maps are 1/216,000; and summary maps are 1/432,000. Inoh's work, completed before the Japan's industrialization drive some 150 years ago staring with the opening of the country at the start of the Meiji Period, provides an ideal starting point in an attempt to trace the impact of human habitat to the enclosed coastal seas. For more recent period, official maps and IKONOS satellite images are used. Increase in land reclamation is most visible during 1960 to 1985. According to statistics and maps, the peak period seems to have been during 1970 to 1980 when the increase in land area averaged 9.1 square kilometers per year in Tokyo Metropolis and 5.0 square kilometers per year Nagoya Metropolis. On Osaka area, the period 1960 to 1970 showed an annual average increase of 4.4 square kilometers and from 1970 to 1980, 3.2 square kilometers. The worst time of water pollution seems to have been in the first half of the 1970's. The COD level worsened from throughout the 1970's when the trend was reversed in the late 1970's. The water pollution level has been stabilized in Tokyo Bay and Osaka Bay in the years that followed. Ise Bay in the city of Nagoya has seen some increase even in the 1990's. Fishing was practiced along the coat and in the Bay, but this practice became almost unimaginable. Habitat for birds and small marine creatures vanished as a result of reclamation of wetland. Tokyo, Nagoya, and Osaka have sub-zero meter zones that lie under the sea level under normal climatic conditions. If the sea level rises by 59 cm as predicted by the IPCC report owing to global climate change, the area will increase to 396 square kilometers with 1120 thousand people living there. If a typhoon hits in addition to the predicted sea level rise, the land area will jump to 665 square kilometers with population of 1850 thousand. Comparable number for Tokyo and Osaka stands at 4160 thousand persons and 4210 persons, respectively. Experts are convinced that the Pacific coast of Japan is vulnerable to earthquakes that hit the area with nearly regular intervals. This means (1) damages to sea walls which may cause flooding of the sub-zero meter districts in the cities and (2) possible threats from Tsunamis caused by earthquakes to social infrastructure, offices and residential facilities. Social infrastructure such as bridges, tunnels, harbor facilities, subways and railways, power supply lines, etc. are concentrated in the bay area, adding to the vulnerability of cities to natural hazards. Those complex issues need to be assessed in an integrated manner, and creation of an On-line Learning Tools is advocated and a prototype is operational over Internet.

Natural hazard assessment over Iranian coastlines

M.SOLTANPOUR [1], B. MAJDI [2] & M.R. ALLAHYAR [3]

[1] Assistant Professor, K. N. Toosi Univ. of Tech
E-mail: soltanpour@kntu.ac.ir

[2] Formerly, Graduate Student, K. N. Toosi Univ. of Tech
E-mail: b_majdi@sina.kntu.ac

[3] Head of Coastal Engineering office, General Directorate of Coast and Port Engineering, Ports and Maritime Organization, Iran
E-mail: allahyar@ir-pso.com

1. Introduction

Coastal areas are usually subjected to disasters due to natural hazards. Detecting probable hazards in coastal areas, preparing suitable policy and basic planning are essential to reduce disasters due to a certain hazard. Making proper management decisions will result in preventing from inappropriate development as well as reducing disasters and irreparable damages in the area. Coastal hazards are comprised of geological (earthquake, land-slide, settlement, liquefaction), climatology and hydrological (drought, heavy storms, heavy freezing, flooding and heavy rain) and marine hazards (storm surge, storm waves, water level variations and tsunami). Considering other experiences in the world, an appropriate method is applied for overall hazard assessment in coastal areas. In the mentioned method, each hazard is considered in the study area based on conducted analysis and the hazards are graded based on the intensity to four categories from 1 to 4, where 4 is the more intense one. Finally, effects of all the hazards are considered together in order to obtain an overall hazard assessment. The overall assessment is graded through 7 levels from 1 to 7 (very low to very high level of hazard).

2. Hazard assessment and classification

Gradation of hazard intensity in an area requires scientific judgment, understanding the history of hazards and getting acquainted with contributing parameters in hazards. A powerful statistical system is also required for predicting time and location of hazards. The system must be updated regularly. In this study, seven types which are more effective in the coastlines are investigated and graded in four categories from mild (i.e. 1) to sever (i.e. 4) and are presented in Table 1, separately for the seven hazards.

3. Overall hazard assessment

In addition to separate assessment of each hazard, an Overall Hazard Assessment, OHA, is to be performed for general assessment of a certain area.

Therefore, available hazards are classified to dynamic and non-dynamic categories. Dynamic Hazards occur in a very short period and result in sever disasters, which are earthquake, land-slide, liquefaction, storm waves, heavy storms and Tsunami. On the other hand, some hazards such as shoreline change occurs during long periods and result in minor disasters and are known as non-dynamic hazard. In order to simulate OHA parameter grade of each hazard, both dynamic and non-dynamic ones, are squared and a double value is assigned to dynamic items to magnify dynamic hazards and finally, averaging the obtained quantities, the OHA value is achieved.

4. Conclusion

A comprehensive method is introduced here for .assessing environmental hazards in coastal areas, through which interactive effects of the hazards are predicted in OHA parameter in addition to separate effects of each parameter. Coastal areas are graded in different categories, from low level to high level of hazard intensity.The described method is employed for the Iranian coastlines in the north and south of the country and the results are presented as hazard assessment maps; where an example is presented in Fig.1.

Kind of hazard		Scale	Range	
Geology hazard	seismic	ground acceleration		Low
				Moderately Low
				Moderately High
				High
	Land slide	Number of Land slide		0-5
				5-10
				10-15
				>15
	liquefaction	qualitative data		no history of Liquefactivity
				Low Liquefactivity
				Moderate Liquefactivity
				High Liquefactivity
Climate hazards	Extreme storms	Number of stormy days	Caspian sea	8-13
				13-16
				16-18
				18-21
			Oman sea, Persian golf and Strait of Hormoz	35-67
				67-98
				98-119
				119-130

Kind of hazard		Scale	Range	
Marine phenomena hazards	Hazard waves	Wave height meter Tsunami wave height meter	Caspian sea	<3
				3-5
				5-6
				6-7
			Oman sea, Persian golf and Strait of Hormoz	<2
				2-3
				3-4
				>4
	Tsunami	Tsunami wave height meter		0-0.5
				0.5-1
				1-2
				2-2.7
Geomorphology hazards	Change of shoreline	qualitative		Low erosion rate
				moderate erosion rate
				high erosion rate
				Very high erosion rate

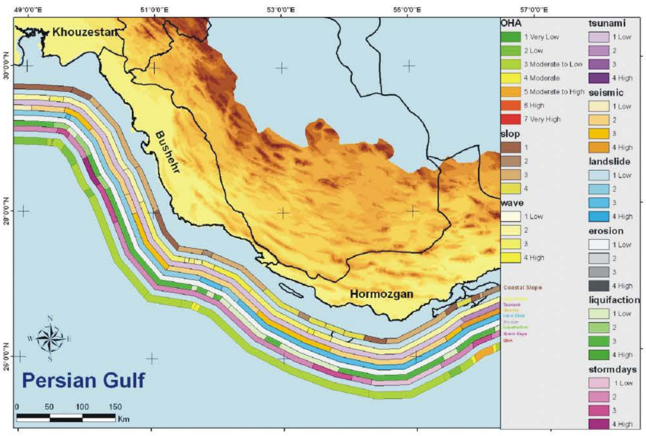

Fig.1 Sample of hazard assessment map for Iranian coastlines over the Persia Gulf

References

Charles H. Fletcher III, Eric E. Grossman, Bruce M. Richmond, and Ann E. Gibbs (2002); Atlas of Natural Hazards in the Hawaiian Coastal Zone; Geologic Investigations Series I-2761

Gharibreza, M. R 2008. Geology and Geomorphology studies of Iran's ICZM

Aghtooman, P. 2008. Hydrodynamic studies of Iran's ICZM

Mashayekhi, SH. Arshad, S. Moradizadeh, F. 2008. Meteorological and Climatology studies of Iran's ICZM