Regional Analysis of Disaster Loss Databases in Arab States

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PREFACE

The expected outcome of the Hyogo Framework for Action (HFA) 2005–2015: Building the Resilience of Nations and Communities to Disasters was to "substantially reduce disaster losses, in lives and in the social, economic and environmental assets of communities and countries". Acknowledging that timely and reliable data and statistics are critical to build long-term resilience through evidence-based policy making and to assess progress in achieving the HFA's expected outcome, the Framework's Priority for Action 2 requested stakeholders to "Record, analyze, summarize and disseminate statistical information on disaster occurrence, impacts and losses, on a regular basis through international, regional, national and local mechanisms" (HFA, 2005).

The expected outcome of the recently adopted Sendai Framework for Disaster Risk Reduction 2015-2030 is "The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries." The Sendai Framework also includes seven global targets that underline the importance of reducing losses. Furthermore, its Priority 1 on Understanding Risk states that it is important to "Systematically evaluate, record, share and publicly account for disaster losses and understand the economic, social, health, education, environmental and cultural heritage impacts, as appropriate, in the context of event-specific hazard-exposure and vulnerability information" (paragraph 24 d).

In order to strengthen accounting for disaster losses, UNISDR spearheaded an initiative called "Global Disaster Loss Collection Initiative" that is designed to assist in the establishment of national disaster loss databases in all regions of the world. This effort commenced in the Arab Region in 2010.

The purpose of this Analysis of disaster loss databases in Arab States is to contribute to a better understanding of the impact of disasters in terms of losses in the region. The main objectives are: 1) to share new disaster loss and damage data assessed through UNISDR Regional Office for Arab States' "Disaster loss database initiative"; 2) to draw a clear picture on the practices, methodologies and the processes used for assessing and managing disaster damage and loss data in Arab countries, and; 3) to provide recommendations to improve existing practices. Beyond the assessment, interpretation and visualization of data on a regional level for the ten countries, additional statistics are provided in an effort to capture the region-wide impact of disasters beyond the ten countries with established national disaster loss databases.

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DISCLAIMER

The findings, interpretations and conclusions expressed in this report are those of the author and do not necessarily reflect the official view of the UNISDR or governments of UN Member States referred to in this publication (which cannot be held responsible for any use of the information contained herein).

All disaster loss data used in this study are owned by governments and publicly available.

The boundaries and names shown and the designations used on the map and tables displayed in this report do not imply official endorsement or acceptance by the United Nations.

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ADRC:	Asian Disaster Reduction Centre
ASCII:	American Standard Code for Information Interchange
CRED:	Centre for Research on the Epidemiology of Disasters
EM-DAT:	Emergency Events Database - International Disaster Database
FAO:	Food and Agriculture Organization of the United Nations
GAR:	UNISDR Global Assessment Report
GDP:	Gross domestic product
GIS:	Geographic Information System
GRIP:	Global Risk Identification Program
HFA:	Hyogo Framework for Action
IFRC:	International Federation of Red Cross and Red Crescent societies
ISO:	International Organization for Standardization
NGO:	Non-Governmental Organization
OFDA-USAID:	Office of U.S. Foreign Disaster Assistance - United States Agency for International Development
UN:	United Nations
UNDP:	United Nations Development Program
UNISDR:	United Nations Office for Disaster Risk Reduction
USAID:	United States Agency for International Development
WHO:	World Health Organization

1. Introduction

1.1 Context

Knowing that timely and reliable data and statistics are critical to disaster risk management and to building long-term resilience through evidence-based policy making, the Hyogo Framework's[1] Priority for Action 2 requests stakeholders to "Record, analyze, summarize and disseminate statistical information on disaster occurrence, impacts and losses, on a regular basis through international, regional, national and local mechanisms" (HFA, 2005).

The Expected outcome of the recently adopted Sendai Framework for Disaster Risk Reduction 2015-2030 is "The substantial reduction of disaster risk and losses in lives, livelihoods and health and in the economic, physical, social, cultural and environmental assets of persons, businesses, communities and countries." The Sendai Framework also includes seven global targets that underline the importance of reducing losses. Furthermore, its Priority 1 on Understanding Risk states that it is important to "Systematically evaluate, record, share and publicly account for disaster losses and understand the economic, social, health, education, environmental and cultural heritage impacts, as appropriate, in the context of event-specific hazard-exposure and vulnerability information" (paragraph 24 d).

In order to strengthen accounting for disaster losses, UNISDR spearheaded the "Global Disaster Loss Collection Initiative" that is designed to assist in the establishment of national disaster loss databases following a methodology called "Desinventar" in all regions of the world[2]. This effort began in the Arab Region in 2010.

National disaster loss databases following this methodology have been developed and rolled-out globally and in the Arab region because the often used International Disaster Database EM-DAT, which generally informs national and global disaster loss statistics, lacks details and has no geo-spatial information on losses. EM-DAT only takes into account events that match at least one of the following criteria: i) Ten or more people killed, ii) 100 or more people affected, iii) A declaration of a state of emergency or iv) A call for international assistance. Conversely national disaster loss databases using the Desinventar methodology record also small-scale events (extensive disasters) beyond the intensive major events covered by EM-DAT. They also provide the geo-spatial information to track exactly where a disaster happened. The use of the Desinventar methodology to establish national disaster loss databases can standardize methods of assessing losses that can be shared openly and inform national, regional and global disaster risk managers.

In the Arab region, efforts were undertaken by UNISDR's Regional Office for Arab States (ROAS) to strengthen the capacities of Arab States in terms of Disasters Risk Reduction. The setting up of disaster loss and damage databases is just one, but very important example of these efforts. In this context, a first regional workshop was organized in Cairo on March 2010, in which representatives of several Arab States were introduced to the methodology and tool. This regional workshop was followed by national trainings, then by a second regional workshop to assess the experiences in establishing national disaster loss databases in the Arab Region, which took place in April 2012.

Recognizing the importance of having sound disaster loss and damage databases to capture this information and use it for risk reduction and development, several Arab countries have expressed their interest to use the methodology and asked for UNISDR support to set up disaster loss and damage databases. To date, ten Arab countries - Comoros, Djibouti, Egypt, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Yemen - have established national disaster loss databases through technical and financial support from UNISDR, other UN agencies (UNDP for Egypt, UN-ESCWA for Tunisia) and the World Bank (Djibouti). The establishment of national disaster loss databases is under consideration for other Arab countries.

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[1] The United Nations General Assembly adopted the *Hyogo Framework for Action (HFA) 2005-2015: Building the resilience of nations and communities to disasters*, during the second World Conference on Disaster Risk Reduction, which was held in Kobe, Japan between 18 and 22 in 2005

[2] DesInventar is based on a clear methodological approach and free tools (Open Source). Through a very simple and user-friendly interface, DesInventar helps to compile a detailed disaster loss and damage inventory, and offers several functions for the analysis of information gathered based on assessments following pre-defined but adaptable indicators. Collected data cover a long time-period with a suggested minimum of 30 years. The DesInventar methodology can be used to analyze trends and disaster impacts, to feed hazards models and to inform decision-makers. "DesInventar" in this report describes thus the use of the so-called methodology and tool for establishing national disaster loss databases following its criteria and characteristics. It is used to describe in particular the UNISDR Arab States' supported establishment of such disaster loss and damage databases in so far ten Arab countries.

1.2 Purpose and objectives of this study

The purpose of this study is to contribute to a better understanding of the impact of disasters in terms of losses in Arab States. To achieve this, previously scattered and often inaccessible data is presented and interpreted in order to improve understanding of the impact of disasters on Arab populations and economies. The spatio-temporal identification of losses is intended to inform development planning to reduce existing and avoid new risks and losses based on past experiences and lessons learned. Moreover, this regional analysis presents findings and recommendations from the process of establishing disaster loss databases to inform future engagement in Arab States.

Beyond the assessment, interpretation and visualization of data on a regional level for the ten countries, additional statistics are provided in an effort to capture the impact of disasters on both the ten countries with disaster loss databases and others for which less detailed statistics are available.

The main objectives of this analysis are 1) to share new disaster loss and damage data assessed through UNISDR ROAS' disaster loss database initiative and 2) to draw a clear picture on the practices, methodologies and the processes used for assessing and managing disaster damage and loss data in Arab countries and 3) providing recommendations to improve existing practices.

The specifics objectives of this study were to:
1. Identify methodologies used for the management of disaster damage and loss data in Arab countries;
2. Understand and present the spatial and temporal distribution of damages and losses in Arab Countries (regionally and country by country);
3. Compare the impact of hydro-meteorological and geological hazards;
4. Identify the risk profiles of each country and of the region in terms of damage and losses and highlight hot spots;
5. Perform gap analysis according to the methodology proposed by UNISDR;
6. Elaborate and analyze the Empirical Loss Exceedance[3] curve on the basis of the available data.

1.3 Document structure

The document is structured in three main sections and annexes. The first is this introduction depicting context, purpose and objectives of the study.

The second section presents and discusses the main findings in four subsections, namely an analysis of i) disaster damages and losses on the basis of national disaster loss databases and ii) EM-DAT methodologies as well as iii) combined statistics for all 22 Arab countries. Subsection iv) describes the disaster loss data gathering process and use of databases.

The third section sets out the principal conclusions and recommendations on possible areas of improvement for disaster loss accounting in Arab countries.

The annexes provide i) analyses of national disaster damage and loss databases country by country ii) an overview of globally available disaster loss databases, iii) information on the methodology used for this study including iv) the questionnaire used to gather information and finally v) a short bibliography.

2. RESULTS AND DISCUSSIONS

2.1 Damages and losses according to national disaster loss databases

2.1.1 Time periods of available national disaster loss databases in the arab region

Publicly available national disaster loss databases in the Arab region cover a timeline varying from one country to another, and overall, ranging between 1944 and 2014, as shown in Table 1.

For the establishment of national disaster loss databases countries mostly adhered to a time period of 30 years suggested by UNISDR. Databases start in 1980 for Egypt, Lebanon, Palestine and Syria; 1981 for Jordan and 1982 for Tunisia. However, some countries used longer timelines to include key events, mostly massive disaster losses that took place long ago, but are still vividly

[3]An Exceedance curve describes the probability that various levels of loss will be exceeded.

remembered. An example is the Agadir Earthquake causing over 12,000 fatalities in 1960, which was included in the Moroccan database. Other longer timelines used include, 1970 for Comoros, 1944 for Djibouti and 1971 for Yemen. Most databases end in 2010-2013, while the Syrian database ends in 2009 and the one in Morocco extends up until 2014.

2.1.2 Analysis of damages and losses based on national disaster loss databases

In the ten Arab countries with national disaster loss databases, the number of events that have occurred is 15,809. These events had a large impact: They caused the death of 20,855 people and led to 140,570 damaged or destroyed houses (Table 1).

Table 1. Summary of disaster damages and losses in ten Arab countries (Full periods - National disaster loss databases)

Countries	Covered period	Number of events	Number of deaths	Number of affected	Houses destroyed	Houses damaged	Houses damaged & destroyed
Comoros	1970 - 2013	90	99	83,794	463	1,724	2,187
Djibouti	1944 - 2012	377	947	5,236	N/A	N/A	N/A
Egypt	1980 - 2010	60	53	20	1,329	1,885	3,214
Jordan	1981 - 2012	626	152	332,148	91	596	687
Lebanon	1980 - 2013	2,508	142	561,870	178	1,342	1,520
Morocco	1960 - 2014	732	14,197	47,403	5,122	21,920	27,042
Palestine	1980 - 2013	411	63	12,235	67	798	865
Syria	1980 - 2009	7,326	679	809,681	468	1,311	1,779
Tunisia	1982 - 2013	1,943	350	91,206	17,821	24,728	42,549
Yemen	1971 - 2013	1,736	4,173	28,861	23,337	37,390	60,727
Total		**15,809**	**20,855**	**1,972,454**	**48,876**	**91,694**	**140,570**

2.1.3 Analysis of damages and losses based on national disaster loss databases (Thirty years period)

In order to compare disaster losses and damages across all ten countries with national disaster loss databases, the last available thirty years were considered for the regional analysis. Since data is available for all the ten countries for this period 1982-2011, except Egypt where the database ends in 2010 and Syria, where it ends in 2009. This timeline also allows for a valuable comparison between national disaster loss databases presented here and the EM-DAT database presented later. Data for this analysis were extracted from the national disaster loss databases (www.desinventar.net). All ten available Arab States disaster loss databases were considered in this analysis (Comoros, Djibouti, Egypt, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Yemen). The breakdown of disasters loss and damage in Arab countries between 1982 and 2011 is displayed in Table 2.

a) Number of disasters in the ten Arab countries with national disaster loss databases

A total of 14,899 events have been recorded in the ten Arab countries over the study period, of which 7,295 events have been reported in Syria, 2,407 in Lebanon and 1,670 in Tunisia (Table 2 and Figure 1). The average number of disasters per country over the last thirty years (1982 – 2011) period is almost 1,500 and the annual average of events per country is 496.

Table 2. Summary of damages and losses (Thirty years period 1982- 2011 – Ten national disaster loss databases)

Countries	Number of events	Number of deaths	Number of affected	Houses destroyed	Houses damaged	Houses damaged & destroyed
Comoros	13	75	27,201	-	1,614	1,614
Djibouti	360	896	5,229	-	-	-
Egypt	56	48	20	1,329	1,885	3,214
Jordan	593	152	332,148	91	596	687
Lebanon	2,407	135	561,810	177	1,331	1,508
Morocco	706	2,157	22,391	5,102	21,915	27,017
Palestine	337	53	57	9	450	459
Syria	7,295	675	808,181	468	1,311	1,779
Tunisia	1,670	385	20,730	17,792	24,639	42,431
Yemen	1,462	3,824	31,927	23,008	37,344	60,352
Total	**14,899**	**8,400**	**1,809,694**	**47,976**	**91,085**	**139,061**

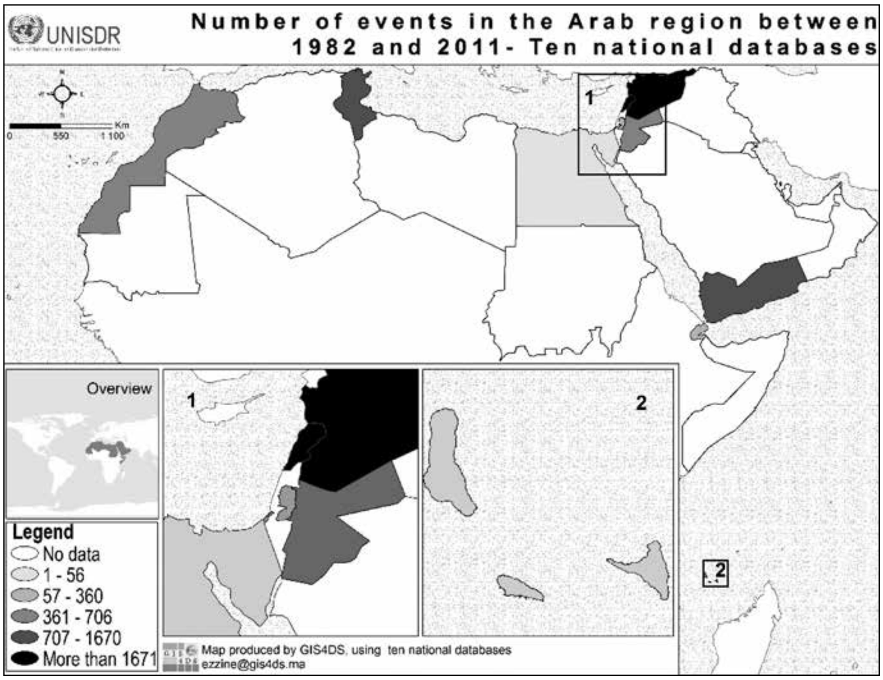


Figure 1. Number of events in ten Arab countries (Thirty years period 1982 to 2011 – National disaster loss databases)

The temporal evolution of the number of events is shown in Figure 2. The number of events experienced several fluctuations from 1982 to 2011, with an overall increasing trend. The highest number of events was recorded in 2007 and in 2009 due mainly to fire and forest fires in Syria.

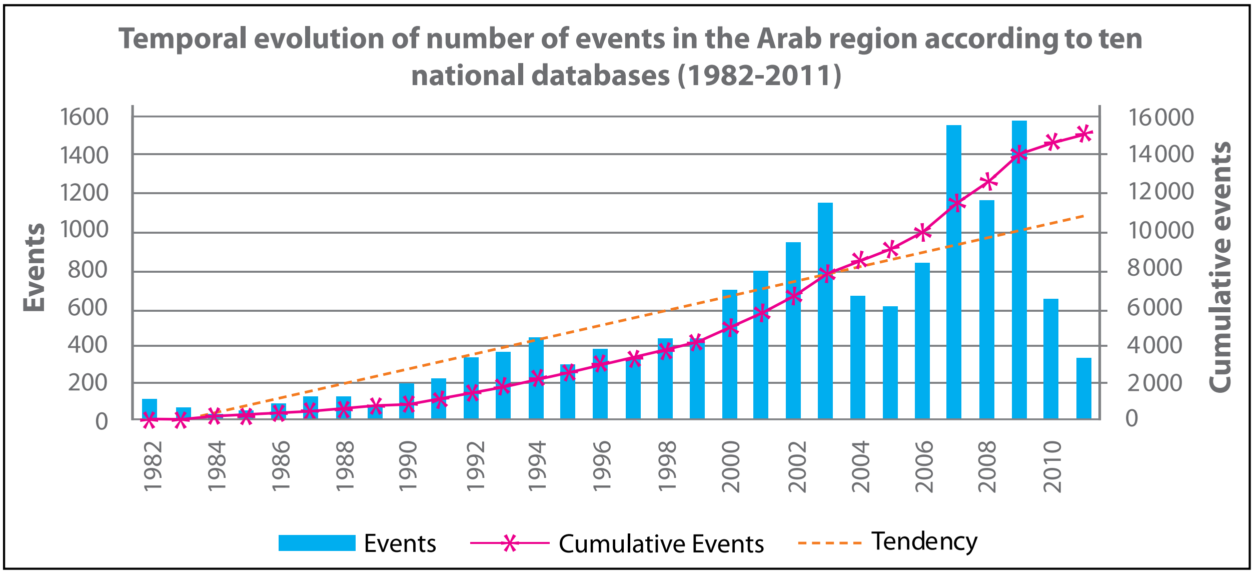


Figure 2. Temporal evolution of number of events in ten Arab countries (Thirty years period 1982 to 2011 – National disaster loss databases)

b) Lives lost due to disasters in Arab countries with national disaster loss databases

Table 2 shows that the recorded events caused the loss of lives of 8,400 people. The highest mortality was observed in Yemen, followed by Morocco where respectively 3,824 and 2,157 fatalities were recorded. Significant numbers of deaths were also recorded in Comoros, Egypt, Lebanon, Syria and Tunisia as it is shown in Figure 3.

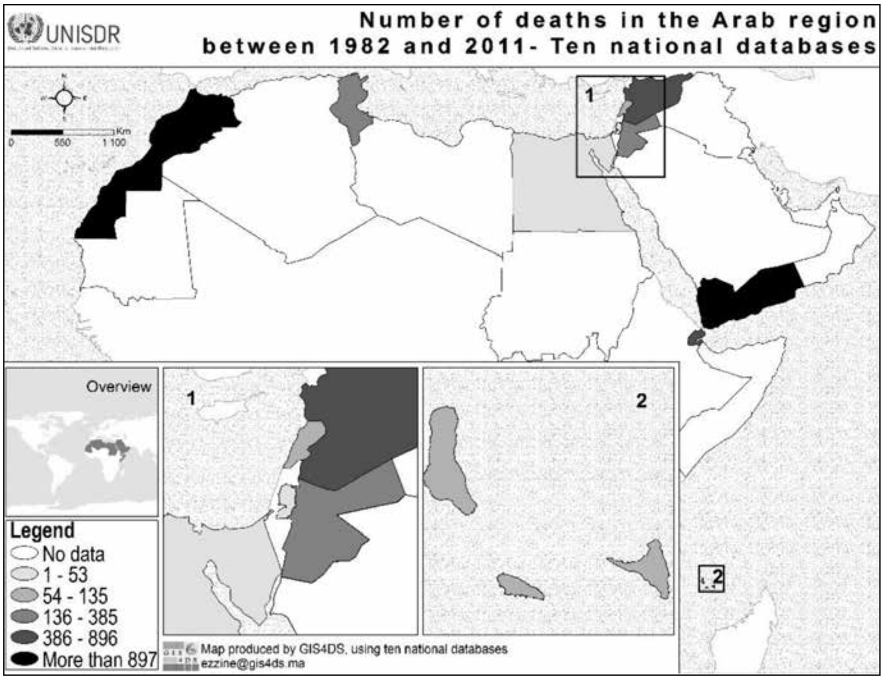


Figure 3. Spatial distribution of number of deaths in ten Arab countries (Thirty years period 1982 to 2011 – National disaster loss databases)

The analysis of the temporal evolution of deaths between 1982 and 2011 revealed that there is no obvious trend in the number of deaths caused by disasters. The annual death toll is less than 500, with the exception of the years 1982, 1995 and 2004 where significant number of deaths was recorded mainly due to earthquakes, flooding and liquefaction resulting in respectively 900, 496 and 484 fatalities. The year 1982 is the deadliest for concerned Arab States; this is mainly due to Yemen's earthquake that cost the life of 900 people and flooding and liquefaction that lead to the loss of 482 lives for each hazardous event.

Moreover, the period 2004 to 2011 appears to have higher mortality. This could be explained by the impact of climate change, which resulted in more hazardous events in the Arab region. It was certainly also the effect of increased exposure of people and assets to natural hazards, which results from manifold factors including demographic changes (urbanization, population growth), unsafe development practices and poverty. Similarly the beginning of improved disaster and loss data recording in the Arab region certainly played a role, making more data available.

Despite this notable increase in the last ten years, the number of deaths in the concerned countries in the Arab region during the period 1982 to 2011 has a stable trend as the linear line in the following figure shows (Figure 4).

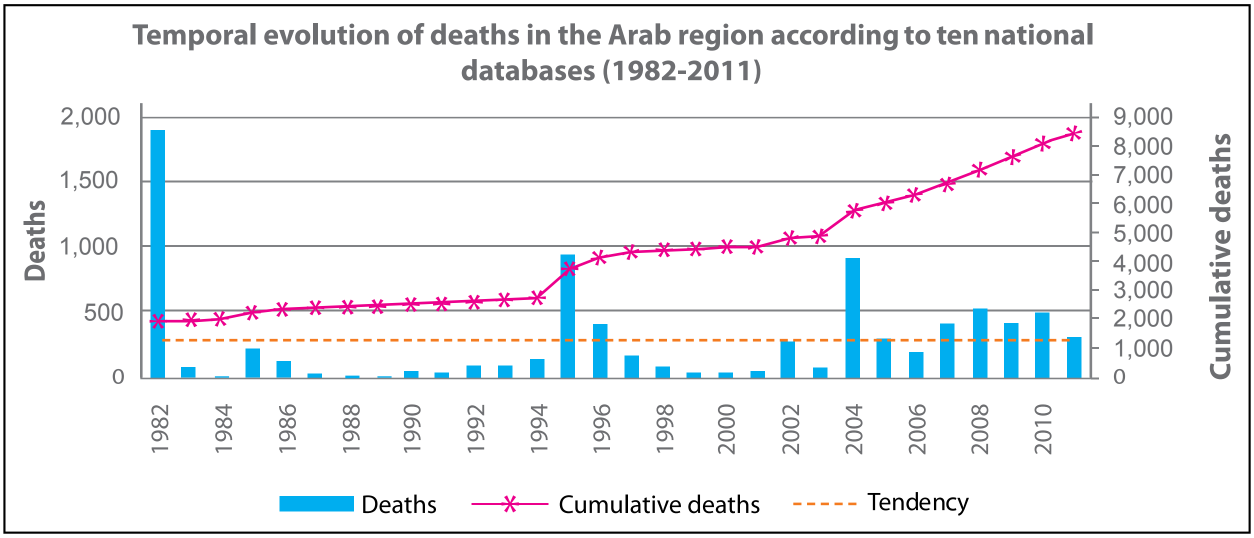


Figure 4. Temporal evolution of number of deaths in ten Arab countries (Thirty years period 1982-2011 – National disaster loss databases)

c) Destroyed and damaged houses in ten Arab countries with national loss databases

The number of destroyed and damaged houses in the Arab region was estimated at 139,061. Areas that recorded the most damage are Yemen followed by Tunisia and Morocco, where respectively 60,352, 42,431 and 27,017 structures were damaged and destroyed. These countries are highlighted in Figure 5, which shows the geographic distribution of the number of destroyed and damaged houses throughout the Arab region from 1982 to 2011.

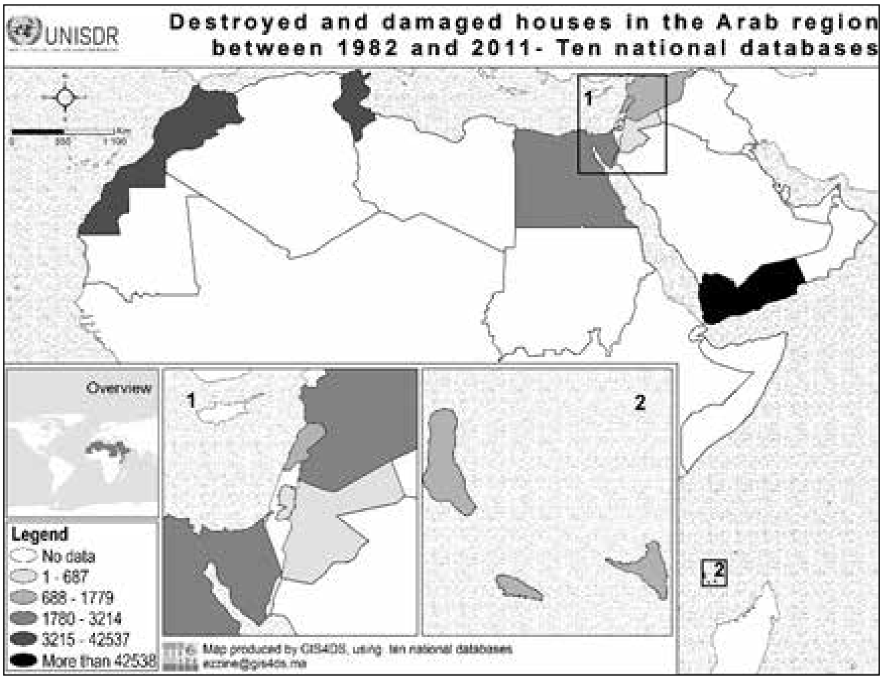


Figure 5. Spatial distribution of destroyed and damaged houses in ten Arab countries (Thirty years period 1982-2011 – National disaster loss databases)

Figure 6 and Figure 7 illustrate the temporal evolution in the number of destroyed and damaged houses throughout the Arab region from 1982 to 2011. In this period, the number of houses destroyed had decreased while the number of houses damaged has increased. The maximum destruction was experienced during 1990 and was mainly due to flood.

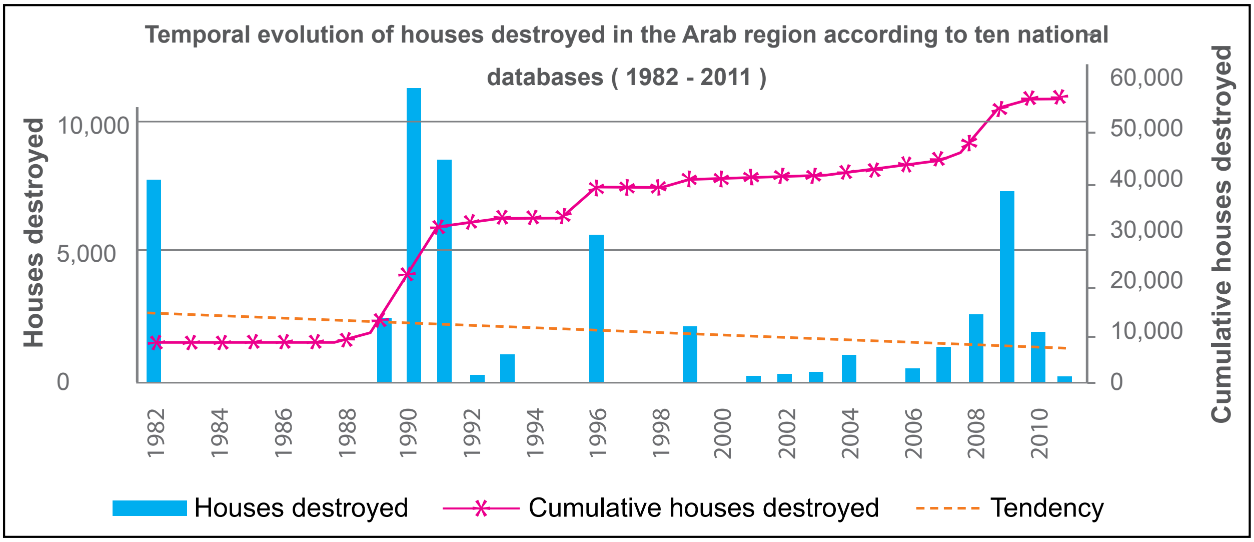


Figure 6. Temporal evolution of destroyed houses in ten Arab countries (Thirty years period 1982 – 2011 – National disaster loss databases)

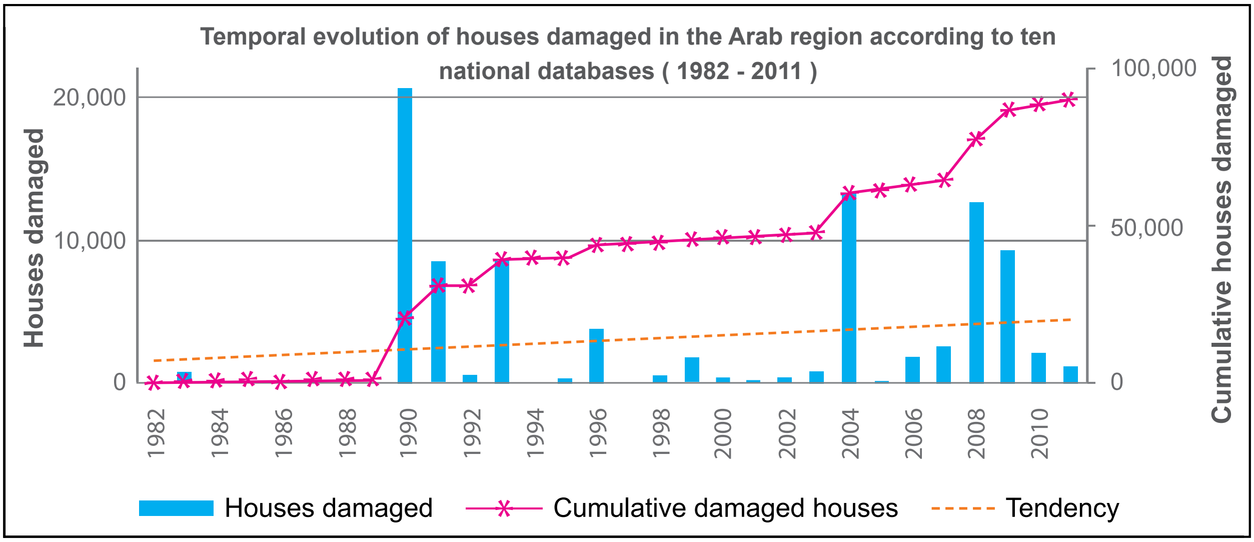


Figure 7. Temporal evolution of damaged houses in ten Arab countries (Thirty years period 1982 – 2011 - National disaster loss databases)

d) Affected people in ten Arab countries with national disaster loss databases

A total of 1.8 million people were affected by disasters in the 10 Arab countries over the last thirty years meaning that annually, an average of 60,332 people were affected. The highest number of affected people was recorded in Syria: 808,181 people were affected mainly by drought in 2005 and frost recorded in 2008. In Lebanon 561,810 people were affected by snowstorm, which occurred in 1992. The third highest number of affected persons was recorded in Jordan where 332,148 people were affected by drought experienced during 1999 and 2000. The spatial distribution of affected people is illustrated in Figure 8.

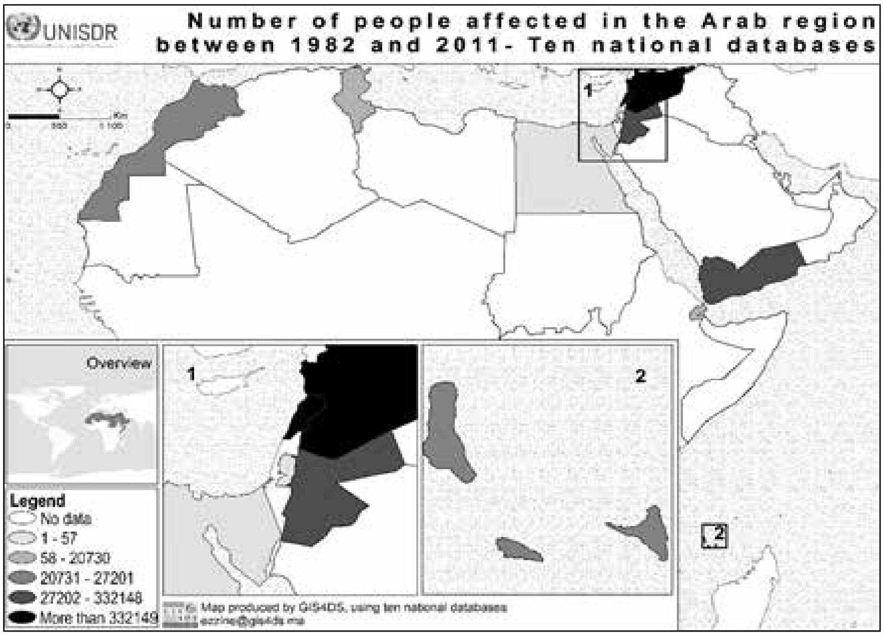


Figure 8. Spatial distribution of the number of affected people in ten Arab countries (Thirty years period 1982 to 2011 - National disaster loss databases)

The temporal evolution of the number of people affected by hazards in ten Arab countries with national loss databases from 1982 to 2011 is shown in Figure 9. Over the last three decades, the number of people affected by natural hazards experienced several variations, with a slight tendency to an increase in the number of people affected.

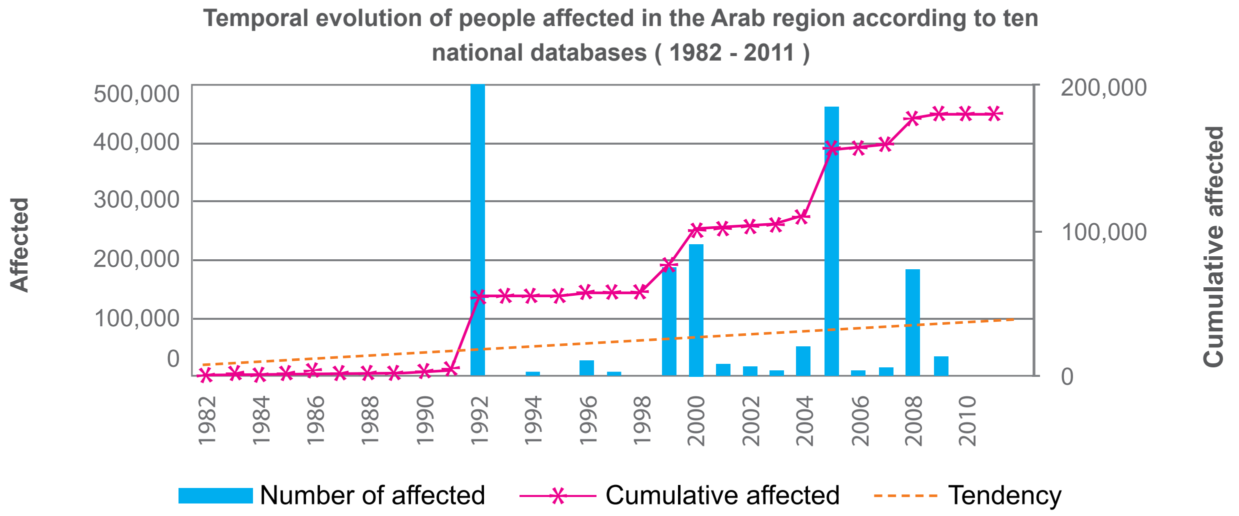


Figure 9. Temporal evolution of number of affected people in ten Arab countries (Thirty years period 1982-2011 – National disaster loss databases)

e) Deadliest disasters in ten Arab countries with national disaster loss databases

Table 3 highlights the ten deadliest disasters in the ten Arab countries with national disaster loss databases for the period 1982-2011. The single most deadly event was recorded in Yemen in 1982 due to an earthquake. Yemen also experienced deadly flooding and liquefaction in 1982. Morocco suffered a major flooding disaster in 1995 with 730 casualties, while an earthquake resulted in 628 fatalities in 2004. Eight of the deadliest ten disasters occurred in Yemen and Morocco.

Table 3. "Top 10" disasters by numbers of deaths in ten Arab countries (Thirty years period 1982 to 2011 - National disaster loss databases)

°N	Countries	Events	Date of the event	Deaths
01	Yemen	Earthquake	16/12/1982	900
02	Morocco	Flood	19/08/1995	730
03	Morocco	Earthquake	24/02/2004	628
04	Yemen	Flood	29/03/1982	482
05	Yemen	Liquefaction	29/03/1982	482
06	Djibouti	Storm	1985	180
07	Morocco	Flood	19/01/1995	150
08	Yemen	Flash flood	20/06/1996	123
09	Tunisia	Fire	15/01/2011	91
10	Morocco	Flood	24/11/2002	80

In terms of destroyed and damaged houses, as indicated in Table 4, Morocco experienced the most destructive event (Earthquake), which destroyed and damaged 13,334 houses. Yemen registered four of the “Top 10” disasters.

Table 4. “Top 10” disasters in ten Arab countries, sorted by damaged and destroyed houses (Thirty years period 1982-2011 - National disaster loss databases)

°N	Countries	Events	Date of the event	Houses damaged & destroyed	Houses destroyed	Houses damages
01	Morocco	Earthquake	24/02/2004	13,334	967	12,367
02	Yemen	Earthquake	29/11/1991	7,500	1,500	6,000
03	Tunisia	Flood	21/11/1991	6,050	6,050	
04	Yemen	Liquefaction	08/08/1996	5,000	5,000	-
05	Morocco	Flood	26/12/2009	4,820	1,302	3,518
06	Tunisia	Flood	23/09/2009	3,723	3,723	
07	Yemen	Earthquake	10/01/1993	3,003	3	3,000
08	Egypt	Liquefaction	18/01/2010	2,255	1,154	1,101
09	Morocco	Flood	24/12/2009	1,749	143	1,641
10	Yemen	Earthquake	22/02/1991	1,749	71	1,678

f) Occurrence and impact of geophysical hazards versus hydro-meteorological hazards in ten Arab countries with national disaster loss databases

Distinction is made in the literature between so-called hydro-meteorological - representing hazards such as floods, cyclones, strong winds, desertification, etc. - and geological hazards – such as earthquakes, landslides, volcanic eruptions, tsunamis, etc. In terms of frequency, hydro-meteorological events are more recurrent than geophysical hazards. Indeed, during the study period in the Arab region, 14,477 hydro-meteorological events were observed while only 422 geophysical hazards occurred.

Figure 10 and Table 5 illustrate and compare the number of deaths caused by geophysical hazards and hydro-meteorological hazards in the Arab region over the study period.

Geophysical events cost 1,865 lives while the number of hydro-meteorological events led to 6,535 fatalities. It is evident that the rate of death[4] caused by geophysical hazards (4.4 deaths per event) is ten times higher than the fatalities caused by hydro-meteorological hazards (0.45 deaths per event). This highlights how disastrous geophysical events can be.

[4]The ratio of deaths over the number of events

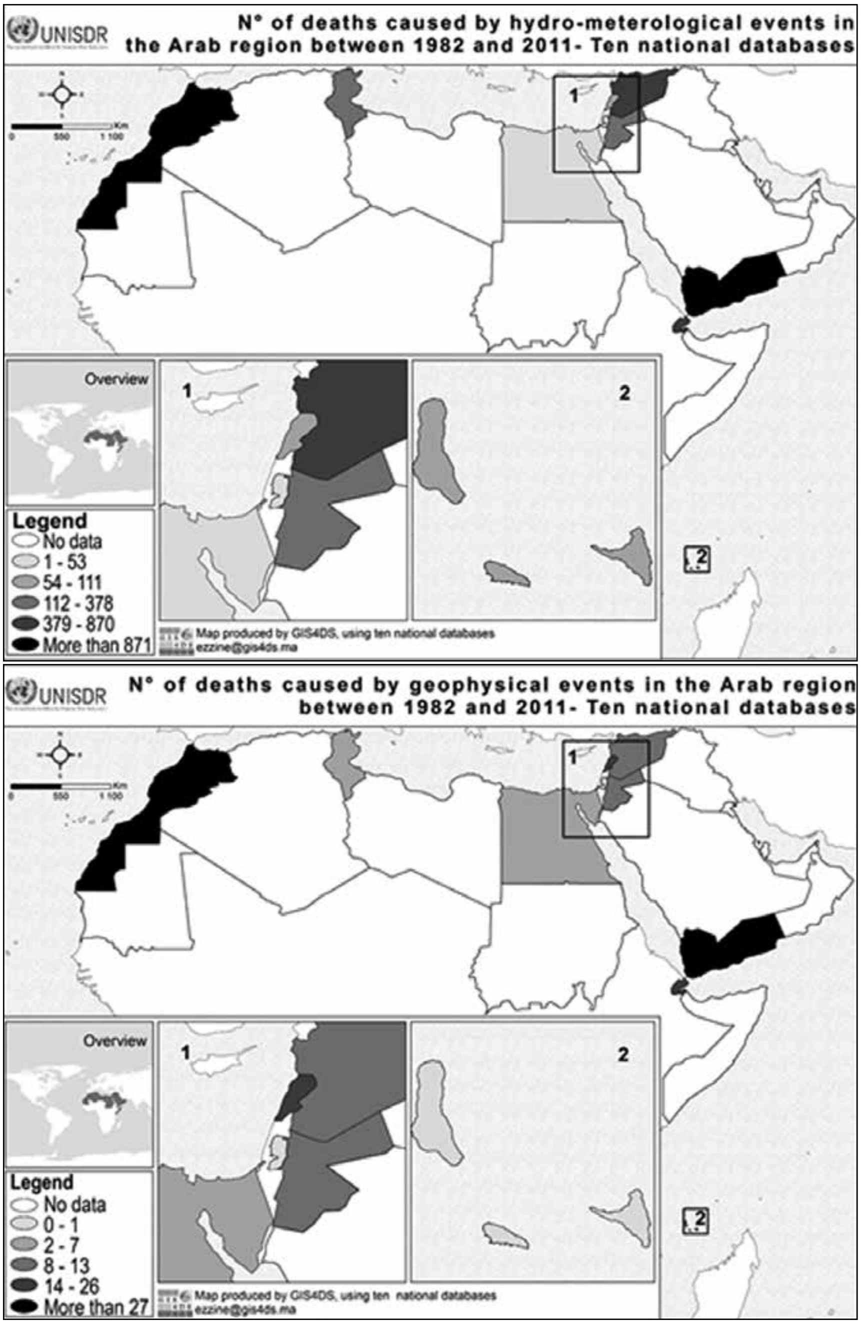


Figure 10. Spatial distribution of number of deaths caused by hydro-meteorological and geophysical hazards in ten Arab countries (Thirty years period 1982-2011 - National disaster loss databases)

In addition, Figure 10 and Table 5 show that fatalities caused by geophysical hazards are mainly concentrated in a few countries like Yemen and Morocco with the number of deaths in Yemen estimated at 1,152 (mainly due to the earthquake on 16 December 1982 resulting in 900 deaths) and 631 in Morocco (mostly due to the earthquake on 24 February 2004, which killed 628 people).

Conversely, deaths caused by hydro-meteorological hazards are spread over a wide area, and affect almost all countries in the Arab region. The highest numbers of deaths caused by hydro-meteorological hazards were recorded in Yemen, Morocco and Djibouti with respectively 2,672, 1,526 and 870 fatalities. Despite the fact that hydro-meteorological disasters affected almost all countries, most casualties were still recorded in the two countries that suffer most from earthquake risk (Morocco and Yemen). These two countries face a double risk and disaster risk reduction needs to be seriously expanded there to reduce future losses.

It is important to note that some geological events such as earthquakes have long return periods. Thus, national disaster loss databases with a normal 30 year span cannot properly reflect such events. Earthquakes, but also other disasters such as tsunamis, may be repeated after periods of 100 years or several centuries, while countries can still remain earthquake and tsunami prone. This means the timeline necessary to draw a proper country profile is beyond the timeline covered in this study and more efforts are needed in the region to obtain comprehensive national disaster loss databases, in order to take the challenge of earthquakes and tsunamis into consideration.

In summary, deaths caused by hydro-meteorological hazards are proportionally low even with a higher number of events (6,535 deaths). They also have a wide geographical distribution over the Arab region. In contrast, deaths caused by geophysical hazards are more significant despite a relative lower number of events, due to the fact that only one geophysical event can cause a tremendous number of deaths. For instance, only six geophysical events recorded in Morocco caused 631 deaths, i.e. one third of all 1,865 earthquake deaths in the Arab region[5].

Table 5. Impact of hydro-meteorological hazards versus geophysical hazards (Thirty years period 1982-2011 - National disaster loss databases)

Countries	Hydro-meteorological events					Geophysical events				
	Number of events	Deaths	Destroyed houses	Damaged houses	Total destroyed & damaged	Number of events	Deaths	Destroyed houses	Damaged houses	Total destroyed & damaged
Comoros	11	75	-	1,614	1,614	2	-	-	-	-
Djibouti	343	870	-	-	-	17	26	-	-	0
Egypt	44	45	1,329	1,646	2,975	12	3		239	239
Jordan	568	143	91	493	584	25	9		103	103
Lebanon	2,303	111	129	1,289	1,418	104	24	48	42	90
Morocco	700	1,526	4,035	9,538	13,573	6	631	1,067	12,377	13,444
Palestine	333	53	9	450	459	4	-	-	-	0
Syria	7,276	662	467	1,287	1,754	19	13	1	24	25
Tunisia	1,649	378	17,689	22,219	39,908	21	7	103	2,420	2,523
Yemen	1,250	2,672	21,327	26,666	47,993	212	1,152	1,681	10,678	12,359
Total	**14,477**	**6,535**	**45,076**	**65,202**	**110,278**	**422**	**1,865**	**2,900**	**25,883**	**28,783**

The above observation on deaths caused by hydro-meteorological and geophysical hazards, also applies to the destroyed and damaged houses. Indeed, houses destroyed and damaged by hydro-meteorological hazards are spread over a large area of the Arab region, while the houses destroyed and damaged by geophysical hazards are concentrated in a few countries, such as Morocco, Yemen and Tunisia (Figure 11).

[5]Obviously it is important to recall earlier information that in 1960 Morocco experienced already a large scale earthquake with the highest number of casualties of 12,000 lives lost. This is not repeated here, as this chapter only considers losses during the last thirty years.

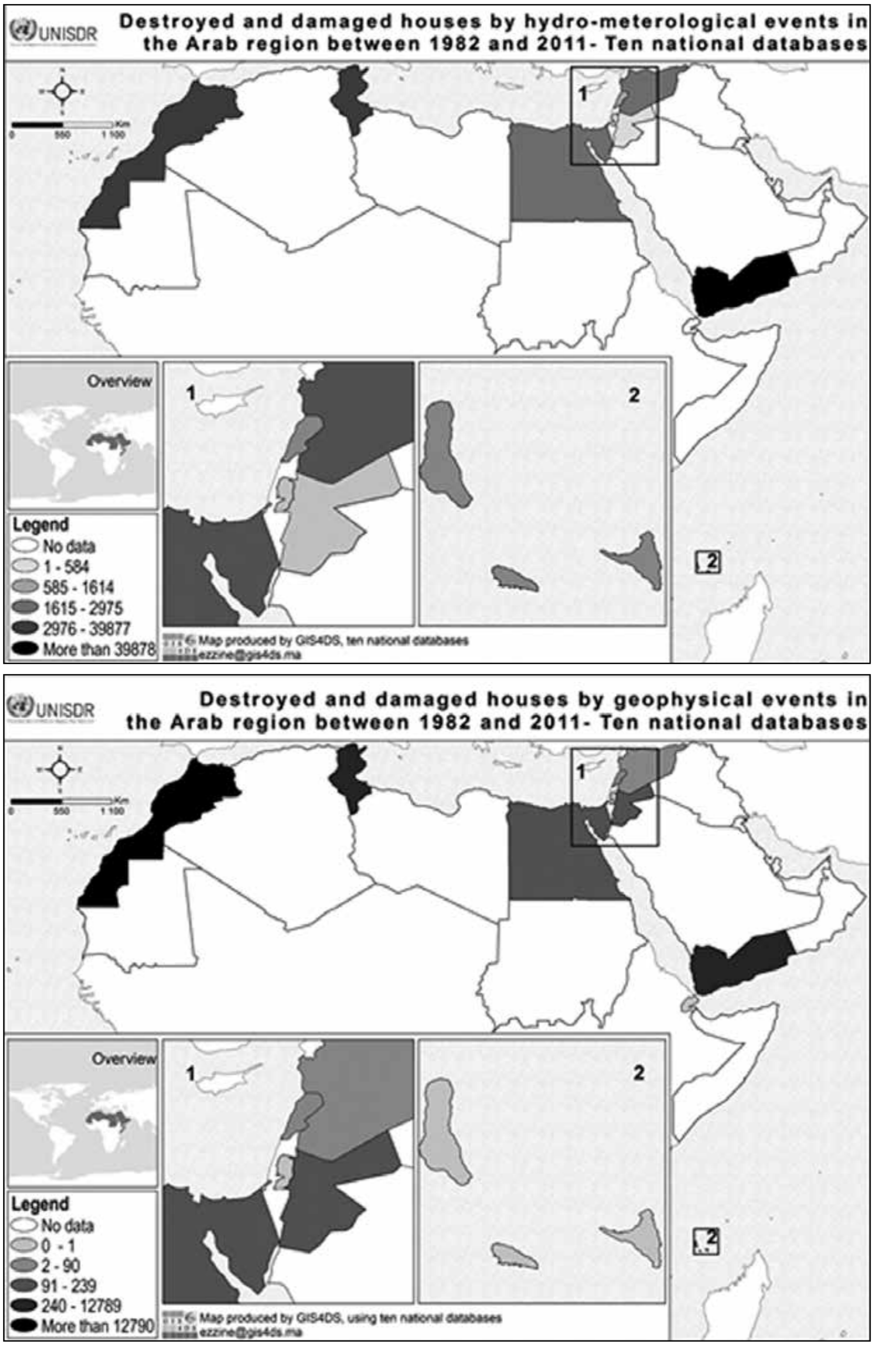


Figure 11. Spatial distribution of destroyed and damaged houses caused by hydro-meteorological and by geophysical hazards in ten Arab countries (Thirty years period 1982-2011 - National disaster loss databases)

It is worth mentioning that hydro-meteorological events destroyed and damaged about 110,278 houses while geophysical events ruined 28,783 houses. Therefore, economic losses due to hydro-meteorological events were more significant than those due to geological events such as earthquakes over the thirty years study period and concerning the ten countries with national disaster loss databases.

g) Spatiotemporal evolution of deaths, destroyed and damaged houses in ten Arab countries with national disaster loss databases

Figure 12 relates to spatiotemporal evolution of deaths for the last three decades, while Figure 13 expresses the spatiotemporal evolution of the number of houses destroyed and damaged. They reveal that Yemen experienced the highest number of deaths throughout the period. The number of houses destroyed and damaged is higher in the decade 2002 to 2011. This increase in the early 2000s reflects also the improved availability of disaster damage and loss data during the establishment of the national disaster loss database. According to available data, no clear trend is discernible.

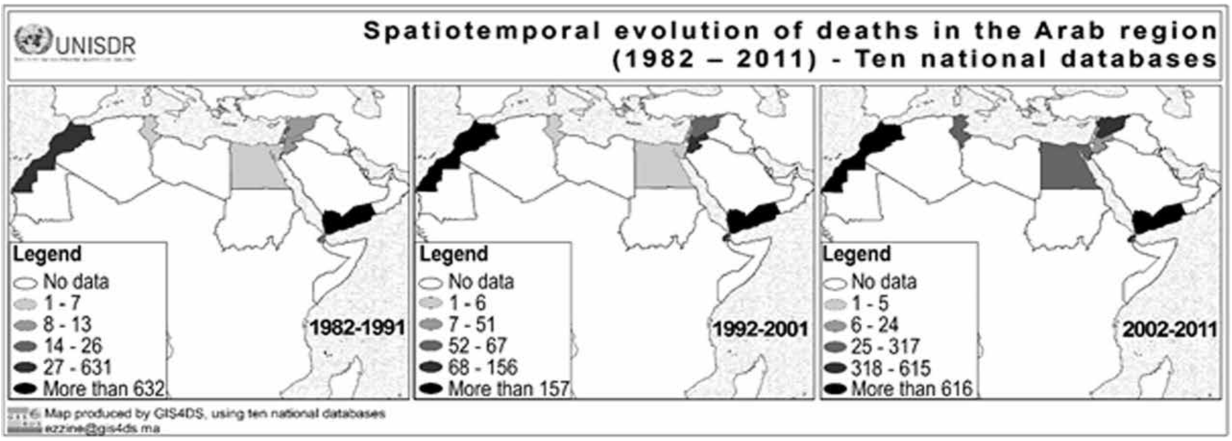


Figure 12. Spatiotemporal evolution of deaths in ten Arab countries (Thirty years period 1982-2011 - National disaster loss databases)

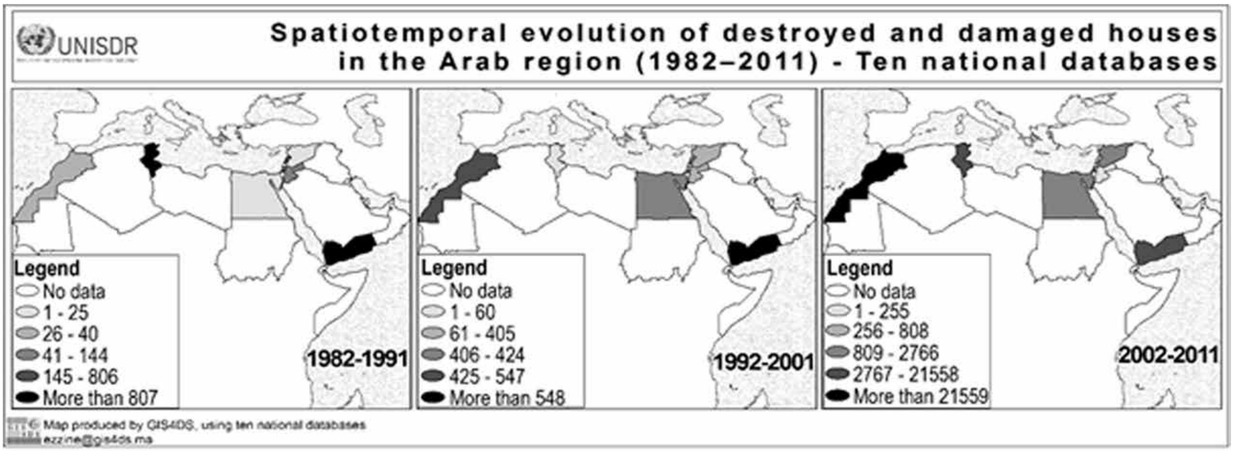


Figure 13. Spatiotemporal evolution of destroyed and damaged houses in ten Arab countries (Thirty years period 1982-2011 - National disaster loss databases)

2.2 Damage and losses according to the international disaster database EM-DAT

As previously mentioned National disaster loss databases exist so far only for ten out of the 22 Arab countries. To obtain further understanding of disaster losses in the remaining 12 countries, but also to compare data from national disaster loss databases with other statistics, this section presents data derived from the International Disaster Database EM-DAT. EM-DAT is the main publicly available disaster database (www.emdat.be). It has the advantage of covering all 22 Arab countries and provides data on a global scale.

However, EM-DAT lacks geo-referencing data at sub-national level. As previously mentioned, it also only includes data on losses or damage that respond to at least one of the four following criteria: i) 10 or more people killed, ii) 100 or more people affected, iii) situation triggers a declaration of a state of emergency or iv) a call for international assistance. The establishment of this threshold for entering a disaster in the database poses important differences with other datasets such as the national disaster loss databases established in Arab States. EM-DAT keeps track of intensive (i.e. major) events only. As such, important differences will appear compared to national datasets, as they do not have a threshold for entering data. The latter allows for keeping track of high-frequency and low intensity (extensive) events and also provides data on sub-national level.

2.2.1 Analysis of disaster losses in Arab states (Thirty years period)

The EM-DAT database covers a timeline ranging from 1900 to 2014. But to make a valid comparison between data collected by national disaster loss databases and data stored in the EM-DAT database, the same time line needs to be covered. The selected time-frame was 1982 to 2011 because most national disaster loss databases cover this timeline.

a) Number of disasters in the Arab Region according to EM-DAT (Thirty years period)

Table 6 presents a summary of the EM-DAT database for all Arab countries during the period 1982 to 2011. The total number of events recorded in this database is 323. These events claimed the lives of 164,100 people and caused a total damage of US$ 19.30 billion. It is worth to mention that EM-DAT economic losses include direct and indirect damages and losses due to disasters. These were compiled using different sources (no more information or detail of the sources of this information is available on the official website)[6].

Table 6. Summary of disasters in the Arab region (Thirty years period 1982 to 2011 – EM-DAT)

Arab Countries	Events	Deaths	Number of affected	Total damages ('000 USD)
Algeria	58	4,193	245,912	6,543,846
Bahrain	NA	NA	NA	NA
Comoros	10	62	351,500	42,804
Djibouti	13	206	1,412,283	3,219
Egypt	21	1,512	173,470	1,342,000
Iraq	8	52	70,890	1,300
Jordan	10	50	348,000	401,000
Kuwait	1	2	200	0
Lebanon	6	46	119,000	165,000
Libya	1	0	0	42,200
Mauritania	22	50	3,126,985	0
Morocco	28	1,814	517,850	1,596,059
Oman	5	143	20,050	4,951,000
Palestine	2	0	0	0
Qatar	NA	NA	NA	NA
Saudi Arabia	12	327	13,535	1,650,000
Somalia	40	3,570	11,151,250	100,020
Sudan	42	150,807	32,122,602	526,200
Syrian Arab Rep	6	118	1,629,000	0
Tunisia	9	222	215,500	332,800
United Arab Emirates	NA	NA	NA	NA
Yemen	29	926	181,565	1,611,500
Total	**323**	**164,100**	**51,699,592**	**19,308,948**

[6]http://www.emdat.be/guidelines

According to the EM-DAT database, the highest number of disaster events were recorded in Algeria (58 events), Sudan (42 events) and Somalia (40 events). More details about the spatial distribution of the number of events are given in Figure 14.

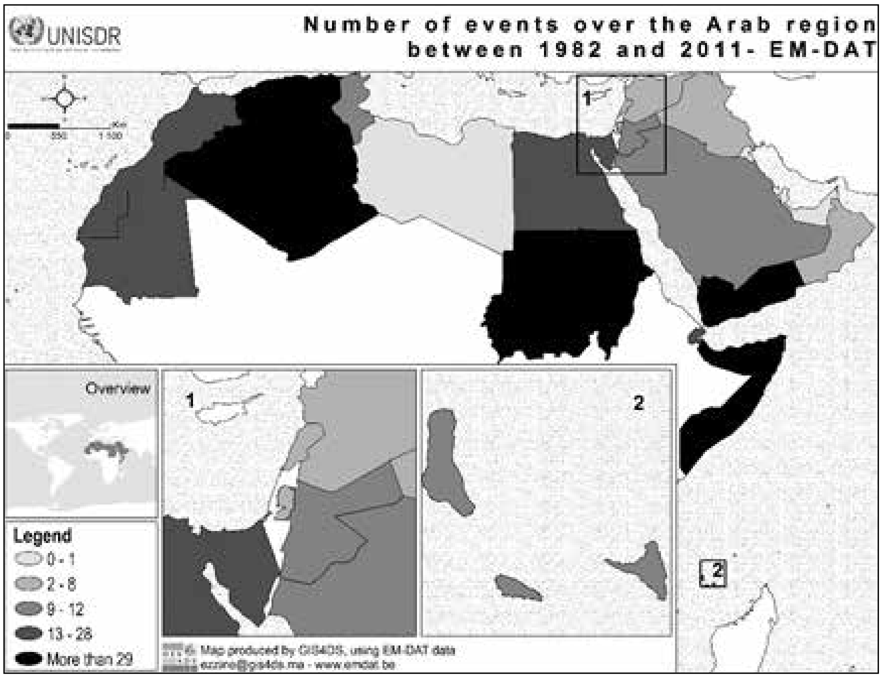


Figure 14. Spatial distribution of number of events in the Arab region (Thirty years period 1982-2011 - EM-DAT)

The temporal evolution of events is highlighted in Figure 15. The trend shows a steady increase of disasters for the 22 Arab countries. This is similar to what national disaster loss databases for the ten concerned countries reveal. It is important also, as it shows that not only small-scale events, but also intensive (major) disasters, which alone are covered by EM-DAT, are increasing in Arab States. EM-DAT registered only slightly more than 300 events for 22 countries, while national datasets for only ten countries alone refer to 14,899 events.

According to EM-DAT statistics, the number of events in the Arab region has increased from four events in 1982 to 21 events in 2010. No information is provided on the EM-DAT website explaining this increase. It can be due to either better awareness to register natural disasters or to changing hazard patterns due to climate change, exposure and remaining vulnerability that lead to more disasters or to both. This conclusion is clear in figure 16 that shows an increase in the hydro-meteorological events versus more or less a global constant tendency of geophysical events. These findings indicate that it is necessary to take measures to mitigate natural disasters in order to reduce significantly the number of events occurring in the Arab region.

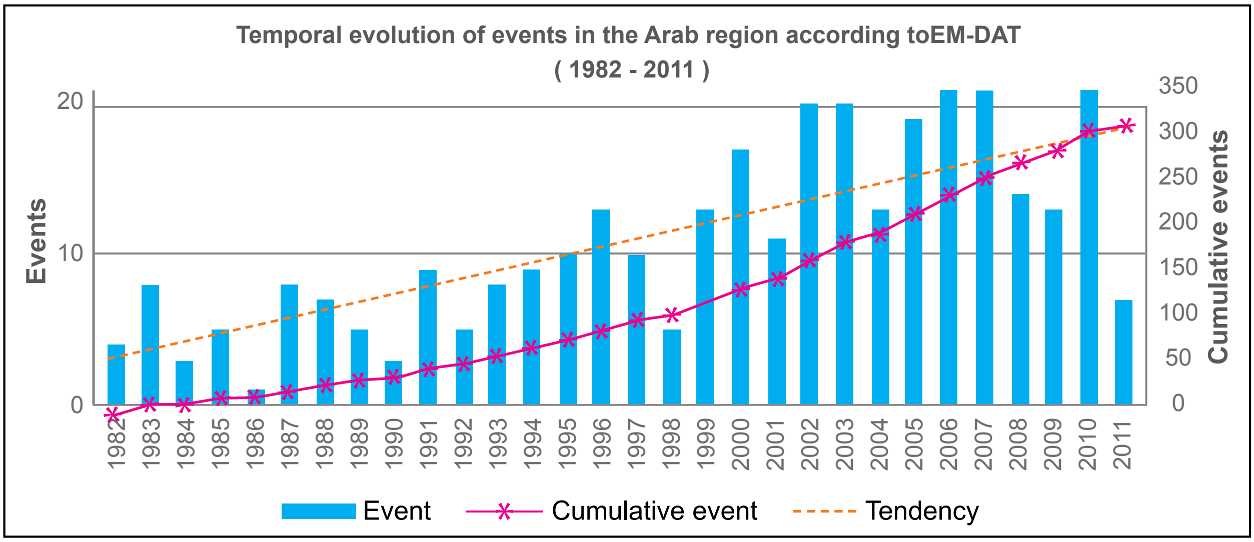


Figure 15. Temporal evolution of number of events in the Arab region (Thirty years period 1982-2011 – EM-DAT)

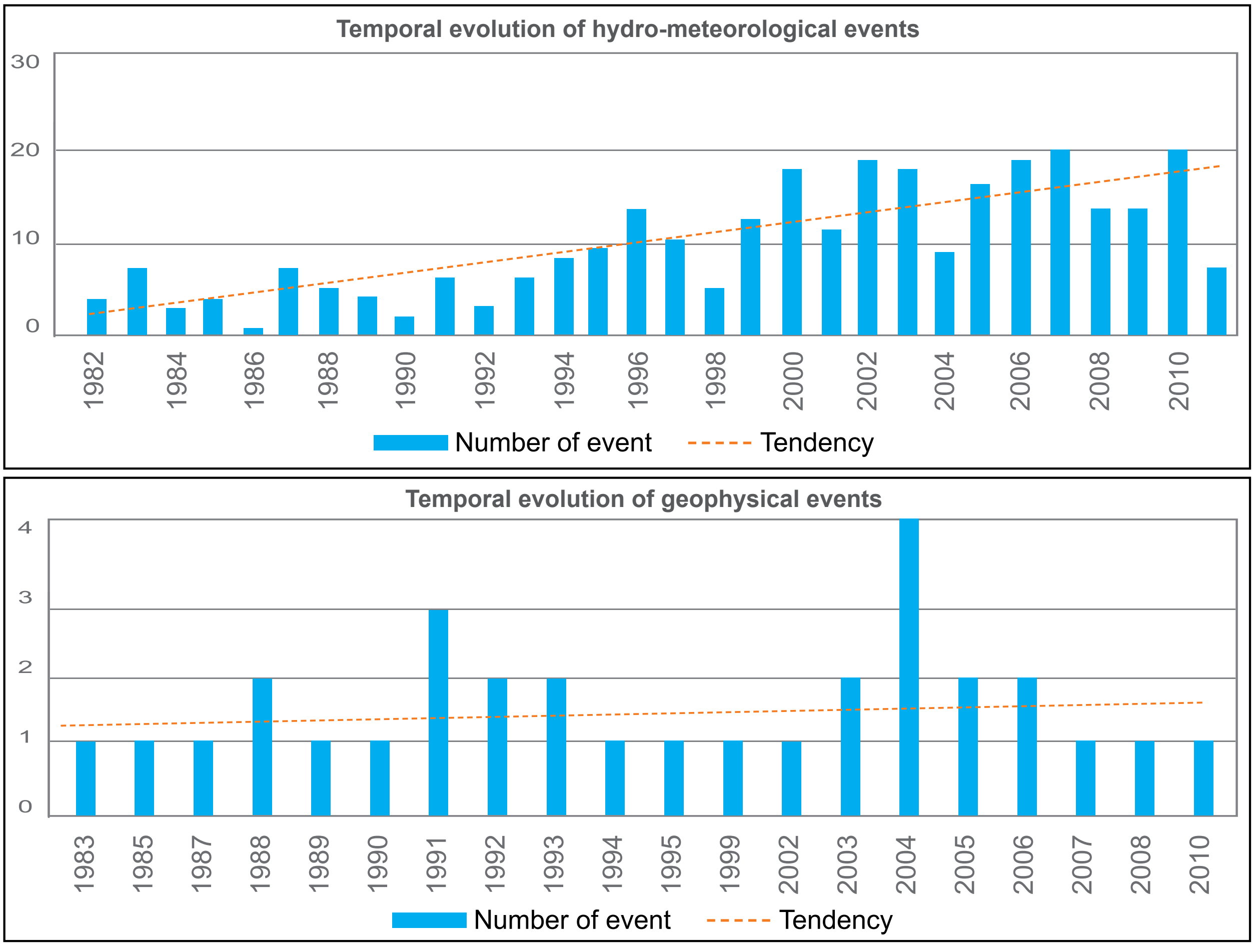


Figure 16. Temporal evolution of hydro-meteorological and geophysical events in the Arab region (Thirty years period 1982-2011 – EM-DAT)

b) Deaths caused by disasters in the Arab Region according to the EM-DAT database

Disasters in the Arab region between 1982 and 2011 caused around 164,100 deaths. The highest number of deaths was observed in Sudan, Algeria and Somalia, which suffered respectively 150,807, 4,193 and 3,570 lives lost.

(Figure 18). The number of deaths in 1983 was very high due to disasters in Sudan. This can distort the other data. Therefore two figures are proposed to capture both the Sudan events and other disasters during this period (Figures 18 and 19). Taking out the 1983 disaster record, the new temporal evolution of deaths is given and illustrates a slight increase in the number of deaths in the Arab region.

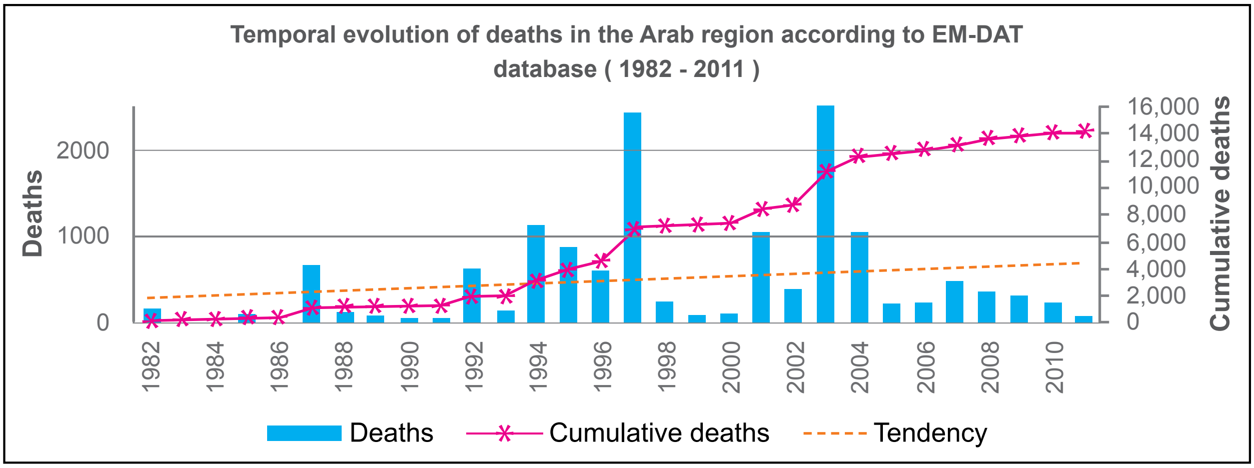


Figure 17. Temporal evolution of deaths in the Arab region according to EM-DAT database (1982-2011)

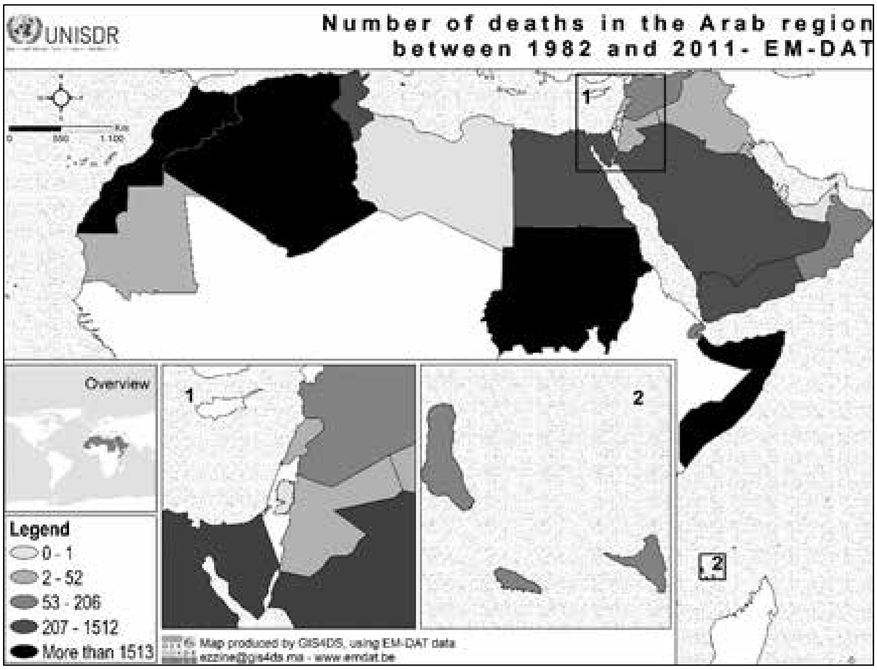


Figure 18. Spatial distribution of number of deaths in the Arab region (Thirty years period 1982-2011 - EM-DAT)

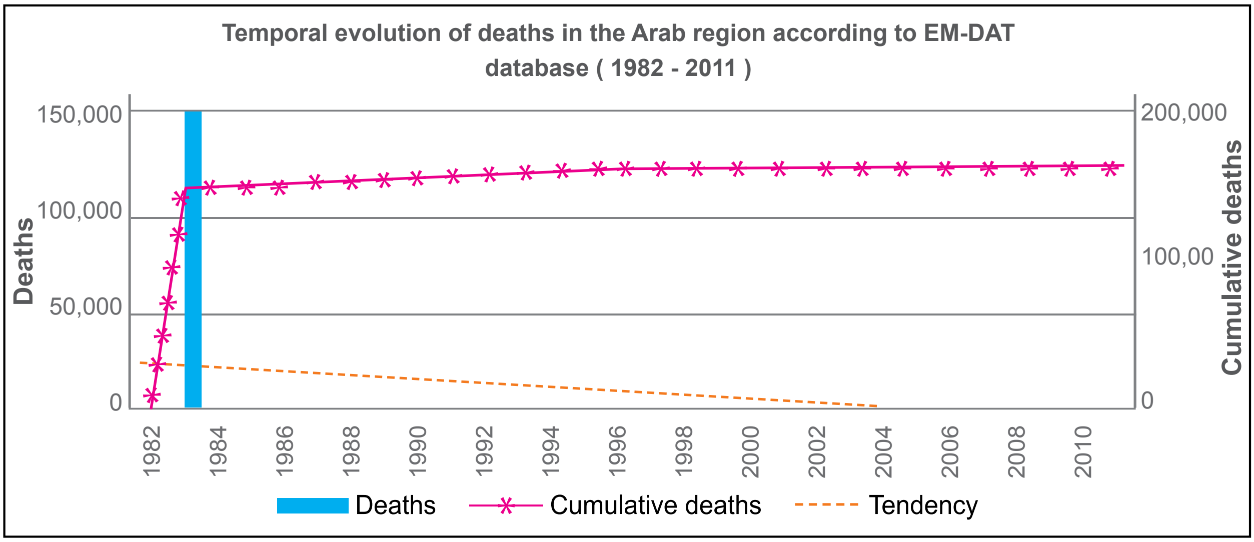


Figure 19. Temporal evolution of deaths in the Arab region (Thirty years 1982 to 2011 - EM-DAT)

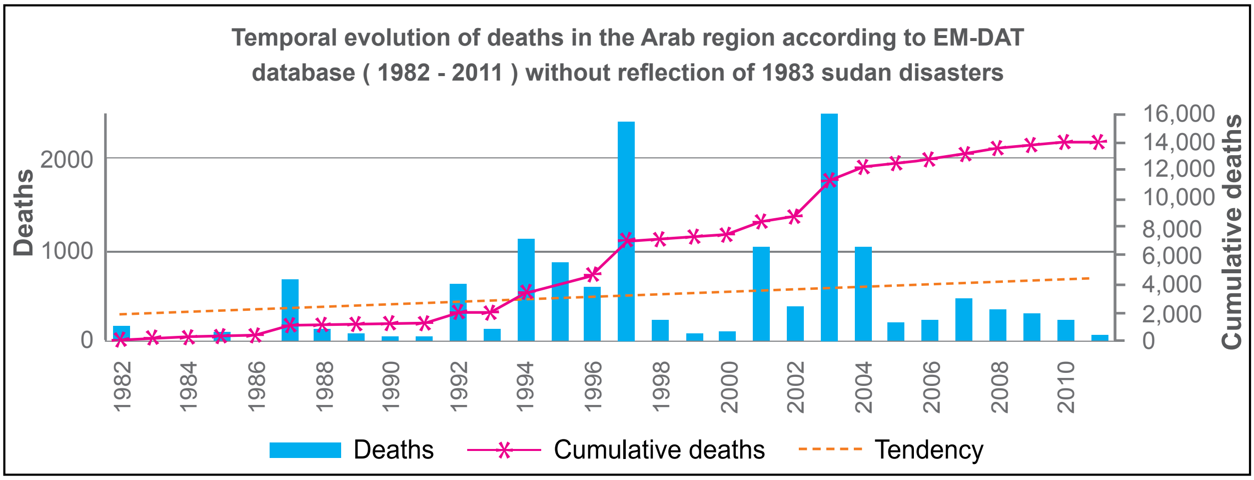


Figure 20. Temporal evolution of deaths in the Arab region, without reflection of 1983 Sudan disasters (Thirty years period 1982-2011 - EM-DAT)

c) Economic losses in the Arab region according to the EM-DAT database

Recorded economic losses vary from year to another, however with a tendency to grow (Figure 21). In general economic losses are important and affect almost all countries. However the most affected countries were Algeria, Egypt, Morocco, Oman, Saudi Arabia and Yemen (Figure 22). It is important to note that for some disasters – e.g. drought in Sudan - the EM-DAT database does not provide sufficient information on the economic damage as the next section reveals.

The Figure 21 shows that the economic losses in Arab States from 1982 to 2011 have an increasing trend. Indeed, the losses were less than two billion USD in 1992, but exceeded five billion USD in 2003.

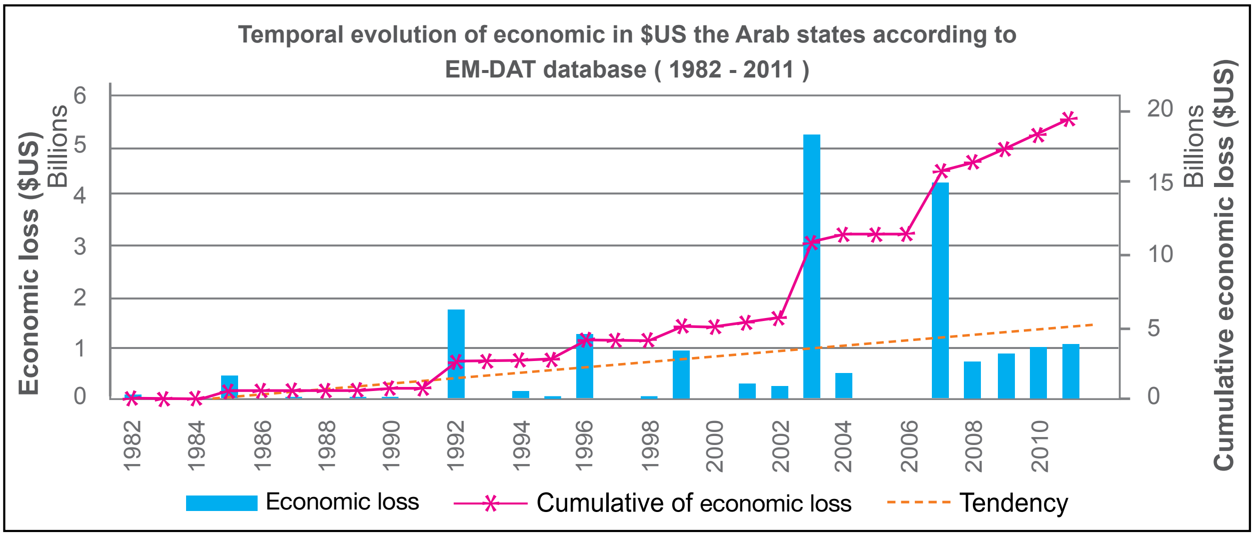


Figure 21. Temporal evolution of economic losses in the Arab region (Thirty years period 1982-2011 - EM-DAT)

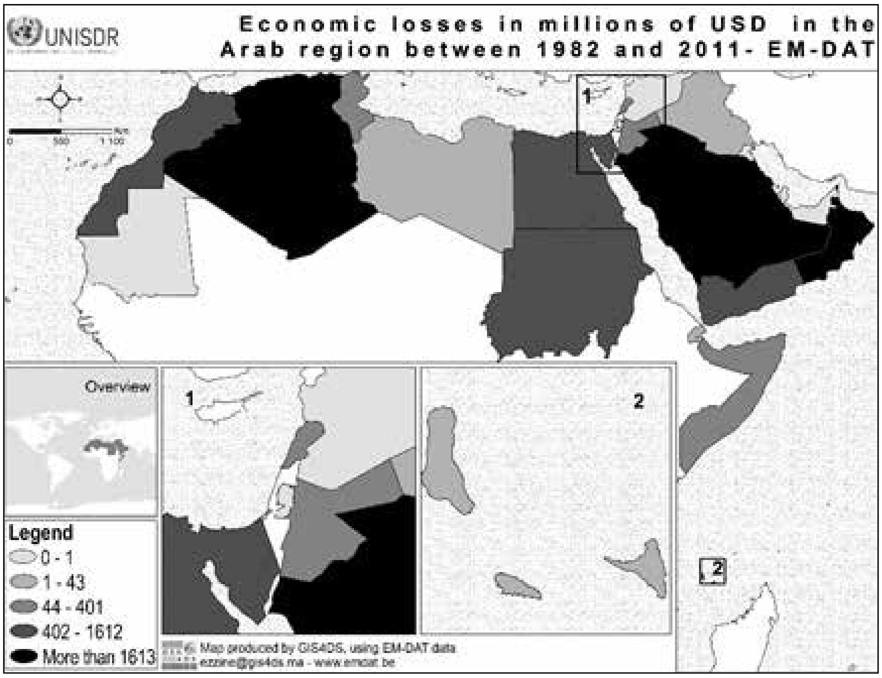


Figure 22. Economic losses in millions of USD in the Arab region (Thirty years period 1982-2011 - EM-DAT)

d) Number of affected people according to the EM-DAT database

Figure 23 illustrates the spatial distribution of the number of people affected and Figure 24 illustrates the temporal evolution of people affected by natural hazards in the Arab region between 1982 and 2011 according to EM-DAT. Many countries like Mauritania, Sudan, Somalia and Syria have more than one million affected people. The number of people affected varies randomly over the years with a slightly increasing trend. The highest number of people affected was recorded in 1991 due to Sudan's drought. No data has been provided in the database on the economic damage (previous chapter).

According to the EM-DAT, natural hazards affected a cumulated number of 51.69 million people in Arab States between 1982 and 2011. Most affected populations lived in Sudan, Somalia and Mauritania with respectively 32.12 million, 11.15 million and 3.12 million people concerned. It appears that there is a correlation between number of events, fatalities and affected people, as the case of Sudan and Somalia reveals (Figure 23).

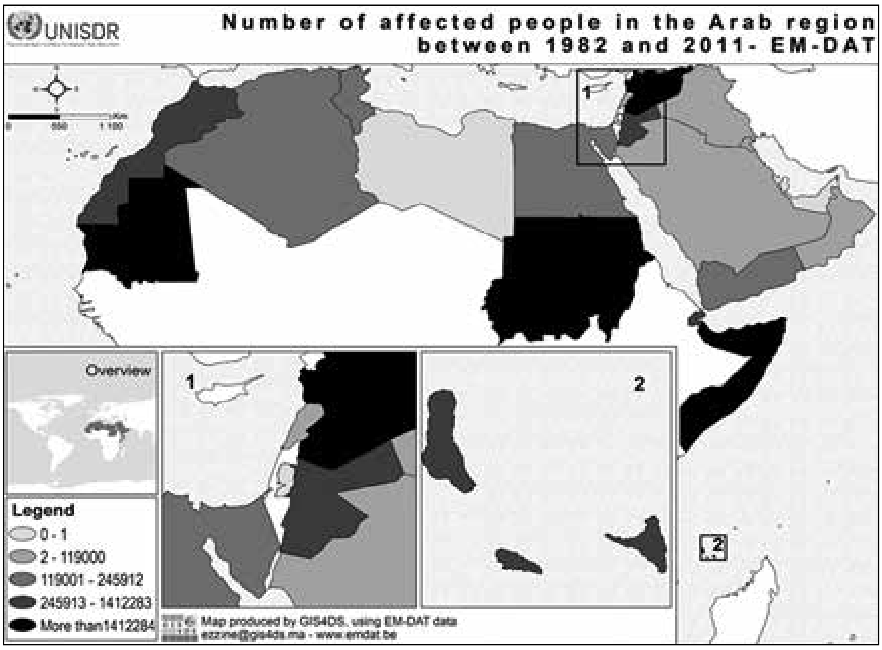


Figure 23. Spatial distribution of number of people affected in the Arab region (Thirty years period 1982-2011 - EM-DAT)

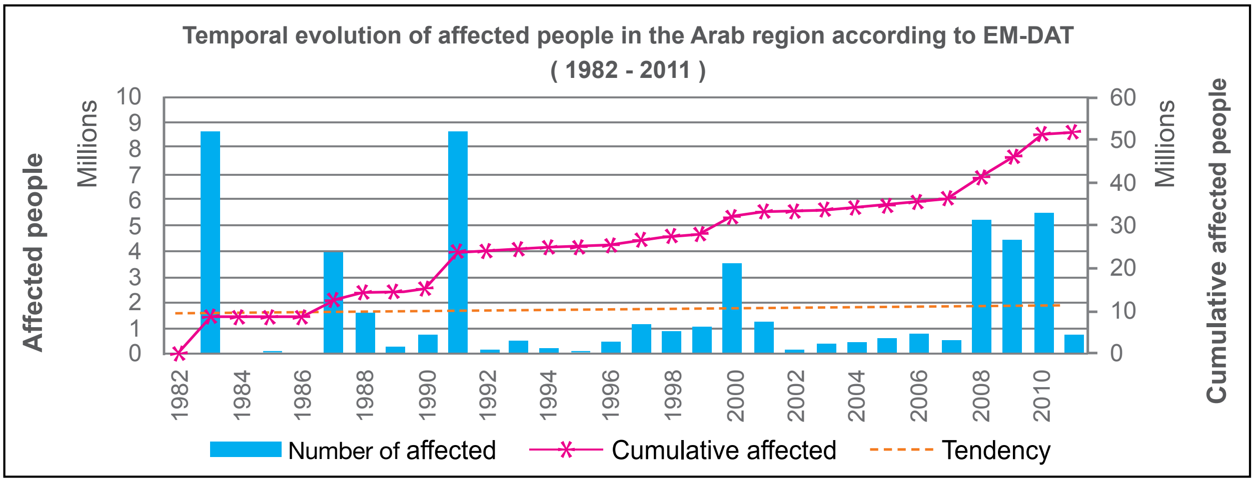


Figure 24. Temporal evolution of affected people in the Arab region (Thirty years period 1982-2011 - EM-DAT)

e) Impact of geophysical hazards versus hydro-meteorological hazards according to the EM-DAT database

Figure 25 illustrates the loss of lives caused by hydro-meteorological and geophysical disasters from 1982 to 2011. According to this database, Algeria is the country which experienced the most events, either geophysical or hydro-meteorological ones. The North-African country alone accounts for 45 hydro-meteorological and 13 geophysical disasters. However, most deaths due to hydro-meteorological events were observed in Sudan with 150,804 fatalities, while Algeria experienced its highest lives lost due to geophysical events that caused 2,527 casualties.

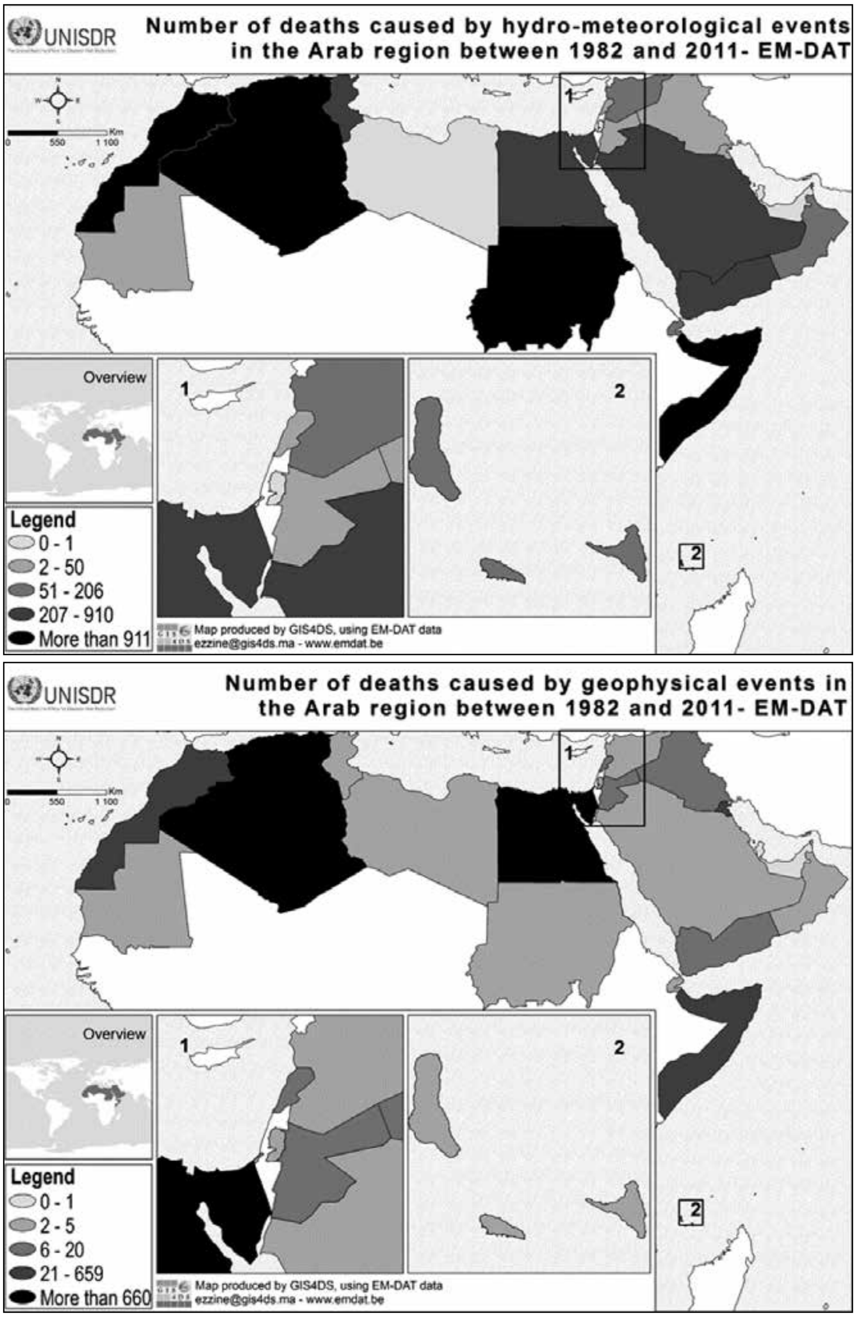


Figure 25. Spatial distribution of deaths caused by hydro-meteorological and geophysical hazards in the Arab region (Thirty years period 1982-2011 – EM-DAT)

Figure 26 shows the total economic damage in millions of US$ caused by geophysical and hydro-meteorological hazards between 1982 and 2011 in the Arab region.

In terms of economic damage in the Arab region, hydro-meteorological events caused more damage (US$ 12.54 billion) than geophysical ones (US$ 6.76 billion) during the considered thirty-years reporting period. Significant economic damages caused by hydro-meteorological hazards were observed in Oman (US$ 4.95 billion), Saudi Arabia (US$ 1.65 billion) and Yemen (US$ 1.61 billion). Regarding economic damage caused by geophysical hazards, the highest losses were reported in Algeria with US$ 5.06 billion due to the 2003 earthquake in Boumerdès.

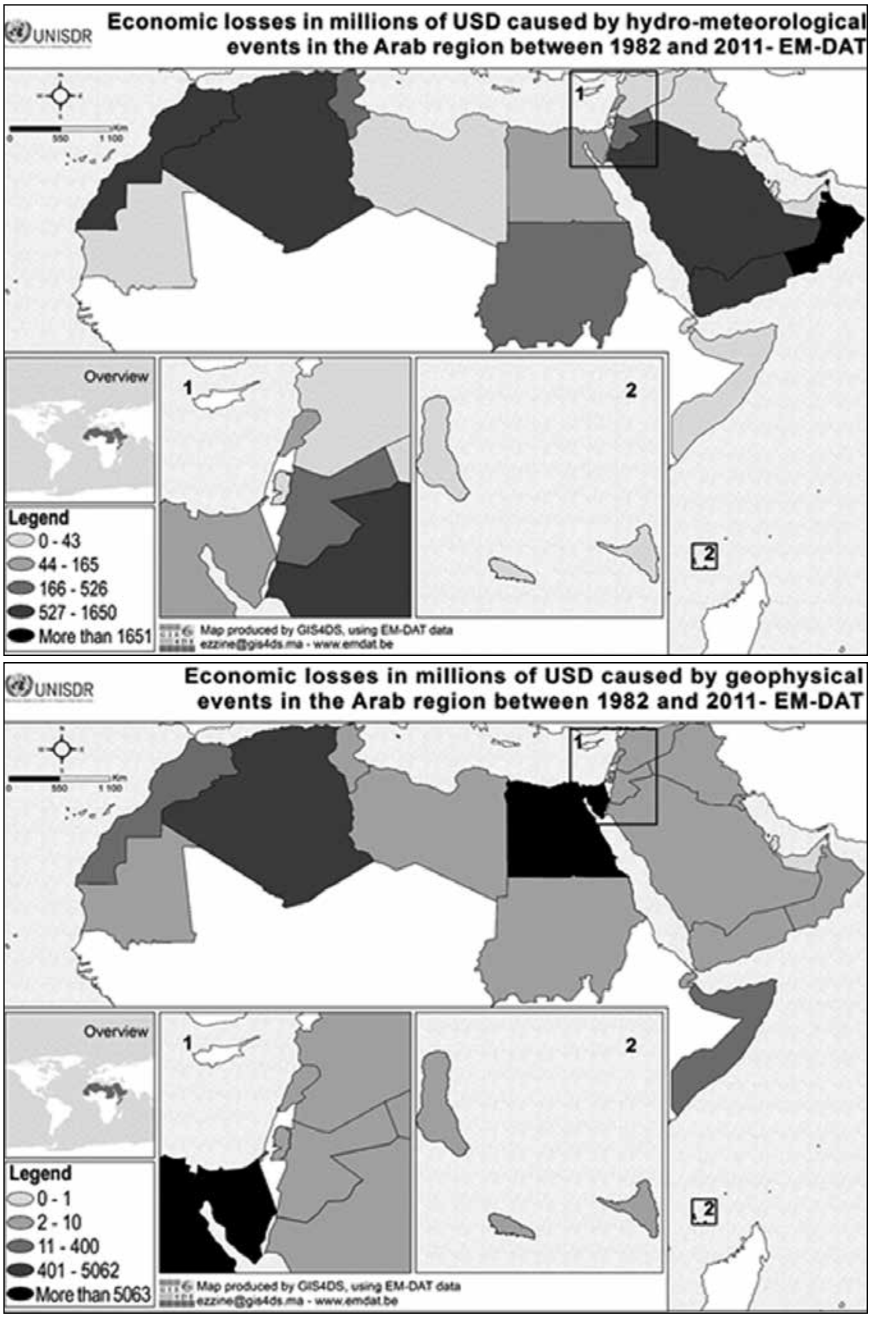


Figure 26. Spatial distribution of economic losses caused by hydro-meteorological or geophysical hazards in the Arab region (Thirty years period 1982-2011 - EM-DAT)

Table 7 explains that hydro-meteorological events are more frequent than geophysical events.

Thus, hydro-meteorological events are in the range of 292 against 33 geophysical events. It is worth mentioning that deaths related to geophysical hazards concerned only 11 countries (Algeria, Comoros, Egypt, Iraq, Jordan, Kuwait, Lebanon, Morocco, Somalia, Sudan and Yemen). Fatalities caused by hydro-meteorological hazards had relatively greater geographical extent and concerned 17 countries in the Arab region.

Table 7. Occurrence and impact of hydro-meteorological and geophysical hazards in the Arab region (Thirty years period 1982-2011 – EM-DAT)

Countries	Hydro-meteorological events			Geophysical events		
	Nb. of events	Deaths	Damages (US$ 000)	Nb. Of events	Deaths	Damages (US$ 000)
Algeria	45	1,666	1,480,917	13	2,527	5,062,929
Bahrain	NA	NA	NA	NA	NA	NA
Comoros	6	61	42,804	4	1	0
Djibouti	13	206	3,219	0	0	0
Egypt	16	818	142,000	5	694	1,200,000
Iraq	7	32	1,300	1	20	0
Jordan	10	50	401,000	1	20	0
Kuwait	1	2	0	1	242	0
Lebanon	5	26	165,000	1	20	0
Libya	1	0	42,200	0	0	0
Mauritania	22	50	0	0	0	0
Morocco	26	1,155	1,196,059	2	659	400,000
Oman	5	143	4,951,000	0	0	0
Palestine	2	0	0	0	0	0
Qatar	NA	NA	NA	NA	NA	NA
Saudi Arabia	12	327	1,650,000	0	0	0
Somalia	39	3,272	20	1	298	100,000
Sudan	40	150,804	526,200	2	3	0
Syria	6	118	0	0	0	0
Tunisia	9	222	332,800	0	0	0
UAE	NA	NA	NA	NA	NA	NA
Yemen	27	910	1,611,500	2	16	0
Total	**292**	**159,862**	**12,546,019**	**33**	**4,500**	**6,762,929**

Table 8 shows “Top 10” disasters in the Arab countries for the period 1982-2011, sorted by number of persons killed. The deadliest disaster recorded was a drought that occurred in Sudan and caused 150,000 fatalities. This event is followed by a flood disaster that occurred in Somalia and killed 2,311 people and an earthquake that struck Algeria and cost the lives of 2,266 people.

Table 8. “Top 10” disasters in the Arab region, sorted by number of lives lost (Thirty years period 1982-2011 - EM-DAT)

°N	Countries	Events	Date of the event	Deaths
01	Sudan	Drought	April 1983	150,000
02	Somalia	Flood	19/10/1997	2,311
03	Algeria	Earthquake	21/05/2003	2,266
04	Algeria	Flood	10/11/2001	921
05	Morocco	Flood	17/08/1995	730
06	Morocco	Earthquake	24/02/2004	628
07	Egypt	Flood	02/11/1994	600
08	Somalia	Drought	April 1987	600
09	Egypt	Earthquake	12/10/1992	552
10	Somalia	Earthquake	26/12/2004	298

The “Top 10” disasters in terms of economic damage are given in the Table 9. It reveals that Algeria experienced the most costly disaster that led to a loss of US$ 5.00 billion. This was followed by costly disasters due to floods and an earthquake that occurred respectively in Yemen and in Egypt and cost each US$ 1.2 billion.

Table 9. “Top 10” disasters in the Arab region, sorted by economic damage (Thirty years period 1982-2011 – EM-DAT)

°N	Countries	Events	Date of the event	Economic damage ($costs (million US
01	Algeria	Earthquake	21/05/2003	5,000
02	Yemen	Flood	13/06/1996	1,200
03	Egypt	Earthquake	12/10/1992	1,200
04	Saudi Arabia	Flood	24/11/2009	900
05	Morocco	Drought	June 1999	900
06	Algeria	Flood	01/10/2011	779
07	Saudi Arabia	Flood	24/12/1985	450
08	Yemen	Flood	23/10/2008	400
09	Morocco	Earthquake	24/02/2004	400
10	Jordan	Extreme temperature	30/01/1992	400

Figure 27 shows the spatiotemporal evolution of the number of deaths caused by disasters for the period 1982-2011 in the Arab region according to EM-DAT database. This figure confirms the finding raised by national disaster loss databases showing that the last years experienced an expansion in the geographical spread and in the number of countries affected by disasters.

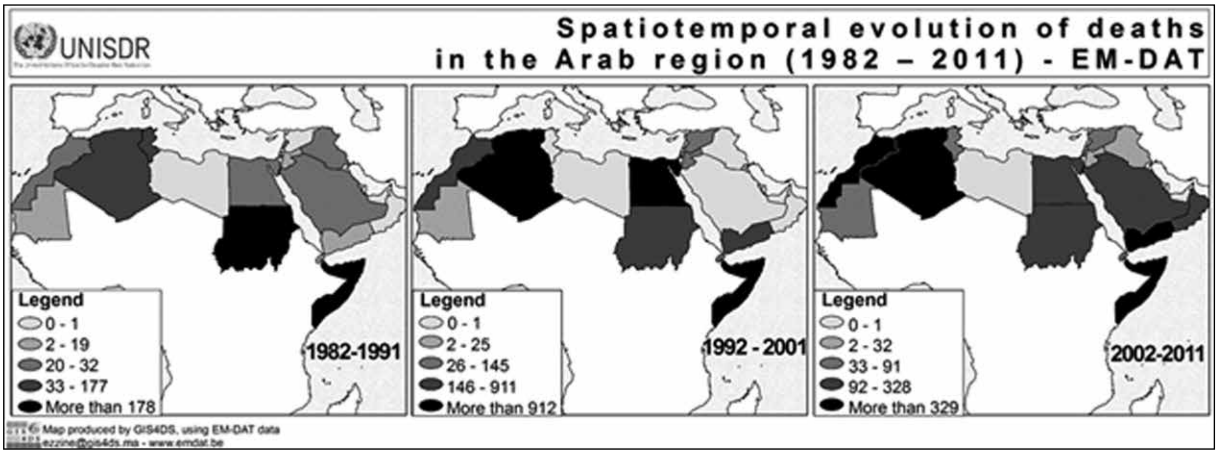


Figure 27. Spatio-temporal evolution of deaths in the Arab region (Thirty years period 1982-2011 - EM-DAT)

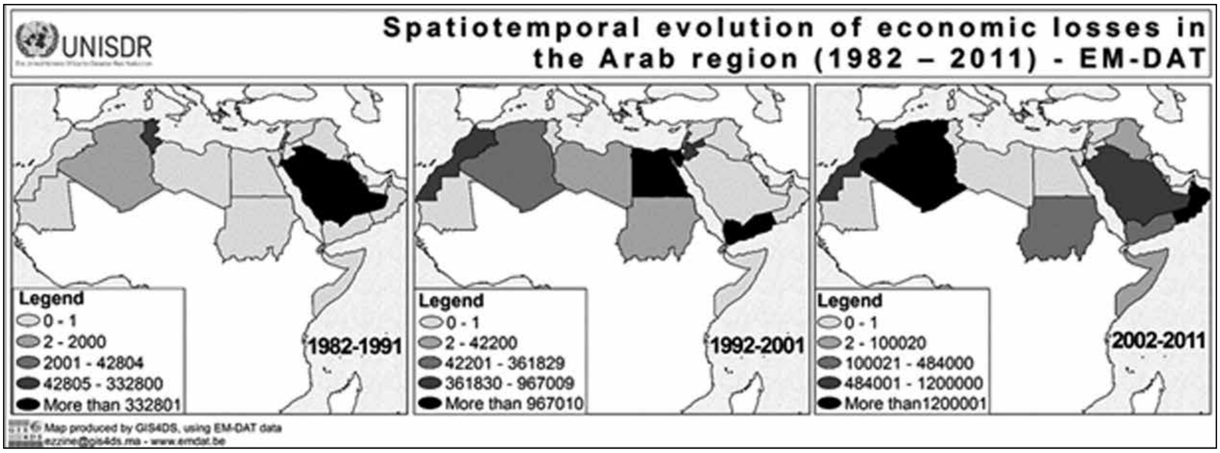


Figure 28. Spatio-temporal evolution of losses in the Arab region (Thirty years period 1982-2011 - EM-DAT)

2.2.2 Overview of all available em-dat data on the arab region (1900 to 2014)

The overall number of disaster events that occurred in the Arab region during the period 1900 and 2014 is 439 according to EM-DAT statistics. These events caused 206,998 deaths and affected 67.9 million people. The economic losses due to these events are evaluated at over 25.06 billion US$. The details of these statistics are summarized in Table 10.

Table 10. Disaster damages and losses in the Arab region (1900-2014 - EM-DAT)

Arab Countries	Event	Deaths	Number of affected	Total damages (USD 000')
Algeria	78	11,747	1,192,260	11,814,846
Bahrain	0	0	0	0
Comoros	16	584	443,275	47,804
Djibouti	17	231	1,844,283	5,719
Egypt	27	1,612	254,470	1,356,000
Iraq	14	67	920,890	61,300
Jordan	14	584	351,700	403,400
Kuwait	1	2	200	0
Lebanon	8	622	119,000	165,000
Libya	3	336	2,000	47,200
Mauritania	30	58	7,524,210	59,500
Morocco	45	14,432	1,029,164	1,751,159
Oman	8	276	25,050	4,951,000
Palestine	5	6	63,971	0
Qatar	0	0	0	0
Saudi Arabia	16	405	15,556	1,650,000
Somalia	53	23,025	15,410,830	100,020
Sudan	48	150,952	36,103,482	558,200
Syria	8	118	1,799,000	44,000
Tunisia	18	975	584,159	440,800
United Arab Emirates	0	0	0	0
Yemen	30	966	230,647	1,611,500
Total	**439**	**206,998**	**67,914,147**	**25,067,448**

As reported earlier, the EM-DAT database does not consider all events but focuses on major loss events based on the four criteria specified above. This explains the low number of overall events. In addition, it must be assumed that data reaching back over hundred years may not have been as complete as one would like to have, as EM-DAT was also only set up in 1988, which makes it difficult to assess complete loss data globally from as far back as 1900.

2.3 Disaster impact in the Arab region (Thirty years period – national disaster loss databases and EM-DAT)

The EM-DAT statistics include only major events that fit at least one of four criteria, but they have the advantage of being able to cover all the 22 Arab countries.

However, national disaster loss databases are able to record all historical events independent of their size, i.e. they also include low intensity and high frequency events. Since the establishment of disaster loss databases is a new initiative in the region only ten countries developed their national disaster loss databases using the DesInventar methodology.

In an effort to establish a more comprehensive picture of disaster loss and damage in the region, this section combines national disaster loss data with other data available through the EM-DAT. For this, the ten existing national disaster loss databases (Comoros, Djibouti, Egypt, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Yemen) were combined with EM-DAT data for the remaining 12 countries. For countries with national disaster loss databases, figures were compared with EM-DAT and the higher value from any of the database was retained for the number of events, fatalities or people affected. This was made under the assumption that both databases followed a sound data collection process, but may at certain instances be more accurate for EM-DAT or for national disaster loss databases.

In a second step the economic losses were retrieved from EM-DAT for all countries while the number of houses destroyed and damaged was retrieved directly from the countries with national disaster loss databases. This combination of national disaster loss databases and the EM-DAT database is displayed in the following table.

Table 11. Summary of disaster damages and losses in the Arab region (Thirty years 1982-2011 - National disaster loss databases and EM-DAT)

Arab Countries	Events	Deaths	Affected	Total damages ('000 US$)	Houses destroyed	Houses damaged	Houses damaged & destroyed
Algeria	58	4,193	245,912	6,543,846	-	-	-
Bahrain	0	0	0	0	-	-	-
*Comoros	13	75	351,500	42,804	0	1,614	1,614
*Djibouti	360	896	1,412,283	3,219	0	0	0
*Egypt	56	1,512	173,470	1,342,000	1,329	1,885	3,214
Iraq	8	52	70,890	1,300	-	-	-
*Jordan	593	152	348,000	401,000	91	596	687
Kuwait	1	2	200	0	-	-	-
*Lebanon	2,407	135	561,810	165,000	177	1,331	1,508
Libya	1	0	0	42,200	-	-	-
Mauritania	22	50	3,126,985	0	-	-	-
*Morocco	706	2,157	517,850	1,596,059	5,102	21,915	27,017
Oman	5	143	20,050	4,951,000	-	-	-
*Palestine	337	53	57	0	9	450	459
Qatar	0	0	0	0	-	-	-
Saudi Arabia	12	327	13,535	1,650,000	-	-	-
Somalia	40	3,570	11,151,250	100,020	-	-	-
Sudan	42	150,807	32,122,602	526,200	-	-	-
*Syria	7,295	675	1,629,000	0	468	1,311	1,779
*Tunisia	1,670	385	215,500	332,800	17,792	24,639	42,431
UAE	0	0	0	0	-	-	-
*Yemen	1,462	3,824	181,565	1,611,500	23,008	37,344	60,352
Total	**15,088**	**169,008**	**52,142,459**	**19,308,948**	**47,976**	**91,085**	**139,061**

*=Countries that have national disaster loss databases (Extracted from national disaster loss databases and EM-DAT)

As the analysis shows, in the thirty years period between 1982 and 2011, the total number of disaster events in Arab countries (combining national disaster loss databases and EM-DAT) is 15,088. Syria experienced 7,295 events; the most affected country in the region. However, Sudan is the country that experienced most fatalities, with 150,807 deaths for a total of 169,008 in Arab States. This is mainly due to a 1982 drought. Overall, 52 million people were affected by natural hazard related disasters. The economic damage caused by natural disasters in the Arab region is evaluated at 19.3 billion US$.

Figure 29 compares national disaster loss databases and EM-DAT, as well as their trends over the three decades. It is obvious that there are more events recorded in the national disaster loss databases than in EM-DAT. However, EM-DAT presents more casualties (Table 12). This can be explained by the fact that EM-DAT database covers 22 countries, while there are only ten national disaster loss databases. Also, countries with major disaster losses such as Algeria and Sudan have yet to establish national disaster loss and damage databases. Hence, their disaster losses information is only available through EM-DAT.

Furthermore, as shown in the figure, the majority of disasters and losses were incurred in the last decades, especially between 1992 and 2011. During this period, more than 90 % of the events were recorded. The recorded damage and losses follow the same tendency. This means more effort needs to be taken to mitigate the effects of increasing disaster events and limit the associated casualties.

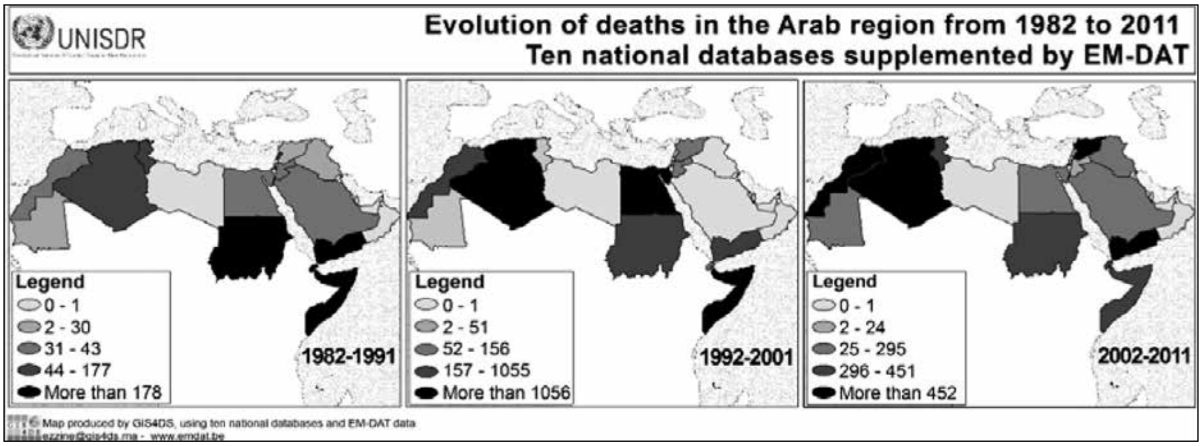


Figure 29. Evolution of number of deaths in the Arab region (National disaster loss databases and EM-DAT)

Table 12 compares national disaster loss databases and EM-DAT for the ten Arab countries with information from both databases. It shows that the events recorded in the EM-DAT database for the ten countries represent less than one percent of the disasters recorded in national disaster loss databases for the period 1982-2011. This highlights a clear improvement of disaster loss data country profiles thanks to the national disaster loss database establishment.

Considering the number of lives lost, EM-DAT data for the same countries shows only around 60% of the casualties that are recorded in the national disaster loss databases during the period 1982 to 2011.

Conversely, figures regarding the number of affected people are approximately three times higher in EM-DAT compared to national disaster loss databases.

Table 12. Comparison of loss data for ten Arab countries (Thirty years period 1982-2011 - EM-DAT vs. national disaster loss databases

Arab Countries	Events			Deaths			People affected		
	EM-DAT	National disaster loss database	Difference*	EM-DAT	National Disaster Loss Database	Difference*	EM-DAT	National Disaster Loss Database	Difference*
Comoros	10	13	3	62	75	13	351,500	27,201	-324,299
Djibouti	13	360	347	206	896	690	1,412,283	5,229	-1,407,054
Egypt	21	56	35	1,512	48	1,464	173,470	20	-173,450
Jordan	10	593	583	50	152	102	348,000	332,148	-15,852
Lebanon	6	2,407	2,401	46	135	89	119,000	561,810	-442,810
Morocco	28	706	678	1,814	2,157	343	517,850	22,391	-495,459
Palestine	2	337	335	0	53	53	0	57	57
Syria	6	7,295	7,289	118	675	557	1,629,000	808,181	820,819
Tunisia	9	1,670	1,661	222	385	163	215,500	20,730	194,770
Yemen	29	1,462	1,433	926	3,824	2,898	181,565	31,927	149,638
Total	**134**	**14,899**	**14,765**	**4,956**	**8,400**	**6,372**	**4,948,168**	**1,809,694**	**-1,693,640**

*Difference is "National disaster loss database value" minus "EM-DAT value" for a record, where a positive value shows the increase in assessed losses due to national disaster loss data and a negative value that EM-DAT proposed a higher value.

2.4 National disaster loss data gathering process and database use

2.4.1 Availability and content of national disaster loss databases

Ten out of twenty-two Arab countries, namely Comoros, Djibouti, Egypt, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Yemen, have installed and implemented their national disaster loss databases. Algeria uses a standalone database that was not accessible during this study. The ten national disaster and loss databases were implemented within the framework of the Global Damage and Loss Data Collection initiative, which was launched in the Arab region in 2010.

Thanks to this initiative this regional analysis of disaster risk impact was possible and new statistics and evidence on damage and loss are now available. These strongly improved the overall availability of data for these ten countries, and by corollary, the region as a whole as explained in the previous chapters. New data assessed using national disaster loss databases from 1982 to 2011 illustrates a very important increase in recorded number of disaster events from 134 events recorded in EM-DAT to 14,899 events in national disaster loss databases. In terms of deaths, national disaster loss databases recorded 3,444 more fatalities (representing an increase by 69%). Additionally national disaster loss databases provide a geo-localization, i.e. events are displayed by sub-national administrative areas, which is critical for risk mapping.

Secondly, the added value of the availability of national disaster loss databases further highlights the need to overcome the remaining impediment to establish national disaster loss databases in other Arab countries to ensure improved assessment of extensive, i.e. low impact but high frequency disasters. These remaining 12 countries continue to feature only intensive, i.e. major events, which largely underreport on the real impact of disasters.

A third aspect to take in consideration concerns the periods covered by existing national disaster loss databases and the comprehensiveness of their data. One aspect in this regard concerns the periods covered by those databases. Available national disaster loss databases cover periods starting in 1944 for the first country (Djibouti), while others only record events from 1982 onwards. There is also no regular and systematic update of the databases. As of September 2014, out of the ten available databases, two provide data through 2012, three through 2013 and one each through 2009, 2010 and 2011. Only two databases are updated until 2014, namely Comoros and Morocco. In principle, these databases have no end date, but should be maintained in order to systematically integrate latest disaster loss information. Ideally, they would also extent their coverage to assess disaster events that occurred prior to 1982 for long-term statistics and trend analysis. This is a challenging endeavour, not only for national disaster loss databases, but concerns all historical databases, including EM-DAT.

Another weakness revealed in this study is the availability of more than one national disaster loss database for the same country such as Comoros. The available data in the Ministry of Environment and the one available in the Directorate General for Civil Security (DGSC) linked to the Ministry of Interior should be merged to constitute one reliable national disaster loss database.

2.4.2 Review of national disaster loss database collection practice in Arab states

The survey revealed an absence of a clear and agreed process for disaster and damage loss data gathering. The list of reliable sources of information in the Arab States is different from one country to another. The collected information ranges from official information gathered from governmental institutions to information extracted from newspapers and other media. Even if some sources of information, such as media, do not always provide the level of required detail and can sometimes overestimate the impact of the disaster, they remain commonly used by almost all countries for their national disaster loss databases.

The use of such kind of sources to establish disaster damage and loss databases can be explained by several reasons, namely:

1. Detailed disaster damage and loss data collection is a relatively new practice in the Arab region;

2. Access to data is challenging, in particular where there are no publicly accessible statistical data and archive systems;

3. Most countries have not clearly defined the national institution responsible for the disaster loss data collection process and management;

4. National partners, who established the national disaster loss database, were not necessarily representing a national institution responsible for damage and loss data gathering.

The survey carried out to prepare this analysis revealed that all countries, which established national disaster loss databases, collected this data nationwide. In some countries, like Jordan and Morocco, data was gathered at the central level. This centralized approach can lead to a poor and non-exhaustive database. Instead, these countries as well as others should have involved local partners and institutions during data collecting process.

Another challenge that was evident concerns the use of human resources involved in the data collection process. It appears that mainly government officials and national consultants and national UN Volunteers countries collect data. In some countries, only consultants were involved in the data gathering process, while in others a combination of national officials, volunteers and/or consultants jointly collected data (Morocco and Syria). Since the data gathering process should be sustainable, national officials should be in charge of overseeing this important task and should carry it out with the support of employees or volunteers. Consultants could also be use to focus on tasks such as national and regional training and in-depth analysis of national disaster loss databases.

Overall the management of national disaster loss databases should be carried out by services related to the national accounts and statistical data services. Obvious entry points for UNISDR’s efforts to establish national disaster loss databases have been the nationally declared Hyogo Framework for Action Focal Points, who mostly represent Ministries of Environment or Interior in the region. However, the analysis revealed that data gathered with their support, were not sufficiently owned nor shared by all national technical Ministries and institutions.

The survey also investigated the archiving mechanism. The study found that there is no proper disaster loss data archiving strategy in the region. For some countries, a copy of the national disaster loss database is stored, while others do not have any data backup. Given the risk of computer crashes and the risk of data loss, it is a priority to implement a data archiving strategy in the Arab region and at national scale.

2.4.3 Data access challenges

All national respondents to the survey carried out to arrive at this report shared the same concerns on difficulty of accessing disaster loss data. According to the survey, the problems that hindered data gathering and proper use of national disaster loss databases are institutional, technical, logistical and legal (as per survey results from Jordan, Morocco, Syria and Tunisia) and even political in some countries. In fact, there is no legal framework related to (public) data access and sharing in the Arab countries. In this context, even if data is available, it is usually fragmented in several departments so accessing it is very difficult. In some countries, data collectors were endowed with a support letter to facilitate data access, but this was not always sufficient for full access needed to include data in the national disaster loss database.

In some countries, there were changes in terms of the government services in charge of disaster loss databases due to institutional restructuring during the setup of the disaster loss databases. This delayed or even impeded the normal implementation of national disaster loss database projects.

Overall these challenges call for more awareness-raising on the importance of the data collection in particular among higher decision-making spheres. It is highly recommended to promote institutional and legislative mechanisms to facilitate open data access.

2.4.4 Appreciation of national disaster loss database quality

The establishment of databases to include events that go back far in time is challenging – not only for national disaster loss databases, but also for others like the EM-DAT, which also faces the challenges of developing comprehensive databases. Some surveyed countries indicated that their databases are complete and reliable. Morocco and Comoros are aware that their databases are not exhaustive. The diagnostic of databases shows that almost all of them contain gaps (years for which no data was entered) for multiple years of record. These can mean either that no disasters occurred during the period or those disasters occurred but the event was not registered in the database.

For the ten national disaster loss databases in Arab States, which were analyzed in more detail, this is reflected by the various periods covered and the "blanks" of no entries for certain periods. Most databases starting earlier than 1982 first record major events which are still in people's mind or historical archives. However they are often followed by periods where data is lacking. Statistical accounting and analysis showed that some databases are not comprehensive and contain several gaps i.e. no entries on disaster events for longer periods, such as in Egypt, Morocco and the Comorian national disaster loss database. While it can be assumed that in some countries and during some years no disasters were recorded, the lack of available information in particular on extensive, small scale disasters, could explain these gaps while de facto disasters occurred but were not properly recorded. This data discontinuity is a major handicap that severely hampers the appropriate use of data and the development of risk-informed documents and decisions. If poor and erroneous data is collected this will result in incomplete analyses. This calls for further investigation and efforts to complete existing databases, something which was also compounded by the limited resources (human and financial) to establish and/or update national disaster loss databases.

An important aspect, to ensure data correctness is its public validation. The strength of most national disaster loss databases in Arab States was that they were validated, except in Morocco and in Comoros, however at time of writing this was in process in the latter. Syria and Jordan validated their data by competent authorities and then checked and compared it with other sources. Tunisia validated its data through several regional and a large national workshop.

The database covers a wide range of natural hazards from hydro-meteorological to geophysical and even in some instances epidemical and technological hazards[7]. Most hazards considered in national disaster loss databases are floods and flash floods, landslide and drought. However, some national disaster loss databases do not contain all types of hazards, such as drought. This phenomenon is not included in the databases of Egypt, Lebanon and Morocco. This is an important finding that needs to be taken into account specifically to improve the existing disaster statistics. It reveals that national disaster loss databases' loss data is still underreported. It is strongly recommended to raise awareness of the Arab countries in order to grant special attention to drought.

Besides these weaknesses that undermine the overall completeness and quality of the databases, another point is related to the languages used for the databases. Several Arab countries use different languages for their disaster loss databases, i.e. Arabic, English or French.

[7]The database results displayed here have not included technological or other man-made disasters as road accidents. These were e.g. included in the Tunisian disaster loss database.

Lebanon, Syria and Yemen use more than one language for the same database. This hampers the overall readability of the data and its comparability unless multi-lingual experts review them. It would be better to have a uniform use of language for national disaster loss databases for the region, which could ideally be a process to have results in the main three languages used, i.e. Arabic, English and French. Nonetheless, it should be noted that the establishment of national disaster loss databases is still a new and evolving initiative. The process of ensuring data quality still needs to be further developed and refined.

2.4.5 Current use of national disaster loss databases in arab states

According to information collected through the survey, there is limited use of newly assessed disaster loss data at national and regional level. In fact, the use of national disaster loss databases for the production of risk management plans and programmes and their use in decision-making remains in primitive stages or is not yet properly addressed at all.

Where national disaster loss databases are used, their use varies from country to country. In Tunisia, the regular users are the Department of Civil Defence, the Ministries of Equipment and Agriculture and the Met Service Directorate and related services. These services use the collected information before, during and after hazards to review losses and damage, inform decision makers and for spatiotemporal monitoring of loss and damage.

In Syria, mainly the government and UNDP use the database to analyze the loss and damage, to inform decision-makers and to analyze vulnerability. In Jordan the database users are limited to civil defence members, which analyze the loss and damage to discern vulnerability and inform decision-makers. In other countries, such as Morocco, there is no discernible use of the disaster loss database to analyze vulnerability.

Following UNISDR's open data access policy, most national disaster loss databases are available on the UNISDR maintained national disaster loss database "DesInventar" website http://www.DesInventar.net. This site thus allows the use of data by various audiences, public or private.

It should be noted though that despite the fact that the data are available on the website for several years, the data is not yet systematically referred to even in public communications by national governments, stakeholders or even international partners, who helped to establish these databases. UNISDR issued several press releases to feature the new dataset findings and published a first review of national datasets in Jordan, Syria and Yemen[8] . The UN Office's flagship publication the Global Assessment Report includes national disaster data references in its global analysis.

As a consequence of the above findings, it is extremely important to further raise awareness in Arab countries on the possible use of national disaster loss databases to promote their establishment, maintenance and potential use for risk reduction plans and programmes.

The Arab States region can also benefit from other regions, which have a longer history in the use of disaster loss databases. Examples of their use have also been well documented and could inform Arab States stakeholders (UNDP)[9].

In Latin America for example national disaster loss databases, established following the DesInventar methodology were useful for:

Research:
f) Forensics, disaster trends and disaster impact assessment
g) Climate variability
h) Risk assessments
i) Hotspots analysis of historical losses

Policy:
j) Disaster response
k) DRR
l) Recovery
m) National resource allocation
n) Development planning

The promotion of national disaster loss databases and their use is even more important in Arab States were disaster risk reduction is not a very common topic and needs to gain sufficient attention by decision-makers. Further evidence on disaster losses would be a critical aspect to help raise awareness of the general public to understand better the real challenges and issues needed to reduce existing risks and avoid future ones.

[8] This report "Disaster Risk - Poverty Trends in Jordan, Syria, Yemen: Key Findings and Policy Recommendations" was published in 2012 and is accessible at: http://www.unisdr.org/files/27853_arabriskpovertypolicynotejuly2012.pdf
[9] UNDP, 2013. A comparative review of country-level and regional disaster loss and damage databases. http://reliefweb.int/sites/reliefweb.int/files/resources/Comparative%20Review%20of%20country-level%20and%20regional%20disaster%20loss%20and%20damage%20databases.pdf

3. CONCLUSION AND RECOMMENDATIONS

This analysis presented disaster loss and damage data from Arab States and examined the practices, methodologies and the process used for establishing and managing disaster damage and loss databases in the Arab region. It presented, for the first time, new national loss and damage data resulting from newly established national disaster loss databases, including a presentation of disaster losses spatio-temporal distribution. It also compared this expanded datasets with other previously available data for the region emanating from the International Disaster Database EM-DAT. The second part of the analysis examined further how disaster loss data is gathered and used. This review sought to present new results, identified progress and good practices, but also presented main challenges to current disaster loss data management practices in the countries and the region as a whole, and contributes below with suggestions for improvement.

As the report revealed, the UNISDR led initiative to establish at national disaster loss databases in Arab States played a paramount role in collecting new and archiving disaster data. A quick comparison between the traditionally used EM-DAT and national disaster loss databases of countries that possess both databases highlighted how significant these countries' loss profiles have changed and how a more appropriate picture about disasters in these countries can be drawn.

3.1 Disaster impact according to national disaster loss databases

The key finding of the regional analysis of damages and losses in Arab States according to the ten available national disaster loss databases in the Arab countries are:

1. Heavy and costly loss and damage: A total of 14,899 events were recorded over the thirty years study period 1982 – 2011. These events cost the lives of 8,400 people and destroyed and damaged 139,061 houses. The highest mortalities were observed in Yemen, followed by Morocco and Djibouti where respectively 3,824; 2,157 and 896 fatalities were recorded. The areas that recorded the most destroyed and damaged houses are Yemen followed by Tunisia and Morocco.

2. Hydro-meteorological events are much more frequent and destructive than geophysical ones in the ten countries: Respectively 14,477 and 422 hydro-meteorological and geophysical events were recorded. The total of the destroyed and damaged houses by hydro-meteorological events is higher than those of geophysical events. However the ratio of deaths over the number of events is higher for geophysical events than for hydro-meteorological ones.

3. Temporal analysis of damage and loss through national disaster loss databases showed a random distribution: Several gaps and discontinuities in the time series were detected in several databases. This reflect the challenges of retrospective historical data collection, in particular in countries, where there is a lack of open data access and no or limited tradition of archiving such information.

4. The number of events experienced several fluctuations from 1982 to 2011, with a clear overall increasing trend: The last decades experienced more disasters, especially between 1992 and 2011. The period 1982 – 2011 experienced 95 % of the events. The recorded damage and loss follows the same tendency.

5. The period 2004 to 2011 appears to have higher mortality, than the years before: This could be explained by the impact of climate change, which results in more intense and frequent hazardous events in the Arab region such as the cyclones affecting Oman and Somalia or respectively more frequent winter storms and flooding in the Mashrek and the Gulf region. Other factors and risk drivers are increased exposure and vulnerability of populations due to demographic growth and uncontrolled urbanization, rural to urban migration, absent or sub-optimal land-use and urban planning, destruction of eco-systems, pollution and poverty. Additionally, the beginning of disaster and loss data recording in the Arab region reflects a slow, but increasing awareness by governments on the importance of disaster risk management and climate change adaptation which may have contributed to better statistics. Better recording was mainly spearheaded by the UNISDR led launch of Global Disaster Loss Collection Initiative and more recent events were still fresh in memories, allowing their recording.

3.2 Disaster impact in the Arab region (combined statistics em-dat and national disaster loss databases)

EM-DAT analysis confirmed national disaster loss databases analysis findings and complemented them with data for those twelve countries without national disaster loss databases. However, the restrictive criteria of the International Disaster Loss Database, which only considers major disasters or those triggering official declarations of emergency, are less comprehensive on an individual country basis. Nonetheless this combination was helpful to arrive at statistics for Arab States, which was improved by the ten national disaster loss databases. The analysis of losses using EM-DAT and national disaster loss databases provided a greater overview of losses and damages in the Arab region[10]. Disaster loss and damage impact for both combined databases revealed that:

1. The total number of events recorded in the 22 Arab countries rose to 15,088 instead of 323 recorded in EM-DAT (during 1982 and 2011). These events claimed the lives of 169,008 people, affected 52.14 million people and led to a combined damage of US$ 19.30 billion.

2. While, deaths caused by hydro-meteorological hazards have relatively greater geographical extent and concern 17 countries in the Arab region, deaths related to geophysical hazards are more concentrated and concern only 11 countries (Algeria, Comoros, Egypt, Iraq, Jordan, Kuwait, Lebanon, Morocco, Somalia, Sudan and Yemen).

3.3 Findings from the damage and loss data gathering process

The Global Damage Data collection initiative, promoted by UNISDR-ROAS in the Arab region has led to the implementation of ten national disaster loss and damage databases in Comoros, Djibouti, Egypt, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Yemen. Thanks to this initiative new data has been assessed. Moreover, the initiative helped raise awareness – with varying level of success– on the importance to systematically assess loss data. This outcome is not to be underestimated because it helped kick start a process which still needs to be further substantiated to be sustainable and useful over time. This first regional analysis of disaster losses in Arab States has made it possible to contribute to the debate on how to address disaster loss reporting in the region. In spite of the success and usefulness of newly available data, the analysis revealed many shortcomings associated with the process of disaster damage and loss data management. The main weaknesses are explained by the absence of clear and agreed national mechanisms for DRR data management, and especially for the case of damage and loss in Arab States. The identified issues that handicap the implementation of ideal disaster loss and damage databases in the Arab countries are institutional, organizational, logistical, technical and even political for some countries. In several cases, these lead to incomprehensive and poor national disaster loss databases.

3.4 Recommendations

To further substantiate and expand the successes of the national disaster loss initiatives and to address various existing constraints and shortcomings regarding their establishment, management and use, the following recommendations are proposed:

1. Further institutionalize the disaster damage and loss data management process. A comprehensive disaster damage and loss databases requires the establishment of a sound enabling environment for disaster loss and damage data collection and management. Current processes followed have not succeeded in ensuring that disaster loss data is sufficiently used to inform disaster risk reduction and development efforts. Disaster loss data collection and management should be further institutionalized with clear mandated authority conferred by legislation and related decrees stressing clarity in roles and responsibilities. Importantly, human, technical and financial resources should be mobilized to support the whole process, from data gathering to the relevant documentation of analytical reports and their dissemination among decision-makers and the general public through open access. It is highly recommended that relevant partners should be a governmental institution, which is also part of the national disaster risk reduction platform[11]. The relevant institution should enjoy the necessary authority for the management of the disaster damage and loss data cycle.

[10] The most telling example of this is the major drought in 1985 in Sudan, which resulted in over 150.000 casualties. Also major earthquakes and flooding in Algeria need to be mentioned. Loss data for these events is only available through the International Disaster Loss Database.
[11] More information on National Platforms for DRR and their role as multi-stakeholder, multi-sectoral national coordination mechanisms can be found on the following UNISDR supported website: http://www.preventionweb.net/english/hyogo/national/.

Countries which established national disaster loss databases collected the data nationwide. In some countries, like Jordan and Morocco, data was gathered at the central level. Such a centralized approach can lead to a poor and non-exhaustive database. Instead, these countries as well as others should involve local partners and institutions during data collecting processes.

In some countries, only consultants were involved in the data gathering process, while in others a combination of national officials, volunteers and/or consultants jointly collected data (Morocco and Syria). Since the data gathering process should be sustainable, i.e. regular, continual and systematic overtime, national officials should be in charge of overseeing this important task and carry it out with support of employees or volunteers. Consultants could focus on tasks such as national and regional training and in-depth analysis of national disaster loss databases.

2. Make disaster damage and loss databases an integral part of the national disaster reduction system. Disaster damage and loss databases are not a secluded tool. The national disaster loss reporting and analysis must become an integral part of the national disaster reduction system, especially the data information system. National disaster loss databases should be customized and adapted in order to inform decision-makers and help them to implement national DRR strategies and appropriate plans for disaster risk reduction.

3. Deepen understanding and ownership of disaster loss databases. It is paramount that governments have a clear understanding that data and inventories of disasters are vital for identifying and tracking patterns of disaster risk, and are aware of their role in managing national disaster loss databases. National institutions, in charge of disaster risk management and their partners must provide appropriate databases, and facilitate their use in the different phases of the disaster risk cycle to make important decisions and avoid creation of new risk, while reducing existing ones. These aspects have to be further addressed in Arab States.

4. Further promote the concept and practice of managing disaster loss databases through capacity development. Linked to the previous aspects, the advantages and approaches to arrive at, and maintain a comprehensive disaster damage and loss database are still not sufficiently known in the region. There is an imperative and urgent need to develop and roll-out a capacity-building plan in order to strengthen the regional and national competencies in terms of damage and loss assessment and convince countries without databases to adopt good practice. This however also applies to countries with existing databases, as many stakeholders and their mostly governmental services remain reluctant or clearly reject disaster loss data sharing practices and open access by the general public and sometimes even other Ministries and technical services.

5. Continue and expand technical and non-technical support and coaching from national, regional and global partners and mobilize resources for it. Thanks to the UNISDR initiative, ten Arab States implemented their national disaster loss databases. Continued support by regional and international partners is required to help the remaining countries to set up, customize and use their national disaster loss databases, in order to ensure the full benefits of the databases. UNISDR should lead this effort in collaboration with UN Country Teams and support by other international partners like the World Bank and others. Similarly, the League of Arab States as the main regional organization, and other sub-regional partners as the Cooperation Council of the Arab States of the Gulf and the Maghreb Union (Union du Maghreb Arabe) should devise policies and support programmes to fund and build in-house capacity for disaster risk accounting. Arab High Income countries and traditional donors should contribute to such efforts.

Beyond support through regional and national training of countries without national disaster loss databases, refresher trainings for the other countries are strongly recommended. These training sessions could be organized for different levels, from beginners to advanced level. Similarly, the central national institution should continue to support sub-national partners at governorate and municipality level.

A proposed diagram for technical and non-technical support regarding risk knowledge and especially disasters damage and loss databases in the Arab region is given in the following figure:

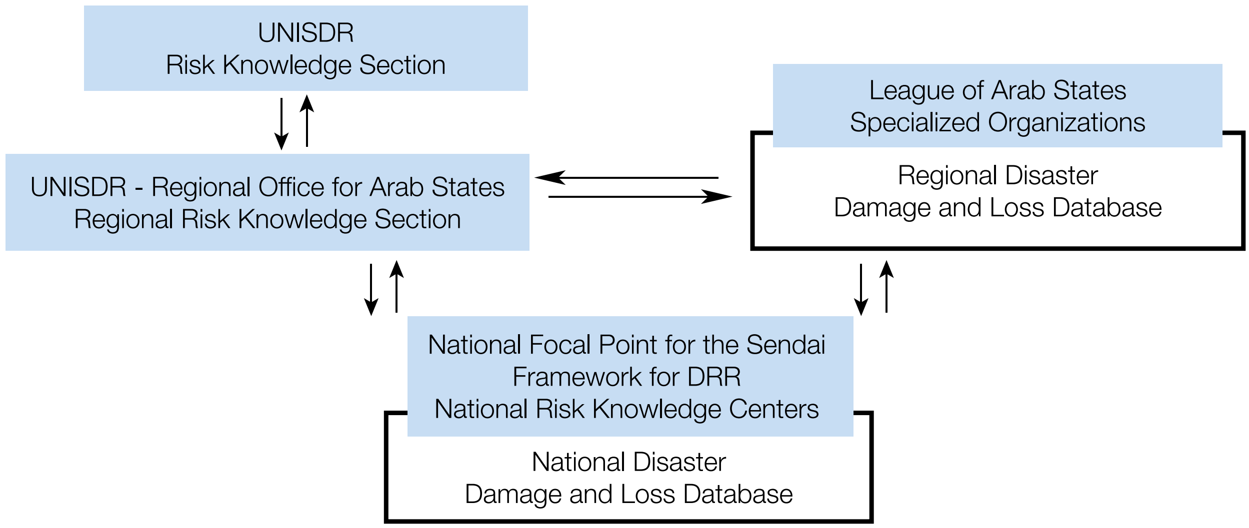


Figure 30. Diagram for a proposed scenario for risk knowledge support in the Arab region (LAS= League of Arab States)

Developments and progress made in the area of risk knowledge at the UNISDR headquarters and at regional level (UNISDR-ROAS) will be regularly shared with League of Arab States specialized organizations. The UNISDR ROAS regional Risk Knowledge section and the specialized organizations of the League of Arab States will ensure the strengthening of capacities of Arab States institutions in terms of the risk-information and in the knowledge management cycle, including disaster damage and loss data gathering and analysis. The proposed National Disaster Risk Knowledge Centre is a national institution which should have all the needed DRR expertise. It should operate under the auspices of the national focal point (NFP) of the Sendai Framework for DRR.

7. Improve and sustain the data collection process and perform quality controls. To elaborate and follow clear and detailed schemes for systematic data collection, interpretation and use of spatio-temporal assessment, it is important to specify which institutions at national, sub-national and possibly regional and global level need to be involved. This effort should include a capacity development plan to improve national competencies, with provisions for an archiving strategy.

Since the quality and completeness of data are crucial for useful analysis, at the end of the data collection process, data should be double-checked and the quality assessed according to control mechanism. Thus, the national disaster risk reduction data management strategy should review what reliable sources of information should be used and quality control is needed during and after the regularly repeated data collection process.

8. Perform an in-depth national analysis of disaster loss databases. It appears from the survey that there is currently very limited use of national disaster databases. Also, the available functionalities of the DesInventar methodology are underutilized by almost all countries. To address this shortfall and further explore the potential of the methodology, it is suggested to develop a detailed analysis of needs and possibilities and to establish updated standard templates and/or guidelines for national disaster collection and use. These templates could be used to generate basic results from the national disaster loss database, and should be adapted by each country according to its needs.

9. Further build the DesInventar tool to strengthen risk analysis capabilities. While DesInventar played a crucial role in terms of disaster damage and loss data gathering, archiving and analysis in the Arab region, it is time now to explore the development of an improved version with more analytical capabilities, including probabilistic risk assessment, Average Annual Loss estimation and other specific indicators. This could help to overcome existing shortcomings in the Arab region and will contribute to the implementation and addressing new challenges raised in the Sendai Framework for DRR, especially as it relates to the first pillar (Understanding Risk).

4. ANNEXES

4.1 National disaster loss profiles

The following national disaster loss profiles present a summary of information available in the national disaster loss databases established with UNISDR support in ten Arab countries.

4.1.1 Comoros

Data assessed in Comoros refers to ninety (90) disasters. These events have caused the death of 99 people, the destruction of 463 and damage to 1,724 houses. Table 13 illustrates the data collected for losses caused by natural disasters. Its reading highlights that flood is the most recurrent phenomena with 70 events followed by fire. But storm is the event that cost most lives. Indeed the country experienced only two storms but they led to the death of 67 people representing 67% of deaths due to natural disasters. With regard to losses of houses (destroyed and damaged), cyclones and volcanic eruptions caused most damages.

Table 13. Summary of disasters, damages and losses in Comoros

Hazard	Number of events	Deaths	Houses destroyed	Houses damaged
Cyclone	4	7	0	1,611
Drought	1	0	0	0
Volcanic eruption	3	0	293	0
Fire	10	4	10	19
Flood	70	21	160	94
Storm	2	67	0	0
Total	**90**	**99**	**463**	**1,724**

The distribution of losses caused by disasters per province is presented in Table 14. The bulk of deaths are registered in the region of Mwali with 67 followed by the region of Ngazidja with 24 cases. It is the region of Ndzouani that recorded the most losses in terms of damaged houses in the order of 1,620. In terms of destroyed houses, the region of Ngazidja recorded the highest loss with 393 houses destroyed.

Table 14. Distribution of disasters damages and losses in Comoros sorted by province

Governorates	Number of events	Deaths	Houses destroyed	Houses damaged
Mwali	23	67	31	8
Ndzouani	29	8	39	1,620
Ngazidja	38	24	393	96
Total	**90**	**99**	**463**	**1,724**

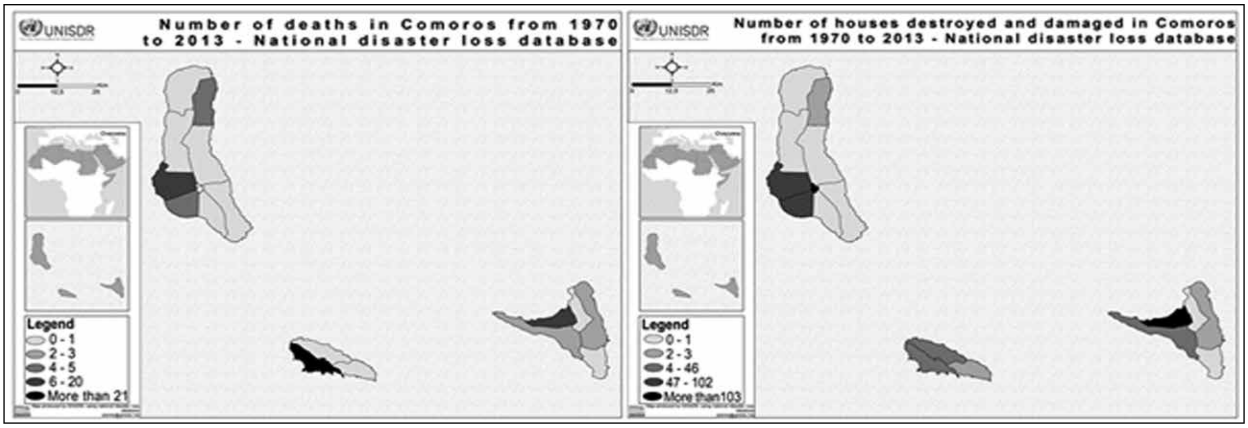


Figure 31. Spatial distribution of deaths and lost and damaged houses in Comoros

Figure 32, Figure 33 and Figure 34 illustrate the temporal distribution of the number of deaths, number of houses destroyed or damaged.

In terms of temporal evolution in the number of deaths, there appears a high fluctuation with a decreasing trend.

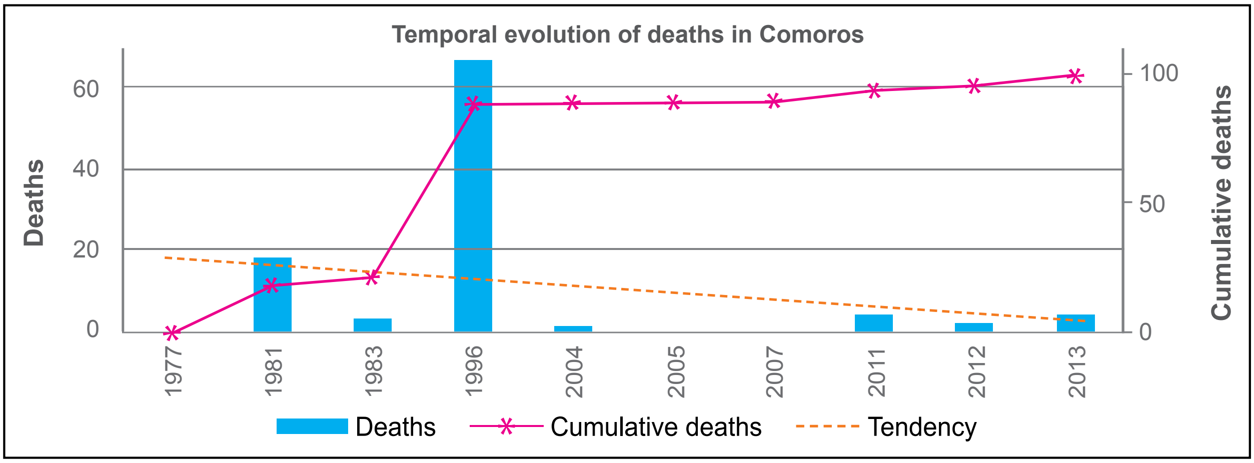


Figure 32. Temporal evolution of lives lost in Comoros (1970-2013)

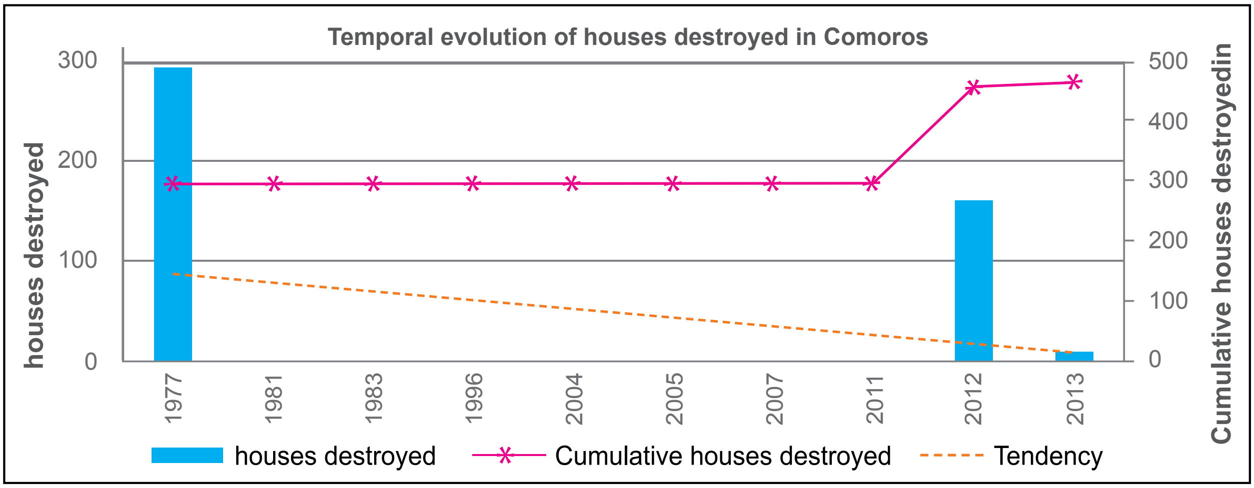


Figure 33. Temporal evolution of houses destroyed in Comoros (1970-2013)

Due to the lack of data, no strong conclusion can be drawn about the destroyed and damaged houses.

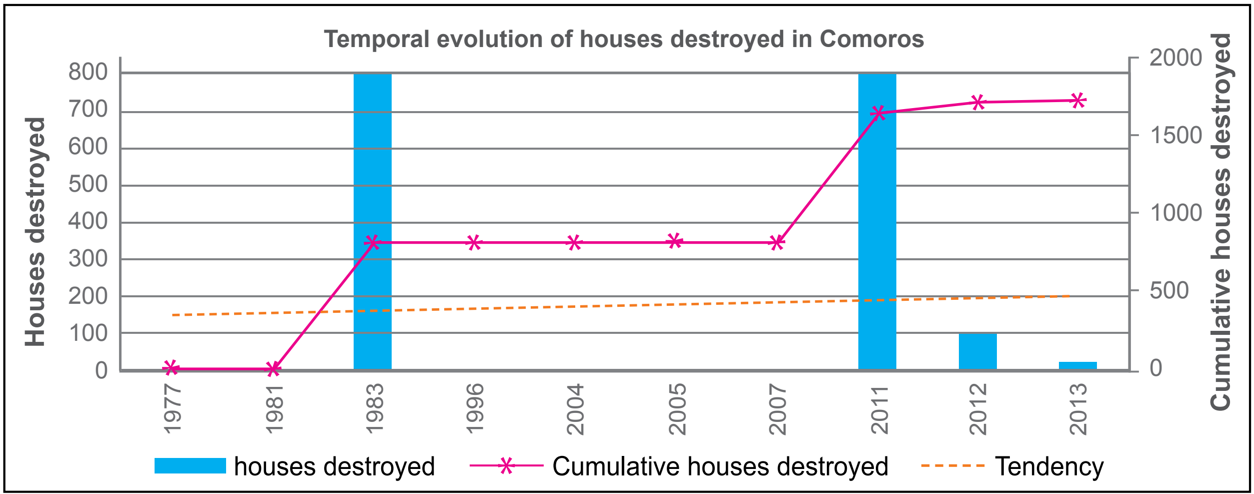


Figure 34. Temporal evolution of houses damaged in Comoros (1970-2013)

Table 15. "Top 10" disasters in Comoros, sorted by number of deaths and type of disasters

°N	Hazards	Deaths	Date	Houses destroyed	Houses damaged
01	Storm	67	16/02/1996	0	0
02	Flood	18	01/01/1981	0	0
03	Cyclone	3	01/01/1983	0	805
04	Cyclone	3	01/01/2011	0	805
05	Flood	2	01/04/2012	32	
06	Flood	1	01/02/2011	0	1
07	Cyclone	1	01/03/2004	0	0
08	Fire	1	01/08/2013	0	1
09	Fire	1	01/08/2013	1	0
10	Fire	1	01/08/2013	1	

4.1.2 Djibouti

Data available for Djibouti covers a time period ranging from 1944 to 2012. During that period Djibouti experienced 377 events as displayed in Table 16. These events led to the death of 947 persons, of which respectively 360 and 199 casualties were caused by flood and storm. It appears that flood is the most frequent event in the country (111 events), followed by drought (85 events). Unfortunately, the damages caused by disasters in Djibouti were not recorded.

Table 16. Summary of disasters and losses in Djibouti

Hazard	Number of events	Deaths	Houses destroyed	Houses damaged
Flood	111	360	NA	NA
Storm	34	199	NA	NA
Drought	85	142	NA	NA
Heat Wave	2	60	NA	NA
Thunderstorm	43	54	NA	NA
Rain	15	46	NA	NA
Landslide	8	30	NA	NA
Cold Wave	5	21	NA	NA
Snowstorm	1	11	NA	NA
Windstorm	42	10	NA	NA
Fire	19	6	NA	NA
Tornado	1	6	NA	NA
Hailstorm	1	2	NA	NA
Earthquake	10		NA	NA
Total	**377**	**947**	**NA**	**NA**

The summary of geographic distribution of disasters and losses in Djibouti is displayed in Table 17. The governorate of Ali Sabieh experienced highest mortality rates, where the death toll reached 559.

Table 17. Distribution of disasters and losses in Djibouti sorted by province

Governorates	Number of events	Deaths	Houses destroyed	Houses damaged
Ali Sabieh	87	559	0	0
Arta	3	0	0	0
Dikhil	73	23	0	0
Djibouti	4	153	0	0
Obock	101	30	0	0
Tadjourah	109	182	0	0
Total	**377**	**947**	**0**	**0**

Figure 35 illustrates the geographic distribution of the number of deaths at the provincial level in Djibouti. With the exception of the province of Arta where there is no human life loss, all other provinces experienced human casualties. This leads to the assumption that data might not have been collected in Arta province.

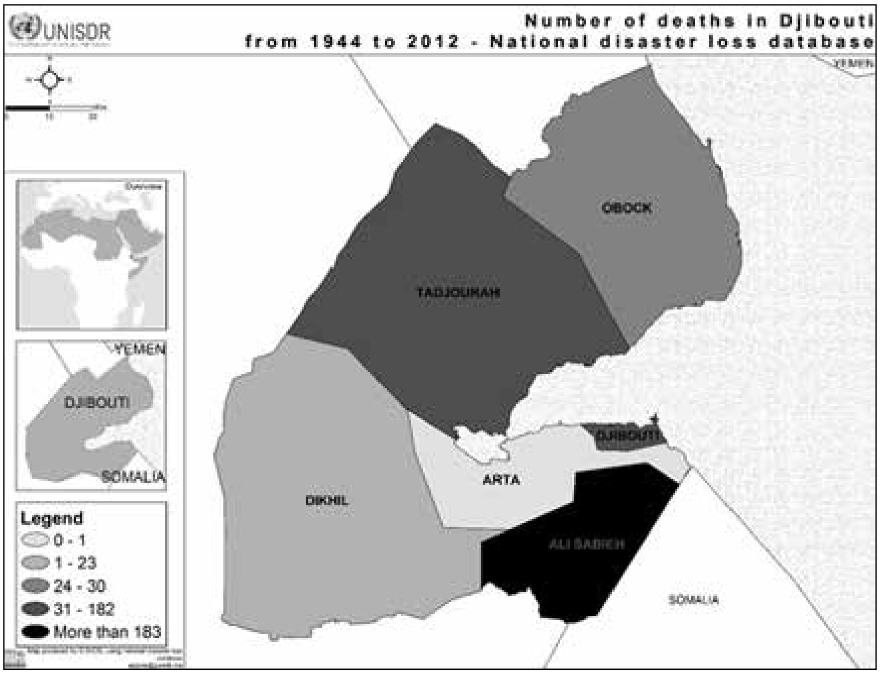


Figure 35. Spatial distribution of deaths in Djibouti

Figure 36 illustrates the temporal analysis of the number of deaths. This figure shows that the number of deaths is quite randomly distributed over time and there is no apparent trend.

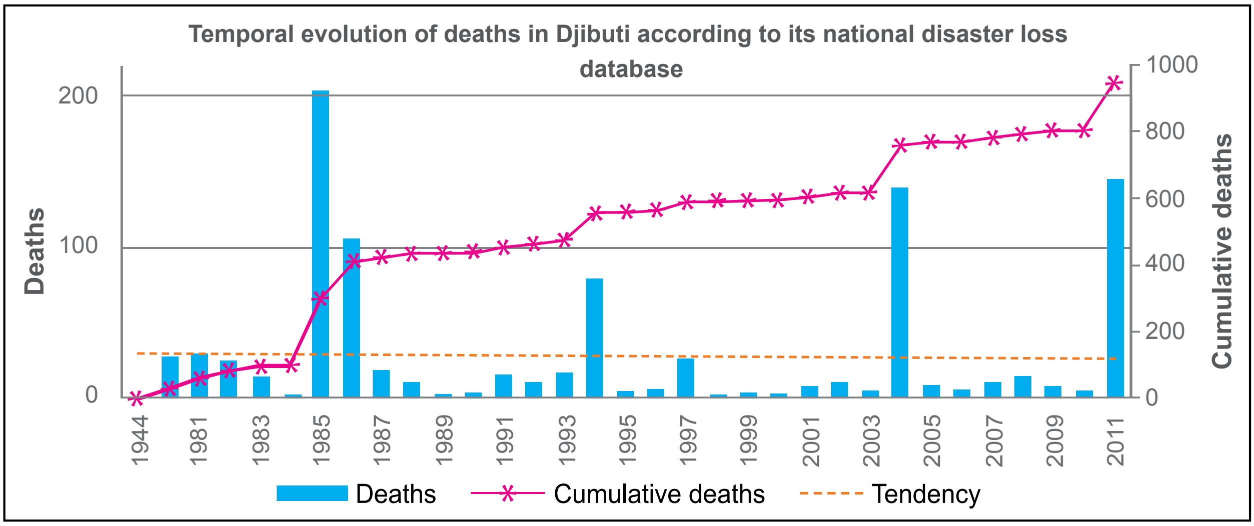


Figure 36. Temporal evolution of deaths in Djibouti (1944-2012)

Analysis of disaster data helped to identify the "Top 10" hazards that caused most deaths (Table 18). Of these, the deadliest event is a storm that cost the life of 180 people in February 1985.

Table 18. "Top 10" disasters in Djibouti sorted by number of deaths and hazard type

N°	Hazards	Date of event	Deaths	Houses destroyed	Houses damaged
01	Storm	-/02/1985	180	0	0
02	Flood	-/04/2004	78	0	0
03	Flood	-/11/1994	50	0	0
04	Flood	17/08/2004	50	0	0
05	Flood	-/02/1986	38	0	0
06	Drought	-/06/2011	31	0	0
07	Heat Wave	-/05/1986	30	0	0
08	Heat Wave	1986	30	0	0
09	Drought	-/08/2011	29	0	0
10	Drought	-/05/2011	28	0	0

4.1.3 Egypt

Egypt's national disaster loss database covers the period 1980 to 2010. It reveals 60 recorded events, which claimed the lives of 53 people and destroyed and damaged, respectively about 1,329 and 1,885 homes. The statistical breakdown of the collected data is presented in Table 19.

Given the size of the country and its population, the highest in the Arab world with nearly 90 million people, the Egypt national disaster loss database does not seem to properly include all phenomena during the thirty years reporting period. The databases does not, for example, include casualties and other losses from the 1992 Earthquake close to Cairo, which according to publicly available sources caused 545 deaths, injured 6,512 and made 50,000 people homeless[12].

Table 19. Summary of disasters, damages and losses in Egypt

Hazard	Number of events	Deaths	Houses destroyed	Houses damaged
Earthquake	13	3	0	239
Fire	4	36	0	0
Flash Flood	1	0	0	0
Flood	1	0	0	6
Liquefaction	38	9	1,329	1,640
Structural collapse	3	5	0	0
Total	**60**	**53**	**1,329**	**1,885**

The summary of the geographic distribution of deaths and damages caused by disasters in Egypt between 1980 and 2010 is reported in Table 20. Using available data, the most affected governorate is Bani Suef which recorded 30 deaths. Aswan experienced more destroyed and damaged houses as compared to other governorates, with 1,194 and 1,101 houses respectively.

[12] See for example the following article on the earthquake in the Journal of Seismology http://link.springer.com/article/10.1023%2FA%3A1009717023043#page-1

Table 20. Distribution of disasters, damages and losses in Egypt by province

Governorate	Number of events	Deaths	Houses destroyed	Houses damaged
Bani Suef	7	30	0	379
Giza	4	11	0	0
South Sinai	29	8	135	405
Aswan	9	4	1,194	1,101
New Valley	4	0	0	0
Suez	7	0	0	0
Total	**60**	**53**	**1,329**	**1,885**

Figure 37 illustrates the distribution of the number of deaths and houses destroyed and damaged at governorate level in Egypt. In this figure, we see that disasters that have caused many casualties are located at Bani Suef, Aswan, Giza and South Sinai. The other governorates experienced fewer events and so less damages and losses (human life and destroyed and damaged houses).

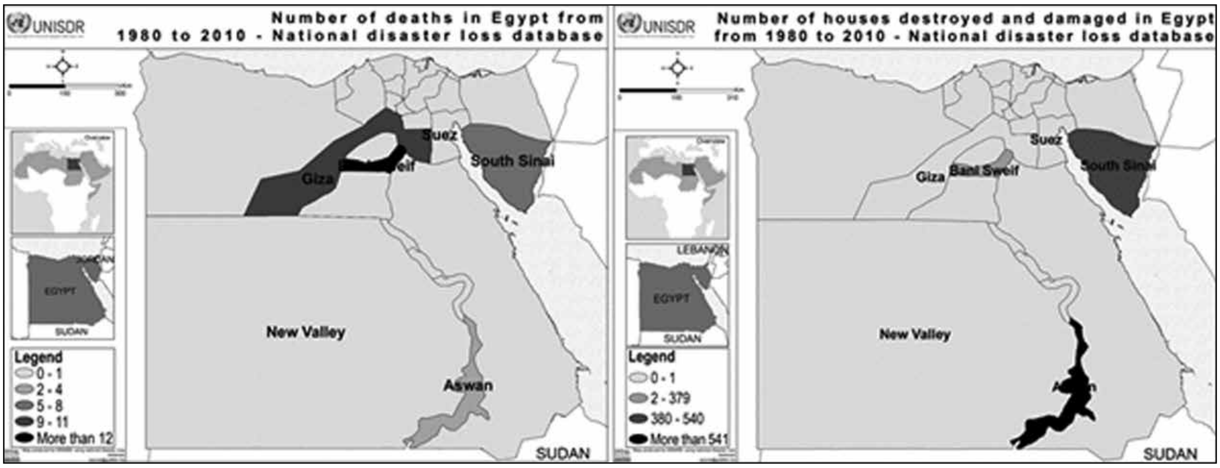


Figure 37. Spatial distribution of death and loss and damage houses in Egypt

Figure 38, Figure 39 and Figure 40 show the temporal evolution of losses caused by disasters from 1980 to 2010. It can be concluded from these that losses from disasters are mainly concentrated in recent years. It seems to indicate that data collected is not complete, as the most deadly disaster (1992 Earthquake) is not included.

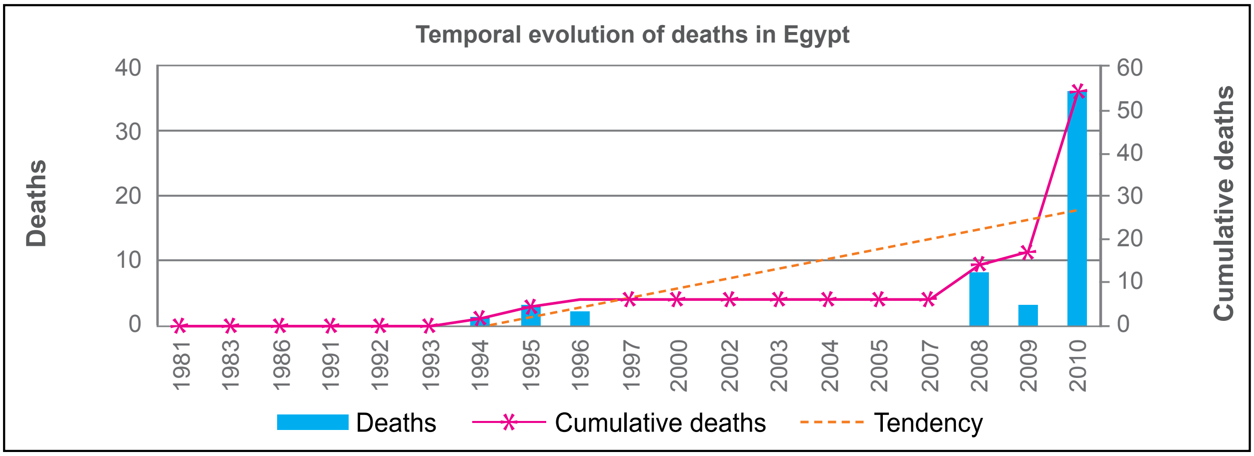


Figure 38. Temporal evolution of deaths in Egypt (1980-2010)

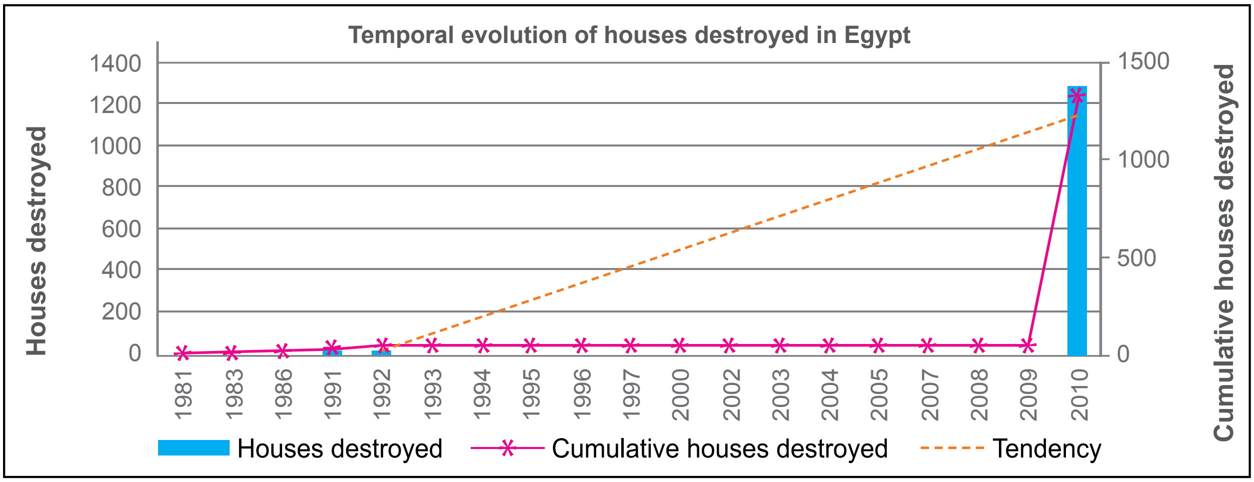


Figure 39. Temporal evolution of destroyed houses in Egypt (1980-2010)

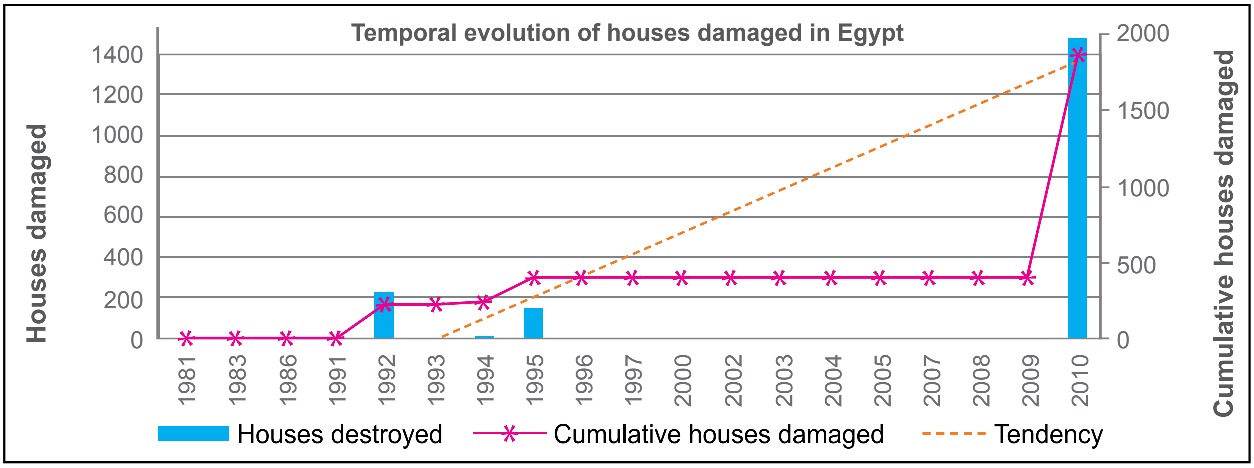


Figure 40. Temporal evolution of damaged houses in Egypt (1980-2010)

Analysis of the database has allowed us to highlight hazards that caused most fatalities. The deadliest natural hazard has been according to the database a fire killing 30 people on 18 September 2010.

Table 21. Top 10 disasters in Egypt sorted by the number of deaths and hazard type

N°	Hazards	Date of event	Deaths	Houses destroyed	Houses damaged
01	Fire	18/09/2010	30	0	0
02	Fire	01/02/2008	6	0	0
03	Liquefaction	18/01/2010	4	1,154	1,101
04	Earthquake	23/11/1995	3	0	0
05	Structural collapse	07/06/2009	3	0	0
06	Liquefaction	17/01/2010	2	122	371
07	Structural collapse	29/10/2008	2	0	0
08	Liquefaction	18/11/1996	1	0	0
09	Liquefaction	18/11/1996	1	0	0
10	Liquefaction	02/11/1994	1	0	0

4.1.4 Jordan

The statistical breakdown of data collected in Jordan from 1981 to 2012 is presented in Table 22. During these years, 626 events were recorded. These correspond to storms, frost, floods and droughts. The table below reveals that disasters during the reference period have claimed the lives of 152 people. Destroyed and damaged houses caused by these events are 91 and 596 respectively.

Table 22. Summary of disasters, damages and losses in Jordan

Event	Number of event	Number of deaths	House destroyed	Houses damaged
Flash flood	51	56	9	55
Flood	95	31	8	46
Snowstorm	164	19	64	324
Cold Wave	9	17	0	0
Rains	19	10	2	66
Landslide	7	8	0	12
Structural collapse	7	7	8	2
Liquefaction	2	2	0	0
Earthquake	38	1	0	91
Fire	5	1	0	0
Avalanche	2	0	0	0
Drought	92	0	0	0
Dust storm	3	0	0	0
Forest fire	26	0	0	0
Frost	94	0	0	0
Heat wave	12	0	0	0
Total	**626**	**152**	**91**	**596**

The geographical breakdown of the loss and damage caused by natural disasters in Jordan between 1981 and 2012 is reported in Table 23. It can be seen from this table that in terms of number of deaths, the region of Amman occupies the first place with 37 deaths. In terms of destroyed and damaged homes, the highest losses were recorded at Irbid with respectively 69 and 328.

Table 23. Distribution of disasters damage and loss in Jordan by province

Governorates	Number of events	Deaths	Houses destroyed	Houses damaged
Amman	94	37	2	26
Az Zarqa	34	24	0	6
Irbid	83	23	69	328
Ma'an	100	17	1	31
Madaba	25	14	0	8
Al Balqa	70	11	3	59
Al Mafraq	41	11	8	5
Ajloun	27	8	2	0
Jarash	15	3	1	7
Al Aqabah	35	2	1	98
At Tafilah	41	2	3	18
Al Karak	61	0	1	10
Total	**626**	**152**	**91**	**596**

Figure 41 reveals that the geographic distribution of deaths and destroyed and damaged houses is different from governorate to governorate; Amman experienced more deaths with a total of 37, while Irbid had most destroyed (69) and damaged (328) houses.

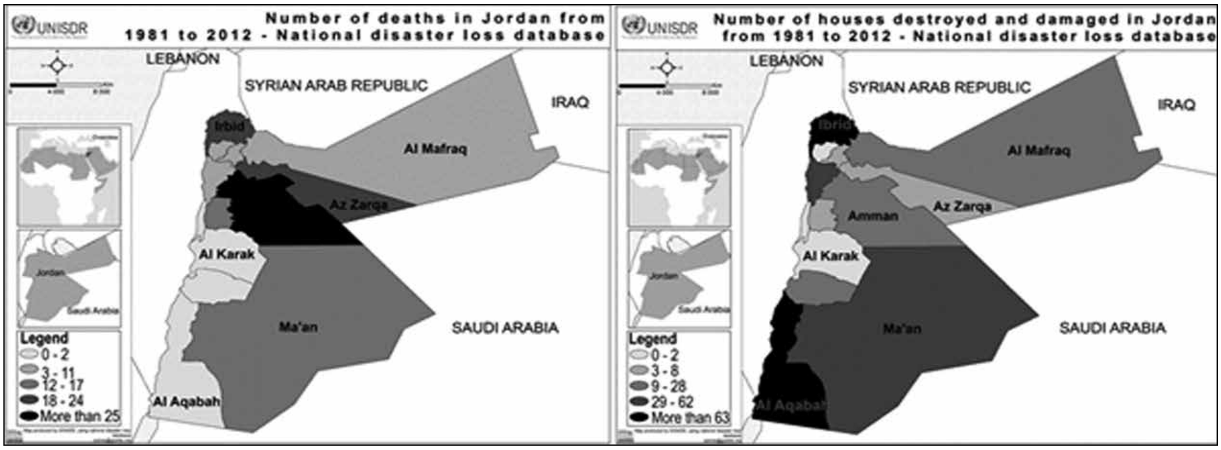


Figure 41. Spatial distribution of deaths and lost and damaged houses in Jordan

Figure 42, Figure 35 and Figure 44 illustrate the temporal evolution of losses caused by disasters. These illustrations show that recorded losses or damages, expressed in terms of deaths and in terms of destroyed and damaged houses, is distributed randomly in time. It is noteworthy that the temporal evolution of fatalities is slightly decreasing overtime, while the number of destroyed and damaged houses is stable.

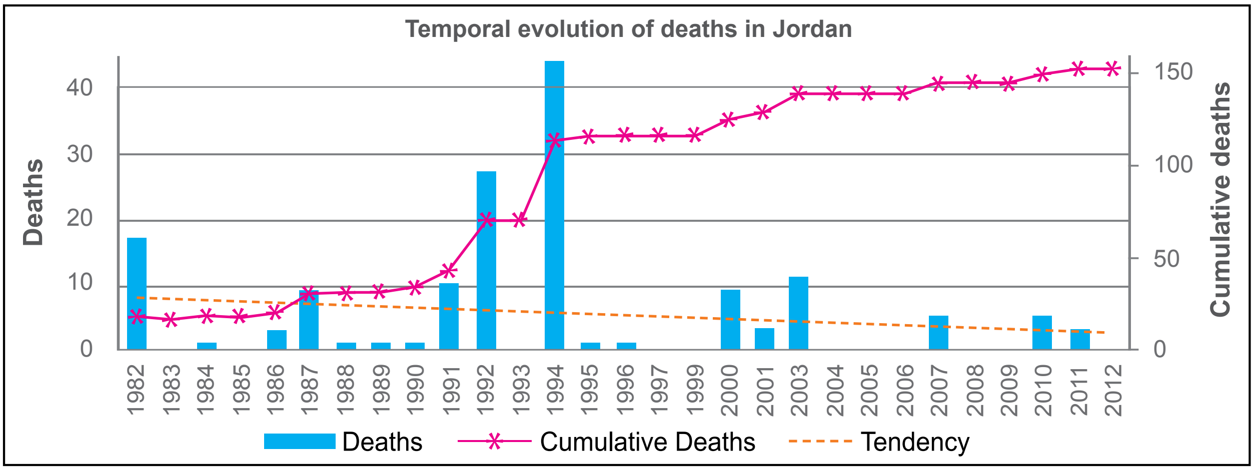


Figure 42. Temporal evolution of deaths in Jordan (1981-2012)

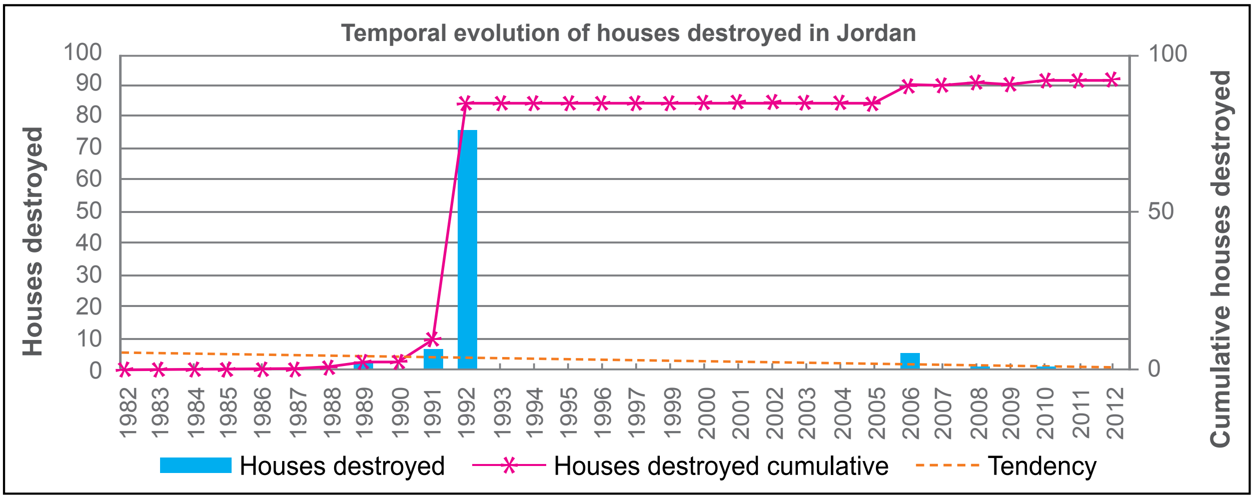


Figure 43. Temporal evolution of destroyed houses in Jordan (1981-2012)

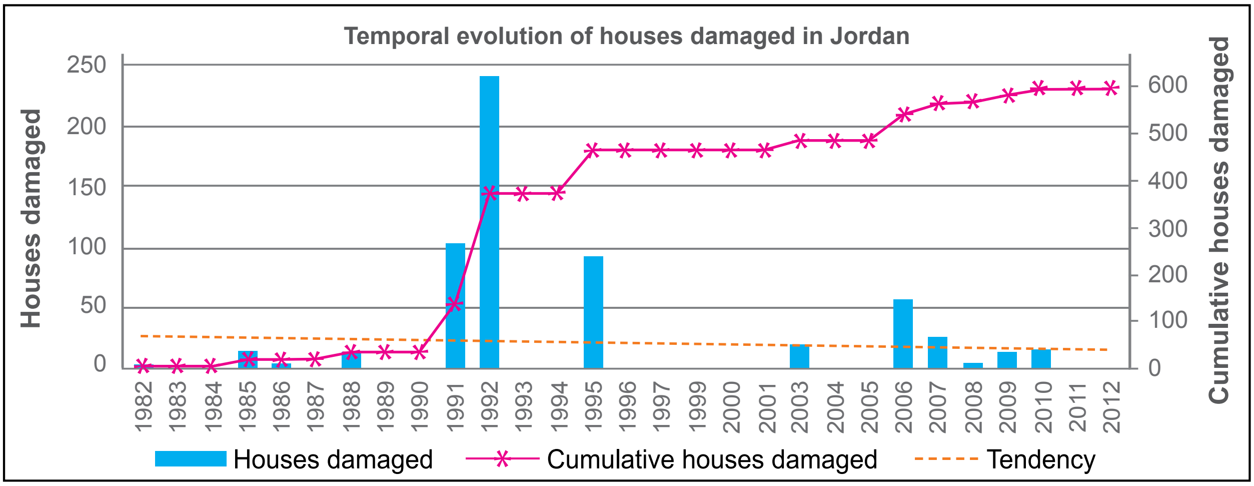


Figure 44. Temporal evolution of damaged houses in Jordan (1981-2012)

Analysis of the database has allowed us to highlight the hazards that caused most fatalities. The deadliest natural hazard has been according to the database floods, with each event killing nine people in December 1987 and in January 1994.

Table 24. "Top 10" disasters in Jordan sorted by the number of deaths and types of disaster

N°	Hazards	Date of event	Deaths	Houses destroyed	Houses damaged
01	Flood	-/01/1994	9	0	0
02	Flood	-/12/1987	9	0	0
03	Flash flood	15/05/1982	7	0	0
04	Rains	14/05/1982	7	0	3
05	Flash flood	03/11/1994	6	0	0
06	Landslide	05/02/1992	6	0	0
07	Flash flood	03/11/1994	5	0	0
08	Flash flood	01/11/1994	5	0	0
09	Flash flood	01/11/1994	5	0	0
10	Flash flood	03/11/1994	5	0	0

4.1.5 Lebanon

Data collected in Lebanon covers the period 1980 to 2011 and presents 2,508 disaster events, which are displayed in Table 25. It appears that forest fires cause most frequent disasters in the country, followed by flash floods with respectively 1,424 and 128 events. Lebanon's disaster loss database records 142 deaths, of which landslides caused the highest number of casualties (23). These events caused significant damage on buildings. The destroyed and damaged houses totaled respectively 178 and 1,342, ruined mainly by torrents, forest fires and flash flood.

Table 25. Summary of disasters, damages and losses in Lebanon

Hazard	Number of events	Deaths	Houses destroyed	Houses damaged
Winter storm	335	92	48	809
Landslide	65	23	40	15
Snow storm	83	6	1	1
Cold wave	4	3	0	0
Storm	62	3		14
Wind storm	28	3	0	1
Flood	83	2		16
Forest fire	1,424	2		72
Torrent	38	2	26	286
Avalanche	4	1	0	1
Flash flood	128	1	36	34
Freezing rain	2	1	0	0
Rain	4	1	0	0
River flood	12	1		34
Thunder storm	10	1	1	1
Earthquake	35	0	8	26
Erosion	102	0	12	23
Hail	1	0	0	0
Heavy wind	8	0	0	0
High waves	2	0	0	0
Hurricane	1	0	0	0
Mountain wave	1	0	0	0
Sand storm	17	0	0	0
Heavy rain	50		5	8
Lightning	9		1	1
Total	**2,508**	**142**	**178**	**1,342**

The summary of geographic distribution of disaster damages and losses in Lebanon during the period is displayed in Table 26. Most events occurred in Mont Liban region (761). This region experienced 51 deaths. While Baalbek Hermel recorded the most destruction and damage of houses.

Table 26. Distribution of disaster damages and losses in Lebanon by province

Governorates	Number of events	Deaths	Houses destroyed	Houses damaged
Mont Liban	761	51	62	44
Békaa	139	42	17	476
Akkar	289	23	15	194
Baalbek-Hermel	136	12	44	499
Beirut	72	4	4	5
Nord	402	4	13	10
Nabatiyé	354	3	3	62
Sud	355	3	20	52
Total	**2,508**	**142**	**178**	**1,342**

The maps shown in Figure 45 report that loss and damage observed in Lebanon, divide the territory into two main areas. An area where the numbers of deaths and destroyed and damaged houses exceed 10 casualties and 100 houses damaged or destroyed are the governorates of Baalbek-Hermel, Bekaa, Mont Liban and Akkar. The second area is composed of other governorates, where the numbers of deaths and destroyed houses are less than 10 and 100, respectively.

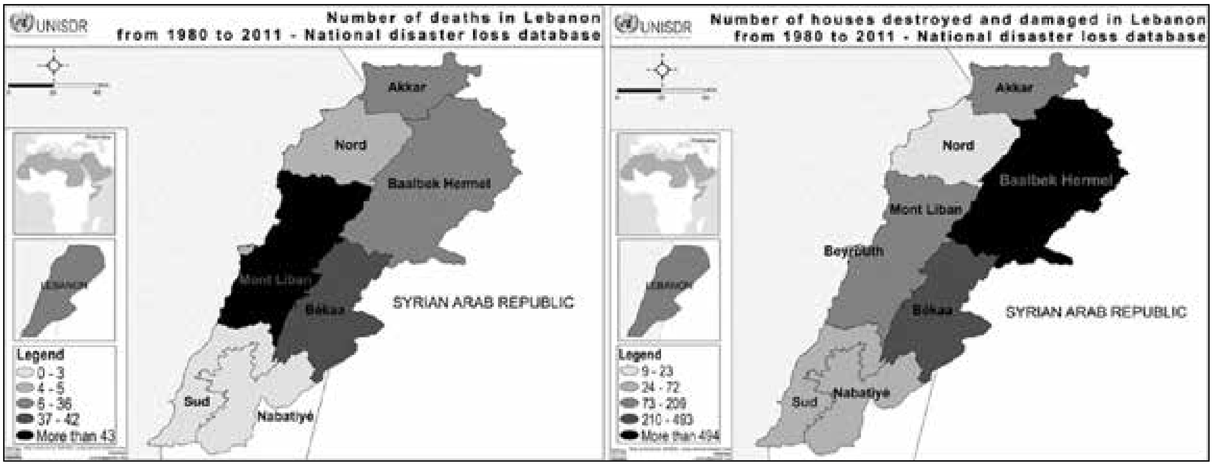


Figure 45. Spatial distribution of deaths and lost and damaged houses in Lebanon

The temporal analysis of the number of deaths and houses destroyed and damaged is illustrated in Figure 46, Figure 47 and Figure 48. These figures show that the number of deaths in Lebanon over time has a decreasing trend while the number of houses damaged and destroyed remained stable. The destroyed and damaged houses are randomly distributed over time.

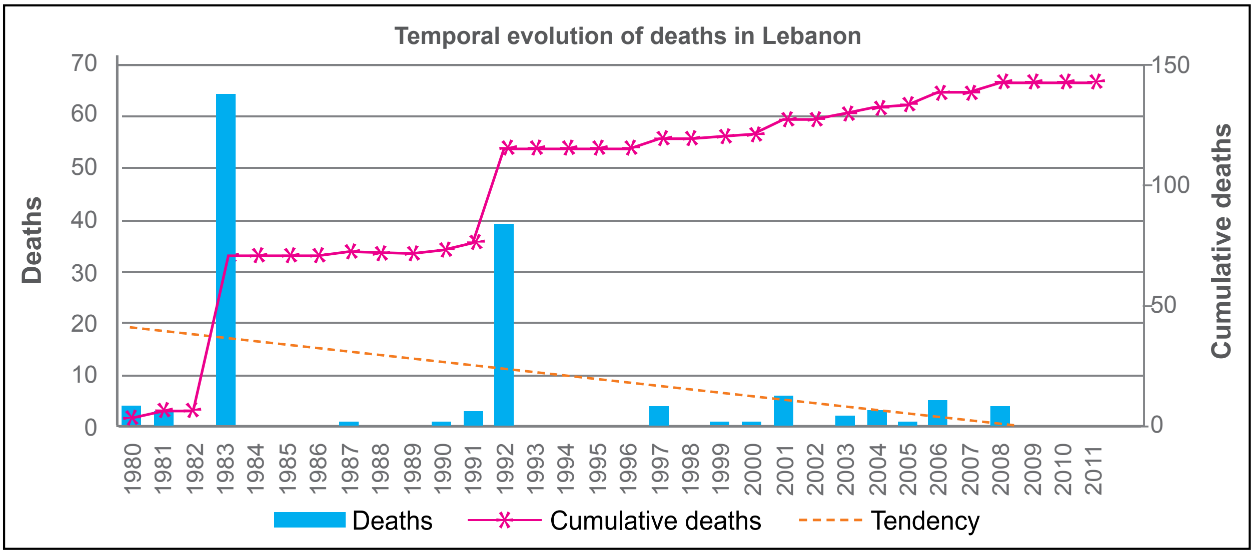


Figure 46. Temporal evolution of deaths in Lebanon (1980-2011)

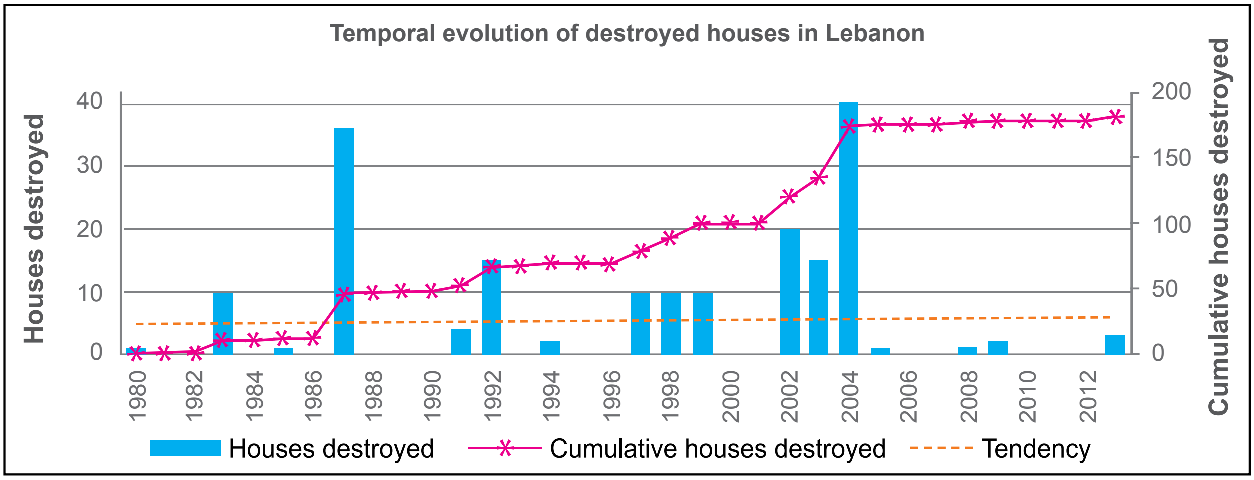


Figure 47. Temporal evolution of destroyed houses in Lebanon (1980-2011)

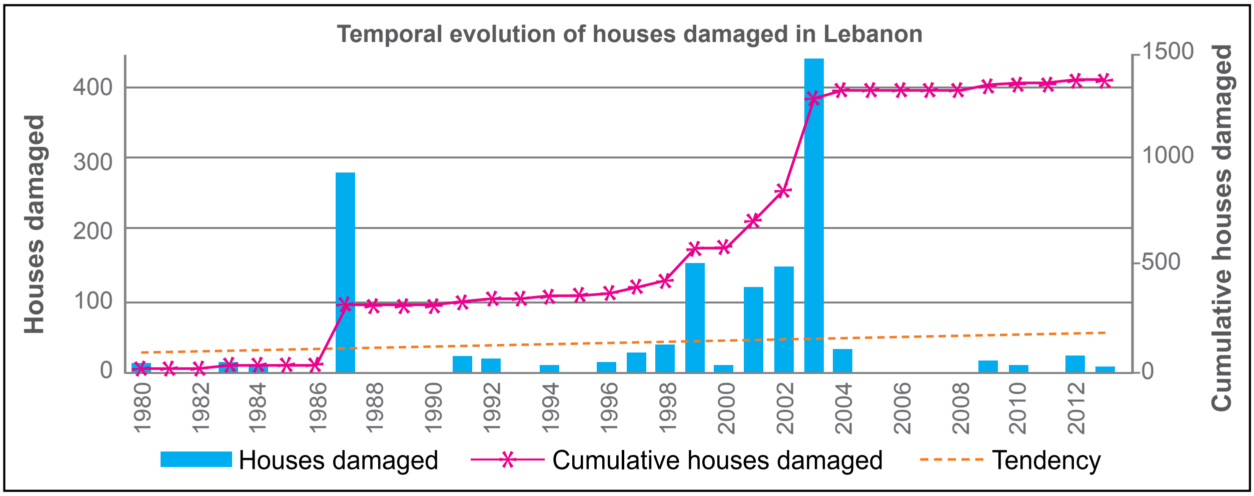


Figure 48. Temporal evolution damaged houses in Lebanon (1980-2011)

The counting of the database in Lebanon gave the ranking of the top risks causing most deaths (Table 27). Highest death toll was recorded for a winter storm with a total of 39 deaths.

Table 27. "Top 10" disasters in Lebanon sorted by number of deaths and type of disasters

°N	Hazards	Date	Deaths	Houses destroyed	Houses damaged
01	Winter storm	18/02/1983	39	0	0
02	Landslide	10/12/1983	19	10	0
03	Winter storm	02/11/1992	15	0	0
04	Winter storm	06/02/1992	13	0	0
05	Winter storm	02/11/1992	3	0	0
06	Winter storm	09/02/1992	3	0	0
07	Snow storm	11/01/1983	3	0	0
08	Winter storm	29/11/1991	2	0	0
09	Winter storm	25/03/1980	2	0	0
10	Winter storm	06/02/1992	2	1	0

4.1.6 Morocco

During the period 1960 to 2014, 732 disasters were recorded in Morocco. Table 28 shows a breakdown of disaster losses and damages. It appears that forest fire is the recurrent hazard, with 640 events. The recorded events caused 14,197 deaths, from which 12,641 were due to earthquakes and 1,333 were due to floods. Regarding destroyed and damaged houses, they amount to 5,122 and 21,910 respectively.

Table 28. Summary of disasters, damages and losses in Morocco

Hazard	Number of events	Deaths	Houses de-stroyed	Houses damaged
Earthquake	8	12,641	1,079	12,380
Flood	84	1,360	4,039	9,455
Fire	640	196	4	85
Total	**732**	**14,197**	**5,122**	**21,920**

The distribution of losses caused by disasters across the provinces of Morocco is presented in Table 29.

Table 29. Distribution of disasters, damage and losses in Morocco by province

Governorates	Number of events	Deaths	Houses destroyed	Houses damaged
Souss Massa Draa	21	12,006	2,256	6,780
Marrakech Tensift Al-Haouz	26	910	8	16
Taza Al Hoceima Taounate	73	689	969	12,484
Grand Casablanca	24	196	126	89
Doukkala Abda	9	131	100	0
Gharb Chrarda Beni Hssen	65	113	1,216	1,296
Meknès Tafilalet	91	62	43	107
Chaouia Ouardigha	22	45	17	34
Tanger Tétouan	227	25	338	968
Rabat Salé Zemmour Zear	31	13	12	13
Tadla Azilal	21	7	32	100
Fès Boulemane	26	0	1	7
Oriental	95	0	4	26
Laayoune Boujdour Sakia El Ham	1	0	0	0
Total	**732**	**14,197**	**5,122**	**21,920**

The analysis reveals that the region of Souss Massa Draa is the one that experienced most losses. Indeed, a very large number of 12,006 deaths are registered in this region. This is mainly due to the devastating massive earthquake of 1960 in Agadir (see below). This region is followed by that of Marrakech Tensift Al-Haouz where the death toll reached 910.

Figure 49 provides more details about the geographic distribution of deaths, destroyed, and damaged houses in Morocco.

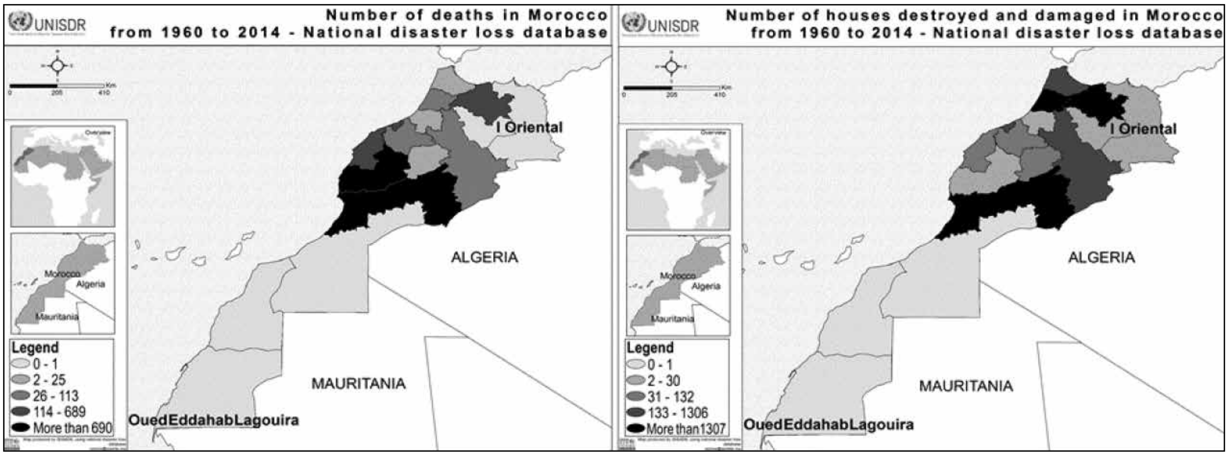


Figure 49. Spatial distribution of deaths and lost and damaged houses in Morocco

Figure 50, Figure 51 and Figure 52 show the temporal evolution of the losses caused by disasters from 1960 to 2014. Taking into account the disastrous event of 1960 (the massive Agadir earthquake), we can assume the number of deaths is decreasing. This event alone accounts for around 85% of deaths in Morocco, considerably influences the trend. The number of destroyed and damaged houses is conversely increasing.

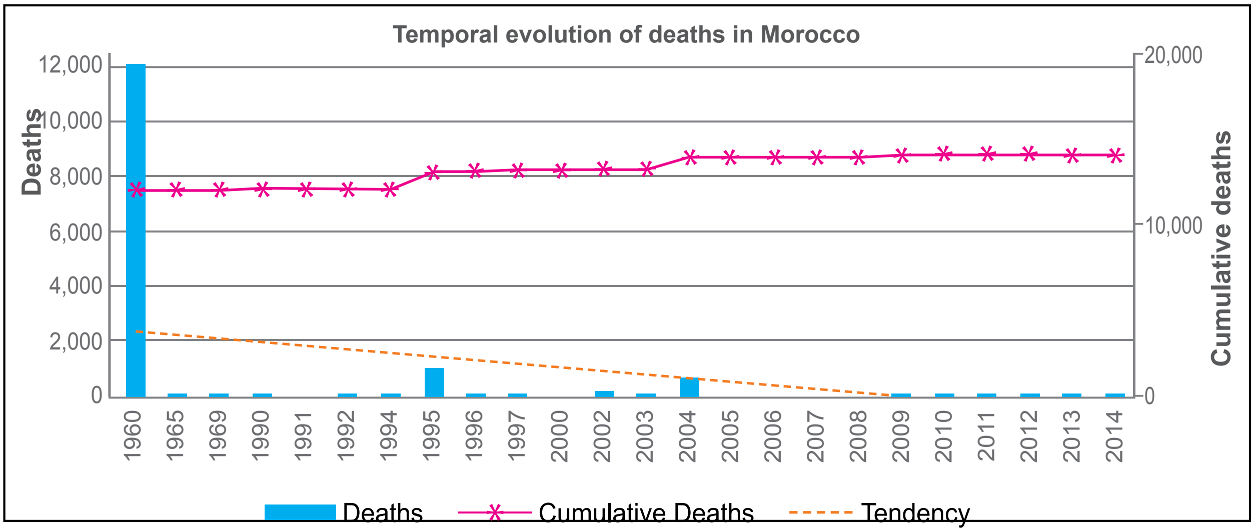


Figure 50. Temporal evolution of deaths due to disasters in Morocco (1960-2014)

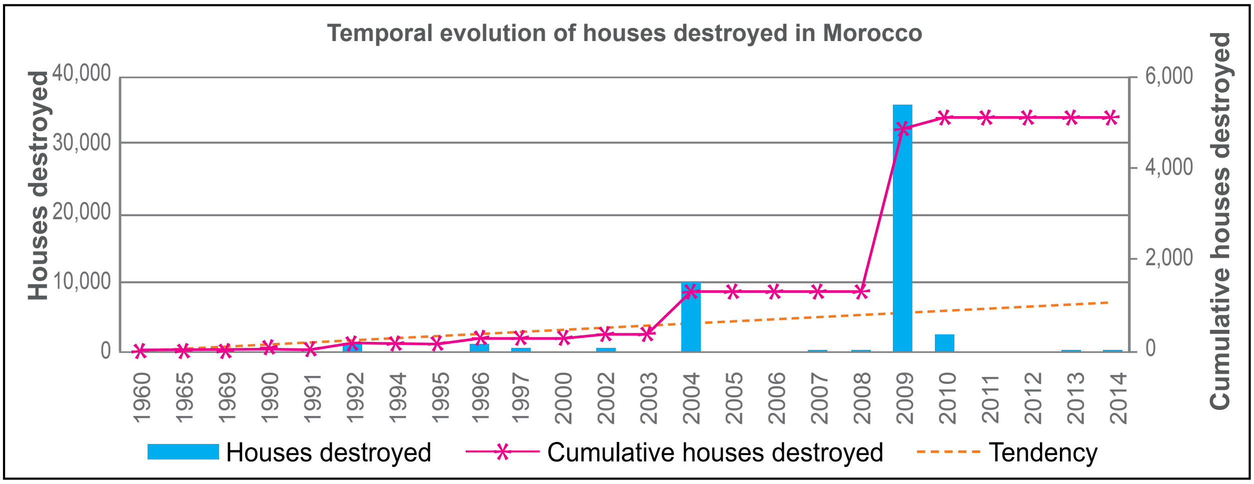


Figure 51. Temporal evolution of destroyed houses in Morocco (1960-2014)

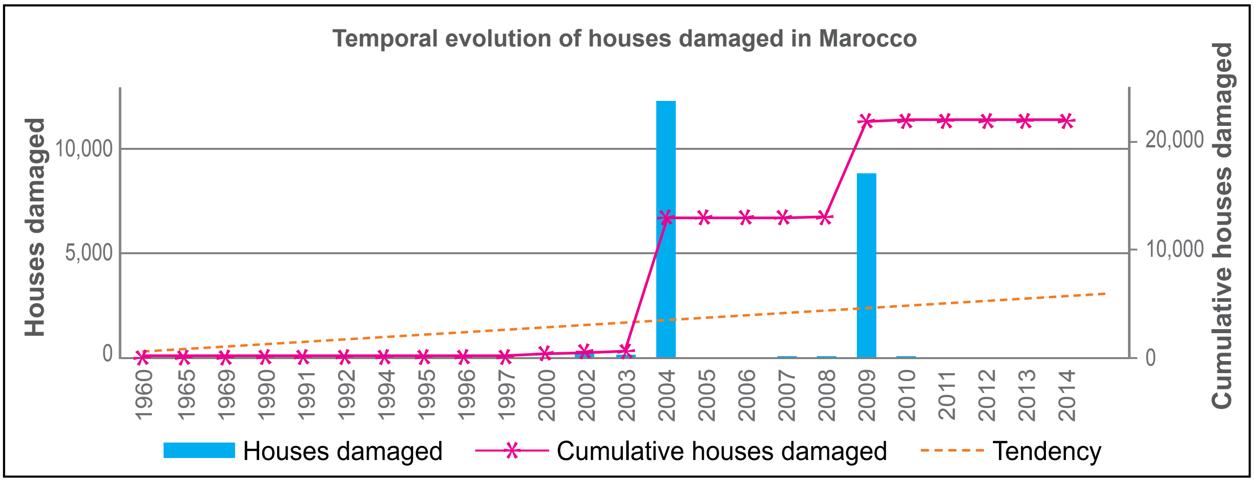


Figure 52. Temporal evolution of damaged houses in Morocco (1982-2011)

The review of the database provided the “top ten” hazards that caused most deaths (Table 30). Of these, the deadliest event is the Agadir earthquake that cost the lives of 12,000 people on 29th February 1960. No data has been retrieved for the number of houses destroyed or damaged.

Table 30. "Top 10" disasters in Morocco, sorted by number of deaths and hazard type

°N	Hazards	Date of event	Deaths	Houses destroyed	Houses damaged
01	Earthquake	29/02/1960	12,000	0	0
02	Flood	19/08/1995	730	0	0
03	Earthquake	24/02/2004	628	967	12,367
04	Flood	19/01/1995	150	0	0
05	Flood	24/11/2002	80	0	0
06	Flood	19/09/1997	60	19	0
07	Fire	26/04/2008	55	0	0
08	Fire	01/11/2002	52	0	0
09	Fire	01/11/2002	50	0	0
10	Flood	06/02/2009	50	400	720

4.1.7 Palestine

During the period 1980 to 2013, about 411 disaster events were recorded in Palestine, as displayed in Table 31. The Palestine disaster loss database has records for 63 casualties, of which 18 were caused by structural collapse. These events caused significant damage on buildings. They destroyed 67 and damaged 798 houses, ruined mainly by flood and storms. It appears that forest fire is the most frequent event in the country, followed by flood with respectively 110 and 82 events.

Table 31. Distribution of disasters, damage and losses in Palestine

Hazard	Number of events	Deaths	Houses destroyed	Houses damaged
Structure	18	18	2	0
Rains	25	16	0	26
Flood	82	15	37	555
Storm	46	5	27	191
Cold wave	7	3	0	10
Thunderstorm	9	3	0	10
Snowstorm	29	2	1	3
Forest fire	110	1	0	3
Avalanche	1	0	0	0
Drought	11	0	0	0
Earthquake	3	0	0	0
Fog	1	0	0	0
Frost	25	0	0	0
Heat wave	30	0	0	0
Landslide	1	0	0	0
Windstorm	13	0	0	0
Total	**411**	**63**	**67**	**798**

The summary of geographic distribution of disasters, damages and losses in Palestine is presented in Table 32. It reveals that the West Bank governorate experienced by far the highest mortality, where the death toll reached 53. In terms of damaged and destroyed houses, it is also this region that recorded most losses with 568.

Table 32. Distribution of disasters damage and loss in Palestine by province

Governorates	Number of events	Deaths	Houses destroyed	Houses damaged
West Bank	344	53	42	526
Gaza	67	10	25	272
Total	**411**	**63**	**67**	**798**

Figure 53 illustrates the distribution of the number of deaths and houses destroyed and damaged at governorate level in Palestine. In these figures, we see many casualties affect both parts of the country (Gaza and West Bank). However the West Bank is most affected both by casualties and by houses losses.

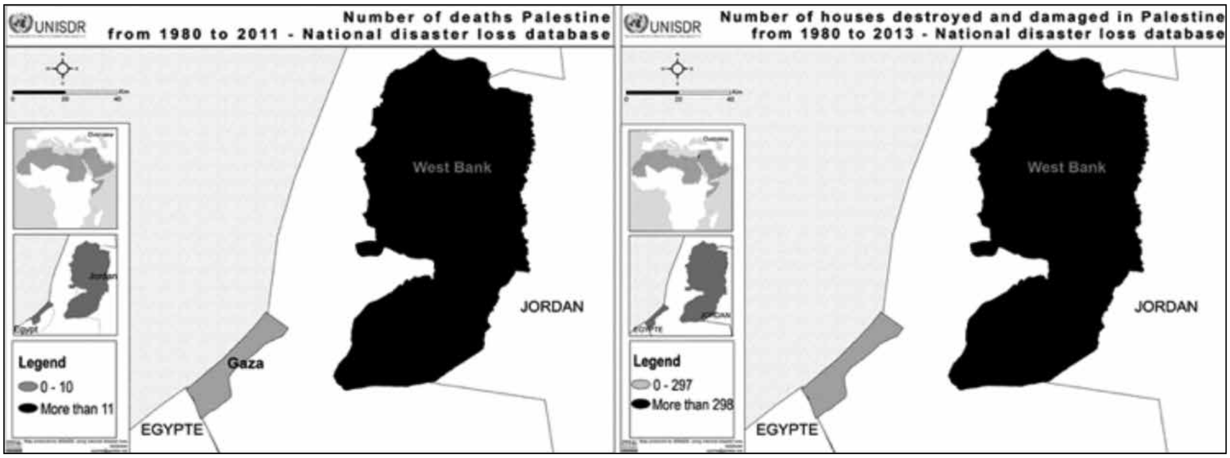


Figure 53. Spatial distribution of death and lost and damaged houses in Palestine

The temporal analysis of the number of deaths and houses destroyed and damaged is illustrated in Figure 54, Figure 55 and Figure 56. These figures show that the destroyed and damaged houses are recurrent in these last decades. However, deaths caused by natural disasters are decreasing.

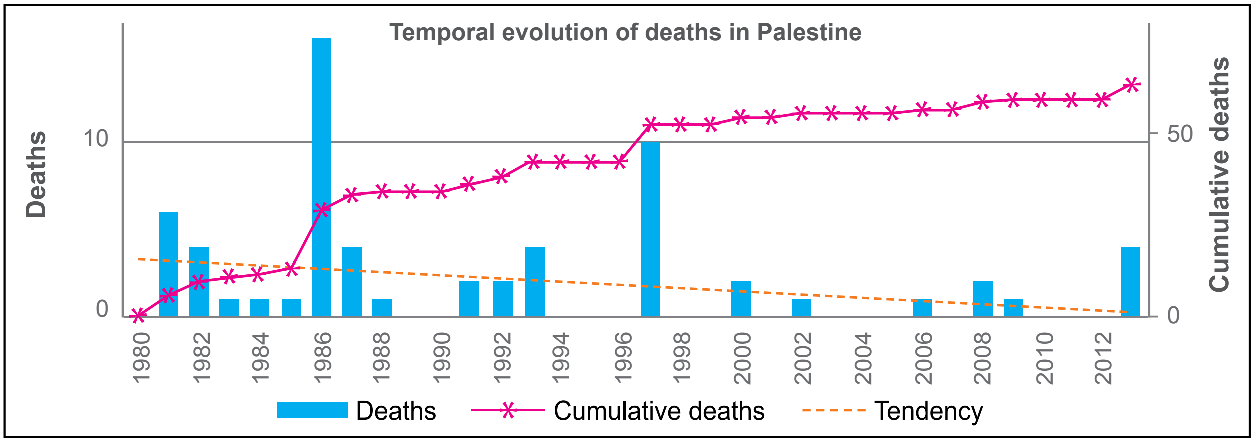


Figure 54. Temporal evolution of deaths in Palestine (1980-2013)

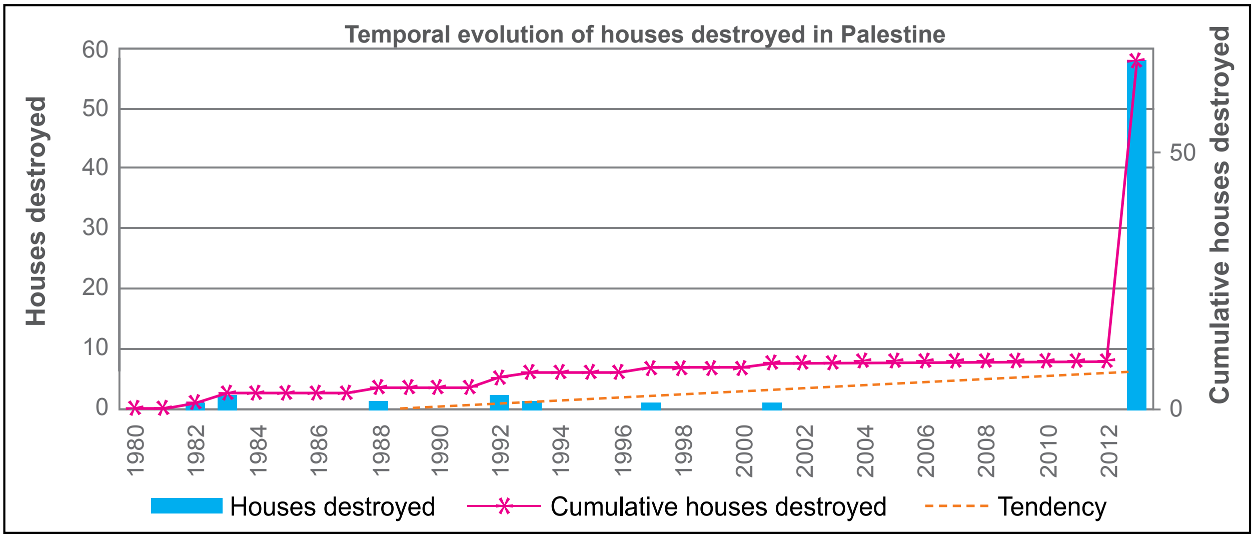


Figure 55. Temporal evolution of destroyed houses in Palestine (1980-2013)

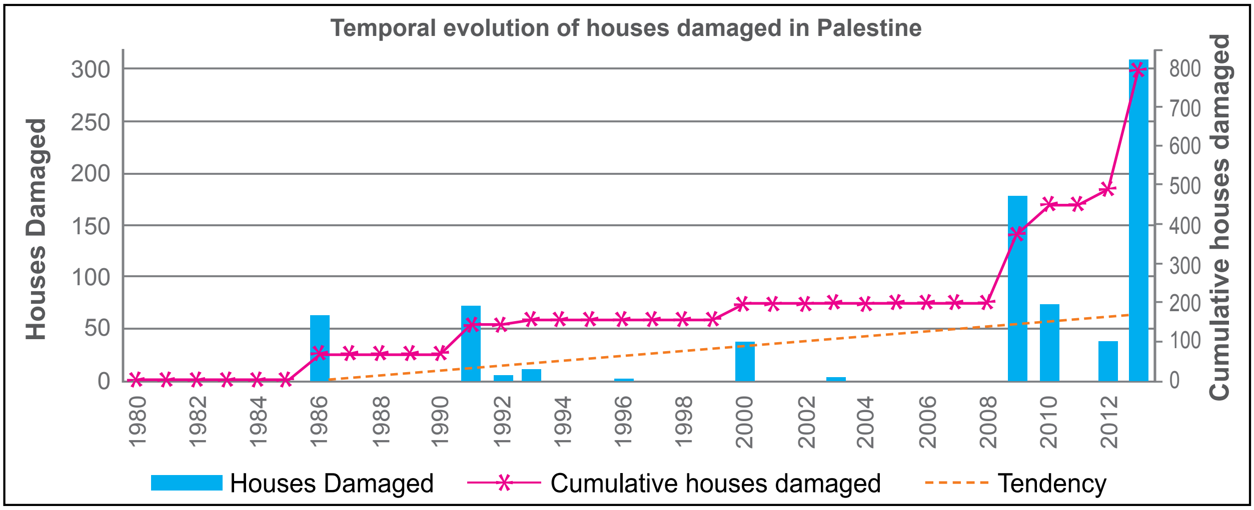


Figure 56. Temporal evolution of damaged houses in Palestine (1980-2013)

Analysis of the Palestine database allowed depicting the "Top 10" hazards that caused most deaths (Table 33). Of this, the deadliest event is a rain that cost life to 13 people.

Table 33. "Top 10" disasters in Palestine sorted by the number of deaths and hazard type

°N	Hazards	Date of event	Deaths	Houses destroyed	Houses damaged
01	Rains	04/10/1986	13	0	0
02	Flood	19/03/1997	9	0	0
03	Structural collapse	09/08/1981	4	0	0
04	Structural collapse	07/01/1993	3	1	0
05	Storm	19/10/1987	3	0	0
06	Flood	09/01/2013	3	0	100
07	Structural collapse	09/03/1986	2	0	0
08	Cold wave	29/01/2008	2	0	0
09	Structural collapse	04/10/1982	2	0	0
10	Structural collapse	16/04/1982	1	0	0

4.1.8 Syria

Data collected in Syria during the period 1980 to 2009 presents about 7,326 events, as displayed in Table 34. Syria disaster loss database contains 679 deaths, of which 326 were caused by fire. These events caused significant damages on buildings. The destruction and damage to houses totaled respectively 468 and 1,311 units, ruined mainly by fires. It appears that fire and forest fire are the most frequent events in the country.

Table 34. Distribution of disasters, damage and losses in Syria

Hazard	Number of events	Deaths	Houses destroyed	Houses damaged
Fire	2,833	326	69	336
Forest fire	3,204	257	398	916
Cold wave	123	24	0	1
Frost	172	23	1	3
Rains	383	19	0	36
Strong winds	127	15	0	1
Liquefaction	107	7	0	9
Heat wave	44	2	0	1
Snowstorm	117	2	0	0
Avalanche	6	1	0	0
Flash flood	8	1	0	0
Flood	93	1	0	3
Surge	33	1	0	1
Alluvion	7	0	0	0
Cyclone	2	0	0	1
Drought	27	0	0	0
Landslide	14	0	0	2
Storm	11	0	0	0
Thunder storm	6	0	0	1
Tornado	9	0	0	0
Total	**7,326**	**679**	**468**	**1,311**

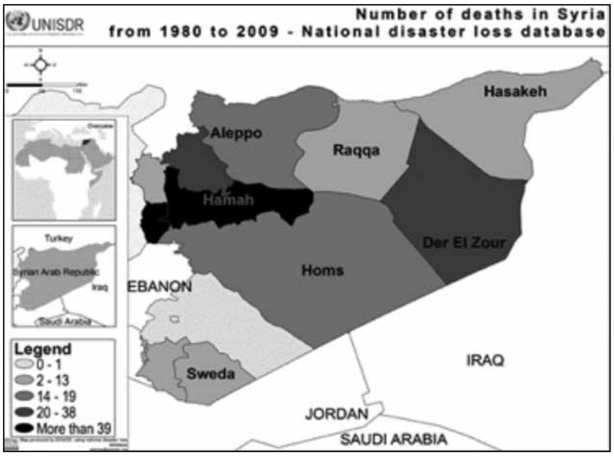
The summary of geographic distribution of disasters damages losses in Syria is presented in Table 35. It appears that the governorate of Hama is the one that experienced the highest mortality, where the death toll reached 278. In terms of destroyed and damaged houses, Tartous recorded most losses with 91 and 635 respectively.

Table 35. Distribution of disasters damage and loss in Syria by province

Governorates	Number of events	Deaths	Houses destroyed	Houses damaged
Hama	1,483	278	40	268
Tartous	2,334	230	91	635
Edlib	801	38	67	68
Der El Zour	125	33	251	132
Homs	748	19	8	41
Aleppo	598	15	3	87
Qunitera	137	13	1	1
Lattakia	182	12	0	3
Raqqa	107	11	3	8
Sweda	466	11	2	47
Dara'a	160	10	2	6
Hasakeh	128	8	0	6
Ref Damascus	39	1	0	9
Damascus	18	0	0	0
Total	**7,326**	**679**	**468**	**1,311**

Figure 57 illustrates the distribution of deaths and houses destroyed and damaged at governorate level. Casualties have been recorded for almost all governorates in Syria. However, the governorates of Dara'a, Hasakeh, Lattakia, Damascus and Sweda are the ones less affected by natural disaster related deaths.

In terms of damaged and destroyed houses, only six governorates experienced losses of less than 10 houses. These are Aleppo, Damascus, Dara'a, Der El Zour, Hasakeh and Raqqa.



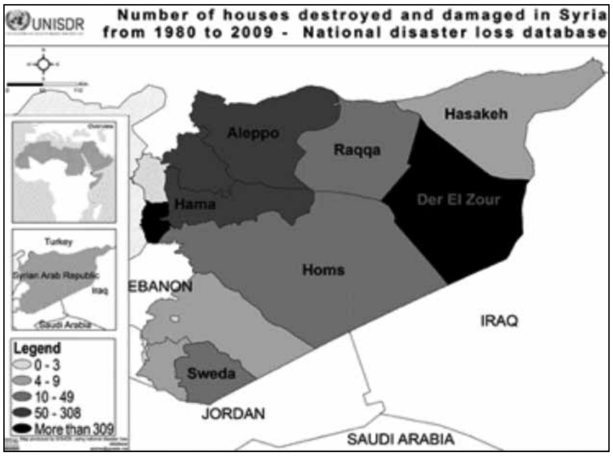


Figure 57. Spatial distribution of death and lost and damaged houses in Syria

The temporal analysis of the number of deaths and houses destroyed and damaged is illustrated in Figure 58, Figure 59 and Figure 60. These figures show that the number of destroyed and damaged houses in the last two decades have been going up (from 1990 until 2009). It looks like there is acceleration in catastrophic phenomena.

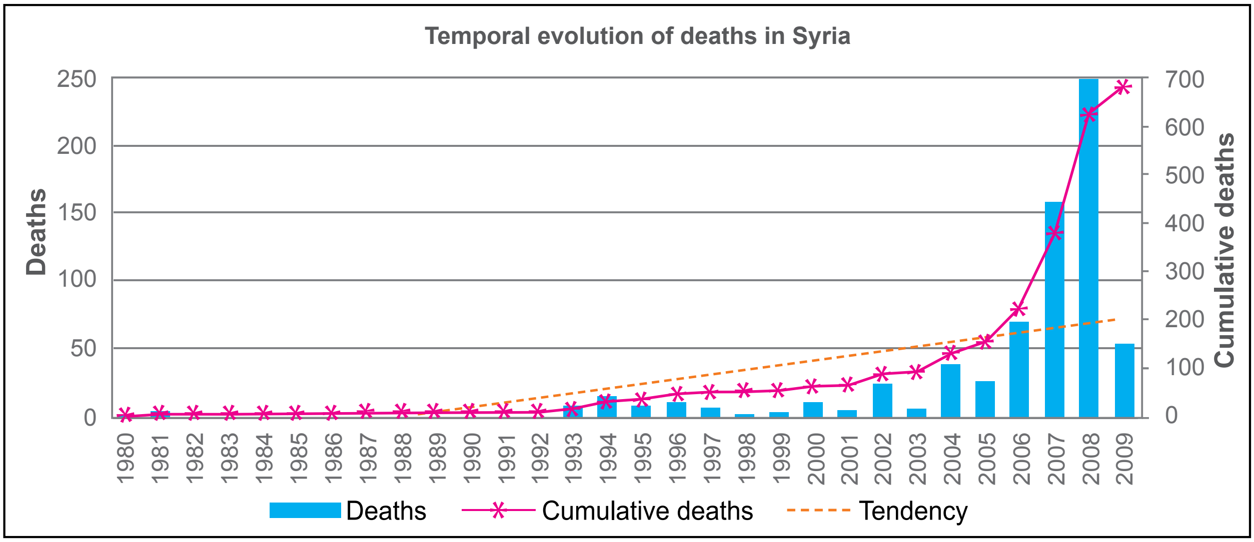


Figure 58. Temporal evolution of deaths in Syria (1980-2009)

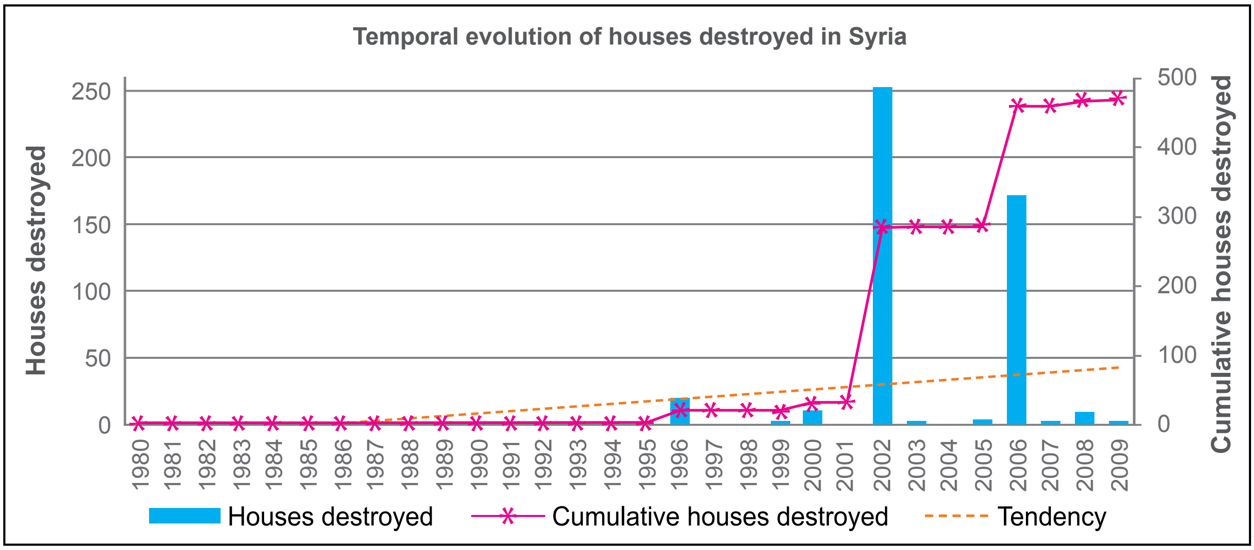


Figure 59. Temporal evolution of destroyed houses in Syria (1980-2009)

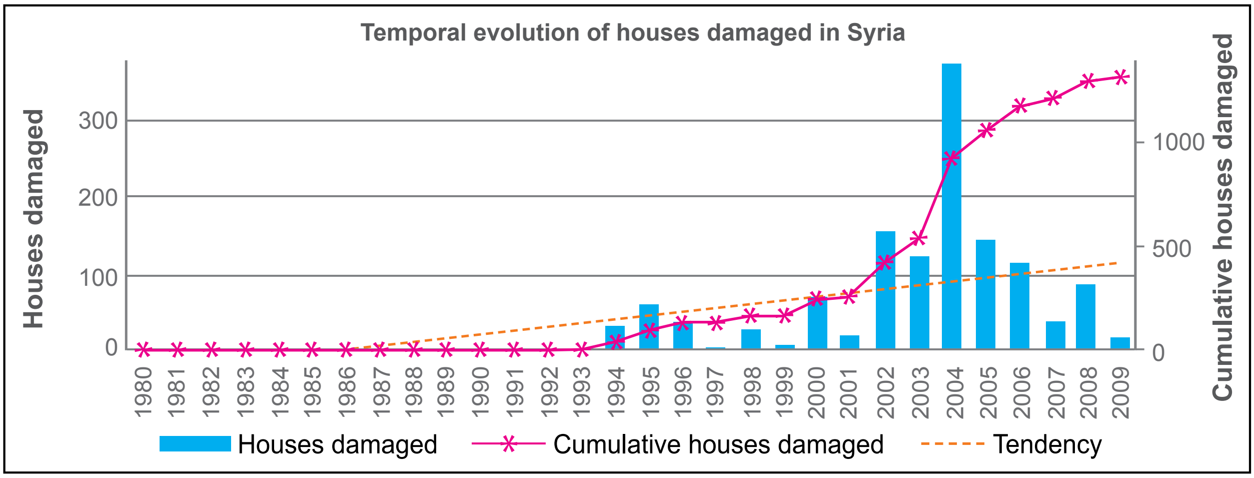


Figure 60. Temporal evolution of damaged houses in Syria (1980-2009)

Analysis of the Syrian database allowed depicting the "Top 10" hazards that caused most deaths (Table 36). The first two deadliest events are forest fires that cost the lives of 21 people, destroyed and damaged 251 and 129 houses respectively.

Table 36. "Top 10" disasters in Syria sorted by the number of deaths and hazard type

°N	Hazards	Date	Deaths	Houses destroyed	Houses damaged
01	Forest fire	23/11/2005	21	251	129
02	Forest fire	23/08/2008	21	0	0
03	Fire	13/06/2009	15	0	0
04	Forest fire	27/07/2008	11	0	0
05	Fire	08/06/2009	10	0	0
06	Fire	08/06/2009	10	0	0
07	Forest fire	20/06/2009	7	0	0
08	Fire	22/07/2008	7	0	0
09	Forest fire	29/08/2000	6	0	0
10	Fire	22/05/2009	6	0	7

4.1.9 Tunisia

Data collected in Tunisia during the period 1982 to 2013 presents about 1,943 events, as displayed in Table 37. Tunisia's disaster loss database contains 353 deaths, of which 258 were caused by floods. These events caused significant damages on buildings. They destroyed and damaged houses totaling 17,821 and 24,728, respectively, ruined mainly by floods. It appears that drought and floods are the most frequent events in the country.

Table 37. Summary of disasters, damages and losses in Tunisia

Hazard	Number of events	Deaths	Houses de-stroyed	Houses damaged
Flood	395	258	17,660	22,096
Fire	87	51	5	7
Structural collapse	8	20	0	0
Electric storm	5	8	0	0
Snowstorm	30	7	0	0
Strong winds	35	3	1	66
Landslide	13	2	27	110
Hailstorm	94	1	0	0
Drought	1,121	0	0	0
Earthquake	20	0	103	2,420
Forest fires	121	0	5	0
Frost	1	0	0	0
Heat wave	2	0	0	0
Hurricane	1	0	0	0
Storm	10	0	20	29
Total	**1,943**	**350**	**17,821**	**24,728**

The distribution of losses caused by disasters across the provinces of Tunisia is illustrated in Table 38. It reveals that the governorate of Sfax is the one that experienced most losses. Indeed, most of the causalities were registered in that governorate with 105. The houses destroyed and damaged in the region are respectively 1,369 and 3,228. However, regarding to the houses destroyed and damaged, the Tozeur region registered most losses with 15,000 houses destroyed and 348 houses damaged.

Table 38. Distribution of disasters, damages and losses in Tunisia by province

Governorates	Number of events	Deaths	Houses destroyed	Houses destroyed
Sfax	73	105	1,369	3,228
Zaghouan	81	43	0	132
Monastir	37	40	458	1,907
Gafsa	83	23	103	12,743
Ariana	28	17	0	3
Sidi Bouzid	121	17	50	0
Beja	93	16	5	60
Jendouba	112	13	24	65
Le Kef	157	12	27	107
Kairouan	154	11	83	1
Nabeul	75	9	1	31
Tataouine	80	9	0	0
Gabes	20	8	0	0
Bizerte	112	7	0	2
Sousse	111	6	0	536
Tunis	52	5	0	354
Mahdia	77	4	0	338
Kasserine	134	2	200	0
Siliana	136	2	1	0
Medenine	50	1	0	0
Ben Arous	43	0	0	0
Kebili	16	0	500	4,873
Manouba	57	0	0	0
Tozeur	41	0	15,000	348
Total	**1,943**	**350**	**17,821**	**24,728**

Figure 61 reveals that the geographic distribution of deaths and destroyed and damaged houses is very heterogeneous over Tunisia; hence, there are governorates like Ben Arous, Kebili, Manouba, and Tozeur that did not experience any deaths from disasters.

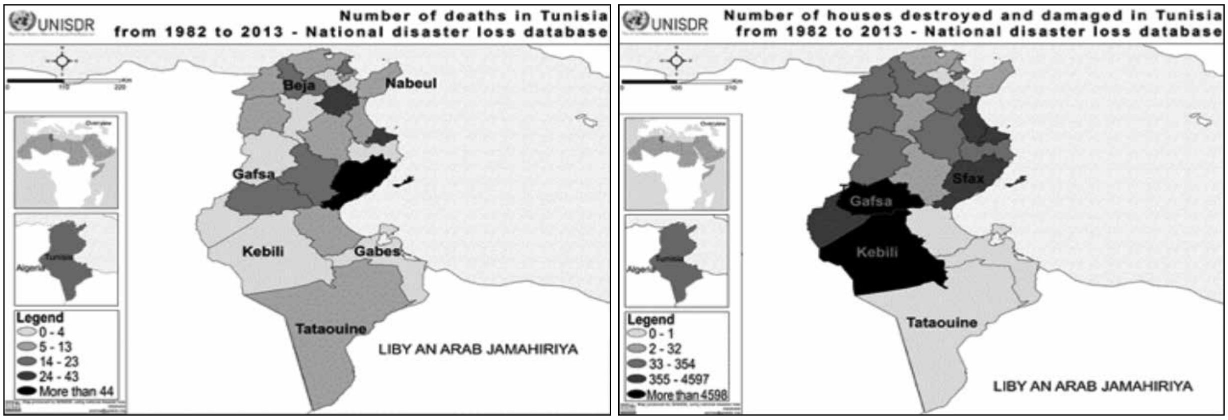


Figure 61. Spatial distribution of deaths and lost and damaged houses in Tunisia

Figure 62, Figure 63 and Figure 64 illustrates the temporal evolution of losses caused by disasters. These illustrations show that the loss or damage recorded, expressed in terms of deaths and in terms of destroyed and damaged houses, is distributed randomly in time.

Note that the absence of deaths and damaged or destroyed houses in a given interval (e.g. 1995 to 2002) does not necessarily mean non-occurrence of disasters, but this absence may probably be due to gaps in data collection.

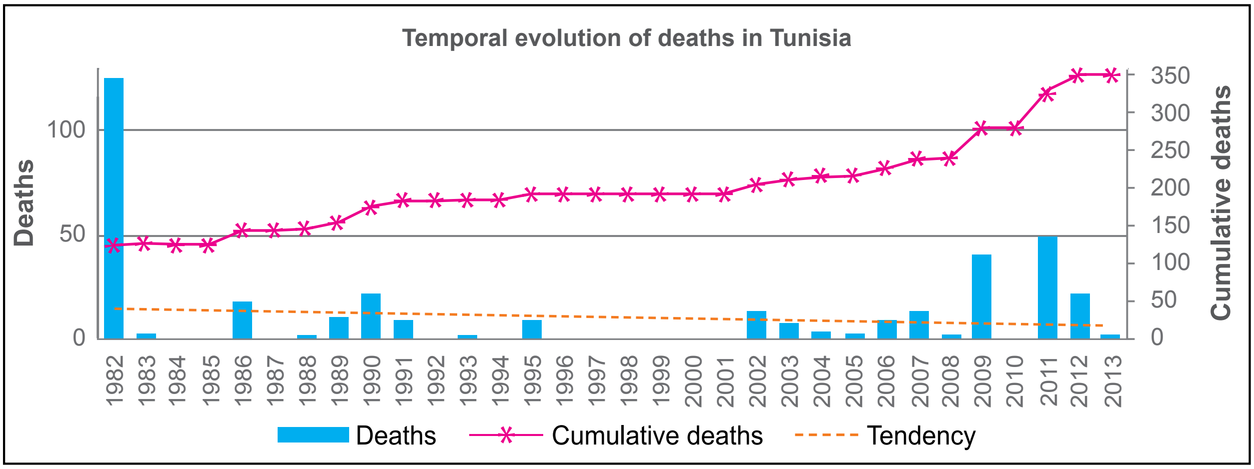


Figure 62. Temporal evolution of death in Tunisia (1982-2013)

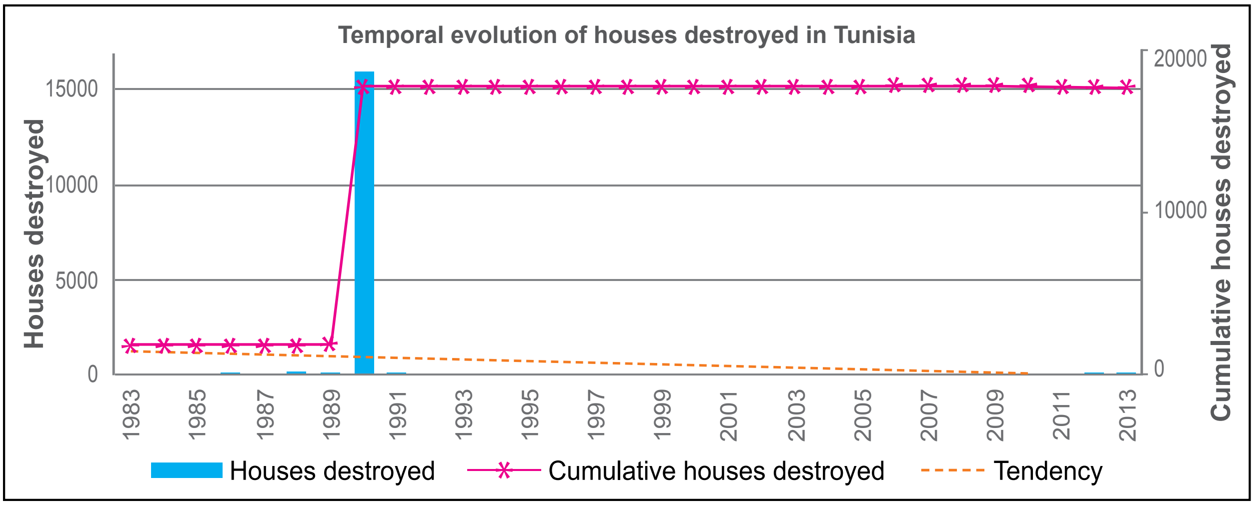


Figure 63. Temporal evolution of destroyed houses in Tunisia (1982-2013)

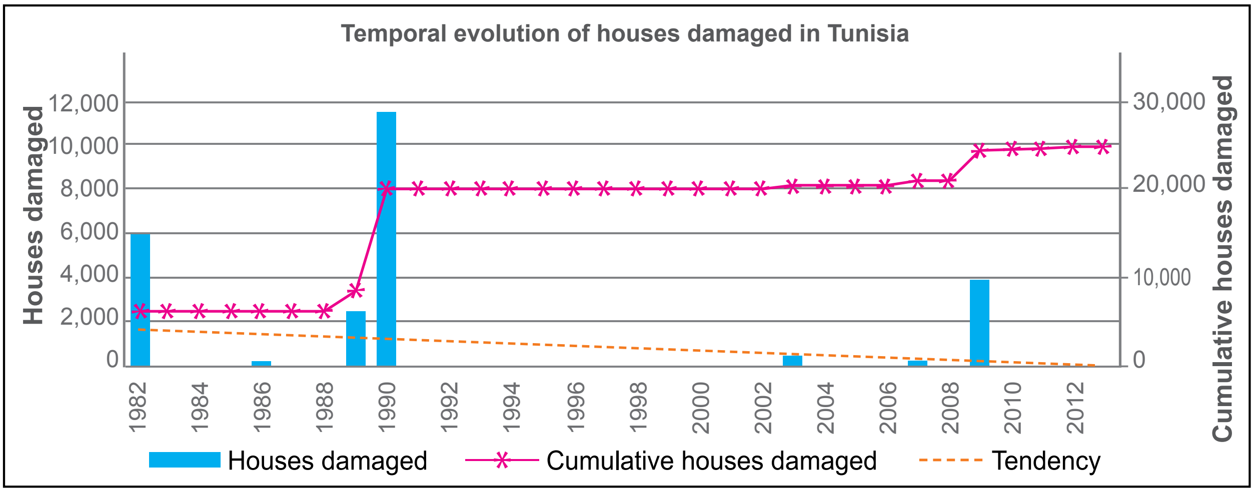


Figure 64. Temporal evolution of damaged houses in Tunisia (1982-2013)

The "Top 10" disasters in Tunisia sorted by number of fatalities are shown in Table 39. Reading shows that hydro-meteorological hazards are the most deadly in this country. The deadest event is a fire that killed 36 people (Table 39).

Table 39. "Top 10" disasters in Tunisia, sorted by number of deaths and hazard type

°N	Hazards	Date of event	Deaths	Houses destroyed	Houses damaged
01	Fire	15/01/2011	36	0	0
02	Flood	1982	25	200	300
03	Flood	23/09/2009	21	0	3,723
04	Flood	1982	20	300	300
05	Flood	2009	18	235	600
06	Flood	05/11/1982	17	0	0
07	Flood	30/04/2002	13	0	0
08	Flood	30/10/1986	12	0	0
09	Flood	13/10/2007	12	0	0
10	Flood	1982	10	235	600

4.1.10 Yemen

During the period 1971 to 2013, about 1,736 events were recorded in Yemen, as displayed in Table 40. Yemen's disaster loss database contains 4,173 deaths, of which 1,281 were caused by liquefaction. These events caused significant damages to buildings. The destroyed and damaged houses totaled respectively 23,337 and 37,390, ruined mainly by liquefaction, earthquake and floods. It appears that liquefaction is the most recurrent event in the country.

Table 40. Summary of disasters, damages and losses in Yemen

Hazard	Number of events	Deaths	Houses destroyed	Houses damaged
Liquefaction	792	1,281	11,289	13,946
Earthquake	95	918	1,682	10,678
Flood	161	847	8,577	10,647
Thunderstorm	158	469	75	6
Landslide	213	271	176	253
Flash flood	42	172	136	1,202
Frost	3	76	0	0
Rains	112	53	250	258
Structural collapse	67	44	936	315
Fire	27	18	127	29
Sand storm	11	7	0	0
Surge	6	5	0	0
Subsidence	4	4	0	0
Cyclone	3	3	64	0
Tsunami	5	2	0	0
Coastal erosion	1	1	0	0
Storm	8	1	25	0
Strong wind	15	1	0	56
Alluvion	2	0	0	0
Drought	4	0	0	0
Heat wave	3	0	0	0
Sedimentation	1	0	0	0
Snowstorm	2	0	0	0
Tornado	1	0	0	0
Total	**1,736**	**4,173**	**23,337**	**37,390**

Table 41 illustrates the distribution of the number of deaths and houses destroyed and damaged at governorate level in Yemen. Almost all governorates of the country record many casualties affecting. However, the governorates of Dhamar and Shabwah are the ones most affected by natural disasters in terms of number of deaths.

Table 41. Distribution of disasters, damages and losses in Yemen by province

Governorates	Number of events	Deaths	Houses destroyed	Houses damaged
Dhamar	139	1,024	232	2,230
Shabwah	48	720	5,281	1,151
Aden	95	580	721	3445
Sana›a	50	238	307	332
Taizz	192	225	197	227
Al Mahwit	154	204	150	558
Al Hudaydah	152	202	1,317	774
Ibb	124	161	1,746	7760
Hajjah	144	151	441	292
Hadramaut	138	146	9,657	5,111
Marib	29	142	318	1,340
Amanat Al Asimah	32	89	19	139
Lahj	93	71	81	836
Sa'adah	32	55	57	3,001
Abyan	91	47	514	2421
Amran	72	41	39	28
Raymah	35	29	90	192
Al Maharah	65	18	80	7,201
Al Dhale'e	20	15	2,002	12
Al Jawf	10	10	50	218
Al Bayda	21	5	38	122
Total	**1,736**	**4,173**	**23,337**	**37,390**

In terms of number of houses damaged and destroyed, only Amran governorate experienced losses less than 100 houses. The most damages are in the large governorate of Hadramaut with over 10,000 houses destroyed and damaged.

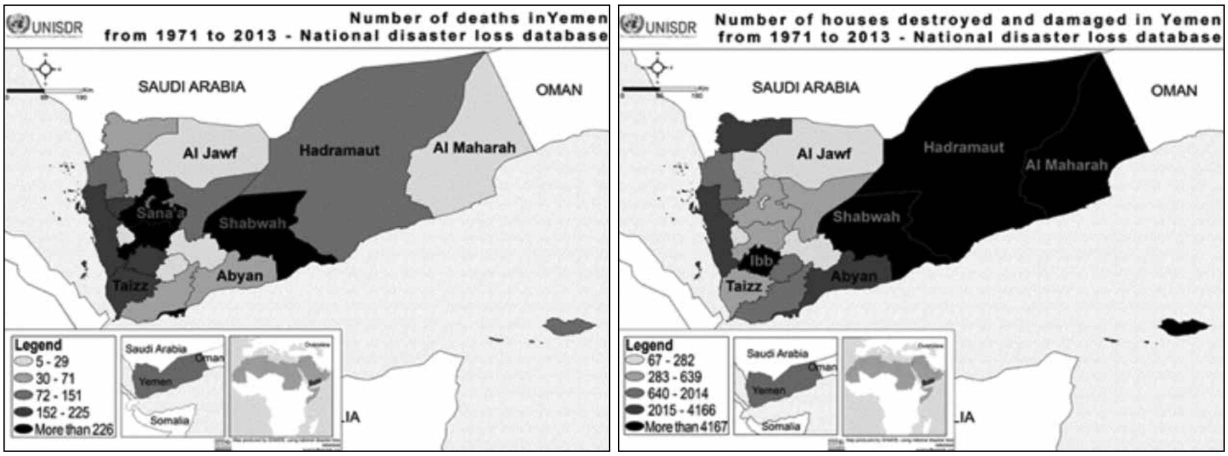


Figure 65. Spatial distribution of deaths and lost and damaged houses in Yemen

The temporal analysis of the number of deaths and houses destroyed and damaged is illustrated in Figure 66, Figure 67 and Figure 68. Analysis of the temporal evolution of the number of deaths and houses destroyed and damaged reveals the high frequency of disasters in Yemen. The country records annually a series of catastrophic events causing loss of lives and houses. There is no apparent correlation between destroyed and damaged houses on one hand and lives lost on other hand. This might be due to the lack of information on damages caused by some phenomena like earthquakes as shown in Table 42. However, the damages and losses appear to be decreasing from 1971 to 2013.

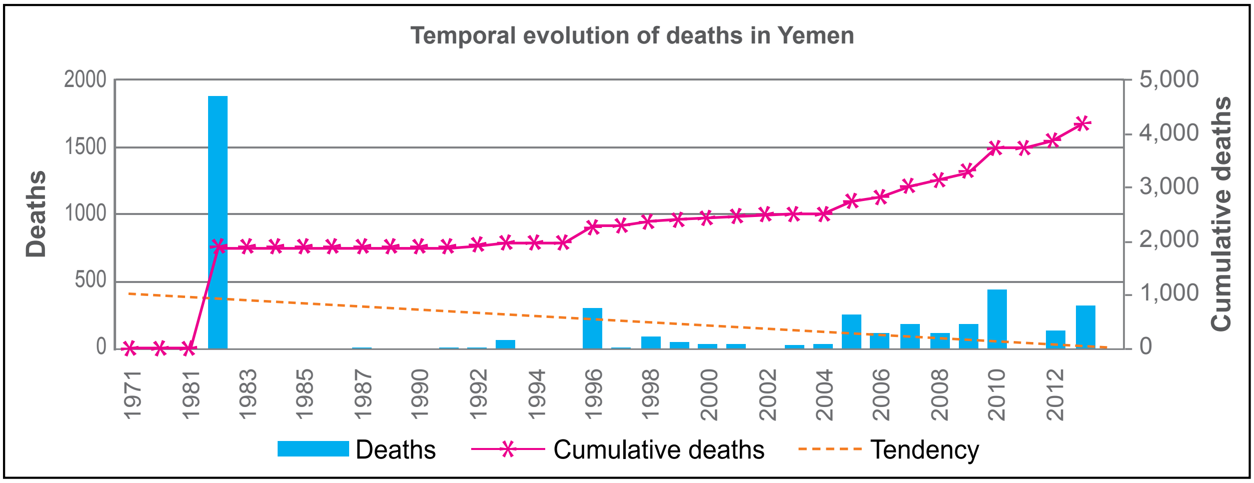


Figure 66. Temporal evolution of deaths in Yemen (1971-2013)

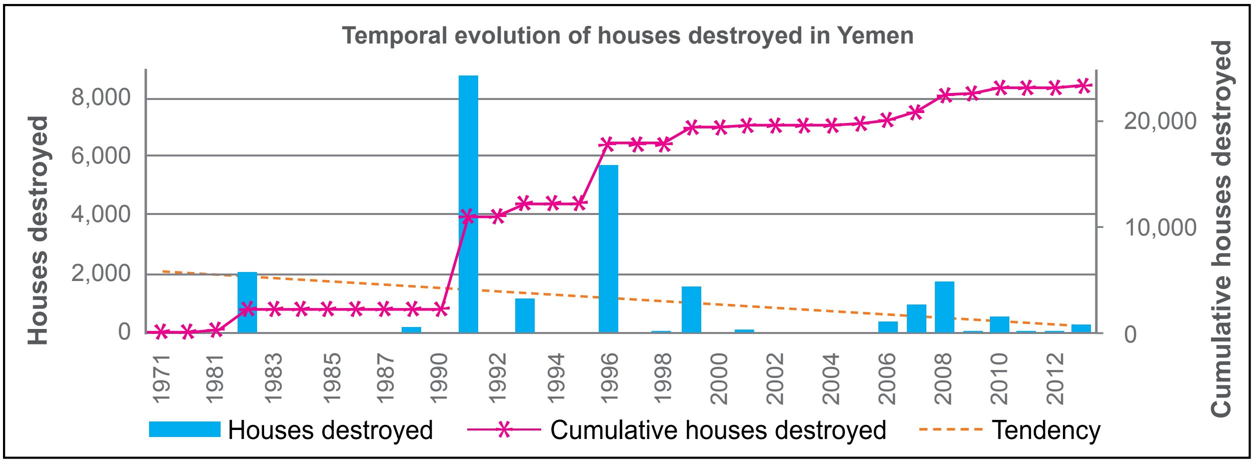


Figure 67. Temporal evolution of destroyed houses in Yemen (1971-2013)

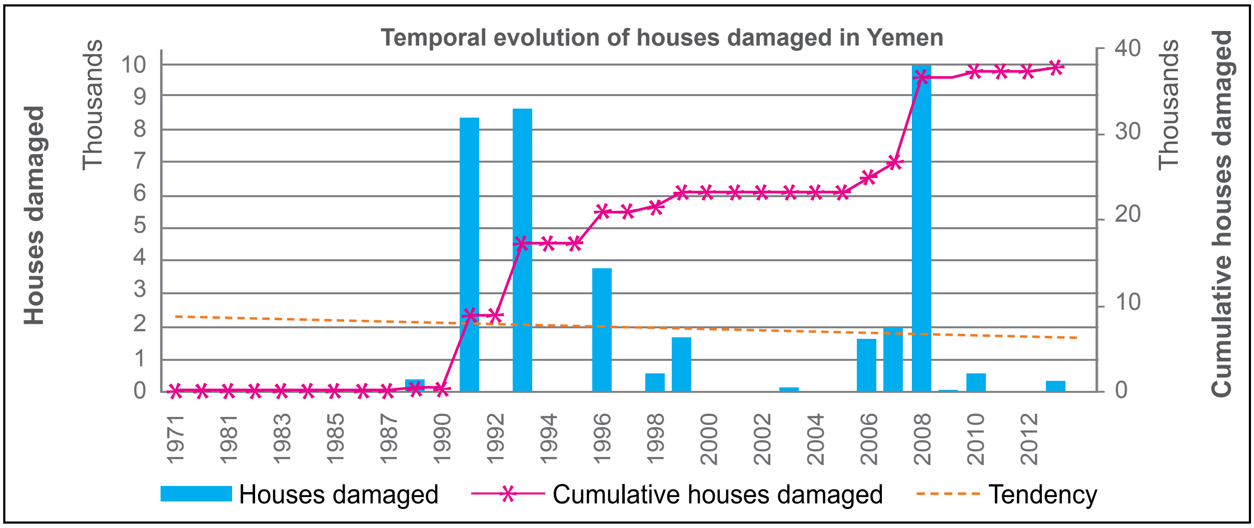


Figure 68. Temporal evolution of damaged houses in Yemen (1971-2013)

The analysis of the Yemen database allowed depicting the top ten hazards that caused most deaths (Table 42). Of this, the deadliest event is an earthquake followed by an epidemic that cost the life of 900 people and 550, respectively.

Table 42. "Top 10" disasters in Yemen, sorted by number of deaths and hazard type

°N	Hazards	Date	Deaths	Houses destroyed	Houses damaged
01	Earthquake	16/12/1982	900	0	0
02	Liquefaction	29/03/1982	482	0	0
03	Flood	29/03/1982	482	0	0
04	Flash flood	20/06/1996	123	124	1,150
05	Frost	03/04/2009	76	0	0
06	Liquefaction	08/08/1996	75	5,000	0
07	Thunder storm	04/12/2012	70	50	0
08	Landslide	28/12/2005	65	20	0
09	Flood	18/08/2013	65	0	0
10	Landslide	2005	64	12	0

4.2 Overview of globally available disaster damage and loss databases

The literature review showed that all authors agree on the key importance of disaster damage and loss databases for risk identification as well as for measuring progress in implementing provisions of the Hyogo Framework for Action. The application of these databases covers several areas as it was reported by a recent study conducted by the United Nations Development Programme (UNDP)[13] .

Some of the key specific application areas are, but are not limited to:

1. Guiding relief, recovery and reconstruction programs following disasters – Physical damage and its economic equivalencies provide a basis for identifying recovery and reconstruction financing requirements;
2. Assessing risks of future disasters – Although past loss and damage is not a complete indicator of future losses – in light of climate change, growing societal hazard exposure and changes in patterns of hazard vulnerability – it is nonetheless essential data for generating vulnerability curves necessary for assessing the risks of future loss and damage and for validating and calibrating risk assessments;
3. Calibrating the cost-effectiveness of investments intended to reduce losses;
4. Tracking loss patterns and trends, including progress towards achieving the HFA expected outcome of a substantial reduction of disaster losses;
5. Performing thematic analysis (e.g. gender differences in morbidity and mortality, assessing sector-specific losses);
6. Tracking, monitoring and evaluating the outcome indicators on loss and damage for a number of international policy frameworks in the areas of disaster reduction and climate change.

Recognizing the importance of disaster loss and damage databases, and their broad scope of applications, many institutions have developed global disaster loss databases. These sources of information have been widely used, since they provide useful information on intensive large-scale disaster losses. They inform annual global and country statistics, especially for countries that do not have their own database.

For the purposes of this analysis, disaster loss and damage databases were grouped into two broad categories, namely: open global and national disaster loss databases and reinsurance industry based disaster loss databases.

As example of the first category one can mention:
1. The Disaster Inventory System, known as DesInventar, was developed by La Red and is maintained and promoted by UNISDR, UNDP and other partners. The DesInventar database is freely accessible and contains 82 disaster loss databases: www.desinventar.net
2. The International Disaster Database, known also as Emergency Database or by the abbreviation of EM-DAT maintained by the Centre for Research on the Epidemiology of Disasters (CRED). This database is freely accessible via this link: www.emdat.be
3. The Global Disaster Identifier Database, known by the abbreviation GLIDE. This database is accessible online at http://www.glidenumber.net/ and is maintained by the Asian Disaster Reduction Centre (ADRC) in collaboration with ISDR, CRED, UNDP, IFRC, FAO, World Bank, OFDA/USAID, LA Red, and OCHA/Relief Web.
4. The Global Risk Identification Program (GRIP) features national disaster databases on it DisDAT portal: http://www.gripweb.org/gripweb/?q=disaster-database. While almost all available national disaster loss databases in the DisDAT portal are based on the DesInventar methodology and tool, it also features a few other websites mainly from OECD countries.

The second category related to reinsurance industry based disaster loss databases can be described by two examples:
- The Munich Reinsurance database, known by the abbreviation of NatCatSERVICE. The database publish some information following this link: http://www.munichre.com/en/reinsurance/business/non-life/georisks/natcatservice/default.aspx;
- Swiss Reinsurance database, known by the abbreviation Sigma. The database is not publicly accessible but Sigma does provide a yearly publication (http://www.swissre.com/sigma/);

4.2.1 Open global and national disater loss databases

4.2.1.1 DesInventar

DesInventar is a common conceptual and methodological framework for the generation of National Disaster Inventories and the construction of damage and losses databases. La Red, an NGO consortium in Latin America, initially developed it. DesInventar was then promoted by UNDP and UNISDR who sponsored the implementation of similar systems in different region such as the Caribbean, Asia and Africa. This instrument

[13] The following paragraphs are quotes from the UNDP (Bureau for Crisis Prevention and Recovery 2013) publication "A comparative review of country-level and regional disaster loss and damage databases." It is available at: http://www.undp.org/content/dam/undp/library/crisis%20prevention/disaster/asia_pacific/lossanddamagedatabase.pdf

is experiencing a very remarkable development and continuous expansion.

DesInventar allows a systematic and homogeneous recording of small, medium and large disasters damage and loss data, and that, based on pre-existing official data, academic records, newspaper sources and institutional reports. Once historical data is collected, it can be spatiotemporally analyzed.

As software, DesInventar is an open source that can be freely downloaded and installed in different platform such as Windows, Linux, Solaris, and Macintosh. It is interoperable because it allows exchanging files with different formats (MS-Excel, MS-Access, ASCII Text / GIS). Also, it is compatible with several types of database, like MS Access, Oracle, MS SQL Server 2000 and 2005, PostgreSQL and MySQL. DesInventar is also compatible with different servers, such as Apache, Tomact, Ms-IIS.

DesInventar functionalities can be grouped into two distinct but complementary modules, namely DesInventar and DesConsultar:

1. DesInventar Module: As its name suggests, DesInventar (Disasters Inventory) allows the inventory and capture of geographic and alphanumeric data, through simple and user-friendly interfaces. The collected data is stored in a structured database. This includes data from administrative boundaries with three levels (e.g. region, provinces, communes), in addition to data related to natural hazards and losses that result.

2. DesConsultar Module: As for this module, through simple queries, it provides access to the collected data and allows analysis taking into consideration spatial and temporal dimensions. This module also allows the generation of added value documents that can better inform decision makers (tables, graphs and maps).

Besides its interesting functionalities, another key element of DesInventar is its data that is systematically collected, recorded and archived, starting from small events with light impact until mega disasters. These data are geo-referenced and reported according to administrative boundaries on three levels (e.g. regional, provincial and communal boundaries). The DesInventar database covers a broad spectrum of indicators related to loss and damages caused by disasters. The list includes the indicators given below and it can be extended if necessary depending on user needs:

Events or hazard identification / characteristic (date, duration, source, location, event type, magnitude, cause) ▪ Number of deaths, ▪ injured, ▪ affected, ▪ missing, ▪ relocated, ▪ evacuated, ▪ victims; ▪ Magnitude ▪ Losses $Local ▪ Losses $USD ▪ Damages in roads Mts ▪ Damages in crops Ha ▪ Lost Cattle	▪ Hospitals ▪ Education centres ▪ Transportation ▪ Communications ▪ Relief ▪ Agriculture ▪ Water supply ▪ Sewerage ▪ Power and Energy ▪ Industries ▪ Education ▪ Other sectors ▪ Health sector ▪ Latitude and longitude

DesInventar software and 82 developed databases are accessible online and can be consulted, analyzed and downloaded freely. In addition, documents and interface are available in several languages.

It should be noted that in-depth analysis of damages and losses based on DesInventar have been implemented in all regions, starting with Latin America (GRIP, 2010), later Asia and since 2010 in Arab States, Europe and Africa.
Website: www.desinventar.net

4.2.1.2 Global risk identification program (GRIP)

The former Global Risk Identification Program (GRIP) features national disaster databases on its DisDAT portal. Though the programme has been closed, the website still exists and provides access to 50 disaster loss and damage databases. Almost, all the available national disaster loss databases in the DisDAT portal are based on the DesInventar methodology and tool. However it also features a few other websites mainly from OECD countries, with their own national methodology.

It is reported on the GRIP website that GRIP is the result of a fruitful collaboration between the Centre for Research in Epidemiology of Disasters (CRED) and the Global Risk Identification Program (GRIP), with the financial support of United States Agency for International Development (USAID). Of the 50 databases, six are global, two are regional, forty-one are national and one is sub-national[14] .
Website:
http://www.gripweb.org/gripweb/?q=disaster-database

4.2.1.3 EM-DAT

As mentioned on the EM-DAT website, EM-DAT or the International Disaster Database as it calls itself is a global database on natural and technological disasters that contains entries for more than 18,000 disaster losses and damages worldwide, dating back as early as 1900 and up to now as it is maintained up-to-date (EM-DAT, 2014). The Centre for Research on the Epidemiology of Disasters (CRED) at the School of Public Health at Louvain University in Belgium maintains EM-DAT. It was created with the initial support of the WHO and the Belgian Government[15] .

The database information is compiled from various sources, including UN agencies, non-governmental organizations, insurance companies, research institutes and press agencies.

The EM-DAT database includes disasters that fit at least one of the following criteria:

• 10 or more people killed;
• 100 or more people affected;
• Declaration of a state of emergency;
• Call for international assistance.

Disaster data and information are gathered and recorded on a daily basis by CRED. All the information is entered per country level. The variables considered and recorded in the database are (EM-DAT, 2014)[16] :

• Disaster number: A unique disaster number for each event.
• Country: in which the disaster has occurred.
• Disaster group: Three groups of disasters are distinguished in EM-DAT: natural disasters, technological disasters and complex emergencies.
• Disaster type: Description of the disaster according to a pre-defined classification.
• Date: When the disaster occurred.
• Killed: Persons confirmed as dead and persons missing and presumed dead.
• Injured: People suffering from physical injuries, trauma or an illness requiring medical treatment as a direct result of a disaster.
• Homeless: People needing immediate assistance for shelter.
• Affected: People requiring immediate assistance during a period of emergency; it can also include displaced or evacuated people.
• Total affected: Sum of injured, homeless, and affected.
• Estimated Damage: Estimated damages are given in (000') US$.

This database is very widely used, as it is the only public one covering all countries and has a large number of historical entries. It is however tainted by essentially two major constraints. First, it is considered partial and draws an incomplete picture of disaster impact, since it does not take into account all disasters. Only those who fit the above mentioned criteria are recorded. Additionally EM-DAT does not pay adequate attention to geographic distribution of losses and damage, since the data is presented by country only and not lower administrative units. This spatial resolution is thus insufficient for the proper understanding and characterization of disasters.
Website: www.emdat.be

4.2.1.4 Glide

The Global disaster identifier database, or GLIDE is a new initiative launched by Asian Disaster Reduction Center (ADRC) and promoted by the Centre for Research on the Epidemiology of Disasters (CRED) of the University of Louvain in Brussels (Belgium), OCHA/ReliefWeb, OCHA/FSCC, UNISDR, UNDP, WMO, IFRC, OFDA-USAID, FAO, La Red and the World Bank.

[14] The following paragraph has been largely taken from the GRIP website accessed in July 2014.
[15 and 10] The following paragraph has been largely taken from the EM-DAT website accessed in July 2014.

The main objective of this initiative is to propose a globally common Unique ID code for disasters (http://www.glidenumber.net/)[17] . The GLIDE code is composed of two letters to identify the disaster type (e.g. EQ - earthquake); the year of the disaster; a six-digit, sequential disaster number; and the three-letter ISO code for country of occurrence. So, for example, the GLIDE number for an occurred earthquake in Morocco in 2004 is: EQ-2004-000153-MAR.
The GLIDE database contains 5,753 records which are freely accessible.

Each record in this database is described by several indicators, such as: event, number, country location, date, time, duration, magnitude, information sources and specific comments.

The GLIDE website does not indicate whether disasters are recorded systematically and exhaustively or only disasters that meet some criteria are archived. However, it states that during the experimental stage (2002 - 2003) the disasters that fall out of EM-DAT criteria were processed and recorded. The GLIDE website contains information on Arab countries.

Website: http://www.glidenumber.net/

4.2.2 Disaster loss databases compiled by reinsurance companies

In addition to the above-mentioned databases, which are distinguished by their global character and whose access is open to the public, the reinsurance industry compiled and maintains additional disaster loss databases with limited access restricted to subscribers. Only summary, synthetic reports and some maps are published and accessible without charge. NatCatServices Munich Reinsurance and SIGMA Swiss RE databases are the popular examples of this category.

4.2.2.1 Natcatservices munichre database

The NatCatServices database was created by the Munich Reinsurance Company (MunichRe). It is a German insurance company created in 1880. The NatCatServices includes more than 30,000 records, which are described by the same indicators as SIGMA database but it does not take into account the estimated percentage of GDP countries.

The indicators used in this database are:
- Region & Country
- Type of Event
- Number of events
- Number of victims
- Damage insured - economic damage (in USD)

Raw data is not accessible for the public, but NatCatService publishes a selection of analyses free of charge, such as annual statistics from 2004 onwards, informative maps, Focus Analyses and comprehensive basic knowledge in Touch Natural Hazards.

Website: http://www.munichre.com/natcatservice

4.2.2.2 SIGMA Swiss RE database

The Swiss Reinsurance Company (SwissRe) set up the SIGMA Swiss RE database includes events from 1970 to present. According to the Swiss RE website, there are approximately 7,000 entries in the database with 300 new entries per year. Data and information are compiled from different sources including newspapers, Lloyds, primary insurance and reinsurance periodicals, internal reports, and online databases[18] .

Sigma requires at least one of the following for inclusion in the database:
- At least 20 deaths
- And/or 50 injured
- And/or 2000 homeless
- And/or insured losses exceeding US$14 million (marine), or US$28 million (aviation), or US$35 million (all other losses),
- And/or total losses in excess of US$70 million.

Recorded information in SIGMA Swiss RE includes fatalities, missing, injured, and homeless along with detailed accounting of insured and uninsured damages.
Website:
HTTP://WWW.SWISSRE.COM/SIGMA

[17] The following paragraph has been largely taken from the GLIDE NUMBER website accessed in July 2014.
[18] The following paragraph has been largely taken from the Swiss RE website accessed on July 2014

4.3 Methodological approach

The methodology used for this study was three-fold.

The first was a literature review of available disaster loss reports from Arab States and a survey to learn from global and regional practices to compare with what has been done in this region. To this end, many reports and documents related to damage and loss were collected and reviewed[19,20,21,22] . Furthermore, the available disaster loss and damage national reports were considered[23,24] . To learn from concrete examples, country focal points for data collection and supervision of the establishment of disaster loss databases, as well as representatives of regional organizations involved in disasters risk reduction were contacted and asked to complete a survey (see Annex 3).

The second approach focused on the analysis of actual loss and damage data, to extract information and process the data to analyze and present disaster damage and losses at country and regional level. Contact was established with Arab countries' focal points and partner organizations and served to gather information on their national disaster loss and damage databases. This contact complemented information available online. Ten national disaster loss databases are available online via DesInventar website (www.desinventar.net). These databases were double-checked, and the updated versions were retrieved, where available.

National disaster loss and damage data was processed and analysed using Geographical Information System (GIS) applications to arrive and display national and regional loss maps and loss statistics, and also to perform the spatiotemporal monitoring.

Although the available indicators in the national data bases cover events, lives lost, affected people, homeless, losses, destroyed houses, damaged houses, this analysis focused specifically on events, lives lost, affected people, houses destroyed and damaged. In this sense, the analysis sought to focus on the geographical distribution of losses and damages caused by hydro-meteorological and geological hazards in the region. This helped to highlight Arab countries that are affected by the same phenomena and to see areas where high losses were recorded. Similarly, this analysis helped to identify hot spots (area of concentration in terms of casualties, recurrent disaster event points and top ten disasters) in the Arab region and to compare the damages and losses caused by hydro-meteorological and geophysical hazards.

The data analysed also included a review of temporal distribution of the recorded data to characterize evolution, tendencies and frequency of damage and losses caused by disasters over time. The list of related indicators includes the number of fatalities, injured people, destroyed and damaged houses. The temporal distribution is presented by bar graphs and also by maps to highlight the evolution in space and time (spatiotemporal evolution).

The spatial and temporal analysis conducted for the region as a whole was carried out for Arab countries, in order to establish country profiles considering hydro-meteorological and geophysical hazards and related disasters.

Bearing in mind that only ten out of 22 Arab countries have so far established publicly available national disaster loss and damage databases, the study also took into consideration another open and available disaster loss and damage database, which is EM-DAT. The use of these two database sets allowed to, first, complete the analysis at the level of countries that do not have their national disaster loss databases and, secondly, to compare the extracted information from the national disaster loss databases with those derived from the EM-DAT database.

In this report, national disaster loss database data was extracted from the ten Arab countries (Comoros, Djibouti, Egypt, Jordan, Lebanon, Morocco, Palestine, Syria, Tunisia and Yemen), which have established such databases, following UNISDR's support, while for the remaining twelve Arab countries without national disaster loss databases, data from the International Disaster Database EM-DAT was considered. For those countries that have both national disaster loss databases and EM-DAT, the higher value from any of the databases was retrieved as the country event or number of fatalities or number of people affected value. In a final step the economic losses were retrieved directly from EM-DAT for all countries, while the number of houses destroyed

[19] GRIP, 2010. Establishing and Institutionalizing Disaster Loss Databases in Latin America. Guidelines and Lessons.http://www.gripweb.org/gripweb/sites/default/files/documents_publications/latin_america_2012_04_25.pdfhttp://www.gripweb.org/gripweb/sites/default/files/documents_publications/latin_america_2012_04_25.pdf

[20] UNISDR. 2012. Disaster risk and poverty trends in Jordan, Syria, Yemen: key findings and policy recommendations. http://www.unisdr.org/we/inform/publications/27853

[21] Emanuela and Marco Toto. 2014. Historical collection of disaster loss data in Albania. 80p. http://www.unisdr.org/we/inform/publications/36736

[22] UNDP. 2009. Risk Knowledge Fundamentals Guidelines and Lessons for Establishing and Institutionalizing Disaster Loss Databases. http://www.undp.org/content/dam/undp/library/crisis%20prevention/disaster/asia_pacific/updated%20Guidelines%20and%20Lessons%20for%20Estabilishing%20and%20Institutionalizing%20Disaster%20Loss%20Databases.pdf

[23] Tahar Gallali, 2014. Base de données DesInventar - Tunisie. Rapport analytique. Consultation pour le compte de l'UNDP.

[24] Hicham Ezzine, 2014. Elargissement de la base de données nationale sur les pertes liées aux catastrophes naturelles au Maroc (inventaire des catastrophes pour le Maroc). Consultation pour le compte de l'UNISDR.

and damaged was taken from national disaster loss databases for the ten Arab Countries that possess these datasets.

It should be noted that the EM-DAT database was processed and analysed according to the same steps and methodology used for the national disaster loss databases using a GIS tool for visualization. Therefore, to make the comparison possible between data from national disaster loss databases and EM-DAT, the same timeline was chosen for both databases covering the period 1982 – 2011. Furthermore, to give the reader an idea about the extent of disasters in the Arab region the entire recorded data in both databases was presented (i.e. data going beyond the three decade timeframe either from national disaster loss databases or from EM-DAT).

The third methodology undertaken was an analysis of the process of damage and loss data collection, their use and their possible improvements throughout Arab countries. This analysis helped to identify the various approaches followed at national level in terms of data collection, storing and use. It helped to identify good and bad practices, i.e. provided insights on helpful practices and others that should be avoided or improved. The main source of information for this exercise was a survey among country focal points and partners involved in the data gathering process and subsequent data use. The survey form focused on the following points (more details are provided in annex 3):
o) Disaster loss database availability
p) Data collection process
q) Problems and challenges faced during the data gathering phase
r) Personal appreciation of the national disaster loss database
s) Current use of the national disaster loss databases in Arab States.
t) Prospects to improve the national disaster loss databases.

The analysis of the responses received, contributed to the recommendations for improving and sustaining the process of damage and loss data gathering and archiving in Arab States.

The overall study objective to develop loss exceedance probability curves as a fourth step was intended but finally not carried out. This is due to the lack of precision of available loss data.

4.4 Survey template used to collect data

SECTION A. IDENTIFICATION

Full name: _______________
Authority / Organization: _________________
Email : ________________
Phone : __________________
Country: _____________________

SECTION B. DISASTER LOSS DATABASE AVAILABILITY

Does your country have a national disaster loss database to record disaster losses and damages?
- ◊ Yes
- ◊ No

If so, is it "DesInventar"?
- ◊ Yes
- ◊ No, please, specify and describe the database

____

What are the main functionalities of this database?

____

What are the main products of this database?

____

What is the covered period?

____

What is the number of collected RECORDS?

____

Does the collected data have a geo-reference?
- ◊ Geographic Code
- ◊ Latitude Longitude
- ◊ Other type of geo-reference
- ◊ No

In which institution is the database installed?
Are there any other national institution mandated to collect and archive disaster losses and damage?

____

SECTION C. DATA COLLECTION PROCESS

1. What are the sources of information used for data collection?
   - ◊ Official information collected from government institutions.
   - ◊ Information extracted from newspapers / media.
   - ◊ Information gathered from NGOs.
   - ◊ Information gathered from independent accredited institutions.
   - ◊ Other

2. At what level is the data collected?
   - ◊ Data is collected centrally (at national level).
   - ◊ Data is collected at regional and local level.
   - ◊ Data is collected at national, regional and local level.

3. Who collects the data?
◊ Government officials
◊ Consultants
◊ Volunteers
◊ A combination of the three

4. How is the data archived?
◊ Regular backup is performed to save the data.
◊ A copy of the data has been saved.
◊ No backup is available.

5. At what frequency is the data updated?
◊ Data is collected and updated in near real time.
◊ Data is periodically updated on a monthly basis.
◊ Data is periodically updated on an annual basis.
◊ Data is not updated

SECTION D. PERSONAL APPRECIATION OF THE DESINVENTAR DATABASE (IF APPLIED IN YOUR COUNTRY)

6. How do you rate the overall database / what is your overall assessment of the database?
◊ Complete
◊ Incomplete
◊ Reliable
◊ Unreliable

7. Was the collected data validated?
◊ Yes, there was/is a process of data validation
◊ No, the data was not validated

8. How was the collected data validated?
◊ A national validation workshop was organized.
◊ The collected data was checked and compared with other sources.
◊ The data was validated by competent authorities

9. Is the available database comprehensive in terms of events number?
◊ Yes the database is exhaustive.
◊ No, it is not exhaustive, but it contains almost all the data.
◊ No it is not exhaustive, considerable effort must be undertaken to complete the database.

10. What is the geographical extent of the DesInventar Database in your country (in case there is one)?
◊ The database covers the entire country
◊ The database covers a large part of the country
◊ The database covers some key areas

11. What time period is covered by the database?
◊ From the 1960's until now
◊ From the 1970's until now
◊ From the 1990s until now
◊ From 2000 until now
◊ From 2005 until now
◊ Other :____________; ___________; ____________

12 What are the hazards or phenomena considered in the database?◊ Floods / Flash flood
◊ Landslides / Rock fall
◊ Tsunamis
◊ Wildfires
◊ Fire
◊ Storms
◊ Droughts
◊ Earthquakes
◊ Heat waves
◊ Cold Wave
◊ Cyclones
◊ Tornadoes
◊ Sandstorm
◊ Torrential rains
◊ Volcanic Eruption
◊ Epidemics (Please name them)
◊ Locust ____________________________________
◊ Other. Please name them:____________________
____

SECTION E. PROBLEMS AND CHALLENGES FACED DURING DATA GATHERING PHASE

13. Were there any difficulties regarding data access?
◊ Data access was and is still difficult, more awareness is required
◊ Data access was not easy but this problem was overcome.
◊ No problems were encountered during data gathering phase.

14. What kinds of difficulties were associated to data accesses?
◊ Data access issues are technical.
◊ Data access issues are institutional.
◊ Data access issues are legal.
◊ Data access issues are political.
◊ Data access issues are due to their availability (data not available)
◊ Data access issues are logistical
◊ Data access issues are due to others reasons. Please clarify? _________

15. Are there any technical constraints that limit the use of DesInventar?
◊ There are no technical constraints that limit the use of DesInventar
◊ Yes. What are they? _____________

SECTION F. CURRENT USE OF DESINVENTAR IN THE ARAB STATES

16. What are DesInventar users in your country?

____

17. In which phase of disaster risk management, DesInventar is used?
◊ Before Disaster
◊ In the disaster management crisis
◊ After Disaster

18. How do you use DesInventar database?
◊ To analyze the loss and damage
◊ To inform population about loss and damage
◊ To inform decision-makers
◊ For the spatiotemporal monitoring of loss and damage
◊ As input to hazards analysis models.
◊ To calibrate and validate hazards models.
◊ To analyze the vulnerability.

19. Is DesInventar access free/open?
◊ Yes, disaster loss and damage data are accessible to everyone. Please give the links of the website

____

◊ Disaster loss and damage data are open only to ministerial departments
◊ Disaster loss and damage data are open only to the mandated Ministry
◊ The data loss and disasters are not open/ shared.

SECTION G. PERSPECTIVE TO IMPROVING DESINVENTAR USE

20. What do you suggest to improve the process of disaster loss data gathering?
◊ By institutionalizing the process of data collecting and archiving
◊ By better involving representatives of regions and local authorities, for decentralized data collecting and updating
◊ By training regional and municipal officials on DesInventar
◊ By raising awareness among decision makers
◊ Other: Please explain

21. How do you think to improve the use of DesInventar?

____

____

22. What are the functionalities requiring improvement in DesInventar?

____

4.5 Bibliography

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