Land-Ocean Interactions in the Coastal Zone

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18. LOICZ SSC Meeting in Vancouver, Canada, 29 May–1 June, 2007

- Elucidate and assess the role of scientific information for governance and governance baselines in the context of coastal land and sea use
- Evaluate science and stakeholder perspectives in socio-ecological systems
- LOICZ Priority Topics will be operated each in form of sub-projects
- The sensitive interplay between human and global climate change drivers as expressed is rapidly changing Asian megadeltas is shown by Saito et al. It underlines the need for coupled socio-ecological system research.
- Cabri Volga demonstrates the scale of coastal and delta management needs and the complexity of catchment-coast governance issues.

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Scientific Reports

Shrinking Megadeltas in Asia: Sea-level Rise and Sediment Reduction Impacts from Case Study of the Chao Phraya Delta

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Continental large rivers in Southeast and East Asia, which together supplied ~2.5 x 10^9 t yr^{-1} (Gigatonnes per year) of suspended sediment in the past, are delivering less than 1 x 10^9 t yr^{-1} currently because of human activities. In the past, more than 40 km^2 of new land was formed annually by these rivers as delta plains; at present new land formation has come to a standstill, and some deltas are even shrinking. The megadeltas of Asia are thus at risk of destruction because of the reduction of sediment supply and relative sea-level rise caused by human activities.

1. Introduction

Coastal erosion is a crucial ongoing problem along most Asian coasts. Human activities in drainage basins and on coastal plains have led to a decrease of sediment supply to the coasts, caused mainly by dam construction, sand mining, and irrigation, and to a relative sea-level rise (i.e., land subsidence), caused by excess groundwater extraction. These activities, together with the destruction of coastal ecosystems, such as mangrove deforestation (e.g., Syvitski and Saito, 2007) have resulted in the present severe coastal erosion of the megadeltas of Asia.

The Fourth Assessment Report of the Intergovernmental Panel on Climate Change (IPCC 2007) identified Asian megadeltas as one of the environments most vulnerable to future global changes. However, megadeltas are already experiencing acute environmental problems as a result of human activities. To address these issues an international workshop on „Coastal Erosion and Geological Assessment for Deltas in Southeast and East Asia," was held in Bangkok, Thailand, on 24–25 May 2007. Here, we review some of the workshop findings, on the coastal erosion problem.

2. Reduction of Sediment Discharge

There are many large, well-known rivers in the Southeast and East Asia region, including the Huanghe (Yellow River), the Changjiang (Yangtze River), the Zhujiang (Pearl River), the Song Hong (Red River), the Mekong River, the Chao Phraya, and the Ayeyarwady (Irrawaddy) River (Figure 1).

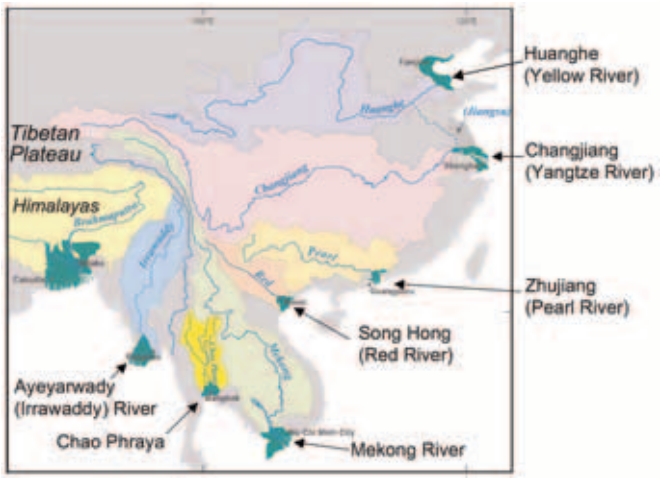

Figure 1: *Megadeltas in Southeast and East Asia. Modified after Woodroffe et al. (2006)*

In the past, these rivers together (Ganges System not included) supplied ~2.5 x 10^9 tonnes (Gigatonnes, Gt) of suspended sediment annually, accounting for significantly more than 10% of global sediment discharge (Milliman and Syvitski, 1992). However, the annual sediment discharge has decreased to less than 1 Gt recently as a result of human activities. During the last 2000 years, these rivers together deposited more than 40 km^2 of new land annually as delta plains along the Southeast and East Asian coasts. At present new land formation has reached a standstill; some deltas are even shrinking.

The Huanghe provides a good example of the reduction in sediment load caused by human activities. The river delivered to the sea more than 1 Gt of sediment annually for the past 1000-2000 years, up until the 1960s. However, since then, the amount of sediment delivered has decreased stepwise with the successive completion of reservoirs and the use of water for irrigation: Sanmenxia Reservoir (in 1960), Liujiaxia Reservoir (1968), and Longyangxia Reservoir (1985), and finally down to only about 150 million tonnes (Mt = 10^6 t) per year after the completion of the Xiaolangdi Reservoir in 1999 (Wang et al., 2007). Soil conservation practices, afforestation, and a decrease in precipitation have also tended to reduce the amount of sediment delivered by the Huanghe to the sea.

The amount of sediment supplied to the East China Sea by the Changjiang, ~0.5 Gt of sediment annually for the last 2000 years (Saito et al., 2001), has been decreasing since the middle 1980s, mainly because of the construction of numerous dams and reservoirs in the drainage basin. Since water began to be stored in the Three Gorges Reservoir in 2003, the river delivers only 150-200

Mt of sediments annually (Yang Z et al., 2006; Yang et al., 2007). The Zhujiang shows a similar reduction of sediment delivery. The annual sediment discharge from the Zhujiang has declined from 80 Mt to 54 Mt on average since 1995. As a result of the steady decline since the early 1990s, in 2004 the annual sediment discharge was about one-third the mean pre-1990s discharge (Zhang et al., 2007).

The Song Hong and Mekong rivers show similar patterns of reduced sediment discharge. After the construction of the Hoa Binh Dam on the upper reaches of the Song Hong in 1989, sediment delivery decreased by more than 30%, from an average of 114 Mt annually during 1959–1985 to an annual average of 79 Mt during 1986–1997 (Thanh et al., 2004). Moreover, it decreased to 51 Mt annually during 1992–2001, on average. Sediment supply to the river mouth of the main distributary (Ba Lat) of the Song Hong decreased from about 26 Mt yr^{-1} in 1949 to 11 Mt yr^{-1} in 2000 (van Maren, 2004).

The Mekong River has also been affected by dams, particularly dams constructed in China. After the completion of the Manwan Dam on the upper reaches of the Mekong River in China in 1993, the annual sediment load was reduced from 71 Mt to 31 Mt at Chiang Saen in northern Laos and from 133 Mt to 106 Mt at Pakse in southern Laos (Kummu and Varis, 2007). A slight reduction of sediment load has also been recorded in the lower reaches of the Mekong in Vietnam (Lu and Siew, 2006).

Sediment discharge of the Chao Phraya, in Thailand, has also been affected by dam construction. For example, the sediment load at Nakhon Sawan, about 300 km upstream from the mouth, decreased markedly after the completion of the Bhumipol Dam in 1965 and the Sirikit Dam in 1972. The sediment load at Nakhon Sawan, more than 30 Mt annually before 1965, had fallen to less than 5 Mt yr^{-1} by the 1990s (Winterwerp et al., 2005). Moreover, construction sand exploitation from the Chao Phraya at Nakhon Sri Ayuthaya, about 120 km upstream from Bangkok, during the last 30 years has cause further reduction of the sediment load .

3. Coastal Erosion of Megadeltas

Reduction of river sediment load impacts sediment deposition in coastal zones and causes shoreline changes. Some Asian megadeltas are clearly shrinking and shorelines are retreating as a result of coastal erosion and other phenomena, such as land subsidence.

The Huanghe delta, which historically received more than 1 Gt of sediment annually, prograded into the Bohai Sea for the past 1000-2000 years, for a land growth rate of 20–25 km^2 yr^{-1}, (Saito et al., 2001). This progradation built a cuspate delta on the western shore of the Yellow Sea, formed during 1128–1855, and a huge lobate or bird's foot delta on the western shore of the Bohai Sea, formed after 1855. In 1976, the river again shifted its course, abandoning its mouth on the north side of the present lobate delta to debouch on the east side, and since then, the area of the former river mouth on the northern side of the delta has been obviously eroding.

The shoreline there retreated more than 7 km during 1976–2000, for a mean net erosion rate of 0.29 km yr^{-1}; conversely, at the new river mouth, the delta has prograded more than 20 km, for a mean net accretion rate of 0.83 km yr^{-1} (Chu et al., 2006; Yang and Wang, 2007; Syvitski and Saito, 2007). Nevertheless, the reduction of the sediment load of the Huanghe has affected delta formation at the new river mouth. Although the total delta area increased until 1995 owing to rapid progradation at the new river mouth, it has been decreasing since 1996 (Chu et al., 2006). Moreover, since the Xiaolangdi Reservoir began to fill in 1999, the shoreline has been generally retreating even in the area of the new river mouth (Wang et al., 2005). Thus, the Huanghe delta, which in the past was the largest delta in the world with a delta plain formation rate of 20–25 km^2 yr^{-1}, is now shrinking.

The Changjiang delta prograded more than 200 km into the East China Sea during the last 6000 years (Saito et al., 2001), and the Shanghai megacity has grown up on the southern part of the delta plain. Sediment load reduction of the Changjiang since middle 1980s has also affected coastal sedimentation. Though shoals have been transformed into tidal flats by delta progradation, the rate of progradation of intertidal wetland has been decreasing for the last 40 years (Yang SL et al., 2006), and the sediment accumulation rate on the delta front slope has also clearly decreased for the last 20 years (Wei et al., 2007). After the start of water storage of the Three Gorges Dam since 2003, sediment discharge of the Changjiang has been decreasing significantly from originally 480 Mt yr^{-1} down to 150–200 Mt yr^{-1} (e.g., Yang Z et al., 2006; Yang SL et al., 2007), it could be impacting sediment deposition along the deltaic coast.

The Song Hong delta has prograded approximately 100 km over the last 6000 years. In particular, sediment discharge increased during the last 2000 years because of deforestation in the drainage basin (Li et al., 2006), with the result that the river formed a huge delta plain of 2500 km^2 during that time (Tanabe et al., 2006). The delta plain accretion rate increased to 3.6 km^2 during 1958–1995 along the whole deltaic coast. However, the sediment discharge of the main distributary of the Song Hong has recently decreased from 20–25 Mt yr^{-1} to ~10 Mt yr^{-1}, and the delta has been seriously affected as a result.

Along a 30 km-long stretch of the Vanly coast southwest of the present river mouth, the mean rate of coastal erosion increased from 8.6 m/y during 1965–1990 to 14.5 m yr^{-1} during 1991–2000, following the completion of the Hoa Binh Dam in the Song Hong catchment at the end of 1989 (Thanh et al., 2004, 2005).

The Mekong River delta has formed a new delta plain of 18,000 km^2 during the last 3000 years (Ta et al., 2005). The average accretion rate is 6 km2 yr^{-1}. Coastal progradation occurs mainly around the mouths of the Mekong River distributaries and on the western side of the Camau Peninsula. This peninsula expanded westward at a rate of 1.2 km^2 yr^{-1} between 1885 and 1985, but the 60-km-long shoreline on the eastern side of the peninsula is mainly eroding. The rate of shoreline retreat is 30-50 m yr^{-1} on average, and a land area of 1.1 km^2 yr^{-1} was lost during 1885-1992 (Nguyen et al., 1999).

4. Coastal Erosion of the Chao Phraya Delta, Thailand

Along with a reduction of sediment supply, a relative sea-level rise resulting from human activities can also be an important cause of coastal erosion. The Chao Phraya delta prograded into the Gulf of Thailand with an average accretion rate of ~1.5 km^2 yr^{-1} during the past 2000 years (Tanabe et al., 2003), but has experienced serious coastal erosion over the last 40 years (Figure 2) (Vongvisessomjai, 1992; Vongvisessomjai et al., 1996; Rokugawa et al., 2006).

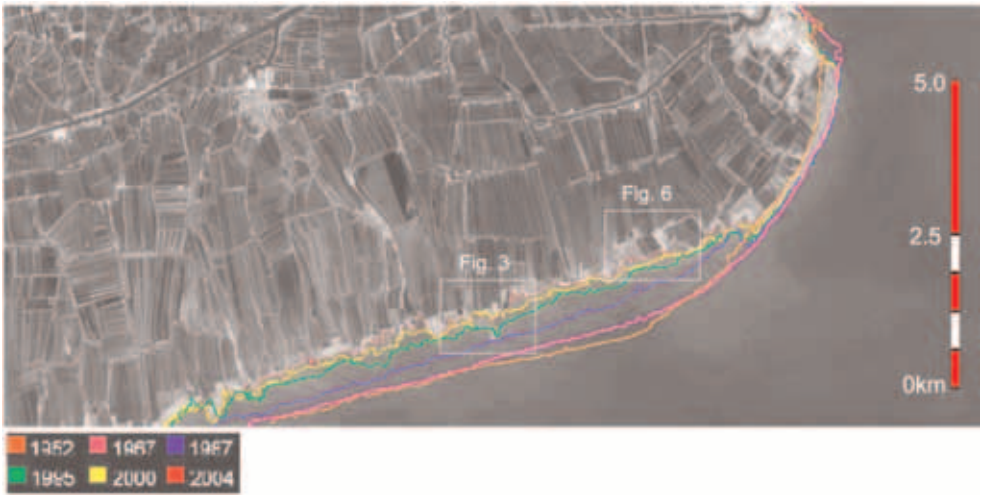

Figure 2: *Shoreline changes of the Chao Phraya delta west of the river mouth in 1952, 1967, 1987, 1995, 2000, and 2004 (modified after Rokugawa et al., 2006). The shoreline retreated overall more than 1 km.*

Since the 1960s, the coast around the river mouth and the neighboring coastal zones has been eroding, mainly because of land subsidence due to excess groundwater extraction and changes in land use. The shoreline had retreated 700 m by the early 1990s, and a maximum of more than 1 km by 2005 (Jarupongsakul and Suphawajruksakul, 2005; Rokugawa et al., 2006). In the upper Gulf of Thailand, where the Chao Phraya debouches, the area of accretion was 8.9 km^2 and that of erosion was 4.5 km^2 during 1969–1976, for a net accretion rate of 0.62 km^2 yr^{-1}; during 1976–1987, they were 4.9 km^2 and 10.3 km^2, respectively, for a net accretion rate of –0.49 km^2 yr^{-1}, and during 1987–1997, they were 7.4 km^2 and 4.5 km^2, respectively, for a net accretion rate of 0.25 km^2 yr^{-1} (Jarupongsakul and Suphawajruksakul, 2005). A total of only 1.5 km^2 of new land formed during the entire 28 years from 1969 to 1997; that is an amount equal to the area of land that previously formed annually under natural conditions.

Though several causes of coastal erosion have been identified (e.g., subsidence, decrease in sediment supply, deforestation for shrimp farms), the main cause on this coast is coastal subsidence. Around 1980, subsidence was rapid, at about 5 cm yr^{-1}, reaching a total of 20 cm within 3–4 years (Haq, 1994; Nutalaya et al., 1996), and this subsidence was accompanied by significant coastal erosion, accounting for the net erosion in the upper Gulf of Thailand during 1976–1987. Sediment reduction, on the other hand, has occurred gradually, particularly in the 1960s and early 1970s, as a result of dam construction (Winterwerp et al., 2005); thus, a close relationship cannot be identified between sediment reduction and coastal erosion around 1980.

The area of mangrove forest has decreased drastically in the lower Chao Phraya delta. During the last 40 years, more than 140 km^2 of mangrove forest has decreased to less than 20 km^2. However, more than 90% of the decrease in the 1980s occurred at Samut Sakhon, in the western part of the delta, where no serious erosion has occurred. The area of mangrove forest in the river mouth area and neighboring coastal zones (Bangkok, Samut Prakarn) did not significantly decrease during that period, because already, by the early 1960s, the area was very small there as a result of the construction of salt farms and fish ponds, charcoal production, agricultural development, port expansion, and urbanization (Szuster, 2003). Therefore, only rapid subsidence can explain the severe coastal erosion that occurred around 1980.

An approximately 60 cm relative sea-level rise occurred during the 1960s to 1980s as a result of land subsidence in the river mouth area and neighboring coastal zones

(Emery and Aubrey, 1991; Haq, 1994). Though groundwater extraction in Bangkok is regulated, subsidence is still continuing, particularly in the areas surrounding the city. During 1992–2000, there was subsidence of more than 20 cm along the coast, with a maximum subsidence of more than 30 cm, which is equivalent to a relative sea-level rise of 2–4 cm yr^{-1} (Winterwerp et al., 2005). During the last 10 years, ongoing subsidence and coastal erosion have been severe. Total subsidence during the last 50 years has been more than 1 m at the river mouth, where the shoreline has retreated more than 1 km.

The main mechanisms of the erosion and shoreline retreat that result from subsidence are submergence and an increase of wave energy in the subsidence-deepened intertidal to nearshore zones, particularly the latter. The slope of the nearshore zone of the Chao Phraya delta is very gentle, with a gradient of 1 m/km. Therefore, subsidence of 10 to 20 cm causes an increase in water depth of 10% to 20% at a point 1 km offshore, and of 5% to 10% 2 km offshore. The mean tidal range here is about 1.2 m, and the maximum tidal range is about 2.5 m. One meter of subsidence means roughly that the previous mean sea-level position becomes the level of the lowest tide, and the level of the highest tide becomes the new mean sea level, assuming that sediment accumulation is negligible.

As most of the mangrove ecosystem develops in the upper part of the intertidal zone, between mean sea level and the level of the highest tide, 1 m of subsidence should cause the mangrove zone to shift landward. However, such a shift has not been observed, though some landward expansion of mangrove vegetation has occurred because of saltwater intrusion. Erosion and a 1 km retreat of the mangrove zone represent a serious problem, but only 1 km of the 20 km-wide mangrove zone was submerged, abandoned, and finally eroded. This is far smaller than the retreat distance estimated from the topography to result from simple inundation associated with a 1-m sea-level rise.

Subsidence has also led to rapid sediment accumulation in the intertidal zone of the Chao Phraya delta , particularly in the upper part of the gulf. The temple Wat Khun Samutchin used to be located on the shore. However, it is now on an artificially protected headland (Figures 2 & 3).

The temple is partially inundated, and the floor of the temple building has been elevated by about 1 m (Figure 4).

An approximately 40 to 50cm-thick layer of sediment has been deposited on the temple grounds, burying three steps leading into the building (Figure 5).

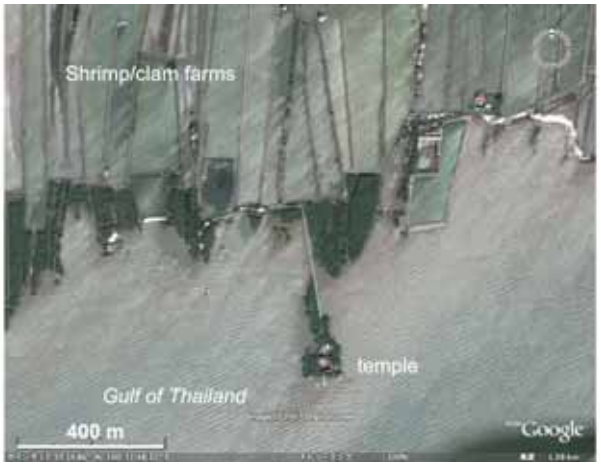

Figure 3: *with kind support of Google Earth™ mapping service Satellite image of coastal erosion of the Chao Phraya delta near the Wat Khun Samutchin (after Google Earth). Approximate location is shown in Figure 2.*

Figure 4: *Wat Khun Samutchin. Photograph taken by Ms. Vareerat Unwerawattana on 24 May 2007. Location is shown in Figure 2.*

Figure 5: *Wat Khun Samutchin. Three steps are buried below the present ground level. Photograph taken by Ms Vareerat Unwerawattana on 24 May 2007. Location is shown in Figure 2.*

Thus, rapid sediment accumulation has also occurred in the intertidal zone in response to the rapid relative sea-level rise. In addition to this natural response of sediment accumulation in an intertidal zone, banking of roads and ridges in aquaculture ponds has also raised the ground level. These mechanisms, along with the physical protection of the mangrove forest, are protecting the shoreline against retreat.

The currently observed 1 km retreat caused by the 1 m of subsidence means that a 1-km-wide strip of the intertidal zone has changed into an offshore slope environment (delta front slope), because the subsidence/shoreline retreat ratio is the same as the offshore gradient of 1 m km^{-1}. If enough sediment is supplied to fill the accommodation space in the intertidal zone, the amount of shoreline retreat will be controlled by a new equilibrium profile offshore (delta front slope) and by the related landward migration of the offshore break.

Aquaculture ponds for clam and shrimp have also accelerated coastal erosion. Once the frontal mangroves are destroyed, the ocean encroaches into the shrimp ponds, exposing the next mangroves to face the sea (Figure 6).

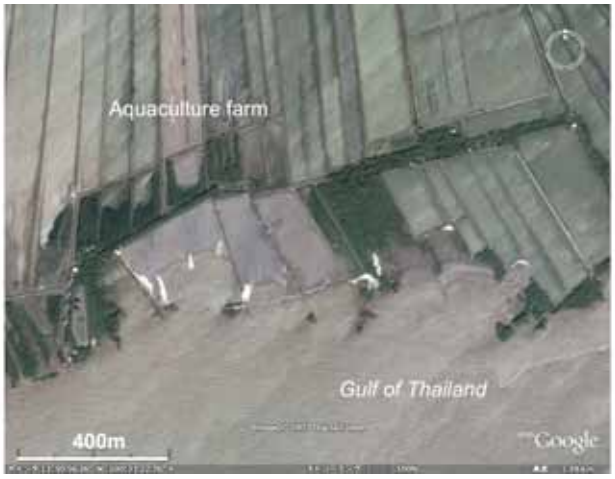

Figure 6: *with kind support of Google Earth™ mapping service Satellite image of coastal erosion of the Chao Phraya delta near the river mouth. Mangrove collapse at the ocean front has led to a landward shoreline shift to beyond the aquaculture ponds. Approximate location is shown in Figure 2 (after Google Earth).*

The reduction of sediment discharge and the decrease of water discharge caused by dam construction have also led to coastal erosion. If the submergence of coastal zones is to be prevented, sediment must accumulate in the intertidal zone to maintain the ground level. However, the sediment supply from rivers has already been reduced during the last 40 years.

This reduction of sediment supply to the coastal zones is also recorded by the measured annual siltation volume in the 18-km-long Bangkok Navigation Channel between the Port of Bangkok and the Chao Phraya river mouth. The siltation volume decreased from 4.4 million m3 yr^{-1} during 1981–1985 to 3.1 million m^3 yr^{-1} in 1993 (Vongvisessomjai, 2007). Dredging and sand mining in the rivers also cause a reduction of sediment supply to the coast. We need more precise data on these sediment removals.

One of the lessons from the Chao Phraya delta is that a relative sea-level rise of only 10 cm can induce coastal erosion along muddy coasts. During the initial phase of subsidence from 1969 to 1973, the total area of coast lost to erosion was 1.8 km^2 (Vongvisessomjai, 1992). The future sea-level rise predicted by the IPCC will surely cause inundation and erosion of some vulnerable muddy coasts. Subsidence resulting from human activities, as in Thailand, has more serious impacts than natural sea-level rise because the rate of relative sea-level rise due to subsidence is usually large. The knowledge gained by studying the Chao Phraya example suggests that mangrove forests will be important mechanisms of physical protection and also sediment trapping for the preservation or restoration of shorelines when relative sea level rises.

5. Conclusion

Megadeltas are characteristic coastal features in Asia. The huge delta plains of Asian megadeltas are important areas in which people live, carry on economic activities, and grow or collect food. The formation of these delta plains took several thousands of years, during which they expanded by more than 40 km^2 annually because of the huge sediment supply from the rivers of Southeast and East Asia. However, most of these megadeltas are currently at risk of destruction and collapse because of human activities in the river drainage basins and on the delta plains.

There is sufficient evidence that human induced relative sea level rise due to intensive land use change is overarching climate related pressures. Natural system response reflects in resilience mechanisms such as mangrove system development/changes but holistic knowledge of their interplay with increasing pressures is still lacking.

Therefore we need more integrated data and knowledge about the drainage basins and coastal zones taking an ecosystem-based perspective so that we can maintain and manage these megadeltas.

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Figure Captions

Fig. 1. Megadeltas in Southeast and East Asia. Modified after Woodroffe et al. (2006)

Fig. 2. Shoreline changes of the Chao Phraya delta west of the river mouth in 1952, 1967, 1987, 1995, 2000, and 2004 (modified after Rokugawa et al., 2006). The shoreline retreated overall more than 1 km.

Fig. 3. Satellite image of coastal erosion of the Chao Phraya delta near the Wat Khun Samutchin (after Google Earth). Approximate location is shown in Fig. 2.

Fig. 4. Wat Khun Samutchin. Photograph taken by Ms. Vareerat Unwerawattana on 24 May 2007. Location is shown in Figure 2.

Fig. 5. Wat Khun Samutchin. Three steps are buried below the present ground level. Photograph taken by Ms Vareerat Unwerawattana on 24 May 2007. Location is shown in Figure 2.

Fig. 6. Satellite image of coastal erosion of the Chao Phraya delta near the river mouth. Mangrove collapse at the ocean front has led to a landward shoreline shift to beyond the aquaculture ponds. Approximate location is shown in Fig. 2 (after Google Earth).

CABRI-Volga and the Volga Delta: Recommendations for an Integrated River Basin Management

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Partners from Russia: Environmental Policy Research and Consulting, Moscow (scientific coordinator); Caspian Marine Scientific and Research Center, Astrakhan; Ecological Projects Consulting Institute, Moscow; Nizhny Novgorod State University of Architecture and Civil Engineering; Research Innovation Projects Institute "Cadaster", Yaroslavl; Saratov State Socio-economic University; UNESCO Moscow Office; Ammophos, Cherepovets.

About CABRI-Volga

CABRI-Volga (**C**ooperation **A**long a **B**ig **R**iver) is a LOICZ-affiliated international coordination project to facilitate cooperation and to coordinate research in environmental risk management in large river basins in the EU, Russia and the New Independent States (NIS). It is based on a partnership of seventeen partner organisations from Russia and seven EU countries, including universities, private research institutes, industry, NGOs and international organizations dealing with a variety of aspects in environmental risk management [3]. The project focus is on the Volga Basin (Figure 1) which comprises 40 percent of the population of Russia, 45 percent of the country's industry and 50 percent of its agriculture.

The key objectives of the project are to:

- Mobilise people and institutions to cooperate internationally
- Enhance joint research on environmental risk management in large river basins
- Follow an integrative approach in environmental risk reduction and sustainable river basin development
- Exchange of scientific knowledge and good practices of various stakeholders in river basins in Europe;
- Strengthen links between scientific community, policy-makers, and society.

Figure 1:
The Volga River Basin
Source: Ruprecht Consult, Cologne

Following more than two years of close cooperation, experience and knowledge exchange between experts from Russia, the European Union, America and Asia on issues related to environmental risk management in large river basins the CABRI-Volga project is coming to an end in February 2007.

During the course of the project, three expert fora were held by the project consortium in the Russian CABRI-Volga cities of Nizhny Novgorod, Kazan and Cherepovets providing a still unique opportunity in Russia to bring together for joint discussions experts from various scientific disciplines and institutional backgrounds such as academia, politics, business, industry, and NGO's. Out of the more than 150 experts, the majority (about 2/3) were from Russia.

CABRI-Volga kept close relations with policy-makers and organised an informative meeting at the Russian State Duma as well as a policy roundtable in Moscow to present and validate its policy recommendations.

CABRI-Volga research and networking is rooted in the earlier UNESCO initiative "Volga Vision"[4].

[4] The Volga Vision. UNESCO Interdisciplinary Initiative for Sustainable Development of the Volga-Caspian Basin. UNESCO, Paris, 2004.

CABRI-Volga: Integrated river basin management

The project supports the integrated river basin management approach. CABRI-Volga recognizes that good water governance needs to be based upon integrated water management at the river basin level. Coordination and cooperation within a water basin becomes a powerful tool for this purpose. It includes institutional coordination (horizontal and vertical) between various government bodies as well as partnerships, dialogue and joint actions of multiple stakeholders within water basin.

CABRI-Volga regards the entire river basin in its integrity including its sub-basins, river-tributes, other water bodies and coastal areas. It also calls for a combination of social, ecological and economic priorities within an entire basin. It suggests that coordination of actions across various thematic areas is essential for sustainable development in the basin: win-win situations become possible as problem-solving in one area contributes to positive results within others. Thus, project activities and expert discussions are organized within five closely interlinked thematic areas:

- Water quality, including drinking water and sanitation
- Water related risks and human security

- Sustainable management of water resources and biodiversity conservation
- Economic development and sustainable transport in the Volga basin
- Institutional cooperation and stakeholder participation.

Among one of the CABRI-Volga conclusions is that, both the integrated water management and coordination at a basin level are not yet effectively applied in practical terms in Russia's Volga Basin. There are significant loopholes in the system of water resources management at the basin level, and enhancing domestic institutional capacities for water related risks reduction is at the top of the Volga Basin agenda. CABRI-Volga recommends promoting further cooperation in integrated water-related risk management between various administrative regions of the Volga Basin and for coordination of actions of stakeholders within each of its four sub-basins – the Lower Volga, the Upper Volga, the Oka and the Kama.

The Volga Delta and adjacent coastal areas of the Caspian Sea are part of the Lower Volga sub-basin. The Integration of local decision-making and actions which take into account the specifics of the Delta and coastal areas with the Volga Basin management schemes is crucial for this region's sustainable development.

The Volga Delta

The Volga Delta the largest river delta on the European continent. With its adjacent coastal areas, the Volga Delta provides the link between the Volga River and the Caspian Sea[5]. The Volga carries 80 percent of the fresh water inflow to the Caspian Sea with the usual nutrients and polluting substances. About 23 species of the Caspian Sea spawn in the Volga River. The Volga Delta is the unique region of the Volga Basin and its environmental health serves as an indicator for the situation in the entire basin. The biodiversity of the Volga Delta is of global importance. It has intact ecosystems, relict plant species and about twenty endemic fish sub-species.

The Delta is famous worldwide as breeding grounds for sturgeon. The Delta along with the part of the Lower Volga (downstream from Volgograd) is the only segment of the Volga where the river flow is not regulated by the cascade of the Volga artificial reservoirs. It is dependent on the upper flow areas not only for polluted waters inflow, but for the level of water supply as well: the highly regulated level of water flow is usually lower than required for the normal functioning of water eco-systems. The role of the Volga Delta is highly valuable because it serves as a natural purification filter where upstream polluted waters undergo physical, chemical and biological purification flowing through its natural ecosystems.

The Volga Delta and adjacent coastal areas of the Caspian Sea require special care and attention. At the same time, the socio-economic situation in the Volga Delta with its coastal regions is much more desperate than in most other Russian regions (GDP per capita is lower than the Russian average); the situation is characterized by a level of urbanization which is lower than the national average, by social problems and a predominant agricultural economy, in particular, in Kalmykia and Dagestan. Oil and gas, including the development of the Caspian Sea deposits provide the potential for the future economic development in the region, posing at the same time additional ecological risks.

The major current environmental problems in the Volga Delta as identified by CABRI-Volga experts include: water quality, with a particular focus on drinking water quality, loss of biodiversity, loss of coastal habitats and degradation of coastal landscapes, decline in commercial fish stocks. Experts agree that the main cause for these problems is ineffective water basin management.

[5] The Volga Delta is in and surrounded by the Astrakhan oblast, Dagestan, Kalmykia republics of the Russian Federation.

Biodiversity

The biodiversity of the Volga Delta is of global importance. Its wetland habitat is considered to be the best conserved in Europe. A part of the Volga Delta is the Astrakhan Biosphere Reserve and approximately half of the estuary zone is designated as a protected wetland site under the Ramsar Convention (800,000 ha). About fifteen rare bird species are registered in the region and listed in the Red Book of the Russian Federation. Three globally significant bird migration routes cross over the Volga Delta, serving millions of waterfowl of many dozens of species. It is estimated that seven to ten million water birds use the area in spring and fall. In the Delta area are spawning grounds of four threatened sturgeon species included in the Red List of the World Conservation Union (IUCN).

CABRI-Volga recognises the necessity to enhance the system of protected areas and natural reserves. It is recommended to consider the need for habitat preservation and normal eco-system functioning in decision-making processes. Improvements in ecological knowledge and user-friendly information dissemination are essential. Regular local public education about biodiversity conservation is equally important.

Fisheries

The river provides significant commercial fishing. The Lower Volga and the Northern Caspian are among the largest fishing areas of the country accounting for about

a half of domestic inland water fish catches, including about 70 percent of sturgeons. The area from Volgograd to the Northern Caspian provides nutrition sources for the majority of migratory and semi-migratory fish of the Caspian Sea and the Volga River, including globally threatened and highly valuable sturgeon species.

Construction of the reservoir cascade on the Volga resulted in a loss of spawning grounds, and its stocks are supported now only through artificial breeding[6]. Spawning grounds of sturgeons are conserved within the Volga-Akhtuba floodplain and in the Delta. The presence of natural spawning grounds is a necessary condition for conservation of the gene pool of these fish species. Effectiveness of fish reproduction depends on the size of flooded areas and the flood regime. The area of the spawning grounds in the Volga Delta has been reduced by about twenty five percent (525,000 ha) from mid-twenty century when they were completely flooded by the Volga in spring and summer. According to official statistics, annual sturgeon catches declined from 11,000 tons (1910–1930) to 1,800 tons by the end of the twentieth century, and total commercial catches declined by almost five times due to loss of spawning grounds, and disturbance of the fish food bases[7]. Over-fishing and poaching has become a significant threat to fish resources. Moreover, the genetic diversity of the sturgeon species is declining due to the choice of standard fishes for artificial reproduction.

CABRI-Volga recommends a combination of measures for the problem-solving in conservation and restoration of fish biodiversity in the Delta and the Caspian Sea. Among them is a set of special technical innovations to increase effectiveness of fish elevators to ensure passage of migratory fish species upstream the Volgograd reservoir. Special efforts are essential to protect and restore the spawning areas, especially upstream of the dams as 80 percent of them had been destroyed. Further support for artificial reproduction is needed. Strict control over poaching and punishment of violations is essential.

[6] Artificial reproduction of fish is widespread (hatcheries, fish farms, etc.). These hatcheries produce over 50 million fry of sturgeons and semi-migratory fish each year. However, only about one percent of fry survives due to their high vulnerability.

[7] The decline of the sturgeon population in the Caspian Sea was caused by the disappearance of 80 percent of the spawning areas upstream of the dams, the changes in the level of the Caspian Sea, the reduction from 120 million to 70 million sturgeon fly through artificial reproduction.

Water Pollution

Sources of water pollution in the Delta are located both within the Lower Volga region and upstream. The main pollutants originate from the Middle Volga, while in the Lower Volga the level of water discharges is about three times less. The main sources are municipal and industrial discharges, agricultural runoff, shipping and oil and gas extraction. Although current levels of surface water pollution are not a major ecological risk in the Delta, the forecasts suggest that an increase in economic activities in coming years may result in water pollution growth.

Among the problems is the lack of reliable scientific knowledge on the interrelation between pollutants and biodiversity, and monitoring results of current pollution levels are insufficient. There are also gaps in the system of regulatory rules and methods for biodiversity assessment within existing procedures of environmental impact assessments, and so far there are no approved ecological limitations on hydrocarbon exploration and extraction in the Northern Caspian and the Volga-Akhtuba floodplain.

The most serious problem for the Delta and coastal regions is the drinking water quality. The quality of water supplied to households meets neither the existing national standards nor the WHO regulations. Main reason is the poor state of water supply system and distribution networks. For example, in Dagestan, the drinking water supply system is unsatisfactory; the water treatment capacity is about one half of the necessary volume. In Astrakhan oblast, which is characterised by higher level of economic development compared to other Delta and Caspian regions, only 30 percent of households are supplied with water, sewage and central heating, and that figure drops to less than ten percent in the coastal zone. As a result, public health is under threat. For example, the epidemiological situation is serious in Dagestan, where the occurrence of typhoid fever is fifteen times higher than in Russia as a whole.

CABRI-Volga recommendation highlight the need for building modern water processing plants and urban wastewater treatment facilities, for modernization of drinking water distribution systems. The speed-up of administrative reforms in water services communal sector is suggested as a part of enhancing the supply of safe drinking water to consumers. It also underlines the need for inventory and regular monitoring of drinking water sources and possible risks they pose for human health.

Oil and Gas

The importance of the lower Volga region is growing due to recent developments in oil and gas sector, including the offshore production in the Caspian Sea and in the coastal areas near the Volga Delta (The Volga Vision, 2004). Gas reserves in the Astrakhan oblast are estimated at six trillion cubic meters, condensate – 1.2 billion tons, oil – seven million tons[8]. At current rates of extrac-

tion, the largest Astrakhan gas condensate deposit may be exploitable for 100-150 years. The rapid growth of oil and gas sector has a variety of implications for sustainable development of the region. It provides a large potential for development of the regional infrastructure and jobs in the region, which would help to reduce the unemployment and social tension. At the same time, it is associated with additional ecological risks to marine and delta ecosystems and might result in water pollution.

CABRI-Volga underlines that it is of utmost importance to find means to decouple the economic growth (based on energy production) in the region from environmental pressures. The recent good news are that, for example, the leading off-shore producer LUKOIL is developing a corporate strategy based on "zero discharge"; besides it is actively involved in implementation in the Astrakhan oblast of the so-called Compensatory Action Programme aiming at support for research in ecology and sustainable development and for local education and training and ecological knowledge dissemination.

[8] At present, about ten percent of oil and condensate and approximately six percent of the total gas production in the Russian Federation is extracted here.

New Russian Water Code

In 2007, the new Russian Water Code entered into force. This national law establishes the new legislative context enabling sustainable development and water resources conservation in the Volga Delta and the coastal areas of the Caspian Sea. It is the framework law regulating the water resources use and water protection in Russia. Similarly to the EU Water Framework Directive it introduces the basin management approaches and envisages comprehensive basin management schemes to be developed for the purposes of integrated water management in the basins of rivers and seas. It calls for integrated management of all water resources within the same water basin, including rivers, lakes and coastal waters of the seas. For example, the unified basin management principles within the Volga Basin are applied to all four Volga sub-basins, including to the Volga Delta and adjacent coastal areas of the Caspian Sea.

The new Russian Water Code introduces tools for strict regulations and control in water use and water protection, including innovations such as agreements between water users and government authorities as well as establishing the special water conservation zones. The Water Code envisages tight coordination of water policies within the same river basin between the federation, the federation subjects[9] and the municipalities. For the purposes of coordination and application of water basin management principles, it establishes basin okruigs[10] (basin districts) which serve as a water governance unit within a river basin. Under the Water Code the coordination of water basin management is provided through the basin water management authorities and the newly established basin councils (four basin councils in the Volga: for the Lower Volga, the Upper Volga, the Oka, and the Kama). The law also encourages cooperation and partnerships between multiple stakeholders and water-users; while efforts in regular monitoring and inventories are envisioned among priority issues.

CABRI-Volga emphasizes the need for regular enforcement, verification and control over the step-by-step implementation of the Water Code by all regions in the Volga Basin allowing to transparently enforce its provisions and to ensure accountability before the civil society. It supports the formation of the new system of basin councils as coordination tool in river basin management and for enhancing participation of all stakeholders in decision-making, and particularly for enhancing local public participation which is still weak. It recommends enhancing strategic planning and coordination at the basin level, including the application of sustainable development approaches.

CABRI-Volga Recommendations Overview

CABRI-Volga has provided a still unique opportunity in Russia to bring together for joint discussions national and international experts from various scientific disciplines and institutional backgrounds such as academia, politics, business, industry, and NGO's.

The derived policy recommendations are directed primarily at decision-makers in Russia and the Volga Basin, but are also intended to provide suggestions and ideas to other stakeholders in the Volga Basin as well as in other river basins.

CABRI-Volga developed ten policy recommendations and thirty-eight concrete activities (see table below) structured according to *fundamental issues* (multi-hazard risk management, water governance, and stakeholder participation), major *policy fields* (socio-economic development, conservation of natural resources and biodiversity, and water management), tools of implementation (financing, information management, and human capacity building) and, finally, future perspectives of a further development of the Volga Basin.

[9] Twenty-three federation subjects are situated in the Volga Basin.

[10] The Water Code establishes twenty basin okruigs in Russia, including four in the Volga Basin (the Upper-Volga, the Oka, the Kama and the Lower Volga); the design of the basin okruigs is based on the combination of two factors: the existing administrative structure in Russia and geographical and hydrological regimes within a particular basin area.

Fundamental Issues	**Recommendation 1: Support systematic multi-hazard risk management** Activity 1.1: Apply integrated risk assessment methods that include social, economic and environmental dimensions for flood prone areas Activity 1.2: Establish an inventory of hydro-facilities and the risks they pose Activity 1.3: Reduce the risk posed by hydro-facilities through rehabilitation and continuous monitoring (starting with the most hazardous facilities) Activity 1.4: Establish an inventory of drinking water sources (surface and ground) and the risk they pose Activity 1.5: Reduce the risk posed by poor drinking water sources through rehabilitation and continuous monitoring
	Recommendation 2: Ensure coordinated strategic planning and implementation Activity 2.1: Enhance institutional capacities in water governance in the Volga Basin Activity 2.2: Apply vertical subsidiarity principles to strengthen cross-scales cooperation among government authorities responsible for water-related risk reduction (national/regional/local) Activity 2.3: Enforce implementation of the new RF Water Code Activity 2.4: Support the formation of the new system of Basin Councils Activity 2.5: Enhance strategic planning at the river basin level including application of sustainable development approaches
	Recommendation 3: Enhance partnership and stakeholder participation in decision-making and action Activity 3.1: Promote diversified river basin partnerships in good water management Activity 3.2: Introduce a participatory institutional system for river basin management
Major Policy Fields	**Recommendation 4: Facilitate the accessibility of the Volga Basin** Activity 4.1: Build an integrative transport strategy Activity 4.2: Link different transport modes according to regional needs and development strategies (focus on freight transport) Activity 4.3: Gradually improve the existing infrastructure and overcome existing bottlenecks
	Recommendation 5: Prevent the degradation of natural resources and the loss of biodiversity Activity 5.1: Enhance the system of protected areas and nature reserves Activity 5.2: Increase ecological knowledge Activity 5.3: Create special programs for flora and fauna Activity 5.4: Incorporate the need for preservation of habitats and normal eco-system's functioning into consideration in decision-making
	Recommendation 6: Carry out effective water quality and water quantity management Activity 6.1: Build modern drinking water processing plants as well as urban wastewater treatment plants and facilities in the Volga Basin Activity 6.2: Improve the drinking water distribution system in order to deliver safe drinking water to consumers Activity 6.3: Address the pollution from non-point sources Activity 6.4: Develop realistic water quality standards based on environmental principles Activity 6.5: Reduce water pollution and enhance sustainable water use Activity 6.6: Improve operation regimes at the Volga hydropower plants

Tools of Implementation	**Recommendation 7: Promote innovative financing solutions** Activity 7.1: Reform the licensing and taxation system to promote environmental performance and to stipulate investments into good environmental practices Activity 7.2: Ameliorate and develop institutional frameworks for effective financing of river basin management Activity 7.3: Develop and maintain innovative, sustainable financing mechanisms Activity 7.4: Provide incentives for private sector water conservation
	Recommendation 8: Improve the information management Activity 8.1: Improve the monitoring system in the Volga Basin Activity 8.2: Improve the system of information and data dissemination to decision-makers Activity 8.3: Improve the system of information sharing with all stakeholders in the river basin
	Recommendation 9: Encourage human capacity building Activity 9.1: Build human capacities in water management through education programmes Activity 9.2: Raise public awareness by making environmental education an integral part of cultural education
Outlook	**Recommendation 10: Invest human and financial resources in the continued Volga Basin development** Activity 10.1: Enhance the interface between science and practice in sustainable development of the Volga Basin Activity 10.2: Enhance multi-stakeholder partnerships for river basin management Activity 10.3: Develop pilot projects to demonstrate the perspectives and challenges of innovative water management Activity 10.4: Promote EU-RF cooperation and exchange of knowledge and practices

LOICZ News

LOICZ Biogeochemical Budgets Website has changed URL

Due to changes in administration, personnel, and programs at the Department of Systems Ecology and the Baltic Nest Institute (now physically housed in the new Resilience Center), the LOICZ biogeochemical budget website has been moved and is now available at:

http://nest.su.se/mnode/

LOICZ DISCO and LOICZ View Typology Tool links have changed URL

Since Bruce A. Maxwell - who is one of the major parents of the LOICZ typology tools has taken up a new challenge at Colby College - Dept. of Computer Science – the URLs for the typology clustering and visualization tools DISCO and VIEW (WLV) moved with him. The new links are:

DISCO: http://fangorn.colby.edu/disco-devel

WLV http://palantir.cs.colby.edu

The backbone of LOICZ: Affiliated Projects

LOICZ has a mandate to address key issues of coastal change and use in the context of scenarios of future human activity and environmental change. LOICZ endorses and seeks to support both fundamental coastal zone research and research that synthesises and up-scales results for dissemination within the scientific community, and outreach to policy makers and the public. An important part of this research is carried out by scientists who affiliate their projects to LOICZ thereby becoming part of the global network of LOICZ. These projects build the backbone for up- and down-scaling of LOICZ results and the LOICZ synthesis.

LOICZ provides a forum to assimilate, integrate and synthesise the outputs of its affiliated projects. Additionally, it provides an opportunity to communicate and disseminate these outputs making them available not only to other scientists, but also the public, decision-makers and managers. Information on affiliated projects is held in a central database that is accessible online through the LOICZ website. It makes basic information and regular updates available to the wider community as well as to LOICZ for its reporting requirements.

Once a project has been entered to the database by its Principle Investigator (PI), it will be reviewed by the IPO and the coordinator of the theme/topic it is contributing to most. As soon as the project is accepted it will appear in the public part of the database. This lean procedure allows LOICZ to maintain an up-to-date record of global research activity that relates to the LOICZ Science Plan as well as ensure that affiliated projects are given opportunity to fully participate in LOICZ activities such as workshops and joint projects.

Moreover, the database accomplishes an essential element that applies for all LOICZ interdisciplinary studies within and beyond the project namely data sharing and exchange. To facilitate this exchange LOICZ has developed a Data Policy to help affiliated projects and LOICZ to fully benefit from each other. Both documents, the Terms of Reference for affiliated activities and the Data Policy, can be found on the LOICZ website.

LOICZ protects its community members by restricting access to contact details in the public part of the database. But every community member and person interested in the activities affiliated to LOICZ is invited to register and then view full contact details and be able to submit and edit own projects. As the database is linked to the LOICZ contact database, all newsletter recipients are already recorded. If you wish to receive your login name and password for the database, please do not use the form as shown in figure 1, but send us an email to loicz.ipo@loicz.org

Do we hold your current contact details?

To receive LOICZ INPRINT it is sufficient that we know your email address, or if you receive the newsletter in hardcopy your postal address. But there is much more information available at the LOICZ IPO that does not make it into the newsletter, for various reasons.

If you are interested in receiving information targeted to your field of expertise, please request your login details from us and update your profile online.

Figure 1: *Registration form of the LOICZ database. Recipients of LOICZ INPRINT and other active or formerly active members of the LOICZ community should contact the IPO for registration. Everybody else is invited to fill in this form.*

Call for research proposals concerned with Land-Ocean Interactions in the Coastal Zone

LOICZ seeks to expand its network of scientists by endorsing research activities concerned with any of its priority topics on a global, regional or national level. Within these topics LOICZ strives to develop:

- methodologies or models that allow data assimilation, processing and synthesis, including up and/or down scaling;
- scenarios of change and/or response to change in socio-ecological systems;
- scientific context for the evaluation of existing policies and structures;
- globally applicable tools for scientific synthesis, decision support and structure development; and
- dissemination interfaces to provide information and assist sustainable coastal development on appropriate scales.

To achieve this, **LOICZ is calling for proposals to bring high quality research activities into the LOICZ cluster of Affiliated Projects.** As well as fundamental science projects, LOICZ also seeks projects that have a multidisciplinary perspective, especially combining natural and social sciences. Projects can have global, regional or local scales and be focused on coastal sciences and/or coastal management. Projects that collaborate with other Earth Science System Partnership (ESSP) projects, especially with other Core Projects of IHDP and IGBP, are sought in particular, as well as projects that synthesise and analyse research outcomes already available or involve dissemination and outreach that will lead to better public knowledge. Details about projects already affiliated to LOICZ can be found in the LOICZ Project database accessible through the LOICZ website. Although LOICZ cannot offer funding to Affiliated Projects, its endorsement provides the following benefits:

- support in proposing for funding;
- promotion of the project and associated activities, its contributing team, outputs and outcomes through the LOICZ website and/or newsletter;
- contribution to workshops, conferences and meetings organised by LOICZ and hence establish linkages to other projects operating in similar fields and/or addressing similar issues; and
- access to a wide circle of information related to funding and the science community that is available through the LOICZ database.

Researchers whose work fits into the LOICZ portfolio are encouraged to submit proposals to the LOICZ IPO as soon as possible. The required form is accessible after registration to the LOICZ project database and additional information can be obtained from the LOICZ website or via contacting the LOICZ IPO.

LOICZ Notes

New LOICZ Regional Node East Asia and LOICZ-Yantai International Seminar

On 23 September, 2007, a new LOICZ Regional Node East Asia will be established at Yantai, China. Accompanying the opening of the Regional Node, a first LOICZ-Yantai International Seminar on „Tackling Land Ocean Interactions on Regional Scale", will be held at the Yantai Institute of Coastal Zone Research for Sustainable Development (YIC), China, from 23–25 September, 2007. A main objective of the seminar is the identification of priority questions on regional scale that need immediate scientific attention within the following topics: ecosystem functioning and socioeconomic impacts in changing coastal zones, material fluxes and ecosystem response, and governance frameworks for ecosystem-based management, among others. More information can be obtained from the local host, Professor Ping Shi (e-mail: pshi@yic.ac.cn), and from Mr. Cheng Tang at the secretariat (e-mail: ctang@yic.ac.cn).

Objectives of the new East Asia LOICZ Node

The 18,000 Km coastlines of China are home to almost 60 percent of the total China population. China's coasts host a variety of industrial and business activities, fisheries, energy facilities, marine transportation and recreation that contribute tens of billions of dollars to the economy per year. As the coastal population continues to increase, there are many competing demands for limited coastal areas and resources. Increasing pressures from pollution, habitat degradation, over-fishing, invasive species, and coastal hazards, including hurricanes and sea-level rise start become problems to the

Fishing farming at the coast of Yantai area (Cheng TANG, Sept. 2006)

Fishing farming at the coast of Yantai area-2 (Cheng TANG, Sept. 2006)

China coast. The increasing coastal population can also create conflicts between of competing coastal uses: beach goers, commercial and residential, commercial, industrial and port development. The challenges of coastal zone management face balancing coastal uses while protecting valuable coastal resources are mounting.

Fishing farming at the coast of Yantai area-3 (Cheng TANG, Sept. 2006)

Yantai Institute of Coastal Zone Research for Sustainable Development (YIC) is a new institute which focuses on coastal resource recycling utilizing, environment protection, ecology process, and integrated management under the supervision of the Chinese Academy of Sciences (CAS). The main objectives of the institute will encourage new multidisciplinary research collaborations and to bring together an extended community of researchers and end-users of research.

Yantai is a beautiful city which located in the north China close to the boundary of Bohai sea and Huanhai sea. The establishment of the Node is a culmination of coastal related activities organized by the YIC of the CAS, led by Prof. Dr. Ping SHI. Its functions include the initiation, facilitation and support of basic and applied research, fostering the exchange of scientific information among scientists, maintaining a database of scientific and technical personnel and resources and popularization of science. As the main goal of LOICZ: „to provide knowl-

Yangma Island, Yantai (Cheng TANG, Sept. 2006)

edge, understanding and prediction to allow coastal communities to assess, anticipate and respond to the interaction of global change and local pressures in determining coastal change", it is definitely necessary for YIC to join such community, to get involved into the hot topics and resolve the local problems with the help of the

Yantai City coast (Cheng TANG, Sept. 2006)

Yellow River Delta (Qianguo XING 2007)

global communities. The Node will play a regional coordinating role in East Asia and help develop regional funding proposals to implement the science agenda of LOCIZ including links with other regional programmes and intergovernmental networks.

IPO Notes

IPO staff changes

I am Christiane Hagemann and am a new colleague at the LOICZ IPO.

During the last nearly two years I have worked in the administration of the International Projects Department of GKSS-Forschungszentrum Geesthacht GmbH. The principal task of this department is giving support to the scientists with the administrative handling of EU-proposals, contract preparation and handling of current EU-Projects.

From starting September 2007 I am a member of the LOICZ IPO staff. I will assist the small and dynamic team of the LOICZ International Project Office with the administration. I am looking forward to communicate to coastal scientists all over the world.

With the background of a professional training as a clerk in an industrial company and with my additional professional experience in several business and financial service companies I am ready for action to support the IPO and I am pleased to be part of the LOICZ community.

Christiane Hagemann

LOICZ IPO received visitors from China

In March 2007, Professor Shi Ping, leader of the prospective LOICZ Regional Node East Asia in Yantai, visited the LOICZ IPO and its host, the Institute for Coastal Research at the GKSS Research Center.

From left to right: *Jindong ZHANG, Ping SHI, J. Pacyna, H. Kremer, J. Weichselgartner, Cheng TANG, V. Dzaak (Photo: D. Hoffmann)*

18th LOICZ SSC Meeting in Vancouver, Canada, 29 May - 1 June, 2007, explores new ways

SSC Chair Jozef Pacyna welcomed the twenty-two participants to the Simon Fraser University, Vancouver, and thanked local organisers and IPO. Moreover, he conveyed apologies, expressed gratitude to past Chair Liana Talaue McManus for her substantial contribution to the LOICZ transition, and dedicated a warm farewell and welcome to former and new SSC members and IPO team colleagues, respectively. After the welcome note of Franciscus Colijn on behalf of the LOICZ IPO host, the GKSS Research Center, the Chair introduced the agenda

The third day and still in a good temper: (almost all) participants of the 18. SSC Meeting in front of the Vancouver Aquarium (Photo: B. Goldberg)

and underlined the major objective of this SSC Meeting: clarification of the LOICZ organization, structures, scientific foci, and responsibilities in order to conclude with a well-elaborated and approved business plan for 2007/08. Progress reports from the Chair, Scientific Theme Coordinators, Priority Topic and Cross-Cutting Activity Leaders, as well as Regional Node Coordinators and IPO were presented and discussed. A dinner at the Fish House Restaurant in Stanley Park, hosted by NILU, and a dinner in the Aquarium hosted by LOICZ plus a public lecture given by former Minister of Fisheries, Canada, John A. Fraser, provided extra room for casual discussions and of course energy. A detailed description of the 18. SSC Meeting can be found in the Meeting Report which will be available soon.

Following the good experiences from SSC 17 in Germany in 2006 which for the first time had a scientific Mini-Symposium associated the Simon Fraser Center for Coastal Studies and the SSC had organised such a Mini-Symposium here in Canada again. On the second day, the SSC members joined a workshop on „Applying the

Best Available Science to Policy, Decision Making and to Changes in Societal Behaviour". Various case studies – ranging from cruise ship tourism to linking sustainable livelihoods to coastal policy – were presented by Canadian scientists, offering an excellent opportunity to exchange and discuss different ideas (see below for detail).

As a second rather new approach taken in this years SSC members divided into three working groups according to the LOICZ Priority Topics. Discussions focused on how each Priority Topic will proceed; on the milestones and products; and on the identification of work items. This provided a solid basis for the development of a mid-term strategy (until 2009/10, i.e. the first half of LOICZ anticipated lifetime at GKSS) and a detailed business plan for 2007/08. Both are currently in a final iteration and editing state and will be made public in autumn 2007.

Key points are that LOICZ will run the Priority Topics as individual subprojects and that a synthesis should be provided before the end of the first phase of the second LOICZ term. The focus remains on Socio-Ecological Systems analysis, on Material Fluxes in context of change and ecosystem goods and services and on Governance. Modelling and further development of typological approaches remain key cross cutting activities and all levels will be supported and in return feed into the LOICZ capacity building efforts. The business plan will provide a tangible record of current and future activities and should serve as a transparent workplan allowing targeted personnel and financial policy in the overall LOICZ management.

SSC-Mini-Symposium „Applying the Best Available Science to Policy, Decision Making and to Changes in Societal Behaviour"

This year's Mini-Symposium was designed around a set of case studies that illustrate a diversity of initiatives in Canada and elsewhere that are applying the best available science to issues posed by coastal ecosystem change. The primary focus was upon bridging between the generation and interpretation of science and policy and decision making. But the big question was to examine how policy and decision making can in turn engender the changes in behaviour (in government, in civil society and in markets) that signal the implementation of a plan of action. The case studies and subsequent dialogue worked to identify enablers and resistors of progress towards ecosystem stewardship and ecosystem-based management of coastal and oceans resources.

Lecture „Who Speaks for the Oceans, and what are they doing about it?"

On 31 May, 2007, the SSC Meeting participants joined the Canada Ocean Lecture „Who speaks for the oceans, and what are they doing about it?", held at the Vancouver Aquarium. A legendary advocate of ocean conservation in Canada, John A. Fraser (former Speaker of the House of Commons, former Minister of Fisheries, and currently Chair of the Pacific Salmon Forum), has given a talk in celebration of Oceans Day 2007 drawing on his unique experience as both government insider and policy critic.

His lecture described the insights into ocean issues arising from new global sources of information and environmental awareness. In this light, Mr. Fraser gave a critical review of how Canada, as a signatory of the UN Convention on Law of the Sea, has performed on its international and national commitments to action and also spoke to the implementation of Canada's Oceans Act.

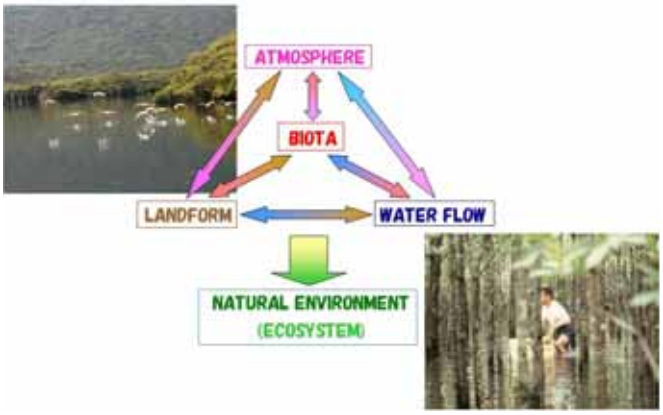
Finally he showed how leadership is being displayed in community-based coastal initiatives, with special attention to British Columbia. If you are interested in listening to the lecture, please visit:

http://www.sfu.ca/cstudies/science/fraser.mov

Publications

The Role of Physical Processes in Mangrove Environments – Manual for the preservation and utilization of mangrove ecosystems

Authors: Yoshihiro Mazda, Eric Wolanski and Peter V. Ridd



This book

- highlights the importance of physical processes to the researchers and engineers in the developing countries, who are endeavoring to maintain the mangrove environment,
- makes coastal physical and biological researchers recognize the peculiarity of mangrove physics and the link between physics and biology to maintain environmental health, and
- provides a manual for preserving and utilizing the mangrove environment.

Total pages: 617 pages
Distribution: without charge
Publication: March 2007
Publisher: Terra Scientific Publishing Company
Contact: Professor Y. Mazda

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Edited by

Yoshihiro MAZDA
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Eric WOLANSKI
Australian Institute of Marine Science
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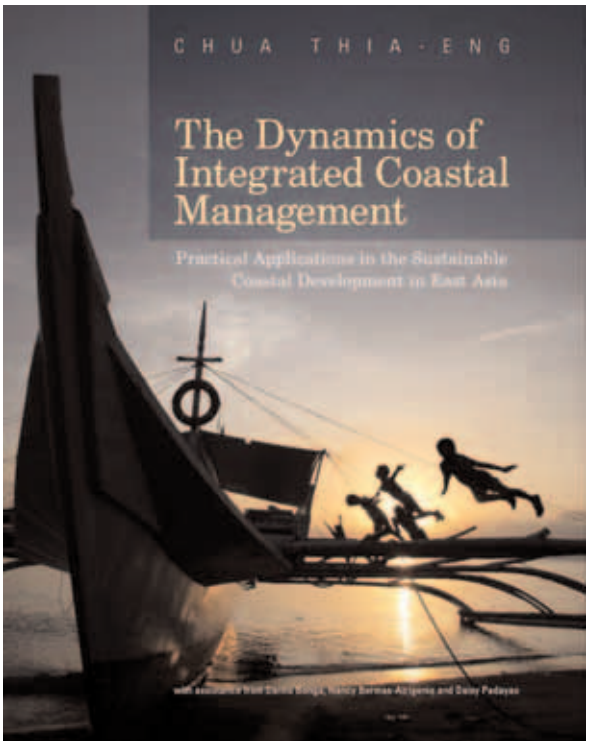
School of Mathematics, Physics and I.T., James Cook University

The Dynamics of Integrated Coastal Management

Chua, Thia-Eng. 2006. The Dynamics of Integrated Coastal Management: Practical Applications in the Sustainable Coastal Development in East Asia. Global Environment Facility/United Nations Development Programme/International Maritime Organization Regional Programme on Building Partnerships in Environmental Management for the Seas of East Asia (PEMSEA), Quezon City, Philippines. 468 pp.

ISBN: 978-971-812-018-7 (Softbound);

ISBN: 978-971-812-019-4 (Hardbound)

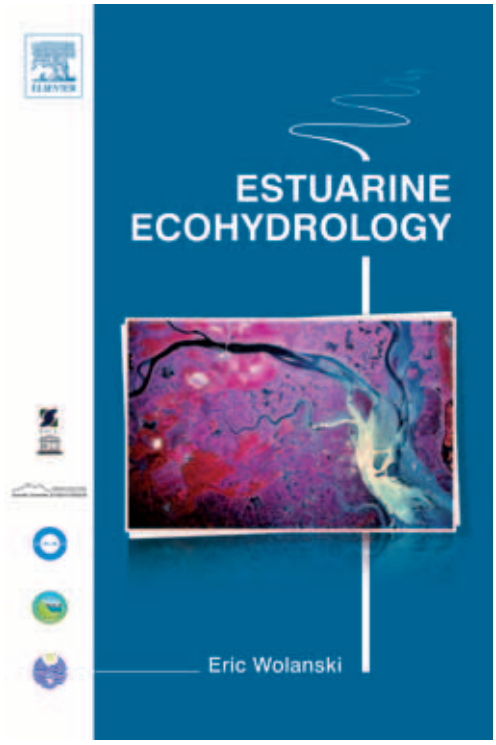


This 16 chapter-book shares the author's 20 years of practical experience in addressing issues related to the integrated management on the coasts and oceans. This book makes clear the rationale underlying the use of the integrated management approach, and the practices used to apply sustainable development principles and international environmental instruments when undertaking ICM programs. It also provides a basic framework within which various problem-solving, management-oriented activities can be developed, and outlines the processes that can be used to guide their planning and implementation.

The Dynamics of ICM can be purchased online at
http://www.pemsea.org/ecomm/onlinestore_new.htm.

Ecohydrology

Ecohydrology is a multidisciplinary science that integrates disciplines such as hydrology, ecology and mathematical modeling with the aim of generating solutions for the worldwide water crisis. This book, appropriate for use as a textbook and as a reference, focuses on the principal components of an estuary, including the river, the estuarine waters, the sediment, the nutrients, the wetlands, the estuarine food web, and the coastal ocean. Although each chapter contains rigorous specialist knowledge, it is presented in an accessible way that encourages collaboration between aquatic, marine and wetland biologists, ecologists, oceanographers, geologists, geomorphologists, chemists, and ecosystem modelers.



Estuarine Ecohydrology demonstrates how, based on an understanding of the processes controlling estuarine ecosystem health, one can quantify its ability to cope with human stresses. The theories, models, and real-world solutions presented will serve as a toolkit for designing a management plan for the ecologically sustainable development of an estuary.

Praise for Estuarine Ecohydrology

„…a brilliant synthesis of the state of the art in estuarine ecohydrology…it opens the perspective for new solutions toward achieving restoration and sustainable development of habitats most intensively used by humanity." **(Maciej Zalewski, Director, UNESCO's European Regional Centre for Ecohydrology)**

„[This book] is particularly valuable because its perspectives are truly global in nature, encompassing different views from the developed world as well as from developing economies." **(Hartwig Kremer, CEO, Land Ocean Interactions in the Coastal Zone)**

„Wolanski brings vast experience in estuarine and coastal seas research in Oceania and its neighboring regions. The book makes a most valuable contribution to our international activities for coastal seas environments." **(Masahiko Inatsugi, Adviser on External Relations, International Center for the Environmental Management of Enclosed Coastal Seas)**

„This book provides a deep understanding of the dynamical processes through an ecohydrological approach acting on estuaries." **(Gerardo M.E. Perillo, Co-Chair, Scientific Committee on Oceanic Research-Land Ocean Interactions in the Coastal Zone Working Group 122)**

1.Special issue on "Monsoon Rivers of Asia"

Geomorphology
Volume 85, Issues 3-4, Pages 129-316 (30 March 2007)
Edited by Z. Chen, A. Gupta and H. Yin

http://www.sciencedirect.com

2.Special issue on "Sedimentological and ecohydrological processes of Asian deltas: The Yangtze and the Mekong"

Estuarine, Shelf and Coastal Science
Volume 71, Issues 1-2, Pages 1-358 (January 2007)
Edited by Zhongyuan Chen, Masataka Watanabe and Eric Wolanski

http://www.sciencedirect.com

3.Special issue on "Morphodynamics of the Red River Delta, Vietnam"

Journal of Asian Earth Sciences
Volume 29, Issue 4, Pages 505-584 (15 February 2007)
Edited by P. Hoekstra and Tj.C.E. van Weering

http://www.sciencedirect.com

Update us so we can update you

LOICZ INPRINT informs you about the LOICZ Project and its activities. But LOICZ has access to much more information and wants to make this information available to you as effectively as possible. To be able to provide you with LOICZ information that fits your expertise and interests most, we need input from your side telling us what your interests in LOICZ are and how we can contact you.

Please complete the following form where applicable and return by fax, post or e-mail to the LOICZ IPO.
(An electronic version of this form can also be found on www.loicz.org under Newsletter.)

First name:	
Last name:	
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Place:	
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Phone (include country code):	
Fax (include country code):	
e-mail:	
(Organization's) website:	
Field of expertise:	

Please indicate which LOICZ theme(s)* you are contributing to:

❑ Theme 1 ❑ Theme 2 ❑ Theme 3 ❑ Theme 4 ❑ Theme 5

Please indicate which LOICZ key topic(s)** you are interested in:

❑ Topic 1 ❑ Topic 2 ❑ Topic 3 ❑ other

How do you want to receive the LOICZ Newsletter in the future?

❑ hardcopy ❑ pdf-file via e-mail ❑ e-mail alert ❑ not at all

* More detailed information on the LOICZ Research Themes is available in the Science Plan on the LOICZ website (www.loicz.org)

** Detailed descriptions of the topics are featured in first issue of INPRINT and on the website

Please return this form by:

- e-mail loicz.ipo@loicz.org
- fax +49 4152 87 2040
- mail LOICZ IPO – GKSS Research Center
  Institute for Coastal Research
  Max-Planck-Strasse 1
  D-21502 Geesthacht, Germany

Have you seen

4th IGBP Congress, „Sustainable Livelyhoods in a Changing Earth System" to be held in Cape Town, South Africa from 5–9 May 2008

(http://igbp2008.co.za

Goals of the 4th IGBP Congress

- To develop ways for IGBP to apply Earth System science and improve IGBP relevance to civil society, the private sector and the policy community;
- To provide a forum for cross-project interaction and integration across the breadth of the programme.
- To identify where IGBP work can better contribute to addressing mitigation and adaptation, large-scale pilot projects on sustainability science and institutional networking.
- To suggest pathways to sustainable solutions, including mitigation, innovation and adaptation.
- To address the challenges of Global Environmental Change and development in Africa (e.g. climate change as a stress factor to African development, water systems)
- To develop a lasting network linking the scientific, political and private enterprises, collectively engaged in developing a closer global-scale environmental management collaboration.

IHDP 7th Open Meeting, „Social Challenges of Global Change", New Delhi, 16–19 October, 2008

http://www.openmeeting2008.org

International Science Conference of the Human Dimensions on Global Environmental Change will take place in New Delhi from October 15-19, 2008. The Energy Resources Institute (TERI) is the co-organizer and local host. The conference will be preceded by a series of short capacity-building workshops. Information on both will be included on the IHDP website; the call for sessions is set to open up in August 2007.

The call to submit abstracts for the IHDP Open Meeting 2008, "Social Challenges of Global Change"- the 7th International Science Conference on the Human Dimensions of Global Environmental Change - opened up on August 31st, 2007. We will be accepting abstract submissions for sessions, oral presentations, and posters until November 30th this year on the new Open Meeting website.

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Job opportunity

PhD position in Marine Ecological Modelling
Université Libre de Bruxelles
Ecologie des Systèmes Aquatiques
More details : www.loicz.org - News

Coping with Global Change in Marine Social-Ecological Systems
FAO, Rome, Italy, July 2008.

The central goals of the symposium are to share experiences across disciplines and to identify key next steps and common elements and approaches that promote resilience of marine social-ecological systems in the face of global changes. This involves:

1. exploring conceptual issues relating to social-ecological responses in marine systems to global changes;
2. analysing case studies of specific examples of social-ecological responses in marine systems to significant environmental changes manifested locally;
3. synthesising the work of natural and social scientists and building comparisons of social-ecological responses in marine ecosystems subjected to major environmental variability;
4. developing innovative approaches to the use of science and knowledge in management, policy and advice;
5. identifying lessons for governance for building resilient social-ecological systems.

Important dates

1 January 2008	**Abstract submission deadline**
1 January 2008	**Deadline for financial support requests**
15 February 2008	**Notification of abstract acceptance**
1 April 2008	**Early registration deadline**
8–11 July 2008	**Symposium**
30 September 2008	**Deadline for submission of manuscripts to publication**

Venue and dates

The symposium will be held at the FAO Headquarters in Rome, Italy, from 8–11 July 2008. The symposium will end by mid-day on 11 July.

More information:
http://www.peopleandthesea.org

Cold-water eddy phenomena

The cold-water eddy phenomena will be one of a wide range of issues to be discussed during a meeting which began in Hobart today of nearly 200 European, US and Australian scientists working with satellite altimetry — instruments that measure the height of the ocean to detect cold and warm water.

A satellite image of the cold water eddy can be found at:

http://www.marine.csiro.au/remotesensing/

Craig Macaulay, CSIRO Marine and Atmospheric Research
03 6232 5219, 0419 966 465
Bill Stephens, CSIRO Media Liaison
02 6276 6152, 0408 817 066

www.csiro.au

Climate Change View Clearer With New Oceans Satellite

Australian scientists will have access to the most detailed measurements of ocean circulation and global sea level variations following the launch next year of a multinational ocean-observing satellite - Jason-2.

"The success of next year's launch will be critical for the maintenance of the global ocean-observing system," says oceanographer, Dr David Griffin, of CSIRO's Wealth from Oceans Research Flagship.

"The continuation of the Jason observations is absolutely vital to gaining a better understanding of, and having ability to predict, changes that are occurring in the climate system."

Dr Griffin said the satellite's data are used to study ocean dynamics, with many applications including:

- Global warming and climate prediction
- Monitoring of mean sea level
- El Niño and La Niña events
- Ocean circulation
- Tides and waves.

Dr Griffin said ocean and climate science is taking full advantage of new monitoring technologies such as Jason-1 and Jason-2 and the Argo robotic profilers, providing near real-time information on ocean behaviour. "When delivered in near-real time, these data form the basis of operational oceanography – in other words, forecasting ocean currents and temperatures," he said.

Further Information:
Visit NASA's website:
http://sealevel.jpl.nasa.gov/mission/ostm-fact-sheet.html
http://sealevel.jpl.nasa.gov/newsroom/newsroom.html

Media Assistance:
Bill Stephens, CSIRO Media Liaison
02 6276 6152, 0408 817 066
Craig Macaulay, CSIRO Marine and Atmospheric Research 03 6232 5219, 0419 966 465
www.csiro.au

What`s new on the web

New Links for LOICZ Budgets WebsiteCluster Tool Disco (DISCO) und Web-LoiczView (WLV)

Budgets Website: http://nest.su.se/mnode/
DISCO: http://fangorn.colby.edu/disco-devel
WLV http://palantir.cs.colby.edu

Monsoon Asia Integrated Regional Study (MAIRS)

www.mairs-essp.org

MAIRS-IPO has set up a webpage of MAIRS Group and you are invited to become a member. By working with "googlegroups", you have to register first with your e-mail address. You may also find that the webpage provides a "forum". Any comments and new messages post on the forum will be also sent to all the members within the group by e-mail. The "MAIRS Updates" can also been downloaded on the MAIRS Google Group website. Please register by yourself and if there is any problem, please do not hesitate to contact:

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You may get copies of the following recent publications in Climate Change online:

Rockel, B., and K. Woth, 2006: Extremes of near-surface wind speed over Europe and their future changes as estimated from an ensemble of RCM simulations, Climate Change, 10.1007/s10584-006-9227-y

http://dx.doi.org/10.1007/s10584-006-9227-y

Déqué, M, D.P. Rowell, D. Lüthi, F. Giorgi, J. H. Christensen, B. Rockel, D. Jacob, E. Kjellström, M. de Castro, and B. van den Hurk, 2006: An intercomparison of regional climate simulations for Europe: assessing uncertainties in model projections, Climate Change, 10.1007/s10584-006-9228-x

http://dx.doi.org/10.1007/s10584-006-9228-x

EAS Congress Secretariat

The EAS Congress Secretariat is thankful to all who participated and contributed in making the East Asian Seas Congress 2006 a success. As a means to share the highlights of the Congress, we are pleased to inform you that a compilation of speeches, presentations, pictures and other documents/materials during the Congress can now be accessed thru:

http://www.pemsea.org/eascongress/

FIRST AFRICAN MARINE ATLAS IN AFRICA LAUNCHED

http://iodeweb2.vliz.be/omap/OMAP/index.htm

The first African Marine Atlas was officially launched at the Project Office of the International Oceanographic Data and Information Exchange (IODE) in Ostend, Belgium. The Atlas was developed by the Ocean Data and Information Network for Africa (ODINAFRICA) with support from the Intergovernmental Oceanographic Commission's (IOC) of UNESCO and the Government of Flanders, Belgium.

The African Marine Atlas provides substantial maps, images, data and information to coastal resource managers, planners and decision-makers from various administrative institutions and specialized agencies in Africa. The Atlas will be of immense benefit to national institutions and a variety of users such as environmentalists, local administrators, park managers, scientific community, fishing cooperatives, tourists, hotel keepers, teachers, NGOs, the general public, and any other interested

persons. It has over 800 downloadable data products derived from the fields of marine geo-sphere, hydrosphere, atmosphere, biosphere, geopolitical and the human socio-economic dimensions.

Update us so we can update you

LOICZ INPRINT informs you about the LOICZ Project and its activities. But LOICZ has access to much more information and wants to make this information available to you as effectively as possible. To be able to provide you with LOICZ information that fits your expertise and interests most, we need input from your side telling us what your interests in LOICZ are and how we can contact you. Please complete the form on page 23.

Calendar

2007

LOICZ-IASC-AMAP-IHDP

Workshop „Arctic Coastal Zones at Risk", Tromso, Norway, 1–3 October, 2007
Info: w3k.gkss.de/events/arctic07

8. International Conference on the Mediterranean Coastal Environment (MEDCOAST 07),

Alexandria, Egypt, 13–17 November, 2007
Info: http://www.medcoast.org.tr

DELTA 2007
MANAGING THE COASTAL LAND-WATER INTERFACE IN TROPICAL DELTA SYSTEMS

Bang Sean, Thailand, 7–9 November, 2007
Info: http://delta07.iwmi.org

ICES Symposium on Environmental Indicators, London, UK, 20–23 November, 2007
Info: http://envind2007.benthos.be

2008

Institute on "The Asian Monsoon System: Prediction of Change and Variability"

The global change SysTem for Analysis, Research and Training (START) and the Asia Pacific Network for Global Change Research (APN) invite applications to the Institute on "The Monsoon System: Prediction of Change and Variability" to be held at The East-West Center and the University of Hawaii at Manoa in Honolulu, Hawaii from 2–12 January, 2008.
Complete announcement and application download may be found on the START webpage: http://www.start.org/curfinopp.html

9th Conference of Meteorology-Climatology and Atmospheric Physics, Thessaloniki (Greece) in May 2008

http://icemte08.geo.auth.gr

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4th IGBP Congress, „Sustainable Livelyhoods in a Changing Earth System", Cape Town, South Africa, 5–9 May, 2008

(http://igbp2008.co.za

UNESCO-ERCE Floodplain Ecohydrology Conference, May 19–23, 2008

http://www.erce.unesco.lodz.pl

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http://www.aims.gov.au/ibm

Coping with Global Change in marine-social ecological system FAO, Rome, Italy, July 2008

http://www.peopleandthesea.org/

31. International Conference on Coastal Engineering (ICCE 2008) / Hamburg, 30 August – 5 September, 2008
http://icce2008.hamburg.baw.de

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IHDP 7th Open Meeting, „Social Challenges of Global Change", New Delhi, 16–19 October, 2008
http://www.openmeeting2008.org

For more meetings and regular updates please also visit the LOICZ website www.loicz.org

Publication details

The LOICZ Newsletter is produced three times per year to provide news and information regarding LOICZ activities. The views and opinions in this newsletter do not necessarily represent the position of LOICZ or its sponsoring organizations.

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The illustration of the coastal zone on the front page is made by the artist Glynn Gorick, UK, 2005 and commissioned by LOICZ/IGBP. The photographs on the front and back page of this newsletter are copyright to Martin Le Tissier.

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LOICZ in brief

LOICZ aims to provide science that contributes towards understanding the Earth system in order to inform, educate and contribute to the sustainability of the world's coastal zone. LOICZ is a core project of the International Geopsphere-Biospere Programme (IGBP) and the International Human Dimensions Programme on Global Environmental Change (IHDP).

The LOICZ IPO is hosted by the Institute of Coastal Research at GKSS Research Centre which is part of the Helmholtz foundation.

LOICZ research as outlined in the science plan and implementation strategy is organised around five themes:

- Vulnerability of coastal systems and hazards to society
- Implications of global change for coastal ecosystems and sustainable development
- Human influences on river-basin-coastal zone interaction
- Biogeochemical cycles of coastal and shelf waters
- Towards coastal system sustainability by managing land-ocean interactions

The Science Plan and Implementation Strategy is available electronically on the LOICZ website and in hard copy at the LOICZ IPO.

Get involved

If you wish to contribute to **LOICZ INPRINT** please send an e-mail to**: loicz.ipo@loicz.org** or visit the LOICZ website **www.loicz.org** for article requirements.

If you have a project you would like to affiliate to LOICZ please go to **www.loicz.org** and click on research for detailed information.

LOICZ

GKSS FORSCHUNGSZENTRUM in der HELMHOLTZ-GEMEINSCHAFT

GLOBAL CHANGE IGBP

IHDP International Human Dimensions Programme on Global Environmental Change