BRIEFING PAPER

Global Climate Risk Index 2006

Weather-related loss events and their impacts on countries in 2004 and in a long-term comparison

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GERMANWATCH

Summary

The Global Climate Risk Index 2006 analyses how much countries and country groups have been affected by the impacts of weather-related loss events (storms, floods, droughts etc.). The figures for 2004, the latest available data, as well as those for the past 20 years show that less developed countries are the most affected. Thus, it is very likely that global climate change, which is expected to cause changes in extreme weather events, increasingly threatens many of these countries.

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Contents

1 Summary

The analyses presented here show how much countries have been affected in 2004 by weather-related loss events like hurricanes or floods. They are based on the data of the NatCat*SERVICE* of Munich Re[1]. The following indicators of affectedness were analysed:

- death toll,
- deaths per 100,000 inhabitants,
- amount of overall losses in US Dollars and
- overall losses in relation to the Gross Domestic Product (GDP).

The indicators are also analysed with regard to their long-term trends by identifying the countries most affected according to the average of annual figures in the past 20 years (separated in two decades). The Climate Risk Index (CRI)[2] is calculated by aggregating the figures for 2004 which are the most current basis of information, and the last decade 1995-2004. This ranking lists the most affected countries, determined by calculating the average rank of a country within all four assessments.

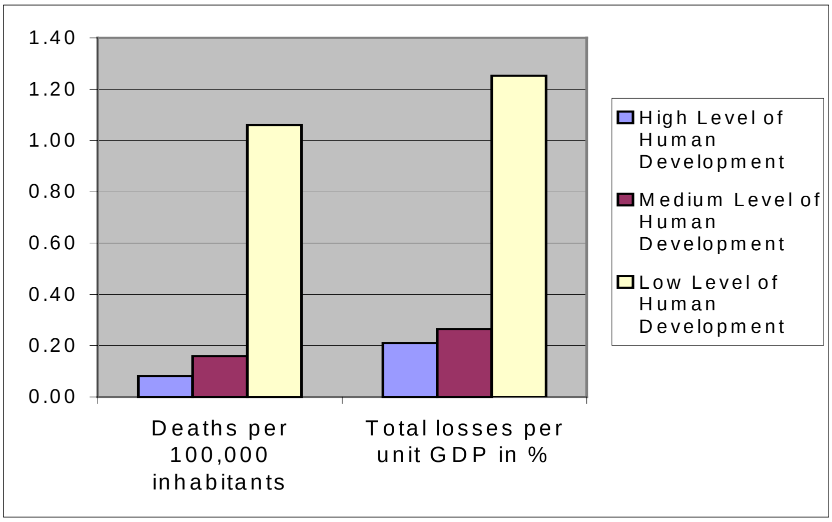

Fig.: Deaths and losses caused by extreme weather events according to the level of development

A general observation is that less developed countries are proportionally much more affected by weather-related damage events, as can be seen in the figure above. It shows how country groups according to the Human Development Index[3] are affected. This conclusion is also verified when looking at the ranking of the 10 most affected countries (Down 10), as shown by the Climate Risk Index for 2004 and 1995-2004 (see tables below). Against the background that climate change is expected to lead to more intense weather events in many of the world's regions, especially developing countries face in-

[1] Germanwatch alone is responsible for the presented evaluations, analyses and conclusions.

[2] The Climate Risk Index analyses how countries are affected by weather-related loss events. In the face of climate change and its expected impacts they have to be seen as an indicator for climate risks. Also see the Climate Change Performance Index (CCPI) developed by Germanwatch, which includes an index-based analysis of the emissions levels, the emissions trends as well as the climate protection policy: http://www.germanwatch.org/ccpi.htm

[3] The HDI, which is annually calculated by the United Nations Development Programme (UNDP), considers apart from the per capita income the life expectancy and the educational level; see also UNDP 2005.

creasing risks. Floods, storms, heatwaves and other consequences of climate change threat to undermine slowly achieved progress in development.

Germanwatch will update the Climate Risk Index regularly to watch the future development in this regard and to identify if and where climate change leaves its footprint through extreme weather events.

Tables: The Climate Risk Index (CRI) - the 10 countries most affected by extreme weather events in 2004 and in the period 1995-2004.

The CRI is calculated as the average rank of each country in the four indicators analysed. (The ranking in the Human Development Index HDI is listed in the right column for comparison only).

Climate Risk Index 2006 (based on values for 2004): Somalia as the most affected country has an average rank of 8.50, i.a. with rank 7 in total losses and rank 2 in losses per Gross Domestic Product (GDP). The ranking is particularly dominated by countries that rank low in the HDI.

	Country	Index value[4]	Rank death toll	Rank deaths per 100,000 inhabitants	Rank total losses	Rank total losses per GDP	For comparison: Rank in HDI 2003[5]
1	**Somalia**	**8.50**	14	11	7	2	-
2	**Dominican Republic**	**9.00**	6	5	14	11	95
3	**Bangladesh**	**9.75**	4	20	5	10	139
4	**Philippines**	**16.75**	5	13	26	23	84
5	**China**	**16.75**	2	48	3	14	85
6	**Nepal**	**17.00**	10	18	28	12	136
7	**Madagascar**	**17.25**	8	10	35	16	146
8	**Japan**	**18.25**	11	42	2	18	11
9	**USA**	**18.25**	7	48	1	17	10
10	**Bahamas**	**20.00**	51	7	15	7	50

Climate Risk Index 1995-2004: Honduras has been the most affected country in the last decade (1995-2004) with an average rank of 11.00, i.a. with rank 7 in death toll and rank 2 in deaths per 100,000 inhabitants. The figures for some countries are dominated by individual very severe events.

	Country	Index Value	Rank death toll	Rank deaths per 100,000 inhabitants	Rank total losses	Rank total losses per GDP	For comparison: Rank in HDI 2003
1	**Honduras**	**11.00**	7	2	25	10	116
2	**Bangladesh**	**17.50**	5	34	14	17	139
3	**Somalia**	**19.00**	20	12	36	8	-
4	**Venezuela**	**19.50**	2	1	28	47	75
5	**Nicaragua**	**21.00**	16	3	50	15	112
6	**Viet Nam**	**21.25**	8	30	24	23	108
7	**Dominican Republic**	**22.00**	11	8	41	28	95
8	**France**	**24.75**	4	11	5	79	16
9	**India**	**26.25**	1	44	9	51	127
10	**China**	**27.50**	3	79	2	26	85

[4] In case of equal index values, the ranking in casualties per 100,000 inhabitants determines the overall ranking.

[5] UNDP 2005

2 Introduction and objectives

2.1 *Increasing risks from global warming and extreme weather events*

The year 2005 has clearly shown what kind of devastating impacts extreme weather events can have on the life situation of many people, both in rich and poor countries. Hurricane Katrina caused damages of more than 100 billion dollars in the USA, an unprecedented scale (Munich Re 2006). Central American countries like Mexico and Guatemala have also been ravaged by devastating hurricanes.

In Guatemala alone, more than 800 people died because of hurricane Stan, many are still listed as missing (Wirtz 2006). The hurricane year 2005 has even beaten the records of the season 2004 (Faust 2006). Scientific studies show that the intensity of hurricanes sharply rose since the 1970s.

This development is barely explicable without the influence of climate change (Emanuel 2005, Webster 2005). The number of weather-related great natural catastrophes[6] also increased (see figure 1). Finally, the fact that such phenomena now even occur in regions that had so far not been affected is another indication for a connection between climate change and hurricane activity. In 2004 a hurricane has been registered for the first time ever in the South Atlantic off Brazil (Pezza/Simmonds 2005). In 2005, hurricane Vince developed to be the most easterly and northerly tropical cyclone ever to occur in the Atlantic, advancing into the Canary Islands (Munich Re 2006).

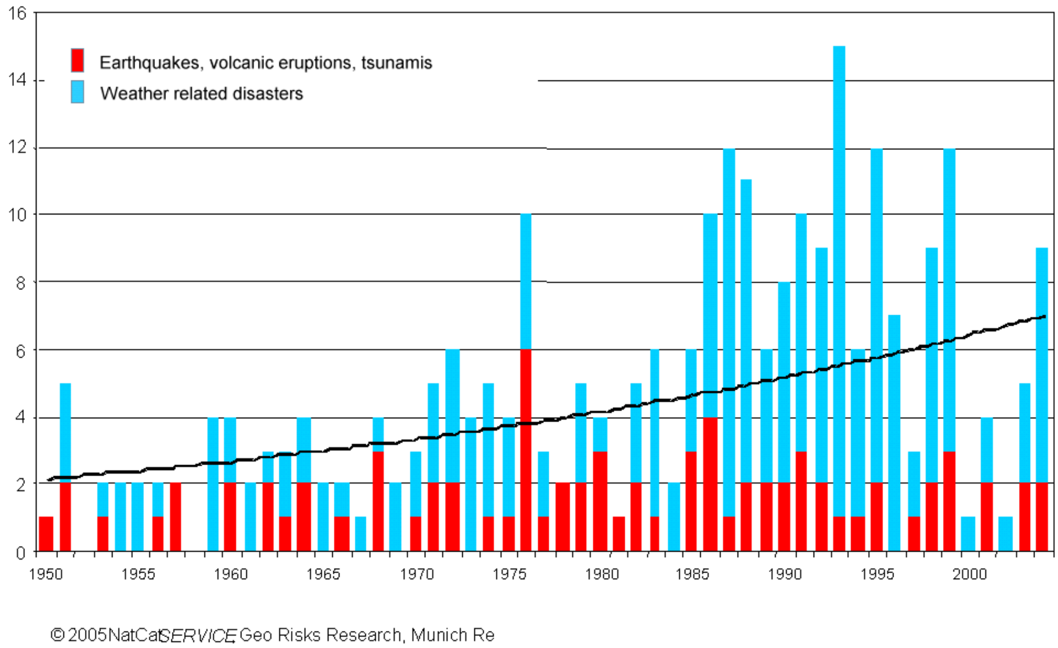

Fig. 1: Development of the number of great natural catastrophes 1950-2004.

Compared to the geological events, the weather-related events show a more pronounced trend of increase; this can at least be interpreted as an indication for a possible influence of climate change.

[6] For definition see Munich Re 2006

Climate change is reality and we are already aware of an increasing number of its impacts, others loom. In addition to drastic reductions of greenhouse gas emissions at global level, one question becomes more and more important in the climate debate: which countries will be affected in which way and to which degree by the impacts and which options are there to adapt to the consequences of climate change. Weather events that cause damage play a central role in this context since their formation and their intensity are determined by climate and for this reason, changes in the future are to be expected. Even if the formation of an individual weather event can never be scientifically traced to climate change, the rise in global average temperature undoubtedly influences the probability of occurence as well as the intensity of such events (see box 1). The increasing intensity of tropical hurricanes over the past 15 years for example shows a tight connection to the simultaneous rise in ocean surface temperature (Faust 2006).

According to the Intergovernmental Panel on Climate Change (IPCC), an increase in risk of floods and droughts is to be expected for many of the world's regions if the concentration of greenhouse gases will continue to increase in the atmosphere (IPCC 2001). Climate scientists have published a number of analyses over the past two years which show an increasingly alarming picture of the impacts of climate change.[7] The knowledge and the statements with regard to various situations of danger now considerably exceed the state described in IPCC 2001 as shown in table 1.

Box 1: Extreme weather events and their connection with climate change

"It is wrong to blame any one event such as [hurricane] Katrina specifically on global warming - and of course it is just as indefensible to blame Katrina on a long-term natural cycle in the climate. Yet this is not the right way to frame the question. … The situation is analogous to rolling loaded dice: one could, if one was so inclined, construct a set of dice where sixes occur twice as often as normal. But if you were to roll a six using these dice, you could not blame it specifically on the fact that the dice had been loaded. Half of the sixes would have occurred anyway, even with normal dice. Loading the dice simply doubled the odds. In the same manner, while we cannot draw firm conclusions about one single hurricane, we *can* draw some conclusions about hurricanes more generally. In particular, the available scientific evidence indicates that it is likely that global warming will make - and possibly already is making - those hurricanes that form more destructive than they otherwise would have been." Rahmstorf et al. 2005

In addition to this, science increasingly pays attention to risks in the earth system which pose significant threats because of the combination of two attributes. First, as a direct or indirect consequence of temperature increase changes could occur which lead to dangerous socio-economic or climatic impacts on a larger scale. Second, it needs to be taken into account that such a change would not be of linear nature but could trigger a non-linear "tipping" of the system initiating irreversible long-term processes, impacts and feedback effects. With rising temperatures, the risks from climate change and the probability increases that such "tipping points" will be reached. Against this background, an increasing number of politicians, environmental and development NGOs as well as scientists claim to put massive efforts into limiting global warming to 2° C by the end of the century compared to 1860 since beyond this level risks seem to increase rather exponentially than linear (e.g. WBGU 2003; ECF/PIK 2004; CAN 2002; see also IPCC 2001).

[7] Schellnhuber 2006

Table 1: Impacts of global temperature increase and examples for consequences

According to new scientific evidence, the certainty that the examples described here will occur has even increased in comparison to IPCC 2001. Source: Stern 2006b

Change	**Region**	**Example Consequenses**
More heatwaves	Continental areas	Temperatures experienced during the European heatwave of 2003 could be commonplace by the middle of the century and unusually cool by the end of the century
Less snow and re-duced glacier extent	Many northern latitudes and areas that rely on snowmelt for summer water supply (e.g. China, India, Peru)	Millions more people suffering water shortage in Peru, China and India; unreliable snowfall could make ski resorts less attractive tourist destina-tions
Sea level rise and increased risk of coastal flooding	Many low-lying areas, including small island states, Western Africa, parts of South East Asia (e.g. Bangladesh)	1-m sea level could potentially affect 6 million people in Egypt, 13 million in Bangladesh, and 72 million in China
More intense precipi-tation events	Northern latitudes	Greater incidence of flooding with increasing weather damages to peo-ple, property and their possessions
Drier summers and increasing risk of severe droughts	Many mid-latitude continental ar-eas, e.g. Mediterranean, Central America, Australia, Southern Africa	Proportion of years where run-off drops to drought levels could increase by 30% by 2050 in Southern Africa
Increasing ocean acidity	Our oceans could become consid-erably more acidic by the year 2100, probably be lower than has been experienced for hundreds of millennia and, critically, at a rate of change probably 100 times greater than at any time over this period.	Widespread impacts of marine eco-systems and biodiversity, with knock-on effects for local communities de-pendent on fishing

For example, the melting of the arctic permafrost might release methane in a dimension that would considerably enhance the global rise in temperature. The possible "tipping over" of the Amazon rainforest might turn this ecosystem into a savanna vegetation and a net source of carbon dioxide by the year 2080. The reason for this transformation might be a self-enhancing effect of three major factors: the dehydration through a disproportionate rise in temperature, the continuing deforestation as well as an expected absence of the natural transport of nutrients through sandstorms from the African Sahelian zone to Brazil in the case of a possible greening of the Sahel.[8]

The various feedback effects might lead to a global warming which is at least twice as high as it is forecasted by today's models with continuing high emissions of greenhouse gases, with temperatures that would be higher than ever before in the past 50 million years (Hadley Centre 2005).

[8] For further information on the transport of nutrients between the Sahel zone and the Amazon see Ridgwell 2002

Table 2: Potential impacts of rapid climate change, with some estimates of likely global trigger temperatures.

Source: Stern 2006b; adapted from Schneider/Lane 2006

Global temperature increase (relative to 2000)	Potential impacts
2 - 3°C	Onset of melt of Greenland Ice Sheet, increasing sea levels by 75 cm by 2100 and causing eventual additional sea level rise of 7 m over millennia Collapse of Amazon rainforest, with forest replaced by savannah, leading to significant consequences for biodiversity and human livelihoods Desertification of many world regions with widespread loss of forest and grassland
2 - 5° C	Potential to trigger melting of West Antarctic Ice Sheet, raising sea levels by a further 5 – 6 m for centuries or up to 75 cm by 2100 Chance of complete collapse of Thermohaline circulation, cooling Northern Hemisphere by several degrees and changing rainfall patterns Potential release of methane from melting tundra and shallow seas, further accelerating warming

A subject that is comparatively new, but might be of extraordinary importance for the most populous region of the world, is the question how the Asian monsoon might alter through climate change. The Indian monsoon brought reliable precipitation in previous years, but this rhythm seems to increasingly falter. Abnormal fluctuations over the past 30 years led to both disastrous famines and devastating floods throughout India. According to a new study implemented by the Potsdam Institute for Climate Impact Research, a strong alleviation as well as an intensification of the precipitation or even a succession of these processes in terms of a "rollercoaster scenario" might be possible (Zickfeld et. al. 2005).

Already today it is known that comparatively minor changes of 10 % in either direction of the monsoon's average precipitation can cause devastating droughts or floods. A weak summer monsoon for example can lead to crop collapses and a lack of food among the rural population - for two thirds of the 1.1 billion Indian inhabitants (Stern 2006a).

Country specific conditions determine vulnerability towards disasters

Undoubtedly every country has not only different climatic conditions, but also different economic and social characteristics. The complex interplay of the different factors such as population growth, income, development level etc. characterises the vulnerability of a country or a population group in the face of the extreme weather events considered here.[9] A lot of scientific research has been carried out to identify and understand the principal factors constituting vulnerability with regard to disaster risks in general, not only weather- or climate-related risks. Some projects have put many efforts into developing sets of indicators and indices.

For example, in a programme of the Inter-American Development Bank (IDB) inter alia a Prevalent Vulnerability Index (PVI) was developed and later applied to a number of countries in Latin America (Cardona et al. 2004). This PVI is built on three factors, a) exposure and physical susceptibility, b) socioeconomic fragility and c) lack of resilience. The higher the overall value the higher the vulnerability.

[9] See Brauch 2005 for a wide-ranging analysis of the term "vulnerability"

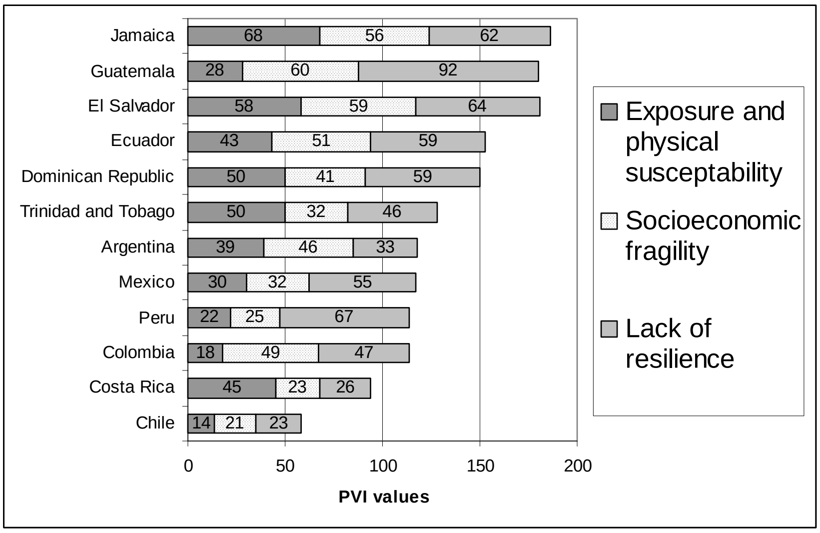

Fig. 2: The Prevalent Vulnerability Index (PVI) applied for 12 Latin American countries

Source: Cardona et al. 2004

A project carried out by Columbia University and the World Bank developed world maps of disaster hotspots showing where the risk of mortality and economic losses due to hazards of natural origin are greatest (see Dilley et al. 2005). This assessment thus focuses foremost on risks as a product of hazard frequency and consequence.

Finally, the United Nations Development Programme (UNDP) has been working on a Disaster Reduction Index (DRI) in order to help frame efforts how to better anticipate, manage and reduce disaster risks. The DRI "measures the relative vulnerability of countries to three key natural hazards - earthquake, tropical cyclone and flood - and identifies development factors that contribute to risk, and shows in quantitative terms, just how the effects of disasters can be either reduced or exacerbated by policy choices." (UNDP 2004)

Carreño et al. in a forthcoming publication pay special attention to the question how progress in disaster reduction can be assessed which could help to identify those measures that are most effective to reduce the impacts from disasters (Carreño et al. 2006).

A recent publication by Munich Re analysed the vulnerability of megacities, so as to give practical advice to reduce vulnerability in particularly important areas where a large number of people and huge material values concentrate (Munich Re 2005).

According to the Third Assessment Report of the IPCC, "populations in developing countries are generally expected to be exposed to relatively high risks of adverse impacts of climate change […]. The exposures and low capacity to adapt combine to make populations in developing countries generally more vulnerable than populations in developing countries" (IPCC 2001: 77).

In the face of the considerably dangerous situation posed by climate change and its impacts, an analysis of the past can provide an important indication for the question which countries are especially vulnerable towards extreme weather events, already under today's climatic conditions or in the face of climatic changes which are already under way. The consideration of socio-economic variables in comparison to damages and fatalities caused by weather events - as done in the present analysis - does not allow an exact measurement of vulnerability, but at least an estimation (Brauch 2005). It is likely that most of the countries identified as extraordinarily affected in this analysis will also become particularly endangered in the future through climate change.

Despite any historical analysis, a deterministic projection of the past into the future, however, is not appropriate. For one thing, the statistical past only partly reflects the altered probability of occurence of damage events due to climate change. Besides, new phenomena can arise for states or regions (see above). Not least do the people also have various measures of adaptation at their disposal. To implement them effectively, however, depends on many factors that determine the overall extent of vulnerability.

However, a too drastic change of the global and regional climatic conditions - likely impacts have already been described in this study - can exceed the adaptive capacity of whole nations. In order to manage the unavoidable, and to avoid the unmanageable in face of climate change both adaptation to the unavoidable consequences and mitigation of greenhouse gas emissions pushing global warming beyond critical thresholds must be pursued.

Prime objective of the Climate Risk Index: sensitization of public and media

Extreme weather events play an important role in the public discussion about climate change since they often receive high attention by the media and the general public. But often the discussion only highlights the absolute figures and records of losses and deaths and thus lacks differentiating between countries' differing conditions such as countries' level of development, number of inhabitants etc. when hit by such events.

Against this background, Germanwatch developed the Global Climate Risk Index to periodically sensitize the general public and the media to the impacts of extreme weather events, their relation to climate change, and to call for a differentiated discussion about the consequences. In addition, we intend to promote the debate about options that could be taken to reduce the adverse impacts, especially on less developed countries.

More particularly, the analyses presented here are to show, for both the year 2004 and the past 20 years, respectively:

- **how intensively countries and country groups have been affected by weather events;**
- **deaths and losses in relation to country-specific conditions;**
- **how intensively especially the less developed countries are affected by the impacts;**
- **what are options to be taken to prepare for, and reduce the risks from climate-related extreme events?**

It has been highlighted and analysed by different actors that many successful initiatives exist to prepare for such disasters (see e.g. UNDP 2002; PAHO 2006). The secretariat of the United Framework Convention on Climate Change, for example, provides an overview of local coping strategies for adaptation to climate change. Many of these are related to extreme weather events (UNFCCC 2006).[10] Using the example of the **Philippines**, the development of climate and weather events as well as possible measures of adaptation in one country will be considered more specifically.

This is the first time that this analysis is published in the present way, with the impacts of the year 2004 and the last two decades. Germanwatch will update and advance these analyses regularly to watch if and how climate change leaves its footprint through extreme weather events in the future and also to present options how countries prepare for the risks.

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[10] For available research papers on adaptation issues, see e.g.: http://www.climateadaptation.net/papers.html

2.2 Introductory remarks on contents and methodology

The evaluations presented here are based on the worldwide accepted data of the NatCat-*SERVICE* of Munich Re's Geo Risks Research of the past 20 years.[11]

It includes "all loss events concerning natural hazards which have resulted in substantial material or human losses" (Munich Re 2003: 6).

Munich Re registers the number of loss events, the death toll, the insured losses as well as the total losses for the world's countries. The latter two indicators are denominated in million dollars (original values, adjusted for inflation).

The present analyses only cover the weather-related event classes of the Munich Re data: a) storms, b) floods and c) extreme temperature events and mass movements (droughts, cold spells etc.).[12] Geology-related events like earthquakes, volcanic eruptions or tsunamis, for which data are also available, are not considered important in this context since they do not depend on the weather and are therefore not to be seen in the context of climate change. The various categories within the weather-related events have been combined for reasons of simplified manageability of the large data collection. In addition to this, the country-specific evaluation is considered more important here than the evaluation by types of events. In the case of extremely devastating events it is mentioned if it had been a flood, a storm or some other type of event. It also has to be noted that the impacts on a country usually are not distributed equally over the whole country and the whole range of social groups. Especially in large countries like China or India the impacts may concentrate on one region. But since relevant data on a sub-national level is much more difficult to assess, these analyses concentrate on the national level.

In **chapter 3** the data for the year 2004 are evaluated according to the country groups[13] defined by the per capita income. Relative figures are additionally analysed in the context of the country groups according to the Human Development Index (HDI) of the United Nations Development Programme (UNDP).

In **chapter 4**, country-specific analyses are carried out for the four indicators "total death toll", "deaths per 100,000 inhabitants", "total losses" as well as "total losses in relation to the Gross Domestic Product (GDP)" with the objective of identifying the 10 most affected countries in 2004 as well as over the past two decades (1985-1994 and 1995-2004; based on annual average figures). The term **Down 10** is applied to the ten countries most affected in any indicator since a negative consequence is attributed to the highest rank, in contrast to the term "Top 10". A distinction of insured/uninsured losses has not been made, since no or only marginal insured damages have been registered for the majority of events, especially in developing countries. The long-term comparison is to help the judgement of possible trends: for example, if the year 2004 has only been an anomaly for one specific country, if there are clear long-term improvements etc.

Mortality and economic losses also play a major role in elaborate assessments of disaster risk undertaken by relevant international organisations, such as the UNDP Disaster Risk Index (UNDP 2004) or the Natural Disaster Hotspot Global Risk Analysis of Columbia University and the World Bank (Dilley et al. 2005). This fact supports the application of these indicators in the analyses presented in this document.

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[11] Germanwatch alone is responsible for the presented evaluations, analyses and conclusions.

[12] In addition to the NatCatSERVICE of Munich Re it should be referred to the extensive data and analyses of the Centre for Research on the Epidemiology of Disasters (CRED) in Belgium (Guha-Sapir et al. 2004).

[13] The Worldbank makes the following sub-division according to the annual per capita income (in USD): low income, $825 or less; lower middle income, $826 - $3,255; upper middle income, $3,256 - $10,065; and high income, $10,066 or more; see World Bank Data/Country Classification: http://web.worldbank.org/WBSITE/EXTERNAL/DATASTATISTICS/0,,contentMDK:20420458~menuPK:64133156~pagePK:64133150~piPK:64133175~theSitePK:239419,00.html

In **chapter 5**, the Climate Risk Index (CRI) of the overall most affected countries is then calculated for 2004 and 1995-2004. The analysis is based on the average rank of each country in the four indicators analysed which are thus weighted equally. The calculation of relative figures is an important supplement to the absolute figures since it puts the country-specific data of losses and deaths in relation to the real conditions within the countries. It is for example evident that a damage of 1 billion dollars has a far smaller economic impact on a rich country like the USA than for one of the poorest countries in the world like Nepal. This is underpinned by the relative evaluations. For this, the general data of the United Nations Statistics Division (UN 2006) and the World Bank have been consulted (World Bank 2006). Where published data had not been available in individual cases, they have been found in other sources or approximately calculated. This has especially been the case for data on the Gross Domestic Product (GDP) of very small countries. In few individual cases the data are based on estimations. The ranking of the Down10, however, has not been considerably influenced by this. It is important to point out that the average figures have been influenced in some individual cases by extraordinarily severe events. This is, for example, the case for the extremely high average of fatalities in the period of 1985-1994 in Bangladesh or in the period of 1995-2004 in Venezuela. In Venezuela there has been a catastrophic flood in 1999 with more than 30,000 deaths, and apart from that hardly any other event took place. Where catastrophes like this one distort the overall result to such an extent it is pointed out in the text since it is only partially visible in the figures presented.

Chapter 6 finally examines the example of the Philippines more specifically. Weather risks and possible measures of adaptation - future ones but also already taken ones - are enormous challenges for this South-East Asian country.

Box 2: Overview of the evaluated indicators

Evaluated indicators:

- Total death toll
- Deaths per 100,000 inhabitants
- Total losses in USD (original figures, adjusted for inflation)
- Total losses per unit GDP in %

Evaluated period of time:

- 1985-2004

3 Country groups in comparison: Deaths and losses caused by weather-related events in 2004

In order to analyse if a general conclusion regarding the relationship between material wealth and affectedness by extreme weather events can be made, a series of analyses has been performed differentiated by country groups. According to the World Bank standards, the world's countries have been divided into four levels of per capita income and for each country group absolute (fig. 3) and relative (fig. 4) indicators of how it has been affected have been calculated.

The following observations and conclusions have arisen from that:

- The richer countries are worst hit financially, both with regard to economic and insured damages.
- In the case of the total economic damages, the distribution, however, is clearly different from the insured damages since the general level of insurance is clearly lower in poorer countries, as shown by data of Munich Re elsewhere (Munich Re 2004).
- In poorer countries an exceptionally large number of people die because of the impacts of weather-related events.
- While the relative figures for fatalities confirm the conclusions drawn from the absolute figures, the relative figures for losses show a different picture than the absolute losses: according to this indicator, the most affected countries are those with the lowest per capita income (fig. 4). This tendency becomes even more evident when the grouping of the countries is made according to the Human Development Index (HDI) (fig. 5). The HDI is based on a more differentiated approach to record the countries' state of development than a pure balancing of the per capita income.[14]

These results underline the thesis that reducing the risks of disasters from extreme weather events is a crucial component when striving for the achievement of the Millennium Development Goals (MDGs) (see also UNDP 2004).

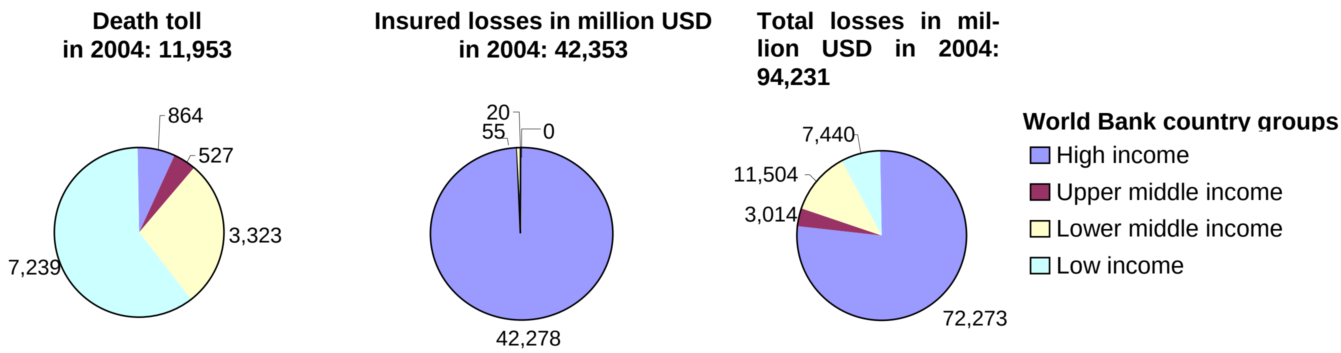

Fig. 3: Deaths and losses caused by weather events by country group in 2004

[14] The HDI, which is annually calculated by the United Nations Development Programme (UNDP), considers apart from the per capita income the life expectancy and the educational level; see also UNDP 2005.

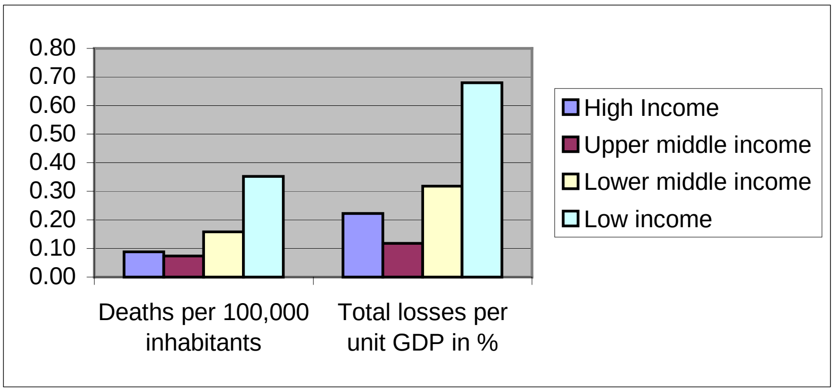

Fig. 4: Relative affectedness with respect to deaths and losses caused by weather events in 2004 by country group based on income.

The chart shows that the countries with lower per capita income are much more affected.

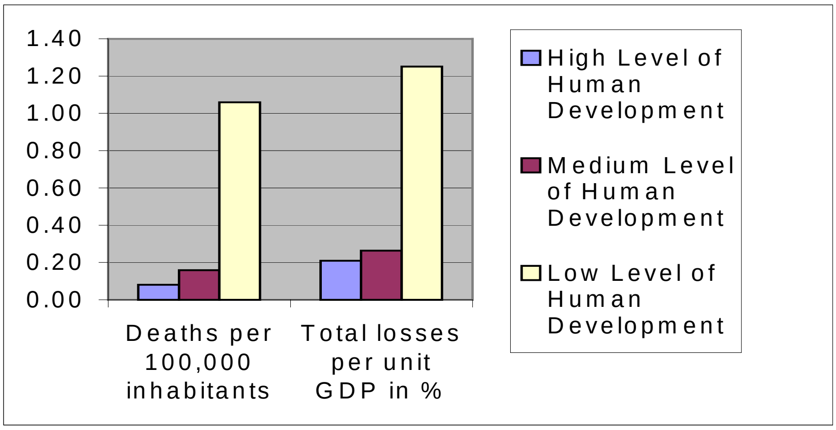

Fig. 5: Relative figures for deaths and losses caused by weather events in 2004 for country groups defined on the basis of the Human Development Index (HDI).

The chart shows that countries with a low level of development are much more affected.

4 Countries in comparison: Impacts of weather-related events - the Down 10 in 2004 and long-term comparisons

4.1 Death toll

The country with the highest death toll caused by weather-related events in 2004 is Haiti, the fatalities were caused by storms and floods (see table 3). Relatively big, heavily populated countries like China, India and Bangladesh follow. With regard to the fatalities caused by weather events, non-industrialised countries are clearly the most affected, the USA being the only industrialised country in the Down 10. By comparing the values for 2004 with those for the previous year or with long-term analyses it becomes clear that 2004 has been a particularly "bad" year for Haiti or Madagascar. China and Bangladesh, on the other hand, do not contrast much from their long-term average. In China, however, the average numbers of deaths have, despite a population growth, clearly declined compared to the first decade. It may be assumed that the economic boom and targeted measures of poverty reduction have done their bit for a reduction of the vulnerability towards extreme weather.

Table 3: The 10 countries with the highest death tolls caused by weather-related loss events in 2004 as well as a comparison with the previous year and the long-term average.

Rank 2004 (2003)	**Country**	**Death toll**		**Annual average**		**Deaths per event**			
		2004	2003	**1995-2004**	1985-1994	**2004**	2003	**1995-2004**	1985-1994
1 (29)	Haiti	**3,463**	72	**382**	208	**1,154**	24	**201**	297
2 (6)	China	**1,328**	1,078	**1,782**	2,691	**78**	54	**71**	131
3 (3)	India	**1,115**	4,405	**4,402**	2,019	**186**	245	**265**	151
4 (5)	Bangladesh	**1,112**	1,212	**812**	16,553	**111**	110	**67**	1,562
5 (9)	Philippines	**1,012**	346	**497**	1,032	**92**	27	**44**	90
6 (44)	Dominican Republic	**445**	22	**399**	9	**148**	5	**235**	7
7 (11)	USA	**299**	322	**372**	283	**3**	4	**3**	4
8 (22)	Madagascar	**266**	86	**84**	53	**89**	21	**47**	33
9 (91)	Myanmar	**220**	0	**226**	7	**220**	0	**323**	12
10 (13)	Nepal	**212**	308	**325**	241	**53**	154	**53**	134

The analysis of the deaths per event provides an indication for the population's vulnerability towards weather events. In Haiti the average in 2004 is very high attributable to two extremely devastating events. The figures of Bangladesh in the decade of 1985-1994 are characterised by a flood event that caused nearly 140,000 fatalities in 1991. The following years could have been characterised by catastrophes of similar dimensions, if there hadn't been effective catastrophe prevention programs. It needs to be added for the USA that the events in 2005 - Hurricane Katrina alone caused more than 1,300 fatalities - that are not mentioned here will cause a significant rise in the figures in future analyses. For Germany, 23 deaths have been registered for 2004 which puts it in rank 39.

Ten year series

It is noticeable that specific countries appear both among the Down 10 in 2004 and in the two decades, namely Bangladesh, China, India and the Philippines (see table 4). Especially India stands out with its clear increase. Particularly in the last decade the Down 10 table is characterised by extraordinary extreme events. The majority of fatalities in France, Germany and Italy can be traced back to the hot summer of 2003 that caused around 15,000 deaths in France alone. In the context of this study a relevant fact is that there is established scientific indication that the probability of occurrence of such a heat wave in the heart of Europe has been substantially increased through man-made climate change (Stott et al. 2004). This also broke the clear "dominance" of the developing countries, but is so far to be regarded as an exception. The figures of fatalities and losses, however, might also increase in the industrialised countries in the future.

The high figures for Venezuela (1995-2004), Mozambique and Bangladesh (1985-1994) have also been caused by extremely devastating events. In 1999, around 30,000 people died in Venezuela because of floods, in 1985 a long period of drought caused around 100,000 fatalities in Mozambique.

Table 4: Long-term average of deaths caused by weather-related damage events.

1995-2004			**1985-1994**		
1	India	4,402	1	Bangladesh	16,553
2	Venezuela	3,007	2	Mozambique	10,039
3	China	1,782	3	China	2,691
4	France	1,521	4	India	2,019
5	Bangladesh	812	5	Philippines	1,032
6	Germany	728	6	Sudan	803
7	Honduras	578	7	Pakistan	484
8	Viet Nam	497	8	Viet Nam	457
9	Philippines	497	9	USA	283
10	Italy	445	10	Afghanistan	273

4.2 Deaths per 100,000 inhabitants

The calculation of the deaths per 100,000 inhabitants helps to evaluate the impact of the death toll more realistically (see table 5). Because for countries that are heavily populated, absolute death tolls can be expected to be higher compared to less populated ones - if comparable weather risks exist. Thus, countries like China, India and Bangladesh do not appear here anymore; instead, apart from Djibouti, only island states are present in the list, namely extremely small islands that are clearly more exposed to weather events and face them more unprotected (apart from Madagascar where, however, it could not be checked whether the events claimed most of the casualties on the main island or on the smaller ones that belong to Madagascar). Niue is an extreme example in the statistical sense since there has only been one fatality, the country, however, only has around 2,000 inhabitants. Also in this relative analysis of 2004 Haiti is extraordinarily strongly affected.

This can also be seen in comparison with the long-term average figures. The figures for the Dominican Republic, Madagascar and Somalia reveal the same picture. According to this indicator, around half of the countries had practically not been affected in the previous year. For Germany a value of 0.03 arises which puts the country on rank 84.

Table 5: Down 10 of the most affected countries according to the relative death toll in 2004

The table shows the values rounded off to one digit, while the calculation was made for two digits behind the decimal point (e.g., in the column Deaths per 100,000 inhabitants / 2004, The Seychelles have a value of 3.52, while the Bahamas have 3.47).

Rank 2004 (2003)[15]	**Country**	**Deaths per 100,000 inhabitants**		**Annual average of deaths per 100,000 inhabitants**	
		2004	2003	**1995-2004**	1985-1994
1 (89)	Niue	**46.4**	0	**5.0***	0
2 (15)	Haiti	**40.3**	0.8	**4.8**	3.2
3 (89)	Grenada	**36.9**	0	**3.8**	0
4 (89)	Djibouti	**9.8**	0	**1.1**	2.5
5 (28)	Dominican Republic	**5.0**	0.2	**4.8**	0.1
6 (89)	Seychelles	**3.5**	0	**0.4**	0.7
7 (89)	Bahamas	**3.5**	0	**0.5**	0
8 (89)	Northern Mariana Islands	**2.5**	0	**0.3**	1.2*
9 (89)	Cayman Islands	**2.3**	0	**1.2**	0
10 (18)	Madagascar	**1.5**	0.5	**0.5**	0.5

* estimation

[15] In case of equal values, the countries are ranked equally.

Ten year series

The average values for the last two decades differ clearly from each other (see table 6). For one thing, extremely devastating events affect the balance in this case, just like in the evaluation of the absolute death tolls. This especially applies to Venezuela (1995-2004) as well as Mozambique and Bangladesh (1985-1994), even if Bangladesh is ravaged by weather catastrophes more regularly. Also France only appears because of the hot summer of 2003. For another thing, relatively low populated countries appear like Niue, Micronesia, the Solomon Islands or Vanuatu that all have less than 1 million inhabitants. Furthermore noticeable is the regional dominance of Central America and the Caribbean over the past 10 years. With Honduras, Nicaragua, Haiti, the Dominican Republic, Grenada as well as Antigua and Barbuda six countries of this region alone are part of the Down 10. A regional Human Development Report identified the vulnerability to extreme weather events as one challenge for improving human development which underlines these results (UNDP 2003).

Haiti is the only country appearing in the tables of both decades. The fact that it is constantly strongly affected can be regarded as evidence for the big vulnerability of this extremely poor country, ranked 153 in the Human Development Index analyses. However, the question needs to be raised if catastrophe prevention has been neglected in face of the known hazards.

Table 6: Long-term average of deaths per 100,000 inhabitants caused by weather-related loss events.

1995-2004			1985-1994		
1	Venezuela	12.5	1	Mozambique	70.3
2	Honduras	9.1	2	Bangladesh	15.3
3	Nicaragua	5.9	3	Solomon Islands	9.8
4	Micronesia	5.7	4	Guinea-Bissau	5.9
5	Papua New Guinea	5.2	5	Vanuatu	4.5
6	Niue*	5.0	6	Haiti	3.2
7	Haiti	4.8	7	Sudan	3.2
8	Dominican Republic	4.8	8	Djibouti	2.5
9	Grenada	3.8	9	Greece	2.1
10	Antigua and Barbuda	2.8	10	Samoa	2.0

*estimation

4.3 Total losses in million US Dollars (original damages, adjusted for inflation)

The analysis of total losses (see table 7) also shows a combination of constants as well as exceptions. While the USA, China, Germany and India constantly record high damages, 2004 has been an extreme year for countries like the Cayman Islands, the Seychelles, Kenya and Somalia.

Japan has also been strongly affected in 2004. The year 2003, on the other hand, has been a "benign" year for this country, as the comparison with the average values of the decades shows. In the case of the Cayman Islands, however, it needs to be added that in comparison with countries like Bangladesh or Kenya, a relatively high amount of damage had been insured, around 50 %, which relativises the actual importance of the damages.

Table 7: The Down 10 of the most affected countries in 2004 according to the total losses (original values, adjusted for inflation), including the long-term analysis.

Rank 2004 (2003)[16]	**Country**	**Total losses in million USD**		**Annual average**		**Losses per event**			
		2004	2003	**1995-2004**	1985-1994	**2004**	2003	**1995-2004**	1985-1994
1 (1)	USA	**48,824**	19,890	**20,014**	15,099	**509**	240	**204**	231
2 (20)	Japan	**15,537**	260	**3,100**	2,505	**914**	43	**263**	261
3 (2)	China	**10,238**	10,671	**11,376**	5,608	**569**	534	**451**	274
4 (108)	Cayman Islands	**3,000**	0	**304**	2	**3,000**	0	**608**	25
5 (43)	Bangladesh	**2,203**	9	**880**	913	**220**	0.8	**72**	86
6 (69)	Kenya	**2,001**	0.5	**204**	1	**667**	0.2	**71**	0,6
7 (108)	Seychelles	**2,000**	0	**200**	0.1	**2,000**	0	**1,000**	0.4
7 (77)	Somalia	**2,000**	0.2	**202**	2	**2,000**	0.1	**92**	2
9 (5)	Germany	**1,366**	2,288	**2,449**	933	**59**	95	**111**	49
10 (8)	India	**1,013**	637	**1,291**	1,479	**169**	35	**78**	111

Another meaningful evaluation is the calculation of damages in purchasing power parities (PPP)[17] which shows a clearer image of their economic importance (Fig. 6). The total losses in countries like China (now on rank 2), Bangladesh, India, Kenya and the Seychelles are clearly upgraded by this, while those of Japan and the Cayman Islands decrease. The Dominican Republic and South Korea appear as new entries in the Down10 according to this analysis. The USA stay on rank 1 with a slight increase. In the case of Somalia, no data with regard to purchasing power parities could be calculated. In the case of Germany, the value slightly decreases to 1,207 million dollars, which makes the country fall out of the Down 10 in this analysis.

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[16] In case of equal values, the countries are ranked equally.

[17] Purchasing power parities are exchange rates that enable a comparison of the GDP that considers the differences in prices between countries.

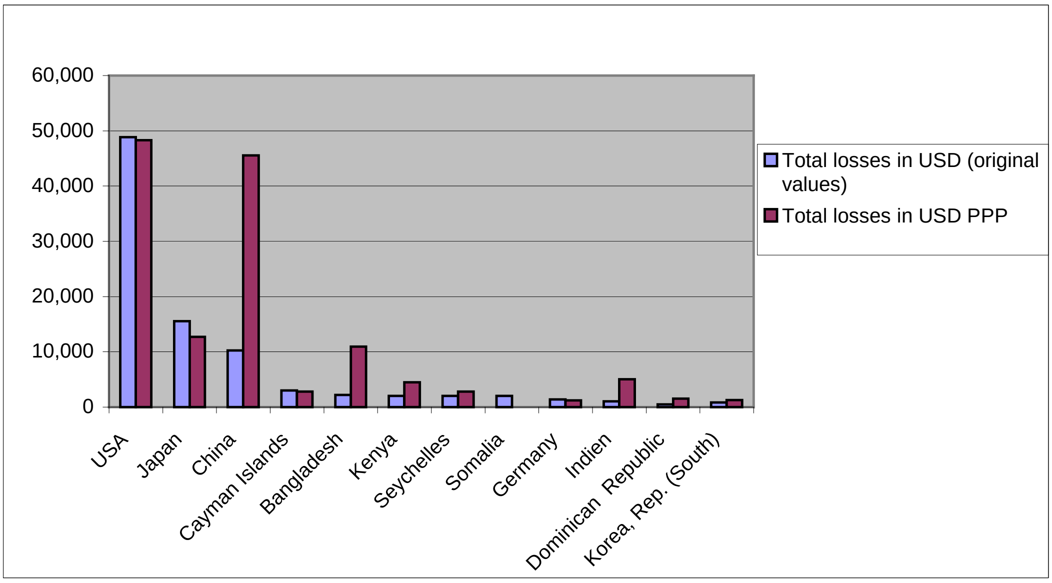

Fig. 6: Total losses in US dollars (original values and according to purchasing power parities).

The calculation of losses according to purchasing power parities shows that poorer countries like China, Bangladesh or Kenya are considerably stronger affected than suggested by the mere values in US dollars.

Ten year series

The analysis over the decades shows that the USA, China and Japan recorded the highest amount of average losses caused by weather-related events both over the past ten years and in the period between 1985 and 1994 (see table 8). All in all, seven of the most affected countries appear in both periods of time, so there is a certain constancy. As expected, the tables are dominated by countries that due to their big economical potential hold greater values that can be damaged. In the first decade, five of the seven (formerly) major economic powers (G7)[18] appear in the table, between 1985 and 1994 even all seven. The extent of damage shows a clear trend. In those countries appearing in both tables, apart from India, the values for the past ten years are clearly higher, despite the values' adjustment for inflation.

Table 8: Long-term annual average of the total losses in million dollars (original values, adjusted for inflation).

1995-2004			**1985-1994**		
1	USA	20,014	1	USA	15,099
2	China	11,376	2	China	5,608
3	Japan	3,100	3	Japan	2,505
4	Germany	2,449	4	India	1,479
5	France	2,137	5	Great Britain	1,282
6	Korea, Dem. Rep. (North)	1,742	6	Italy	1,237
7	Italy	1,740	7	France	997
8	Korea, Rep. (South)	1,545	8	Germany	933
9	India	1,291	9	Canada	928
10	Spain	1,155	10	Bangladesh	913

[18] By now China is the fourth largest economic power, but not a member of the G7.

4.4 Total losses in relation to the Gross Domestic Product (GDP)

In contrast to the losses in absolute terms, a clearer picture of how the countries are actually economically affected is given by the relative losses, i.e. the total losses related to the national Gross Domestic Product (here expressed in %) (see table 9). This results in a ranking that clearly differs from the Down 10 of the absolute losses. All ten are developing countries - not one OECD country can be found in the Down 10 now. Similar to the relative death toll, it is again mostly small island states that appear among the ten most affected countries. Just like the absolute annual losses on the Cayman Islands and the Seychelles have been caused by extreme events, the relative affectedness of those countries is extraordinarily high. For both of them, the damages have been more than twice as high as the Gross Domestic Product of the respective year, just like in Somalia. Just for comparison it might be added that for Germany 200% of the GDP would mean a loss of about 5,400 billion USD.

For almost all countries, 2004 has been an extremely devastating year in comparison with the values of the previous year or the long-term trend which is additionally distorted upwards in the last decade mainly because of the year 2004. In this analysis, Germany ranks 35 with a damage of 0.05 % in relation to the GDP.

Table 9: Total losses in relation to the Gross Domestic Product.

In comparison with the absolute total losses (see previous section) they show a more realistic image of how countries have been economically affected. Especially poorer countries are among the most affected ones. 2004 has been a year of extreme losses: in the case of the first four countries the damage was more than twice as high (> 200%) as the GDP. For comparison: for Germany this would result in losses of about 5,400 billion USD.

Rank 2004 (2003)[19]	**Country**	**Total losses per unit GDP in %**		**Annual average of total losses per unit GDP in %**	
		2004	2003	1995-2004	1985-1994
1 (69)	Seychelles	**284.3**	0	**32.4**	0.03
2 (50)	Somalia	**221.3**	0.01	**12.6**	0.38
3 (69)	Grenada	**206.4**	0	**24.4**	0.05
4 (69)	Cayman Islands	**200.9**	0	**25.3**	-*
5 (69)	American Samoa	**34.3**	0	**-***	-*
6 (69)	Kenya	**12.8**	0	**1.8**	0.01
7 (69)	Bahamas	**9.5**	0	**4.5**	0.01
8 (69)	Niue	**7.7**	0	**-***	-*
9 (69)	Jamaica	**7.2**	0	**0.9**	5.6
10 (48)	Bangladesh	**3.9**	0.02	**1.9**	3.3

*no adequate basis of data on GDP available

[19] In case of equal values countries are ranked equally.

Ten year series

The following analysis demonstrates how countries have been economically affected on a relative scale by weather events over the decades. The results show an image that clearly differs in parts from the ranking in 2004 and even more clearly from the analysis of the absolute damages over the decades (see table 10). When calculating the average values of the last decade, the extreme values for the Seychelles, the Cayman Islands and Grenada put the three countries on the first ranks again. The weather-related extreme events of the past decade played a very dominant role for the Caribbean. Apart from the Cayman Islands also St. Kitts and Nevis, Dominica and Honduras are located in this region. They are directly followed by Belize, Antigua and Barbuda and the Bahamas which cannot be seen on the table because it is restricted to the Down10. It is interesting to see that the evaluations for the ten years between 1985 and 1994 show completely different values; here the Caribbean states are less present (Virgin Islands and Jamaica). This points to an increase in intensity in the case of hurricanes, as it has scientifically been observed (ECF/PIK 2004; Kerr 2005; Faust 2006). There are more and more indications that climate change plays an important role for these changes, even if the dimension of its influence is not yet to be clearly determined. In any case it shows that especially small island states in the Caribbean and the Pacific are particularly vulnerable towards the impacts of climate change (see also IPCC 2001). These figures underline results of the Natural Disaster Hotspots Project carried out by the World Bank and Columbia University, where the Caribbean has been identified as a region with high proportional economic loss risks from hydrologic disasters (Dilley et al. 2005).

Table 10: Long-term average of total losses in relation to the Gross Domestic Product in %.

1995-2004			**1985-1994**		
1	Seychelles	32.4	1	Western Samoa	44.8
2	Cayman Islands	25.3	2	Montserrat	36.6
3	Grenada	24.4	3	Vanuatu	13.8
4	Mongolia	17.8	4	Swaziland	13.0
5	Virgin Islands (USA)	17.0*	5	Cook Islands	11.1
6	Korea, Dem. Rep. (North)	15.9	6	Virgin Islands (USA)	7.9
7	St. Kitts and Nevis	14.2	7	Armenia	6.8
8	Somalia	12.6	8	Jamaica	5.6
9	Dominica	8.0	9	Tajikistan	4.7
10	Honduras	7.1	10	Georgia	4.6

* estimation

5 The Climate Risk Index as a synthesis of the individual analyses: The 10 most affected countries

The Climate Risk Index (CRI) forms the synthesis of the four previously introduced analyses. All four indicators - death toll, deaths per 100,000 inhabitants, total losses in USD and total losses in relation to GDP in % - are equally weighted. The index value is calculated from the rankings in the individual categories. It constitutes the average ranking of a country in the four categories. This represents a simple and transparent approach to balance absolute and relative indicators. Below, the results for 2004 and the last 10 years are presented.

5.1 The 10 most affected countries in 2004

According to this synthesis, **Somalia** was the most affected country in 2004. The reason for this is obviously a devastating flood event that cost 150 lives and caused losses of 2 billion dollars in a country which is extremely vulnerable due to internal conflicts and wide-spread poverty. The **Dominican Republic** is part of the Caribbean and therefore of a climatically highly sensitive region that is often ravaged by tropical storms (see 4.4). The majority of damages in 2004 in this area was caused by two devastating storm events, the fatalities primarily by floods. **Bangladesh** was primarily affected by floods in 2004, both with regard to casualties and absolute damages. The latter, however, have also been clearly above the long-term average, contrary to the casualties. Bangladesh belongs to those countries that will particularly be affected by climate change, since various dangers like sea level rise, the intensification of extreme weather events, possible changes of the monsoon (see above) or the melting of the glaciers in the Himalaya are combined in this region and threaten the heavily populated and extremely vulnerable country (ECF/PIK 2004; Schneider/Lane 2006; Huq 2001).

The combination of relative and absolute indicators relativises the dominance of particularly heavily populated or economically particularly powerful countries. It is to be expected that there are constantly higher death tolls in China, Bangladesh and India compared to other countries due to their large populations. Nevertheless, any fatality is a fatality per se, of course, no matter whether it is in a heavily populated or a poor country. And the same holds true for the overall damages in the richest economies USA and Japan. Where many values are accumulated, much damage can be caused.

Finally - as an orientation related to development policy - the values and rankings in the Human Development Index (HDI) help to judge the respective state of development of each country.

Among the Down10, with **Japan** and the **USA** there are only two industrialised countries that are ascribed to the highly developed countries according to the HDI. Their relatively high ranking is primarily due to the high absolute overall damages, where the USA ranks first, Japan second.

Without this ranking they would have fallen out of the Down 10, although their death tolls are also quite high. The vast majority of the countries among the Down 10 are beyond rank 80 in the HDI.

In the case of Somalia, no HDI values could have been calculated yet. In any case, however, the UN regards Somalia as one of the Least Developed Countries (UN 2006).

Germany achieves an average rank of 41.75 in the four partial rankings, resulting in rank 33 on the overall ranking. The country has only been part of the Down 10 with regard to the absolute overall damages, mainly caused by storms, with damages in 2003 having been considerably higher than in 2004 (see 4.3).

Table 11: Climate Risk Index: the 10 most affected countries of the year 2004.

The Index is calculated as the average rank of each country in the four analysed indicators (the ranking in the Human Development Index HDI is listed in the right column for comparison only). Somalia as the most affected country, for example, achieves an average rank of 8.5, among others with rank 7 in the overall damages and rank 2 in damages per Gross Domestic Product (GDP). The ranking is strongly dominated by countries that rank low in the HDI.

	Country	**Index value**[20]	Rank death toll	Rank deaths per 100,000 inhabitants	Rank total losses	Rank total losses per GDP	For comparison: Rank in HDI 2003[21]
1	**Somalia**	**8.50**	14	11	7	2	-
2	**Dominican Republic**	**9.00**	6	5	14	11	95
3	**Bangladesh**	**9.75**	4	20	5	10	139
4	**Philippines**	**16.75**	5	13	26	23	84
5	**China**	**16.75**	2	48	3	14	85
6	**Nepal**	**17.00**	10	18	28	12	136
7	**Madagascar**	**17.25**	8	10	35	16	146
8	**Japan**	**18.25**	11	42	2	18	11
9	**USA**	**18.25**	7	48	1	17	10
10	**Bahamas**	**20.00**	51	7	15	7	50
33	**Germany**	**41.75**	39	84	9	35	20

5.2 The 10 most affected countries in 1995-2004

The Down10 of the Climate Risk Index for the last decade shows results differing in many points compared to 2004.

Honduras has been the most affected country regarding the average impacts of the last decade, with Down10 ranks in death toll, deaths per 100,000 inhabitants and total losses related to GDP.

However, more than 90% of the deaths and also the losses were caused by one single event, hurricane Mitch in 1998. This event had a devastating impact on the country's economic and social system.

Mitch also hit **Nicaragua** with a similar impact. The **Dominican Republic** in addition was affected very much in 2004, which made up its rank 2 in the CRI for 2004.

Almost all the deaths in **Venezuela**, as has already been discussed in chapter 4.1, occurred with the floodings in 1999.

Viet Nam is one of the countries which have been very constantly affected by extreme weather events in the last decade. In six out of ten years more than 500 deaths and more than 300 million USD total losses were reported.

In **France** and **Germany** (Rank 11) the 2003 extreme heatwave impacted their position in the ranking very much through the large number of fatalities. Nevertheless, in both countries there have also been significant economic losses in the last 10 years, higher in aver-

[20] In case of equal index values, the rank in deaths per 100,000 inhabitants determines the overall rank.

[21] UNDP 2005

age than in 2004, caused by a large number of loss events (an average of 14.5 events in France and 22 in Germany). For example, storm events in France in 1999 led to losses of more than 12,000 million USD.

Bangladesh, China and **India** also experienced a large number of events throughout the decade, some of them with devastating impacts. They are among those countries with the highest number of events.

Table 12: Climate Risk Index: the 10 most affected countries of the years 1995-2004.

	Country	Index Value	Rank death toll	Rank deaths per 100,000 inhabitants	Rank total losses	Rank total losses per GDP	For comparison: Rank in HDI 2003
1	**Honduras**	**11.00**	7	2	25	10	116
2	**Bangladesh**	**17.50**	5	34	14	17	139
3	**Somalia**	**19.00**	20	12	36	8	-
4	**Venezuela**	**19.50**	2	1	28	47	75
5	**Nicaragua**	**21.00**	16	3	50	15	112
6	**Viet Nam**	**21.25**	8	30	24	23	108
7	**Dominican Republic**	**22.00**	11	8	41	28	95
8	**France**	**24.75**	4	11	5	79	16
9	**India**	**26.25**	1	44	9	51	127
10	**China**	**27.50**	3	79	2	26	85
11	**Germany**	**29.50**	6	20	4	88	11

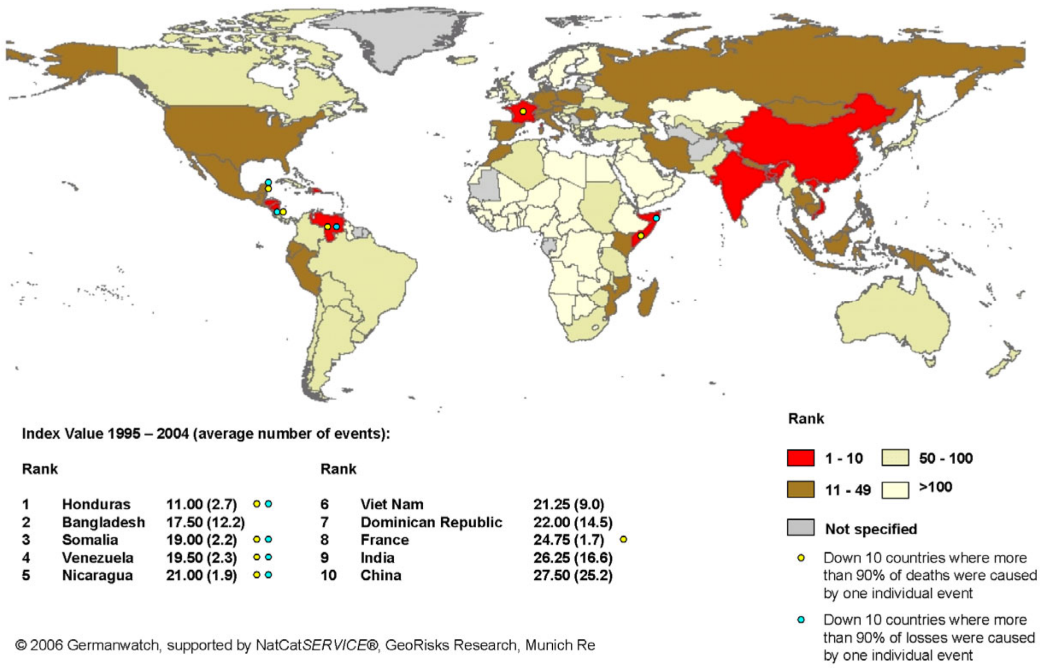

Fig. 7: Climate Risk Index: The 10 most affected countries of the years 1995-2004.

6 Case study: The Philippines

The Philippines are situated in South-East Asia as an archipelago between the Philippine Sea and the South China Sea. The country has a total area of around 300,000 km². The Philippines with their large amount of islands have a comparatively long coast line of altogether 36,289 km, which is roughly the equivalent of the earth's circumference. With a total number of around 87.8 million inhabitants the country is very populous (292 inhabitants per km²). The Philippines are part of a region with a high climatic variability. The South-East Asian tropics are characterised by the change between dry period and rainy season that are influenced by intensive trade wind and the Tropical Convergence Zone. The economic activities are strongly influenced by sudden seasonal and annual changes in precipitation and temperatures. Population and economy of the Philippines have to deal with various weather and other natural risks. On average, around 20 tropical typhoons pass over the Philippine sovereign territory each year, 8 or 9 of which strike the country endangering a large number of people exposed to these risks (Greenpeace 2005; UNDP 2004). They constantly involve severe precipitation and considerable floods.

In addition to this, the country is repeatedly affected by droughts that are partially caused by El Nino. Statistics also show a multitude of earthquakes. According to the data of Munich Re, events of all types have been registered on the Philippines within 14 of the 25 evaluated years (both weather-related and geological).

6.1 Climate trends and hazards

Today's as well as future weather-related climate risks for the Philippines can be attributed to four phenomena:

- Changes in the precipitation regime;
- Rise in temperature;
- Increase of risk caused by typhoons;
- Drought caused by El Nino events.

Figure 8 shows a synopsis of projections in relation to those four aspects, on the basis of which the endangerment of the various regions is evaluated. Especially the risks caused by a change in precipitation and by typhoons are regarded as considerably relevant. Another direct risk is the expected sea level rise as well as indirect impacts, like the impacts of the abovementioned factors on agricultural productivity or the intensified pressure on forests caused by drought. Scientific evaluations indicate both a rise in the average temperature in the past 40 years and increasing fluctuations in temperature that amplify since the beginning of the 1980s. The temperature trend is altogether consistent in comparison with other countries in this region (Greenpeace 2005).

Simultaneously, the overall precipitation decreased over the past 100 years by ca. 6%, especially in winter (dry period) between December and February (Hulme/Sheard 1999). Although the dimension of the previous sea level rise does not show a clear trend, the possible rise in the future will involve great danger. The Philippines feature an enormous coast line, where 10 of the country's biggest cities are situated (Hulme/Sheard 1999). A significant long-term rise will therefore endanger both the living space and the industrial area of a wide range of people.

Manila Bay, for example, is considered to be the second most productive fishing ground in the country. Drinking water reservoirs might lose their vital function, caused by intrusion of salt water.

A rise of 30 cm by 2045 might endanger more than 2,000 hectares and around 500,000 people.

The possible damage of mangroves, seaweed and other marine ecosystems from climate change could endanger the economic existence particularly for the poor coastal population.

For the future, an intensification of floods and drought caused by El Nino is considered likely (IPCC 2001). Both drought caused by El Nino and intense precipitation, storms and floods due to La Nina have left their marks in both population and economy. Particularly during the past 30 years, an increase in number and intensity of El Nino/La Nina events can be noticed.

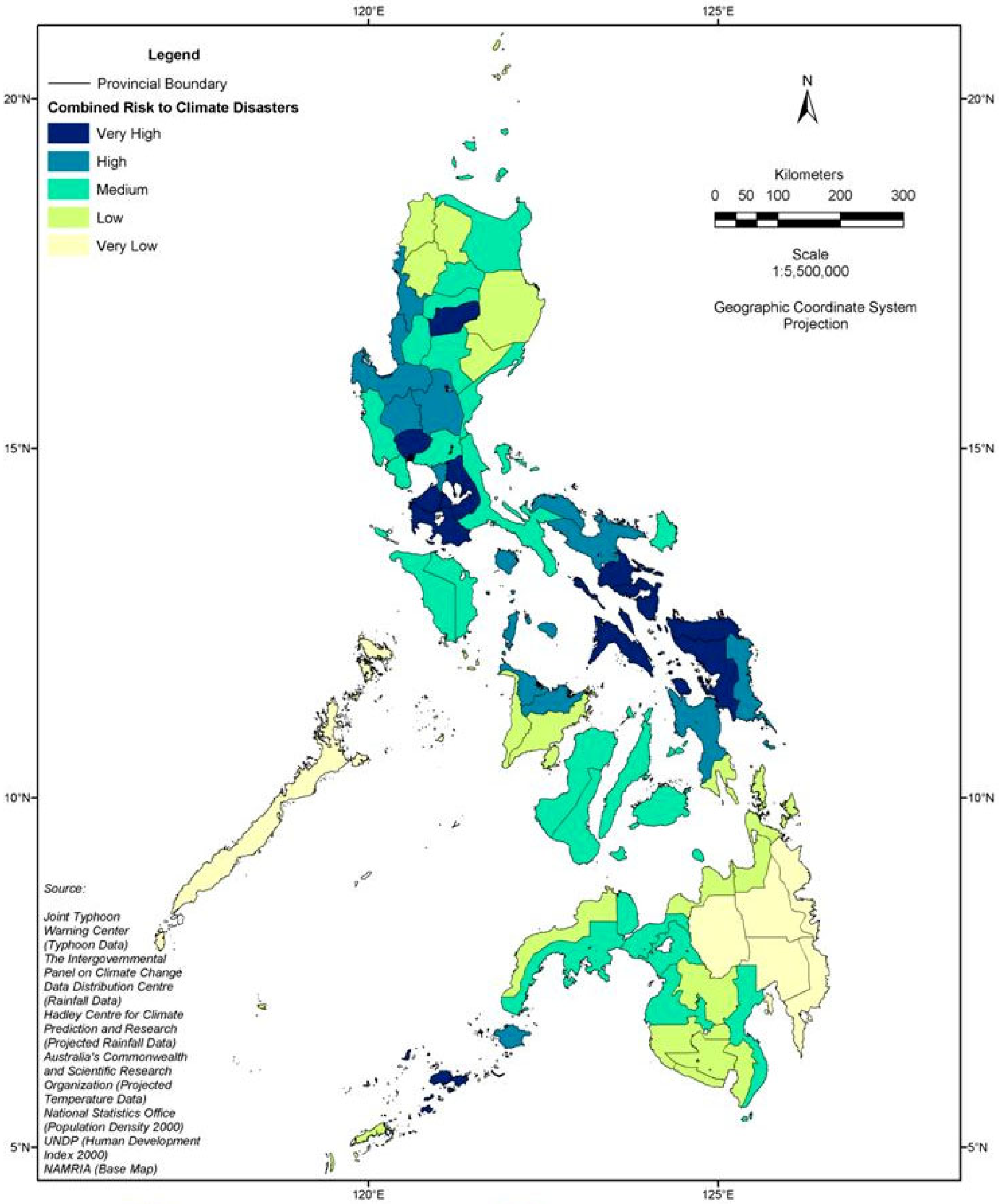

Fig. 8: Endangerment of Philippine regions towards climate change.

For the purpose of this evaluation, projections on the change of precipitation, the rise in temperature and the risks caused by typhoons and drought caused by El Nino have been aggregated (Manila Observatory 2005).

6.2 Weather-related loss events on the Philippines 1980-2004

For 2004, altogether 11 events that cost 1012 lives and caused eonomic losses in the amount of 120.95 million dollars are registered in the database of Munich Re (see table 13). In 2004, the country ranked 4th in the Climate Risk Index of the countries most affected by weather events (see table 11) and rank 18 in the decadal analysis (1995-2004). The figures for 2004 are in no way extraordinarily high. During the past 25 years, higher losses have been registered eight times, within five annual periods more people died. Nevertheless, the comparison in the Climate Risk Index with other countries shows that the Philippines are exposed to serious and regularly occurring weather risks.

Table 13: Weather damage events on the Philippines in 2004.

Category	Events	Deaths	Insured losses in million US$	Total losses in million US$
Storms	8	960	0	100.85
Floods	2	44	0	20.05
Extreme temperature and mass movements	1	8	0	0.05

Figure 9 shows the results of the data evaluation for the past 25 years. Altogether, almost 300 weather-related damage events have been registered that cost more than 21,700 lives and caused losses of more than 4.3 billion US dollars. The average of the years 1980-1984 constitutes a base value for all considered indicators, in order to enable comparability of the development for the different indicators. The period between 1990 and 1994 stands out in the case of almost all indicators, primarily due to a devastating typhoon in 1991 that claimed over 6000 fatalities. Altogether, all lines show a decreasing trend over the past ten years and some even a decreasing trend on the whole compared to 1980-1984 if the period between 1990 and 1994 is left out due to the particularly extreme event. In spite of that, however, clear differences are noticeable.

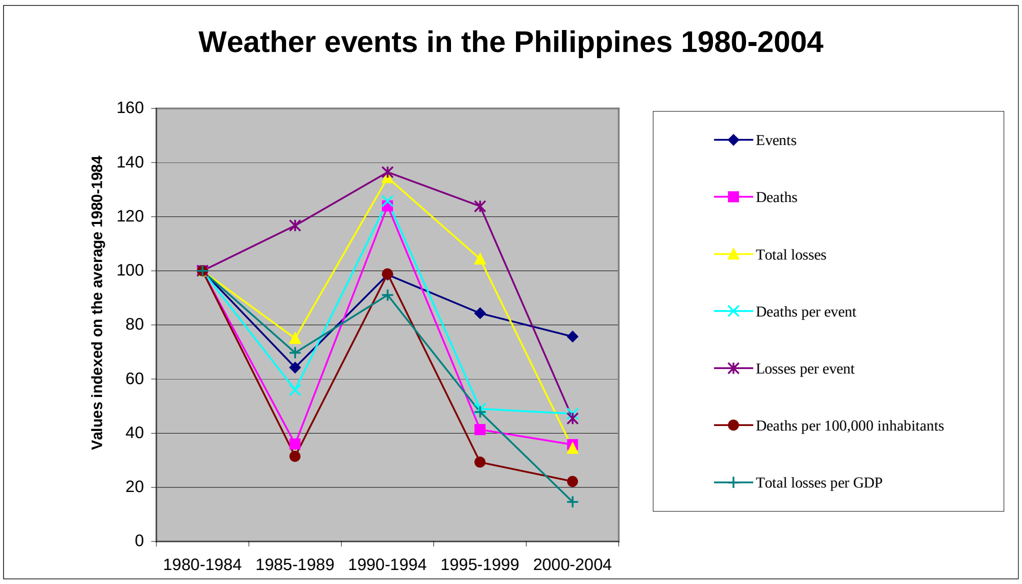

Fig. 9: Weather-related loss events 1980-2004: development of various indicators of affectedness.

In order to decrease the influence of extreme values, the figure shows average values over periods of five years.

The average of the past five years, for example, shows a clear decrease particularly in the case of damages, much more clearly than the decrease in events. So a disproportionate mitigation can be identified here. This might be a response to the relatively effective catastrophe prevention work on the Philippines. Particularly in the case of the overall damages, some kind of a trend reversal is noticeable in comparison with the first ten years. One constant noticeable factor is also the decline of how the country has been economically affected - overall damages in relation to GDP - since the higher values in the period between 1990 and 1994. The event-specific death toll, however, has rather stayed constant, while the death toll per 100,000 inhabitants has decreased even more.

Box 3: Adaptation to climate change using the example of the Philippine National Red Cross

The Philippine National Red Cross: Integrated Community Disaster Planning Programme (ICDPP) (since 1995)

The program consists of six steps:

1. Partnership with municipal and provincial government units: This helps to root the preparedness concept in local planning, to gain technical and financial support for mitigation measures, and to ensure the programme’s long-term sustainability.

2. Community disaster action team formation and training: The core of the programme is the group of community volunteers (including fishermen, women, youth and businessmen) who are trained in vulnerability and capacity assessments, disaster management and information dissemination. They work with the community to prepare a disaster action plan.

3. Risk and resources mapping: This identifies the most important local hazards, who and what may be at risk, and which mitigation measures are possible. The maps are often employed as land use planning tools by local government units.

4. Community mitigation measures: Based on the disaster action plan, the community will initiate mitigation measures, which may be physical structures (e.g. seawalls, evacuation centres), health related measures (e.g. clean water supply) or planning tools (e.g. land use plans, evacuation plans). These measures are undertaken by community volunteers with support from the Red Cross and local government.

5. Training and education: This is integral to all steps of the programme – both in training the disaster action teams and in disseminating information to the whole community.

6. Sustainability: Long-term impact can only be ensured by embedding the concept of communitybased disaster preparedness within local government units (LGUs). This means incorporating the recommendations of community disaster action plans into LGU land use planning and annual budgeting. Sustainability also implies regular update training of the disaster action teams.

The program is run in 75 rural communities in altogether 5 provinces. 105 projects have been realised since the beginning of the program (IFRC 2003).

6.3 Adaptation to climate change

The dangers posed by global warming are not ignored in the Philippines - a country that is so much characterised by weather events. In the "Initial National Communication" to the Climate Secretariat of the UN, the government refers to its country as "considerably vulnerable towards the impacts of climate change" (Philippines 1999: XV). The amount of weather events shows that already now, irrespective of future climate change, measures of prevention and adaptation to storms, floods and drought are due. Adaptation to already known climate risks, however, is considered to be the first central step to a preparation for future risks of climate change which are not exactly known yet.

The various risks certainly demand various measures. The sea level rise needs to be dealt with differently than the danger of intense typhoons. Some measures are more expensive, like the stabilizing of the coast against sea level rise, some less, like early warning systems based on "traditional" communication technology. Indigenous communities on the Philippines, for example, use horns and drums to spread information about approaching weather extremes among the population (Tibig 2003). In its project "Integrated Community Disaster Planning Programme (ICDPP)", the Philippine Red Cross banks on a series of measures that are particularly to enhance the population's or specific local peoples' knowledge about action as well as the capacity to act (see box 3). The "Citizens´ Disaster Response Center" that has, according to own statements, reached more than 3 million Filipinos with its activities, has already taken an active part in catastrophe prevention for 20 years now. With a network of regional centres, the organisation works in the whole country (CDRC 2006). The capacity to act and responsibility of the local players/population plays an important role in the adaptation to climate risks, since the local environmental, economic and social conditions decisively characterise the vulnerability and resistibility of the people towards extreme weather events and therefore also the dimensions of the floods', typhoons' and heatwaves' impacts. The exemplarily mentioned activities of the two organisations start with this premise.

Additionally, approaches to action can be followed at other levels like

- Development of a strategic policy framework for climate change adaptation measures at national level;
- Harmonisation and integration of adaptation to climate change into sustainable economic development;
- Registration of all factors relevant to vulnerability as well as
- Development of adaptation strategies, including various levels of territorial or time planning, in order to meet the locally and regionally differing requirements concerning financial, technical and political instruments (Goco 2005).

6.4 Conclusion

The Philippines are exposed to a wide range of weather risks that might partially aggravate in the future due to anthropogenic climate change. There are, however, a range of initiatives that have already taken an active part in taking measures to prevent weather-related catastrophes for several years now and have supported a wide range of people with their efforts. It is hard to tell how much it is due to these initiatives that the situation with regard to the death toll and the number of economic damages has rather improved over the past years than aggravated. Those activities, however, unquestionably help to deal with the future challenges and dangers of climate change, as long as they keep within reasonable limits that do not exceed the adaptive capacity of the country, its inhabitants and its economy.

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8 Annex

Table 14: Analysis of weather-related events: Partial indicators 2004

Country	Death toll	Deaths per 100,000 inhabitants	Total losses in million USD	Total losses per unit GDP in %
Afghanistan	12	0.05	0.51	0.01
Albania	3	0.09	0.11	0.00
Algeria	9	0.03	15.2	0.02
American Samoa	0	0.00	150	34.26
Angola	28	0.20	0.1	0.00
Argentina	14	0.04	0.07	0.00
Armenia	0	0.00	0.08	0.00
Australia	42	0.21	111.36	0.02
Austria	6	0.07	16.61	0.01
Azerbaijan	3	0.04	0.11	0.00
Bahamas	11	3.47	500	9.51
Bangladesh	1112	0.79	2202.69	3.87
Barbados	1	0.37	0	0.00
Belgium	1	0.01	0.05	0.00
Bermuda Islands	0	0.00	0.01	0.00
Bolivia	0	0.00	0.01	0.00
Bosnia Herzego-vina	0	0.00	0.35	0.00
Botswana	0	0.00	0.05	0.00
Brazil	187	0.10	420.02	0.07
Bulgaria	0	0.00	0.12	0.00
Byelarus	0	0.00	0.02	0.00
Canada	8	0.03	340.39	0.03
Cayman Islands	1	2.27	3000	200.89
Central African Republic	5	0.13	0.1	0.01
Chile	6	0.04	5.05	0.01
China	1328	0.10	10238.41	0.62
Colombia	42	0.09	5.05	0.01
Cook Islands	1	1.25	0.02	0.02
Costa Rica	2	0.05	0.02	0.00
Croatia	2	0.04	0.1	0.00
Cuba	4	0.04	0.25	0.81
Cyprus	0	0.00	0.25	0.00
Czech Republic	3	0.03	0.02	0.00
Denmark	0	0.00	0	0.00
Djibouti	70	9.78	0.02	0.00
Dominican Re-public	445	5.02	500.05	2.68
Ecuador	0	0.00	0.1	0.00
El Salvador	2	0.03	0.05	0.00
Ethiopia	8	0.01	0.6	0.01
Federated States of Micronesia	1	0.93	0.5	0.21
Fiji	10	1.18	0.63	0.02
Finland	3	0.06	24	0.01
France	30	0.05	0.89	0.00
Gambia	6	0.41	0.35	0.08
Georgia	1	0.02	2	0.04
Germany	23	0.03	1366.31	0.05
Greece	1	0.01	240.66	0.12
Grenada	39	36.90	900	206.37
Guam	0	0.00	0.55	0.02
Guatemala	2	0.02	0.07	0.00
Haiti	3463	40.31	2	0.06
Hong Kong	0	0.00	0.01	0.00
Hungary	1	0.01	2.1	0.00
India	1115	0.10	1013.53	0.15
Indonesia	132	0.06	12.74	0.00
Iran	68	0.10	0.24	0.00
Iraq	0	0.00	0.05	0.00
Ireland	0	0.00	12.02	0.01
Israel	0	0.00	2	0.00
Italy	10	0.02	95.62	0.01
Jamaica	18	0.68	575	7.16
Japan	205	0.16	15536.71	0.34
Jordan	2	0.04	0.01	0.00
Kazakhstan	28	0.19	0.07	0.00
Kenya	51	0.16	2000.51	12.82
Korea, Democratic Republic (North Korea)	24	0.11	10	0.10
Korea, Republic (South Korea)	10	0.02	824.76	0.12
Kyrgyzstan	44	0.86	0.08	0.00
Latvia	12	0.52	0.03	0.00
Lebanon	2	0.04	0.31	0.00
Macedonia	15	0.73	3.01	0.06
Madagascar	266	1.53	21	0.48
Malaysia	18	0.07	0.25	0.00
Malta	0	0.00	0	0.00
Mexico	81	0.08	0.97	0.00
Moldova	4	0.09	0.01	0.00
Morocco	0	0.00	0.01	0.00
Mozambique	0	0.00	0.01	0.00
Myanmar	220	0.44	2	0.02
Namibia	6	0.30	1.01	0.02
Nepal	212	0.84	100.04	1.49
Netherlands	0	0.00	150.05	0.03
New Zealand	10	0.25	232.47	0.23
Nicaragua	25	0.45	0.1	0.00
Nigeria	84	0.06	0.65	0.00
Niue	1	46.38	0.5	7.75
Northern Mariana Islands	2	2.50	0.05	0.01
Norway	0	0.00	2	0.00
Pakistan	47	0.03	0.1	0.00
Panama	11	0.36	2.15	0.02
Papua New Guinea	1	0.02	0.05	0.00
Paraguay	2	0.03	0.1	0.00
Peru	103	0.37	3.06	0.00
Philippines	1012	1.22	120.95	0.14
Poland	45	0.12	1.03	0.00
Portugal	83	0.80	1.17	0.00
Puerto Rico	4	0.10	100.01	0.13
Romania	53	0.24	25.95	0.04
Russia	87	0.06	126.23	0.02
Saudi Arabia	5	0.02	0.02	0.00
Seychelle	3	3.54	2000	284.29
Sierra Leone	0	0.00	0.02	0.00
Singapore	0	0.00	0.1	0.00
Slovakia	5	0.09	206.01	0.50
Slovenia	2	0.10	15.01	0.05
Somalia	150	1.51	2000	221.31
South Africa	7	0.02	0.63	0.00
Spain	28	0.07	0.48	0.00
Sri Lanka	8	0.04	0.05	0.00
St. Lucia	0	0.00	0	0.00
St. Vincent	0	0.00	0	0.00
Sweden	2	0.02	0.01	0.00
Switzerland	10	0.14	124.87	0.03
Syria	5	0.03	0.1	0.00
Taiwan	68	0.30	508.1	0.17
Tajikistan	13	0.20	2.8	0.13
Tanzania	14	0.04	0.1	0.00
Thailand	17	0.03	6.3	0.00
Tonga	1	0.98	0.02	0.01
Trinidad and Tobago	4	0.30	0.05	0.00
Turkey	58	0.08	3.47	0.00
Uganda	0	0.00	0.5	0.01
Ukraine	10	0.02	30	0.05
United Arab Emirates	2	0.05	0	0.00
United Kingdom	7	0.01	341.9	0.02
United States of America	299	0.10	48824.17	0.42
Vanuatu	1	0.47	0.1	0.03
Venezuela	12	0.05	0.02	0.00
Vietnam	153	0.19	38.67	0.09
Western Samoa	1	0.56	0.5	0.14
Yemen	16	0.08	0.1	0.00
Zambia	10	0.09	0.5	0.01

Main Sources:

NatCat*SERVICE*, Munich Re

World Bank: World Development Indicators

Table 15: Analysis of weather-related events: Climate Risk Index 2006

(based on values for 2004, see table 14)

Rank Climate Risk Index	Country	Climate Risk Index Value	Rank Total Number of Deaths	Rank Deaths per 100,000 inhabitants	Rank Total Damages in Mio. USD	Rank Damages per unit GDP in%
1	Somalia	8.50	14	11	7	2
2	Dominican Republic	9.00	6	5	14	11
3	Bangladesh	9.75	4	20	5	10
4	Philippines, The	16.75	5	13	26	23
5	China	16.75	2	48	3	14
6	Nepal	17.00	10	18	28	12
7	Madagascar	17.25	8	10	35	16
8	Japan	18.25	11	42	2	18
9	United States of America	18.25	7	48	1	17
10	Bahamas, The	20.00	51	7	15	7
11	Kenya	20.00	26	42	6	6
12	Jamaica	20.75	40	22	12	9
13	India	20.75	3	48	10	22
14	Haiti	21.75	1	2	51	33
15	Taiwan	22.00	22	32	13	21
16	Seychelles	23.00	78	6	7	1
17	Brazil	27.00	12	48	16	32
18	Cayman Islands	27.75	94	9	4	4
19	Vietnam	28.50	13	40	31	30
20	New Zealand	31.75	53	35	20	19
21	Myanmar	32.75	9	27	51	44
22	Romania	33.00	25	36	33	38
23	Australia	34.50	30	37	27	44
24	Macedonia	36.25	44	21	47	33
25	Russia	37.75	17	66	24	44
26	Korea, Democratic Republic (North Korea)	38.75	38	47	41	29
27	Peru	39.50	16	29	46	67
28	Tajikistan	39.50	47	38	48	25
29	Portugal	40.25	19	19	56	67
30	Slovakia	40.25	70	55	21	15
31	Switzerland	40.50	53	44	25	40
32	Grenada	41.00	32	3	126	3
33	Germany	41.75	39	84	9	35
34	Niue	42.50	94	1	67	8
35	Fiji	43.25	53	14	62	44
36	Panama	43.75	51	31	49	44
37	Puerto Rico	44.00	74	48	29	25
38	Colombia	45.50	30	55	43	54
39	Korea, Republic (South Korea)	46.00	53	93	11	27
40	Indonesia	46.75	15	66	39	67
41	Turkey	49.00	24	60	45	67
42	Federated Islands of Micronesia	49.25	94	16	67	20
43	Gambia, The	49.50	66	28	73	31
44	Poland	49.50	28	46	57	67
45	Namibia	50.00	66	32	58	44
46	Djibouti	50.25	21	4	109	67
47	Canada	50.75	61	84	18	40
48	Slovenia	51.00	83	48	38	35
49	Mexico	51.50	20	60	59	67
50	Western Samoa	51.75	94	23	67	23
51	Kyrgyzstan	52.00	29	17	95	67
52	Nigeria	53.00	18	66	61	67
53	Nicaragua	53.25	37	26	83	67
54	Ukraine	53.25	53	93	32	35
55	Iran	54.00	22	48	79	67
56	Austria	54.75	66	63	36	54
57	Angola	55.50	34	38	83	67
58	Algeria	56.25	60	84	37	44
59	United Kingdom	56.75	64	102	17	44
60	Zambia	57.25	53	55	67	54
61	France	57.50	33	70	60	67
62	Italy	57.50	53	93	30	54
63	Finland	58.00	78	66	34	54
64	Thailand	58.75	42	84	42	67
65	Spain	59.00	34	63	72	67
66	Kazakhstan	59.50	34	40	97	67
67	Chile	59.50	66	75	43	54
68	Cuba	59.50	74	75	76	13
69	Afghanistan	59.75	49	70	66	54
70	Vanuatu	60.50	94	25	83	40
71	Greece	60.50	94	102	19	27
72	American Samoa	60.50	107	107	23	5
73	Northern Marian Islands	61.25	83	8	100	54
74	Malaysia	61.50	40	63	76	67
75	Latvia	61.75	48	24	108	67
76	Central African Republic	63.00	70	45	83	54
77	Yemen	63.25	43	60	83	67
78	Cook Islands	64.75	94	12	109	44
79	Pakistan	65.25	27	84	83	67
80	Tanzania	67.50	45	75	83	67
81	Tonga	68.00	94	15	109	54
82	Trinidad and Tobago	68.25	74	32	100	67
83	Georgia	69.00	94	93	51	38
84	Netherlands	69.00	107	107	22	40
85	Albania	70.25	78	55	81	67
86	Ethiopia	70.25	61	102	64	54
87	Argentina	71.00	45	75	97	67
88	South Africa	71.50	64	93	62	67
89	Venezuela	73.75	49	70	109	67
90	Lebanon	74.50	83	75	73	67
91	Azerbaijan	75.25	78	75	81	67
92	Sri Lanka	75.75	61	75	100	67
93	Syria	76.00	70	84	83	67
94	Croatia	77.00	83	75	83	67
95	Ireland	77.00	107	107	40	54
96	Hungary	78.25	94	102	50	67
97	Moldova	78.50	74	55	118	67
98	Barbados	79.00	94	29	126	67
99	Paraguay	79.25	83	84	83	67
100	Guam	80.75	107	107	65	44
101	Costa Rica	82.25	83	70	109	67
102	Israel	83.00	107	107	51	67
102	Norway	83.00	107	107	51	67
104	El Salvador	83.50	83	84	100	67
105	Uganda	83.75	107	107	67	54
106	Czech Republic	84.50	78	84	109	67
107	Saudi Arabia	84.75	70	93	109	67
108	Guatemala	85.00	83	93	97	67
109	Jordan	85.75	83	75	118	67
110	United Arab Emirates	86.50	83	70	126	67
111	Papua New Guinea	88.50	94	93	100	67
112	Bosnia Herzegovina	88.50	107	107	73	67
113	Cyprus	89.25	107	107	76	67
114	Sweden	90.25	83	93	118	67
115	Bulgaria	90.25	107	107	80	67
116	Belgium	90.75	94	102	100	67
117	Ecuador	91.00	107	107	83	67
117	Singapore	91.00	107	107	83	67
119	Armenia	94.00	107	107	95	67
120	Botswana	95.25	107	107	100	67
120	Iraq	95.25	107	107	100	67
122	Byelarus	97.50	107	107	109	67
122	Sierra Leone	97.50	107	107	109	67

Rank Climate Risk Index	Country	Climate Risk Index Value	Rank Total Number of Deaths	Rank Deaths per 100,000 inhabi-tants	Rank Total Dam-ages in Mio. USD	Rank Damages per unit GDP in%
124	Bermuda	99.75	107	107	118	67
124	Bolivia	99.75	107	107	118	67
124	Hong Kong	99.75	107	107	118	67
124	Morocco	99.75	107	107	118	67
124	Mozambique	99.75	107	107	118	67
129	Denmark	101.75	107	107	126	67
129	Malta	101.75	107	107	126	67
129	St. Lucia	101.75	107	107	126	67
129	St. Vincent	101.75	107	107	126	67

Table 16: Analysis of weather-related events: Partial indicators, annual average 1995-2004

Country	Death toll	Deaths per 100,000 inhabitants	Total losses in million USD	Total losses per unit GDP in %
Afghanistan	158.3	x	1.41	0.04
Albania	2.3	0.07	5.91	0.15
Algeria	97.4	0.32	34.17	0.06
American Samoa	0.4	0.70	15.00	x
Angola	11.6	0.09	0.02	0.00
Anguilla	0	x	15.00	2.54
Antigua and Barbuda	2	2.76	41.30	6.32
Argentina	17.5	0.05	498.20	0.21
Armenia	0.4	0.01	11.27	0.53
Australia	20.9	0.11	677.49	0.16
Austria	16.6	0.21	380.72	0.17
Azerbaijan	3.9	0.05	21.57	0.41
Bahamas	1.6	0.53	202.57	4.55
Bahrain	5.7	0.87	0.96	0.01
Bangladesh	812.4	0.62	879.80	1.91
Barbados	0.1	0.04	0.02	0.00
Belgium	2.3	0.02	122.65	0.05
Belize	3.1	1.25	53.01	6.58
Benin	1.3	0.02	0.07	0.00
Bermuda	0.4	0.63	50.42	1.44
Bolivia	32.3	0.39	13.14	0.16
Bosnia Herzego-vina	0.3	0.01	16.10	0.34
Botswana	2.8	0.17	2.56	0.05
Brazil	109.5	0.06	70.20	0.01
British Virgin Islands	0	0.00	0.00	x
Brunei	0	x	0.21	x
Bulgaria	3.8	0.05	1.89	0.01
Burkina Faso	0	0.00	0.01	0.00
Burundi	0.6	0.01	0.00	0.00
Byelarus	7.6	0.08	6.48	0.04
Cambodia	55.4	0.44	23.42	0.64
Cameroon	8.1	0.05	0.48	0.00
Canada	15.4	0.05	617.91	0.09
Cayman Islands	0.1	1.16	304.01	25.26
Central African Republic	1.1	0.03	0.06	0.01
Chad	0.7	0.01	0.60	0.03
Chile	10	0.07	68.62	0.09
China	1781.7	0.14	11375.81	1.04
Colombia	73.1	0.17	12.70	0.01
Congo, Demo-cratic Republic	13.2	0.03	0.40	0.01
Congo, Republic	0.2	0.01	0.01	0.00
Cook Islands	0.9	x	0.51	0.55
Costa Rica	8.2	0.22	51.18	0.34
Croatia	4.5	0.10	41.32	0.18
Cuba	4.2	0.04	237.52	0.88
Cyprus	6.4	0.85	5.76	0.06
Czech Republic	9.6	0.09	479.40	0.71
Denmark	1	0.02	266.07	0.15
Djibouti	7	1.07	0.06	0.01
Dominica	0	0.00	20.51	8.05
Dominican Re-public	399.1	4.82	152.99	0.88
East Timor	0.2	x	0.02	x
Ecuador	40.6	0.33	88.00	0.39
Egypt	13.4	0.02	2.97	0.00
El Salvador	30.2	0.49	47.51	0.37
Eritrea	0	0.00	0.01	0.00
Estonia	0.1	0.01	0.16	0.00
Ethiopia	40.4	0.06	0.96	0.01
Faroe Islands	0	0.00	0.01	x
Federated States of Micronesia	6.1	5.70	0.42	0.20
Fiji	4.3	0.53	4.09	0.21
Finland	0.3	0.01	2.91	0.00
France	1520.8	2.58	2136.60	0.14
French Guyana	0	x	0.01	x
French Polynesia	1.9	0.82	0.31	0.01
Gambia	5.9	0.46	0.14	0.03
Georgia	1.6	0.03	8.93	0.26
Germany	727.7	0.89	2449.21	0.11

Country	Death toll	Deaths per 100,000 inhabitants	Total losses in million USD	Total losses per unit GDP in %
Ghana	11.5	0.06	1.66	0.02
Greece	11.9	0.11	176.59	0.13
Greenland	0	0.00	0.00	x
Grenada	3.9	3.84	90.00	24.40
Guadeloupe	0.5	0.11	6.05	0.17
Guam	0.3	0.20	78.26	3.13
Guatemala	58.6	0.52	30.79	0.15
Guinea	2.6	0.04	0.10	0.00
Guyana	0	0.00	12.30	1.72
Haiti	382.4	4.85	18.69	0.54
Honduras	577.9	9.06	402.32	7.09
Hong Kong	2.4	0.04	15.09	0.01
Hungary	16.2	0.16	69.30	0.12
Iceland	3.5	1.25	0.56	0.01
India	4402.3	0.44	1290.91	0.27
Indonesia	345.3	0.17	1012.57	0.56
Iran	88.3	0.14	1123.92	0.99
Iraq	0	0.00	0.01	0.00
Ireland	2.8	0.07	43.79	0.04
Israel	2.7	0.04	16.63	0.02
Italy	445.3	0.77	1740.49	0.14
Ivory Coast	3.2	0.02	0.10	0.00
Jamaica	4.3	0.17	66.78	0.88
Japan	67.9	0.05	3100.08	0.07
Jordan	1.9	0.04	1.91	0.02
Kazakhstan	16.6	0.11	3.53	0.01
Kenya	40.1	0.14	204.52	1.78
Kiribati	0	0.00	0.01	0.02
Korea, Democratic Republic (North)	46.1	0.21	1741.60	15.95
Korea, Republic (South)	139.8	0.30	1544.98	0.30
Kuwait	0.2	0.01	0.02	0.00
Kyrgyzstan	10.6	0.22	0.63	0.04
Laos	1.5	0.03	2.64	0.15
Latvia	3.5	0.15	0.11	0.00
Lebanon	0.6	0.01	0.22	0.00
Lesotho	0.1	0.01	1.00	0.10
Libya	0	0.00	4.20	0.01
Luxembourg	0	0.00	1.00	0.00
Macedonia	1.5	0.07	35.30	0.87
Madagascar	84	0.55	8.43	0.21
Malawi	8	0.08	20.48	1.09
Malaysia	74.3	0.32	70.79	0.08
Mali	2.1	0.02	0.06	0.00
Malta	0	0.00	4.00	0.10
Mexico	207.9	0.21	894.66	0.18
Moldova	2.9	0.07	3.45	0.20
Mongolia	13.1	0.55	200.02	17.83
Morocco	40.4	0.14	117.97	0.32
Mozambique	115.6	0.66	53.70	1.45
Myanmar	226.3	0.48	0.57	0.01
Namibia	0.8	0.04	0.21	0.01
Nepal	325.3	1.43	18.31	0.35
Netherlan	101.6	0.64	238.34	0.06
New Caledonia	0.2	0.09	0.11	0.00
New Zealand	3.7	0.10	130.85	0.20
Nicaragua	297	5.93	102.67	2.73
Niger	2.4	0.02	3.33	0.15
Nigeria	51.7	0.04	10.74	0.02
Niue	0.1	5.00	0.05	0.77
Northern	0.2	0.29	0.00	0.00
Norway	1.8	0.04	24.60	0.01
Oman	4.1	0.17	1.90	0.01
Pakistan	288.4	0.21	20.08	0.03
Panama	12.7	0.45	1.73	0.02
Papua New Guinea	262.1	5.17	16.82	0.43
Paraguay	14.3	0.27	1.62	0.02
Peru	163.3	0.63	72.93	0.13
Philippines	496.9	0.66	133.48	0.17
Poland	38.5	0.10	468.51	0.26
Portugal	25.3	0.25	147.49	0.12
Puerto Rico	1.4	0.04	658.83	1.22
Romania	66.6	0.30	128.99	0.30
Russia	198.4	0.14	461.02	0.13
Rwanda	10	0.14	0.13	0.01
Saudi Arabia	5.8	0.03	5.38	0.00
Senegal	8.9	0.09	0.96	0.02

Country	Death toll	Deaths per 100,000 inhabitants	Total losses in million USD	Total losses per unit GDP in %
Seychelles	0.3	0.37	200.00	32.45
Sierra Leone	1.5	0.03	0.31	0.04
Singapore	0.2	0.01	0.33	0.00
Slovakia	7.6	0.14	58.47	0.24
Slovenia	1.1	0.06	11.92	0.05
Solomon Islands	0	0.00	0.03	0.01
Somalia	220.5	2.56	202.33	12.64
South Africa	64.7	0.15	115.83	0.08
Spain	56.2	0.14	1155.52	0.18
Sri Lanka	36.3	0.20	5.74	0.04
St. Kitts and Nevis	0.4	0.92	44.20	14.19
St. Lucia	0	0.00	0.65	0.10
St. Vincent	0.8	0.72	2.10	0.63
Sudan	53.3	0.17	4.05	0.03
Swaziland	1.3	0.13	0.51	0.03
Sweden	1.1	0.01	19.02	0.01
Switzerland	110.9	1.54	468.45	0.16
Syria	2.5	0.02	0.14	0.00
Taiwan	67.5	0.30	367.53	0.13
Tajikistan	23.1	0.38	22.59	1.80
Tanzania	28.7	0.09	4.89	0.06
Thailand	146	0.24	154.01	0.11
Togo	0	0.00	0.01	0.00
Tonga	0.1	0.10	0.42	0.26
Trinidad	0.6	0.05	0.32	0.00
Tunisia	2.6	0.03	0.06	0.00
Turkey	45.9	0.07	225.35	0.11
Tuvalu	0	x	0.01	x
Uganda	35.4	0.15	0.31	0.01
Ukraine	18.5	0.04	29.22	0.07
United Arab Emirates	0.2	0.01	28.26	0.05
United Kingdom	21.1	0.04	721.62	0.05
United States of America	371.6	0.13	20013.57	0.21
Uruguay	7.9	0.24	30.52	0.17
Uzbekistan	19.6	0.08	5.06	0.04
Vanuatu	0.1	0.05	0.33	0.13
Venezuela	3007.1	12.48	325.89	0.33
Vietnam	497.4	0.64	427.94	1.37
Virgin Islands (US)	0.9	0.83	116.01	16.99
Western Samoa	0.1	0.06	0.06	0.02
Yemen	54.2	0.31	0.24	0.00
Yugoslavia	0.3	x	85.71	x
Zambia	1.7	0.02	1.41	0.04
Zimbabwe	14.8	0.12	15.47	0.18

X = no figure due to lack of sound data basis

Main sources:

NatCat*SERVICE*, Munich Re
World Bank: World Development Indicators
UNDP: Human Development Report
UN Statistical Yearbooks

Table 17: Analysis of weather-related events: Climate Risk Index 1995-2004

(based on average values 1995-2004, see table 16)

Rank Climate Risk Index	Country	Climate Risk Index Value	Rank death toll	Rank deaths per 100,000 inhabi-tants	Rank total losses	Rank losses per GDP
1	Honduras	11.00	7	2	25	10
2	Bangladesh	17.50	5	34	14	17
3	Somalia	19.00	20	12	36	8
4	Venezuela	19.50	2	1	28	47
5	Nicaragua	21.00	16	3	50	15
6	Vietnam	21.25	8	30	24	23
7	Dominican Republic	22.00	11	8	41	28
8	France	24.75	4	11	5	79
9	India	26.25	1	44	9	51
10	China	27.50	3	79	2	26
11	Germany	29.50	6	20	4	88
12	Italy	30.25	10	25	7	79
13	Korea, Dem. Rep. (North)	30.50	46	64	6	6
14	Indonesia	32.75	14	69	12	36
15	Switzerland	33.50	28	13	22	71
16	Korea, Rep. (South)	34.00	26	53	8	49
17	Mozambique	34.50	27	28	62	21
18	Haiti	35.50	12	7	85	38
19	Philippines	36.75	9	28	43	67
20	Mongolia	37.25	73	35	37	4
21	Iran	37.25	32	79	11	27
22	Papua New Guinea	37.50	18	5	87	40
23	USA	39.25	13	87	1	56
24	Nepal	39.75	15	14	86	44
25	Mexico	40.00	21	63	13	63
26	Grenada	40.75	100	9	51	3
27	Kenya	45.75	51	79	34	19
28	Romania	46.25	38	53	45	49
29	Netherlands	47.75	30	30	31	100
30	Peru	47.75	23	32	55	81
31	Ecuador	47.75	48	49	52	42
32	Spain	48.25	41	79	10	63
33	Belize	49.00	107	15	63	11
34	Cambodia	49.50	42	44	78	34
34	Taiwan	49.50	37	53	27	81
36	Tajikistan	50.75	59	47	79	18
37	El Salvador	51.25	56	40	66	43
38	Russia	51.25	22	79	23	81
39	Cayman Islands	52.50	162	17	29	2
40	Bahamas	52.50	125	37	35	13
41	Antigua and Barbuda	53.00	120	10	70	12
42	Thailand	53.00	25	59	40	88
43	Virgin Islands (US)	53.25	137	23	48	5
44	Poland	54.75	52	94	21	52
45	Austria	55.50	65	64	26	67
46	Morocco	55.75	49	79	47	48
47	Madagascar	56.25	33	35	101	56
48	Guatemala	56.50	40	39	73	74
49	Czech Repub-lic	58.00	81	98	20	33
50	Malaysia	59.00	34	50	56	96
51	Seychelles	59.25	150	48	38	1
52	Australia	59.50	61	90	16	71
53	St. Kitts and Nevis	59.75	146	19	67	7
54	Portugal	61.00	58	58	42	86
55	Algeria	63.25	31	50	72	100
56	Costa Rica	63.25	83	61	64	45
57	Jamaica	63.25	96	69	60	28
58	Japan	63.50	36	117	3	98
59	Argentina	64.00	64	117	19	56
60	South Africa	65.00	39	76	49	96
61	Bermuda	66.25	146	32	65	22
62	Bolivia	66.50	55	46	94	71

Rank Climate Risk Index	Country	Climate Risk Index Value	Rank death toll	Rank deaths per 100,000 inhabi-tants	Rank total losses	Rank losses per GDP
63	Turkey	68.50	47	106	33	88
64	Pakistan	70.25	17	64	83	117
65	Slovakia	70.50	87	79	61	55
66	Cuba	70.75	98	125	32	28
67	Guam	71.25	150	67	54	14
68	Greece	71.25	75	90	39	81
69	Uruguay	71.50	86	59	74	67
70	Hungary	71.50	67	75	58	86
71	Malawi	73.75	85	103	82	25
72	Puerto Rico	74.00	130	125	17	24
73	Canada	74.25	68	117	18	94
74	Fed. States of Micronesia	74.50	91	4	143	60
75	Fiji	75.00	96	37	111	56
76	New Zealand	75.25	103	94	44	60
77	United King-dom	76.00	60	125	15	104
78	Zimbabwe	77.75	69	89	90	63
79	Cyprus	79.25	90	22	105	100
80	St. Vincent	80.25	139	26	121	35
81	Croatia	80.25	95	94	69	63
82	Myanmar	82.25	19	41	138	131
82	Brazil	82.25	29	112	57	131
84	Colombia	82.50	35	69	95	131
85	Sri Lanka	83.75	53	67	106	109
86	Macedonia	83.75	127	106	71	31
87	Azerbaijan	84.50	100	117	80	41
88	Sudan	85.50	44	69	112	117
89	Chile	84.50	79	106	59	94
90	Ukraine	90.25	63	125	75	98
91	Panama	91.00	74	43	125	122
92	Tanzania	91.00	57	98	109	100
93	Niue	92.50	162	6	170	32
94	Paraguay	94.00	70	57	127	122
95	Bahrain	94.50	94	21	132	131
96	Uzbekistan	95.50	62	103	108	109
97	Kyrgyzstan	96.00	78	61	136	109
98	Denmark	96.00	136	144	30	74
99	Iceland	97.25	104	15	139	131
100	Moldova	97.25	108	106	115	60
101	Nigeria	97.75	45	125	99	122
102	Ireland	98.00	109	106	68	109
103	Yemen	99.75	43	52	152	152
104	Kazakhstan	100.00	65	90	114	131
105	Byelarus	100.25	87	103	102	109
106	Albania	100.25	117	106	104	74
107	Botswana	100.50	109	69	120	104
108	Djibouti	100.75	89	18	165	131
109	Guadeloupe	101.25	145	90	103	67
110	Gambia	102.00	92	42	157	117
111	Uganda	102.50	54	76	149	131
112	Belgium	102.75	117	144	46	104
113	Georgia	103.50	125	137	100	52
114	Oman	105.50	99	69	123	131
115	Ethiopia	106.00	49	112	132	131
116	French Poly-nesia	106.25	121	24	149	131
117	Dominica	106.50	170	166	81	9
118	Senegal	108.50	82	98	132	122
119	Armenia	109.00	146	153	98	39
120	Ghana	109.25	77	112	126	122
121	Bosnia Herze-govina	109.25	150	153	89	45
122	Slovenia	111.50	133	112	97	104
123	Israel	111.50	111	125	88	122
124	Rwanda	112.00	79	79	159	131
125	Niger	112.25	115	144	116	74
126	Tonga	112.75	162	94	143	52
127	Guyana	113.00	170	166	96	20
128	Norway	114.00	123	125	77	131
129	Laos	114.25	127	137	119	74
130	Hong Kong	115.50	115	125	91	131
131	Bulgaria	118.50	102	117	124	131
132	Swaziland	118.75	131	87	140	117
133	Egypt	121.00	71	144	117	152

Rank Climate Risk Index	Country	Climate Risk Index Value	Rank death toll	Rank deaths per 100,000 inhabi-tants	Rank total losses	Rank losses per GDP
134	Congo, Dem. Rep.	121.25	72	137	145	131
135	United Arab Emirates	122.00	155	153	76	104
136	Saudi Arabia	122.25	93	137	107	152
137	Jordan	122.50	121	125	122	122
138	Latvia	123.00	104	76	160	152
139	Cameroon	123.75	84	117	142	152
140	Angola	124.50	76	98	172	152
141	Sweden	125.25	133	153	84	131
142	Zambia	126.25	124	144	128	109
143	Vanuatu	126.50	162	117	146	81
144	Sierra Leone	130.50	127	137	149	109
145	Lesotho	134.00	162	153	130	91
146	Malta	135.00	170	166	113	91
147	Chad	137.00	141	153	137	117
148	Northern Mariana Islands	137.00	155	56	185	152
149	Namibia	137.50	139	125	155	131
150	Guinea	137.75	112	125	162	152
151	Trinidad	139.75	142	117	148	152
152	Western Samoa	140.25	162	112	165	122
153	St. Lucia	140.50	170	166	135	91
154	Ivory Coast	141.00	106	144	162	152
155	New Caledo-nia	141.25	155	98	160	152
156	Tunisia	141.50	112	137	165	152
157	Central African Republic	141.50	133	137	165	131
158	Syria	141.75	114	144	157	152
159	Finland	143.25	150	153	118	152
160	Libya	144.25	170	166	110	131
161	Mali	145.00	119	144	165	152
162	Benin	147.75	131	144	164	152
163	Lebanon	150.00	142	153	153	152
164	Singapore	151.50	155	153	146	152
165	Barbados	152.75	162	125	172	152
166	Luxembourg	154.50	170	166	130	152
167	Estonia	155.75	162	153	156	152
168	Burundi	158.00	142	153	185	152
168	Kuwait	158.00	155	153	172	152
170	Kiribati	158.50	170	166	176	122
171	Congo, Re-public	159.00	155	153	176	152
172	Solomon Islands	159.50	170	166	171	131
173	Eritrea	166.00	170	166	176	152
173	Togo	166.00	170	166	176	152
173	Burkina Faso	166.00	170	166	176	152
173	Iraq	166.00	170	166	176	152

Germanwatch

We are an independent, non-profit and non-governmental North-South Initiative. Since 1991, we have been active on the German, European and international level concerning issues such as trade, environment and North-South relations. Complex problems require innovative solutions. Germanwatch prepares the ground for necessary policy changes in the North which preserve the interests of people in the South. On a regular basis, we present significant information to decision-makers and supporters. Most of the funding for Germanwatch comes from donations, membership fees and project grants.

Our central goals are:

- Effective and fair instruments as well as economic incentives for climate protection
- Ecologically and socially sound investments
- Compliance of multinational companies with social and ecological standards
- Fair world trade and fair chances for developing countries by cutting back dumping and subsidies in world trade.

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