatively well settled and renewed in 1995, is predisposed to assure a structured frame for coastal adaptation, especially given that it adopts a decentralized policy in water-resource management.<sup>4</sup> It is moreover what foresees the preamble of water law, which encourages the adoption of a legal text on coastal management. Indeed, it announces that: "this law will constitute (...) an effective means to fight against water pollution *being agreed that the realization of this objective requires a supplementary legislative work in coastal management*".<sup>5</sup> The water policy, on the contrary to coastal policy (which does not exist yet), is well

<sup>3</sup> For example, the United Nations convention on biodiversity (at its COP 7, decision VII/11), the Code of Conduct for the responsible fisheries, the Ramsar convention on wetlands, the Protocol on integrated coastal zone management in the Mediterranean (article 6-c), etc.

<sup>4</sup> Regions contribute to the establishment of the main plan of integrated water management in the river basin. (Parliament of Morocco 1997; Article 7, al. 10 and 11 of the law on the organization of regions). To consult official bulletin, see <http://www.sgg.gov.ma>

<sup>5</sup> Emphasis added. Parliament of Morocco (1995).



structured, and has demonstrated the integrated approach and is more inclusive of climate change parameters.<sup>6</sup>

In line with the water policy, coastal management and adaptation could benefit from the experience of river basin agencies—(Agence de Bassin) “Basin Agencies” BA—which are in charge of application of the integrated water-resources management. These agencies have been created under the Water Act of 1995, in which the river basin, a water territory which does not respond to administrative boundaries, determines their jurisdictions (Tazi Sadek 2006). This spatial approach corresponds to the coastal management approach, which is an approach of purpose, which is a continuation of the coastal bill and the ICZM Mediterranean Protocol signed by Morocco. It’s application will be very fruitful both for coastal management and for coastal adaptation.

Furthermore, it could be integrated into the coastal management plans foreseen by the coastal bill. These “national plans of management, protection, development and conservation of the coast” are indeed based on “the most recent relevant scientific data and [adopt] *integrated and ecosystem approaches of the coast*” (Article 3 of the bill on coastal zone. Emphasis added). Their spatial limits might thus be extended to the whole river basin and to the territorial sea.

Coastal adaptation could also benefit from coordination within the institutional scheme on water management. These institutions are, for example, the Water Interministerial Commission created in 2001 by the prime minister. This commission is responsible for analysis and definition of the principal orientations of water policy. It coordinates the work of other departments in this topic. In addition, the Supreme Council on Water and Climate “constitutes a real forum of dialogue enjoying the credibility for the application of its recommendations”—(Department of Water, official document).

The water policy is based on six essential strategies:

1. Management of the demand on water and valuation of the water
2. Management and development of the offer on water
3. Protection and conservation of water resources, natural environment and fragile zones
4. Reduction of vulnerability from natural risks connected to inundations and to drought
5. Legal and institutional reforms
6. Modernization of the information system and intensification of resources and competences: (research and development, modernization of the administration, etc.)

The water policy, especially since 1995, has an important climate will component (point 4 of the water policy). This could allow it to play an important role, if it is combined with coastal adaptation. It is important to recall that the competence of the BA could be extended to estuaries (Article 16 of the water act). Besides, the water act grants wide powers to these agencies in order to fight against floods. Indeed, the BA can even require owners, local residents of the stream, to build dikes in order to protect against floods (Article 96 of the water law). Furthermore, the municipal council contributes to the realization of the hydraulic equipments intended for the control of rainy waters or for the protection against floods (Article 39–4 of the Communal Charter).

Point 3 of the water strategy could also help the future coastal adaptation policy because water shortage and water pollution are especially visible in coastal areas as they concentrate

<sup>6</sup> Through the role of the Supreme Council on Water and Climate (Conseil Supérieur de l’Eau et du Climat) created by Décret no. 2-96-158 of November 20, 1996

a majority of the population, and as the rural municipalities (*communes rurales*), in which the scarcity is more noticeable, are also coastal.<sup>7</sup> Thus, climate change impacts on water are also coastal problems, in addition to the SLR and to other maritime and land risks.

The water policy should, therefore, take into account the specific needs in the coastal zone and integrate coastal management into the river basin approach. By doing this, the future Moroccan coastal adaptation strategy will work to link the marine component to the land component of the coastal zone in order to reshape an ambitious integrated policy that corresponds to the objective of sustainable development. Indeed, the climate plan already recognizes that a good climate change policy must be inserted into the development policy, which could not be possible without a holistic approach.

## 5 Conclusions

The combination between coastal adaptation and water adaptation may be a complex task and brings up several questions such as—Who could take the lead? Does BA have the legal and financial capacity to handle this task? How to combine the river basin approach with marine management, taking into account their different actors? Could both the Ministry of Equipment and the Ministry of Fisheries, allow the BA to take the lead in coastal adaptation? Is it a feasible and attractive solution?

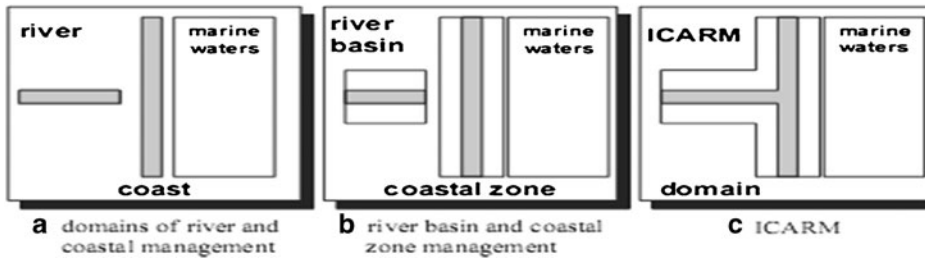
Legally, BA could have an important role in coastal management and coastal adaptation. Indeed, on the basis of Article 16 of the water law, BA could expand its jurisdiction to the estuaries. Nevertheless, its attributions are focused on “management of the water resources of the river basin (...) in order to assure quantitatively and qualitatively the present and future water requirements” (Article 16). In addition, the role of BA is still constrained by the lack of financial resources (Houdret 2008). Moreover, the issue of institutional coordination is overwhelming. Indeed, the majority of governmental departments involved in the coastal zone, have a huge development interest even if the sustainable development principle is used.<sup>8</sup>

For example, the “war of sand”, described by the Moroccan newspapers (see for example, *L’Economiste* 2011, no. 3499 2011/04/01), illustrates this problem. The Department of Equipment, in its role as public domain manager, regulates the usage of the sand, but cannot stop the anarchy. The urban sector needs have overwhelming consequences on the ecosystems.<sup>9</sup> Another example is the role of the Tourism Department, which is leading a big development program on coastal zones (the *Azur Plan* or 2020 Vision). In this framework, it encourages golf areas in coastal zones that already suffer from water stress. The conflict management, between the tourism industry and the agricultural sector, exacerbates stress on water resources. This conflict is particularly relevant in the coastal zone of Agadir in which the water needs of the tourism industry are consuming those of the agricultural sector in rural areas (Houdret 2005, p. 291).

<sup>7</sup> This assertion is based on the former administrative division, which points out that the majority of coastal communes (municipalities) are rural.

<sup>8</sup> The sustainable development principle is inserted into *post Rio* laws. Indeed, the framework environmental law adopted in 2003 recognizes this principle. “Loi relative à la protection et à la mise en valeur de l’environnement” no.11-03, Gov. of Morocco (2003).

<sup>9</sup> 15 million m<sup>3</sup> of sand have been consumed in 2005. And estimations bank on twice as much for 2015. *L’Economiste* (2007), <http://www.leconomiste.com/article/sable-dragage-contre-pillage>. The sand extraction affects the water quality and biodiversity especially in coastal zones



**Fig. 3** Main spatial components of the ICARM. Source: Cocossis et al. 1999, p. 7

The application of ICZM policy will counter these conflicts. Even if this approach is criticized for its “sacred” character in the European water policy for example,<sup>10</sup> it is important to widen the ICZM in order to strengthen the “land-based risks” in the coastal adaptation strategy. What is more, the ICZM should be further focused on the river basin approach. Integrated Coastal Area and River Basin Management (ICARM), offers this possibility. Indeed, ICARM “provides the context to consider aspects of natural and socio-economic systems that have previously been seen as outside the scope of interest of policy makers and planners, concerned only with the sectoral development of river basins or coasts proper” (Cocossis et al. 1999). The ICARM approach is already adopted in the framework of the Mediterranean Action Plan. Its application by the Moroccan authorities will “optimise policy interventions in space and time to reduce potential conflicts, bridging potential gaps and streamline potential overlaps between policies. This will be achieved through recognition of key linkages between coastal area and river basin systems” (Cocossis et al. 1999; Fig. 3).

The application of ICARM strategy necessitates reinforcing the bottom up approach both in coastal and water management. Indeed, the Supreme Council on Water and Climate is still dominated by central government entities and neglects to involve the sector of industry (Chaoui 2005, p. 165) and users. Moreover, the coastal bill does not adopt the concept of ICARM. In addition, the ICARM does not focus enough on the climate change adaptation, maybe because adaptation was not a focus when the ICARM concept was adopted.<sup>11</sup> At the same time, water law even if it underlines the necessity to adopt a coastal management law, does not opt for the unicity of the water resources (Tazi Sadek 2006, p. 274). All these constraints are pushing for a global strategy for coastal adaptation in the framework of the ICARM. The coastal bill, which is currently being discussed in the Moroccan Parliament, shall be the framework for allowing a real integrated coastal policy.

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<sup>10</sup> François Molle thinks that integrated water management at the river basin level (Integrated Water Resources Management, IWRM), “has become part of today’s doxa, the taken-for-granted assumptions and orthodoxies of an approach of an epoch”. (Molle 2009).

<sup>11</sup> Indeed, the concept of adaptation has been considered, for many years, at the international era, as a sign of failure of the climate change policy. This idea affects also national policies. Most adaptation strategies are thus, new strategies. For a historical approach, see for example Burton et al. 2002.

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