GLOBAL CLIMATE RISK INDEX 2008

WEATHER-RELATED LOSS EVENTS AND THEIR IMPACTS ON COUNTRIES IN 2006 AND IN A LONG-TERM COMPARISON

Sven Harmeling

GERMANWATCH

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Brief Summary

Extreme weather events are generally expected to increase in frequency and intensity due to global climate change. They have the potential to significantly undermine progress towards the achievement of the Millennium Development Goals (MDGs).

The Global Climate Risk Index 2008 analyses to what extent countries and country groups have been affected by the impacts of weather-related loss events (storms, floods, heatwaves etc.). These analyses are based on the well-known assessments of the Munich Re database NatCatSERVICE®. The figures for 2006 reveal that Asian countries dominate the ranking of the most affected countries (the Down10), while in the past decade hurricanes in the Caribbean region caused significant losses and deaths. In various respects, inter alia regarding the losses in relation to the GDP or deaths in relation to the population, less developed countries are affected more than industrialised countries.

In terms of adaptation to climate change, it is important to note that there exist many synergies between climate-related interventions and the MDGs. An equitable and effective post-2012 agreement on climate change will have to recognise such synergies and pay increased attention to those communities which are at particular risks from climate change.

Imprint

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1 Extreme events, climate change and adaptive development

"Climate change will very likely impede nations' abilities to achieve sustainable development pathways, as measured, for example, as long-term progress towards the Millennium Development Goals."[1]

The Fourth Assessment Report (AR4) of the Intergovernmental Panel on Climate Change (IPCC) made clear that climate change is reality today. The scientific certainty regarding the major causes of the changing climatic patterns, namely the greenhouse gas emissions released into the atmosphere through different human activities, has increased as compared to the Third Assessment Report. Extreme weather events play an important role not only in climate change science, but also in public discussions about the impacts and consequences of global warming. Throughout the year 2007, numerous events have reminded the world of the necessity to better prepare for disasters and mitigate the long-term consequences of climate change: for example the large-scale floodings in the Sahel or the devastating cyclone over Bangladesh in October.

One single extreme event can hardly be traced back directly to man-made climate change. However, there is an increasing scientific consensus that the likeliness of occurrence of hydro-meteorological disasters increases with rising temperatures. In some areas, even new threats may emerge, as has become obvious in 2004, when for the first time ever the coast of Brazil was hit by a hurricane.

What changes can we expect from climate change with regard to extreme weather events? The AR4 comes to the following conclusions regarding the observed trends and projected changes (table 1).

Regarding the future projections, most of the world´s regions should prepare for increasing risks from extreme weather events.

Many examples provide evidence that extreme weather events can significantly compromise progress towards the Millennium Development Goals (MDGs). Floodings or storms can throw back countries and people for years in a couple of hours. They increase the people´s vulnerability (see box 1).

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[1] Parry et al. 2007

Table 1: Recent trends, assessment of human influence on the trend, and projections for extreme weather events for which there is an observed late 20th century trend [2]

Source: Parry et al. 2007

Phenomenon and direction of trend	Likelihood that trend occurred in late 20th century (typically post 1950)	Likelihood of a human contribution to observed trend	Likelihood of future trends based on projections for 21st century using SRES scenarios
Warmer and fewer cold days and nights over most land areas	Very likely	Likely	Virtually certain
Warmer and more frequent hot days and nights over most land areas	Very likely	Likely (nights)	Virtually certain
Warm spells / heat waves. Frequency increases over most land areas	Likely	More likely than not	Very likely
Heavy precipitation events. Frequency (or proportion of total rainfall from heavy falls) increases over most areas	Likely	More likely than not	Very likely
Area affected by droughts increases	Likely in many regions since 1970s	More likely than not	Likely
Intense tropical cyclone activity increases	Likely in some regions since 1970s	More likely than not	Likely
Increased incidence of extreme high sea level (excludes tsunamis)	Likely	More likely than not	Likely

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Box 1: How extreme weather events compromise progress towards the MDGs

- Extreme events cause deaths: In 2006, more than 1,000 people died in China as well as in India, Indonesia and other countries. Some events in the past decade have caused more than 10,000 deaths each (e.g. hurricane Mitch in Central America in 1998, floodings in Venezuela in 1999, heatwaves in Europe 2003).

- Extreme events can cause economic losses that are sometimes twice as high as the annual Gross Domestic Product (GDP) of a country, for example in Somalia and the Seychelles in 2004.[3] Disasters of this kind limit the available means to invest into measures that contribute to the achievement of the MDGs.

- Floodings can contribute to the dissemination of diseases: In 1999, floodings following hurricane Mitch lead to a sixfold increase of cholera cases.[4]

- More than 103,000 ha of agricultural area were damaged by floodings in Bolivia in 2006: 64,000 ha of maize, soy, rice and sorghum and 30,000 ha of pasture land.[5]

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[2] The IPCC uses the following terms to indicate the assessed likelihood, using expert judgement, of an outcome or a result: Virtually certain > 99% probability of occurrence, Extremely likely > 95%, Very likely > 90%, Likely > 66%, More likely than not > 50%, Unlikely < 33%, Very unlikely < 10%, Extremely unlikely < 5%; see Parry et al. 2007

[3] Anemüller et al. 2006

[4] McSmith 2006

[5] United Nations Office for the Coordination of Humanitarian Affairs 2006

$$\frac{\text{Hazard x Vulnerability}}{\text{Capacity}}$$

Global Warming
Bad Development

= Risk

Unsustainable development drives disaster risk by exaggerating each of these factors:

HAZARDS INCREASING: The unsustainable use of fossil fuels is warming the planet. The resulting change in climate is increasing the frequency and severity of weather-related hazards (e.g. floods, droughts, windstorms) and expanding the range of disease vectors.

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VULNERABILITY INCREASING: Hazards only become disasters when people get in the way. Sustainable development involves poor land use (e.g. building on flood plains, unstable slopes, and coastlines) and environmental degradation (e.g. bleaching of coral reefs, destruction of coastal mangroves, deforestation of water catchments), which are increasing vulnerability by putting millions more in harm's way.

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CAPACITY DECREASING: To cope with the effects of climate change, vulnerable communities need enough skills, tools and money. Yet debt repayments, inequitable trade arrangements, selective foreign investment, and the redirection of aid funds towards geo-strategic regions, mean that the poorest and most vulnerable communities lack the resources to cope. Meanwhile, the inexorable migration of millions from rural to urban areas – in the hope of finding work and avoiding disaster – is undermining traditional coping strategies. On top of this, disasters driven by global warming hit the most vulnerable hardest, further undermining their capacities to cope with future disasters.

(Source: *The End of Development? nef*)

Figure 1: The risk equation.

Source: nef 2004

The level of impacts of extreme events is not always primarily a consequence of the intensity of an event, but it also depends on the vulnerability and the response capacities of the affected areas. The risk from extreme weather events and climate change in general can be expressed in a simplified equation as shown in figure 1.

An increased likeliness of extreme weather events which is expected to be entailed by climate change, in turn endangers the successful pursuit of sustainable development. The IPCC in its AR4 summarised how extreme weather events interact with other existing stresses such as poverty and resource scarcity, high population density in disaster-prone areas, insufficient institutional capacities etc.[6] Often adverse impacts on different economic sectors and certain social groups which are particularly vulnerable are the consequence. In general, groups that face the challenge of coping with multiple non-climatic stresses are those most vulnerable to climate-related risks. Therefore, an effective strategy to prepare for, and mitigate, hydrometeorological disasters must include groups and communities that are at particular risk, and build on their capacities and potentials. There is an increasing wealth of experience in community-based disaster preparedness activities and – more general – in community-based adaptation which has to be recognized and shared.[7] Strategies to adapt to extreme weather events play an important role in the National Adaptation Programmes of Action (NAPAs), e.g. in African Least Developed Countries[8], as well as in the Nairobi Work Programme on Impacts, Adaptation and Vulnerability as part of the United Nations Framework Convention on Climate Change.

Climate-risk interventions can promote the Millennium Development Goals (MDGs)

Increasing the resilience and reducing the vulnerability of especially poor people in disaster-prone areas represent the key elements of adaptation strategies. "Adaptive development" is the key objective rather than separating development from adaptation. In this sense, it is good news that there exist many intervention options related to extreme weather events that bring about synergies with the Millennium Development Goals.[9] To mention only one example: A more resilient irrigation and land use as well as cropping and trade policies serving as adaptative responses to climate risks can support economic growth and thereby contribute to fighting poverty and hunger (Millennium Development Goal 1). The AR4 also identifies sectoral adaptation options related to certain extreme weather events (figure 2). Finally, several studies show that disaster preparedness pays off economically. One dollar invested in disaster preparedness saves between 2.5 and 13 dollars of disaster aid.[10]

Learning from disaster preparedness along with addressing the needs and building on the strengths of potentially affected communities form the key strategies of an international post-2012 climate change agreement that aims to address the developmental challenge caused by climate change and the need to adapt to its adverse consequences with regard

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[6] Parry et al. 2007
[7] http://www.cba-exchange.org/
[8] see Harmeling et al. 2007 for an overview
[9] see e.g. Columbia University 2006
[10] DfID 2005

to extreme weather events.[11] This also entails the increased need for generating financial means, inter alia through contributions by those countries that are mostly responsible for anthropogenic climate change and most capable to offer support, market mechanisms and private sector incentives (e.g. insurance instruments). Moreover, the establishment of appropriately governed financing institutions, such as the Adaptation Fund, are crucial. They need to be designed in a way that enables them to effectively meet the needs of the most vulnerable people.

	Food, fibre and forestry	Water resources	Human health	Industry, settlement and society
Drying/ Drought	*Crops*: development of new drought-resistant varieties; intercropping; crop residue retention; weed management; irrigation and hydroponic farming; water harvesting *Livestock*: supplementary feeding; change in stocking rate; altered grazing and rotation of pasture *Social*: Improved extension services; debt relief; diversification of income	Leak reduction Water demand management through metering and pricing Soil moisture conservation e.g., through mulching Desalination of sea water Conservation of groundwater through artificial recharge Education for sustainable water use	Grain storage and provision of emergency feeding stations Provision of safe drinking water and sanitation Strengthening of public institutions and health systems Access to international food markets	Improve adaptation capacities, especially for livelihoods Incorporate climate change in development programmes Improved water supply systems and co-ordination between jurisdictions
Increased rainfall/ Flooding	*Crops*: Polders and improved drainage; development and promotion of alternative crops; adjustment of plantation and harvesting schedule; floating agricultural systems *Social*: Improved extension services	Enhanced implementation of protection measures including flood forecasting and warning, regulation through planning legislation and zoning; promotion of insurance; and relocation of vulnerable assets	Structural and non-structural measures. Early-warning systems; disaster preparedness planning; effective post-event emergency relief	Improved flood protection infrastructure "Flood-proof" buildings Change land use in high-risk areas Managed realignment and "Making Space for Water" Flood hazard mapping; flood warnings Empower community institutions
Warming/ Heatwaves	*Crops*: Development of new heat-resistant varieties; altered timing of cropping activities; pest control and surveillance of crops *Livestock*: Housing and shade provision; change to heat-tolerant breeds *Forestry*: Fire management through altered stand layout, landscape planning, dead timber salvaging, clearing undergrowth. Insect control through prescribed burning, non-chemical pest control *Social*: Diversification of income	Water demand management through metering and pricing Education for sustainable water use	International surveillance systems for disease emergence Strengthening of public institutions and health systems National and regional heat warning systems Measures to reduce urban heat island effects through creating green spaces Adjusting clothing and activity levels; increasing fluid intake	Assistance programmes for especially vulnerable groups Improve adaptive capacities Technological change
Wind speed/ Storminess	*Crops*: Development of wind-resistant crops (e.g., vanilla)	Coastal defence design and implementation to protect water supply against contamination	Early-warning systems; disaster preparedness planning; effective post-event emergency relief	Emergency preparedness, including early-warning systems More resilient infrastructure Financial risk management options for both developed and developing regions

Figure 2: Examples of current and potential options for adapting to climate change for vulnerable sectors.

Source: Parry et al. 2007

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[11] Bals 2007

2 The Annual Climate Risk Index for 2006 and the Decadal Climate Risk Index for 1997-2006

The Germanwatch Global Climate Risk Index (CRI) identifies those countries most affected by extreme weather events in specific time periods, based on four indicators:

- total number of deaths,

- deaths per 100,000 inhabitants,

- absolute losses in million US$ purchasing power parities (PPP) and

- losses per unit GDP in %.

The figures related directly to extreme events are primarily taken from the Munich Re database NatCat*SERVICE*®. The four indicators listed above are said to at least imply certain levels of development and vulnerability to multiple risks.[12] The Climate Risk Index value is equal to the average ranking of a country regarding these four indicators.[13] Using this method ensures that absolute and relative indicators which better reflect a country´s specific condition, are addressed and balanced. The resulting figures for the ten most affected countries **in 2006** – the Down10 – are shown in Table 1.[14] The results per indicator are analysed in more detail in chapter 3 (2006) and chapter 4 (1997-2006). Chapter 6 provides the figures for German-speaking countries and the full country list. For more background information on the CRI see box 2.

Five out of these ten countries also appeared in the Down10 in 2005, namely Vietnam, India, China, the USA and Romania. Due to a relatively "calm" hurricane season in the Caribbean region in 2006, the 2005 "top" country, Guatemala, does not appear in the current Down10. In fact, it ranks 102 in 2006. While the Climate Risk Index for 2005 was dominated by countries which suffered from the extreme hurricane season in central America, the situation in 2006 differs a lot. Seven out of the Down10 countries are located in Asia, with the Philippines, the Democratic Republic of Korea and Indonesia being the most affected countries. All three countries rank relatively high in each of the four indicators. This is not true for Vietnam, which has been hit particularly in economic terms. India, China and the USA suffer from comparably high absolute numbers of deaths and losses. These figures of course are relativised by the countries´ huge population sizes (especially in the case of India and China). Ehtiopia primarily suffered from the number of deaths, while having less economic losses.

Longer-term observations are necessary and more appropriate to judge a country´s affectedness from weather phenomena. Thus, a decadal analysis is applied to the same indicators. The Down10 of the CRI for the **decade 1997-2006** (table 3) differ signicantly from

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[12] See e.g. Brauch 2005
[13] Chapter 5 provides more detailed information on the underlying methods
[14] For the full list of countries in 2006 see section 6.2. For the rankings of 2004 and 2005, see Anemüller et al. 2006 and Harmeling & Bals 2007, respectively

the results of the year 2006 alone. Compared to the former decadal period (1996-2005), there are little changes.[15] Germany switched the rank with China which is now ranked 11.

For some countries, climate-related loss events represent a well-known and frequently experienced risk, e.g. in Bangladesh, Vietnam or India. Even France and Germany show a large number of registered loss events. However, most of the events in the latter countries were relatively small. Exceptions with extraordinary impacts, such as the European heat-wave in 2003 leading to 15,000 deaths in France and about 8,000 deaths in Germany, a major flooding in Venezuela (30,000 deaths in 1999) and also hurricane Mitch in Central America, significantly influence not only the annual, but also the decadal statistic. Nevertheless, at the same time they indicate a certain degree of vulnerability.

Table 2: The Annual Climate Risk Index (CRI) for 2006 - the 10 countries most affected by extreme weather events.

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). The Philippines have an index value (average rank) of 4, i.a. with rank 4 in absolut number of deaths and deaths per 100,000 inhabitants.

2006 (2005)	Country	Index value[16]	Rank death toll	Rank deaths per 100,000 inhabitants	Rank total losses in PPP	Rank total losses per GDP	Number of regis-tered events	For com-parison: Rank HDI 2005[17]
1 (51)	Philippines	4.00	4	4	5	3	25	90
2 (-)	Korea (Dem. Rep.)	5.75	7	1	13	2	2	-
3 (39)	Indonesia	5.75	3	8	6	6	31	107
4 (5)	Vietnam	9.00	12	19	4	1	13	105
5 (31)	Ethiopia	10.75	5	5	22	11	3	169
6 (4)	India	11.50	2	39	1	4	28	128
7 (8)	China	12.25	1	39	2	7	30	81
8 (13)	Afghanistan	12.75	10	6	26	9	12	-
9 (2)	United States	16.25	9	36	3	17	150	12
10 (3)	Romania	18.00	19	13	19	21	9	60
17	Germany	27.75	23	57	8	23	41	22
21	Austria	31.25	57	45	14	9	13	15
24	Switzerland	32.50	34	15	31	50	32	7

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[15] Harmeling, Bals 2007

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

[17] UNDP 2007

Table 3: The Decadal Climate Risk Index (CRI) for 1997-2006 - the 10 countries most affected by extreme weather events.

1997-2006	Country	Index value[18]	Rank death toll	Rank deaths per 100,000 inhabitants	Rank total losses in PPP	Rank total losses per GDP	Number of registered events	For comparison: Rank HDI 2005[19]
1	Honduras	7.25	7	2	15	5	28	115
2	Nicaragua	15.25	16	3	32	10	18	110
3	Bangladesh	16.00	6	35	6	17	136	140
4	Vietnam	17.75	12	30	10	19	104	105
5	Dominican Republic	18.00	13	6	31	22	17	79
6	Haiti	18.75	14	5	44	12	24	146
7	India	19.50	1	38	3	36	184	128
8	Venezuela	19.75	2	1	33	43	23	74
9	France	24.75	3	10	12	74	140	10
10	Germany	26.25	5	18	8	74	258	22
17	Switzerland	30.25	30	11	28	52	169	7
38	Austria	51.25	64	62	27	52	97	15

Figure 3: Map of the Climate Risk Index (1997-2006) and worldwide disaster "hotspots".

The Down10 countries of the Climate Risk Index are displayed on a world map of disaster "hotspots" as developed by the Columbia University (not only weather-related extreme events). Explanations refer to the primary causes for the ranking of the different Down10 countries.

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; Columbia University
(http://www.earth.columbia.edu/news/2004/images/hotspots_mortality.jpg)

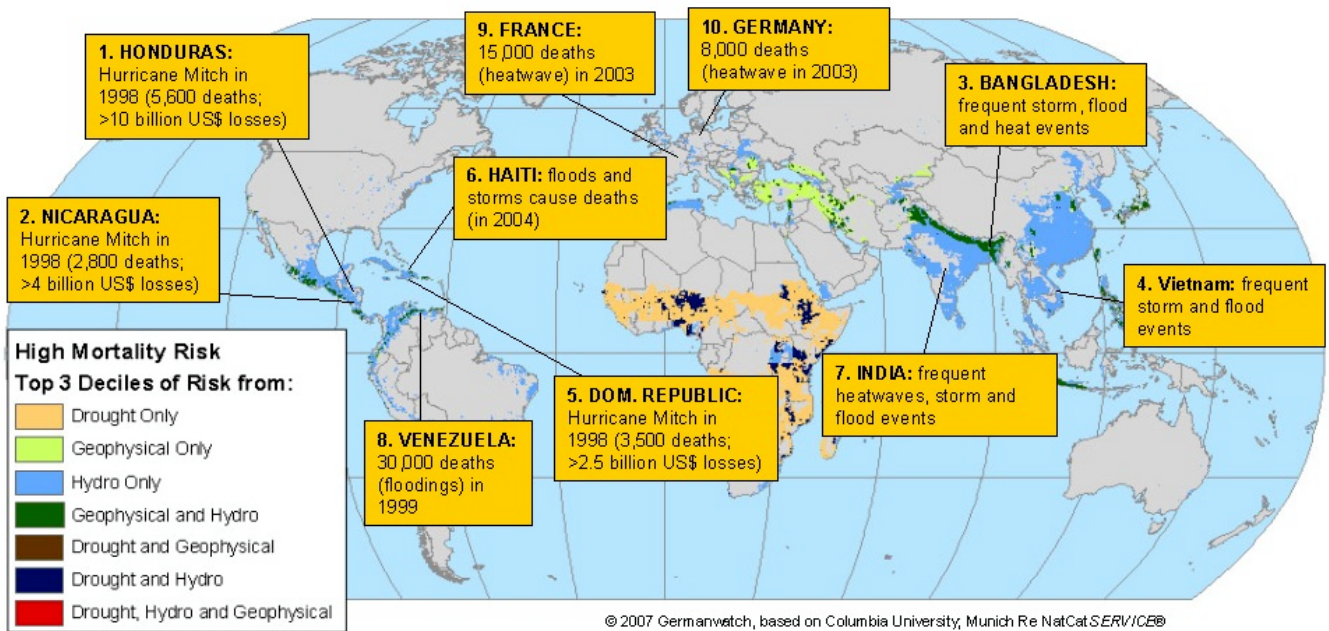[18] In case of equal index values, the ranking in casualties per 100,000 inhabitants determines the overall ranking.
[19] UNDP 2007

Of course, there are other indicators which are relevant with regard to impact and vulnerability analyses. A number of research projects have been undertaken concerning numerous other factors, including

- a science project of the Inter-American Development Bank (IDB) with the objective to develop a so-called "Prevalent Vulnerability Index (PVI)";[20]
- the mentioned research project of the Columbia University which developed and mapped "disaster hotspots" (see underlying map of figure 3).[21]

These approaches are much more complex than the Climate Risk Index, but usually they are not updated annually. Thus, the Germanwatch CRI should be regarded as bringing in an additional perspective, it is not all-encompassing.

From an economic perspective, the assessment of indirect losses could serve as another possible indicator. These would, for example, include missing revenues from tourism after a disaster. In addition, several million people experience severe losses when their houses are destroyed or temporarily inhabitable, or when they are injured.

Box 2: Background of the Germanwatch Climate Risk Index (CRI)

Extreme weather events are not the only phenomenon revealing the impacts of climate change on development. Other very influential factors include glacier melting, sea-level rise etc. However, extreme weather events play an important role in public discussions about climate change, because they usually attract high media attention. Nevertheless, discussions about extreme events often only refer to absolute numbers of deaths and/or maxima of dead persons and economic losses.

Germanwatch developed the global Climate Risk Index (CRI) to regularly sensitise the public and the media for the consequences of weather extremes and to inform them about the interlinkages with climate change. We hope to initiate a differentiated discussion about the consequences of climate change. Above this, we intend to move forward the debate about risk reduction strategies from greenhouse gas reduction to adaptation and insurance options. We put a special focus on less developed countries.

The Climate Risk Index was first published by Germanwatch in 2006 using data until 2004. The present version 2008 is supposed to provide a differenciated view of consequences of weather extremes, especially in the year 2006, and to particularly show

- **which countries or country groups were mostly affected by weather extremes;**

- **in which way numbers of deaths and losses are related to country specific conditions;**

- **to which extent especially less developed countries suffer from the consequences which are neglected by an examination which only focuses on the absolute amount of losses.**

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[20] Cardona et al. 2004
[21] s. Dilley et al. 2005

The latest Human Development Report (HDR) mentions a significant growth in the number of people affected by hydrometeorological disasters. Between 1975 and 2004, the number of people affected in an annual average has risen by a factor of five, to about 262 million.[22] Databases like the ones of the Munich Re or the Centre for Research on Epidemiology of Disasters (CRED) also try to assess the number of affected, homeless or displaced people. Table 4 shows the countries in Africa and Asia with the highest number of affected people (excluding deaths) in 2006 according to the CRED database. However, these figures measured on a national level and over a longer time period are less reliable and accurate compared to the reported number of deaths or the economic losses.[23] Documentation of disasters often does not specify what "affected" really means. This is the main reason why Germanwatch has decided not to include the number of affected people in the CRI. This might have the disadvantage that the situation in Africa, with many affected people but relatively few economic losses and also a limited death toll, is not adequately reflected.

Table 4: Number of people totally affected by extreme weather events in Africa and Asia in 2006

Source: http://www.cred.be

Africa			Asia		
	Country	Total Affected		Country	Total Affected
1	Malawi	5,160500	1	China	88,325,874
2	Kenya	4,283,300	2	Philippines	8,568,968
3	Niger	3,046,472	3	India	7,384,478
4	Ethiopia	3,034,146	4	Vietnam	3,349,410
5	Burundi	2,166,310	5	Thailand	3,257,308
6	Mozambique	1,429,012	6	Afghanistan	2,232,975
7	Mali	1,026,000	7	Indonesia	753,775
8	Rwanda	1,002,000	8	Nepal	280,000
9	Uganda	605,680	9	Bangladesh	230,924
10	Somalia	486,500	10	Malaysia	136,518

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[22] UNDP 2007
[23] Munich Re 2007, personal communication

3 Extreme weather events in 2006

3.1 An overview of extreme weather events in 2006

The results from summarising the total death and loss figures resulting from extreme weather events in 2006 were different compared to previous years. The number of registered events was remarkably higher. The number of deaths was higher than in 2004 and 2005. Despite this fact, disasters in 2006 received less media attention. One reason could be that there was not the one country extraordinarily suffering from deaths, but five with more than 1,000 deaths (see 3.2). The absolute losses varied considerably. The losses in 2006 summed up to about US$ 47 billion which is only half of 2004 and about one fifth of 2005, the extreme hurricane year. Consequently, the insured losses also varied. It is important to note that by far most of the insured losses occurred in developed countries. The insurance coverage in poorer countries is still very limited, albeit increasing in rapidly developing countries.

Table 5: Extreme weather events from 2004 to 2006: global figures

Source. Germanwatch based on Munich Re NatCat*SERVICE*®

Year	Number of events	Death toll	Absolute losses in million US$	Insured losses in million US$
2004	718	11,953	94,231	42,353
2005	716	10,975	214,863	96,864
2006	953	12,422[24]	47,670	15,204

Analysing the deaths and losses according to countries´ development status points to the differing affectedness between richer and poorer countries. For this purpose, the World Bank grouping according to income classes is applied (fig. 4).[25] In relative terms, the low income economies have been much more affected in 2006 than the high income or upper middle income economies.

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[24] It is important to note that these figures exclude deaths from the European heatwave in the Netherlands and in Belgium. Preliminary figures given by government agencies counted deaths in the order of 1,000 in each country. However, given the difficulties in classifying deaths as a consequence of a heatwave, the figures have not been fully accepted by experts. Since no updated, reliable figures existed by the time of writing this paper, it was decided to exclude these.

[25] 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;
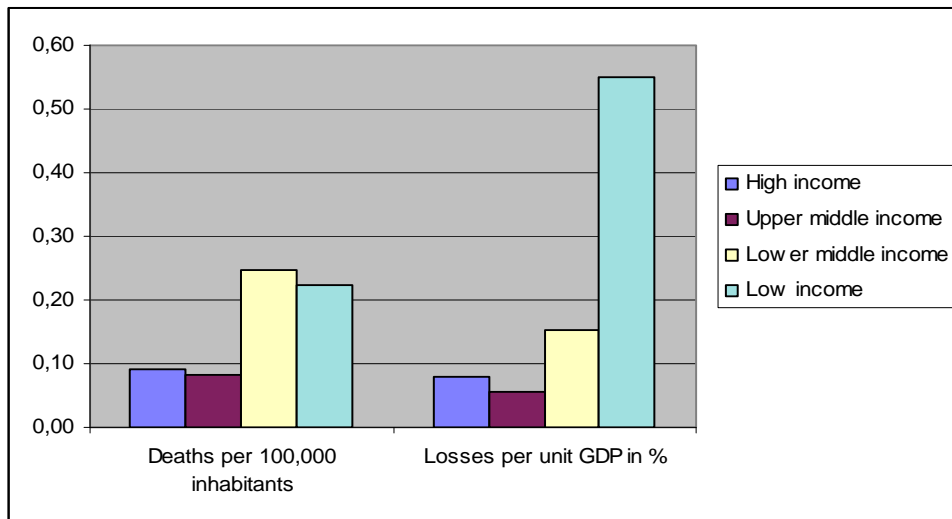
Figure 4: Relative death and loss figures according to income-based country groupings

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; World Bank

3.2 Deaths caused by extreme weather events in 2006

According to the Munich Re figures, about 12,422 people died from extreme weather events in 2006. The five countries with more than 1,000 deaths account for more than 50% of worldwide deaths as a direct consequence of extreme weather events in 2006. While in China and India the 2006 figures are much lower than the long-term average, for Indonesia and Ethiopia this year marked an extreme year. The number of deaths was four (Indonesia) and ten (Ethiopia) times higher than the 20-year average. The same holds for the Ukraine and the Democratic Republic of Korea.

The analysis of deaths per 100,000 inhabitants (table 6, right half) shows a different picture than the absolute figures. "New entries" in the Down10 are Latvia, Somalia, Suriname and Nepal. Latvia, Ukraine, Ethiopia and Suriname experienced much more relative deaths than in the long-term average. It is remarkable that Nepal, number 10, registered only a third of the average deaths of the past 20 years. Suriname only experienced three deaths. However, since the overall population only comprises about 500,000 people, the relative number of deaths is more informative.

Although both parts of table 6 display different indicators, it has to be noted that in 2006 six countries were listed in the Down10 of both categories. In 2005, there was only an overlap of two countries. Regarding the type of extreme event, in seven of the ten most affected countries more than 70% of deaths were caused by events in only one category of weather disasters (figure 5).

Table 6: Countries with the highest absolute and relative numbers of deaths in 2006 and in the period 1987-2006

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

Rank	Country	Death toll 2006	Average 1987-2006	Rank	Country	Deaths per 100,000 inhabitants 2006	Average 1987-2006
1	China	1692	2267	1	Korea (Dem. Rep.)	2.33	See footnote [26]
2	India	1437	3190	2	Latvia	1.96	0.22
3	Indonesia	1297	309	3	Ukraine	1.72	0.16
4	Philippines	1267	808	4	Philippines	1.46	1.13
5	Ethiopia	1080	124	5	Ethiopia	1.44	0.21
6	Ukraine	803	57	6	Afghanistan	1.15	See footnote [27]
7	Korea (Dem. Rep.)	549	50	6	Somalia	1.15	See footnote [28]
8	Pakistan	513	451	8	Indonesia	0.58	0.16
9	United States	422	400	8	Suriname	0.58	0.03
10	Afghanistan	308	269	10	Nepal	0.57	1.36
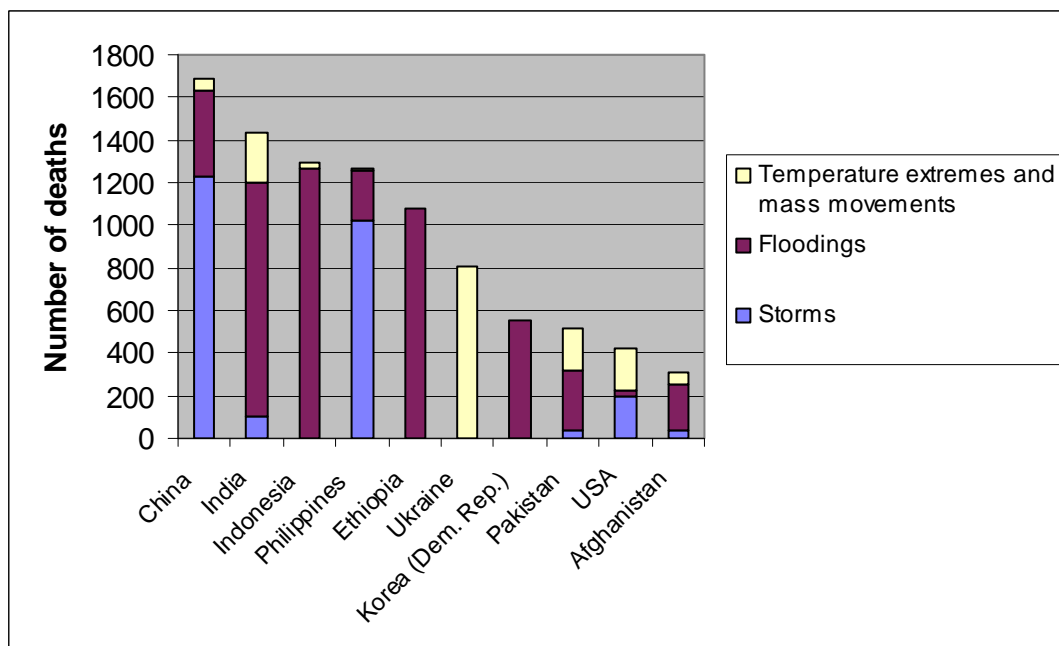
Figure 5: Deaths attributed to different types of extreme weather events

Source: Germanwatch based on Munich Re NatCat*SERVICE*®

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[26] No sufficiently reliable data are available for the population of the past 20 years. The average annual deaths account for 50 persons.

[27] No sufficiently reliable data are available for the population of the past 20 years. The average annual deaths account for 269 persons.

[28] No sufficiently reliable data are available for the population of the past 20 years. The average annual deaths account for 170 persons.

3.3 Losses caused by extreme weather events in 2006

For the analyses presented here, losses were measured in Purchasing Power Parities. This approach is applied because it better reflects the actual economic consequences that people have to face as compared to just stating nominal dollar values (see chapter 5 for a more detailed explanation). Table 7 shows that it was an extreme year for India, since the losses were more than thrice the long-term average.

Table 7: Countries with the highest numbers of absolute and relative losses (PPP) in 2006

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

Rank	Country	Total losses in million US\$ in PPP 2006[29]	Average 1987-2006	Rank	Country	Losses in % of GDP	Average 1987-2006
1	India	31,144	9196	1	Vietnam	2.39	1.34
2	China	24,515	39,356	2	Korea (Dem. Rep.)	1.67	See footnote [30]
3	United States	18,765	26,306	3	Philippines	0.96	0.32
4	Vietnam	6,841	2,015	4	India	0.74	0.46
5	Philippines	4,459	854	5	Malaysia	0.46	0.09
6	Indonesia	2,588	1,968	6	Indonesia	0.27	0.31
7	Japan	2,575	2,107	7	China	0.24	0.89
8	Germany	1,970	1,698	8	Australia	0.23	0.18
9	Russia	1,783	1,896	9	Afghanistan	0.22	See footnote [31]
10	Australia	1,563	776	10	Austria	0.22	0.14

Both China and the USA, number two and three in the loss ranking, nevertheless experienced much smaller losses than in the past 20 years. For the USA, extreme events in 2006 generated less than one tenth of the losses in 2005, when a record number of big hurricanes hit the country. Both Vietnam and the Philippines consider 2006 a drastic year with losses between three and five times the averages of 1987-2006.

The relative economic impact of extreme weather events, measured by the losses in % of GDP, is an important indicator since it relates the losses of an entire country to the country's economic capacity and thus gives a more realistic picture of how severe these impacts actually are. Vietnam ranks number four regarding the relative losses, with losses twice as high as the country´s long-term average. The Philippines and Malaysia were also affected more than average.

The differentiation between losses measured in nominal US\$ and those expressed in purchasing power parities (PPP) leads to remarkably differing results, as can be seen in figure 6. India and China rank above the USA in absolute losses assuming that these are

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[29] The PPP factors are primarily calculated on the basis of the World Economic Outlook Database of the International Monetary Fund: IMF 2007

[30] No sufficient reliable data are available for the GDP of the past 20 years. The average annual losses in are estimated at 880 million US\$.

[31] No sufficient reliable data are available for the GDP of the past 20 years. The average annual losses are estimated at 20 million US\$.

calculated in PPP. The losses in Vietnam, the Philippines and Indonesia are also much more severe than the mere expression in nominal US$ losses would suggest.
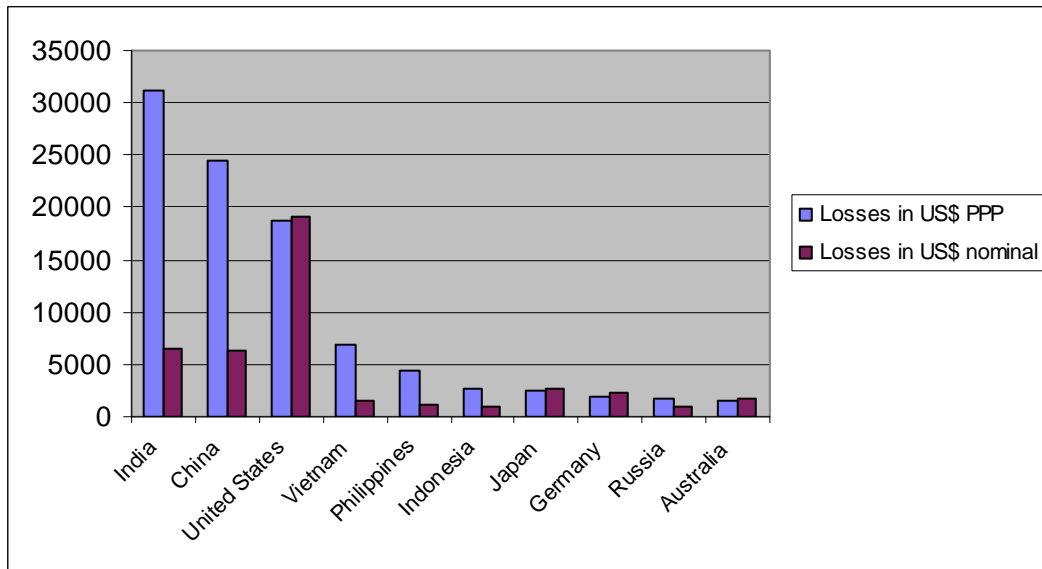
Figure 6: Comparison of losses expressed in US$ PPP and in US$ nominal

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

Regarding the causes of the losses assessed, it is interesting to have a look at the shares of different extreme event types in these losses. Figure 7 displays this analysis for the countries in the loss-related Down10. The shares differ by country: While storms by far have been the most important cause in China, the USA, Vietnam and the Philippines, weather-related floodings entailed the majority of the losses in India and Indonesia.
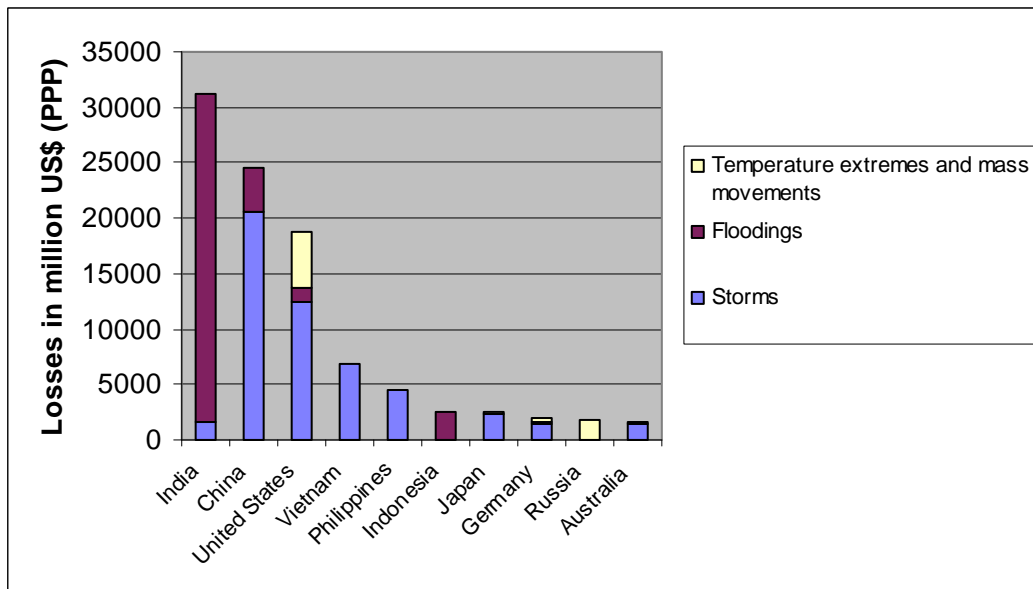
Figure 7: Losses attributed to different types of extreme weather events among the 2006 Down10 countries

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

4 Extreme weather events from 1997 to 2006

4.1 An overview of extreme weather events from 1997 to 2006

In total, during the last decade (1997-2006) extreme weather events caused more than 200,000 deaths and more than US$ 750 billion of direct economic losses. While 2006 has been a relatively "calm" year in terms of economic losses on a global scale, 2004 and 2005 have seen record levels of economic losses (figure 8).
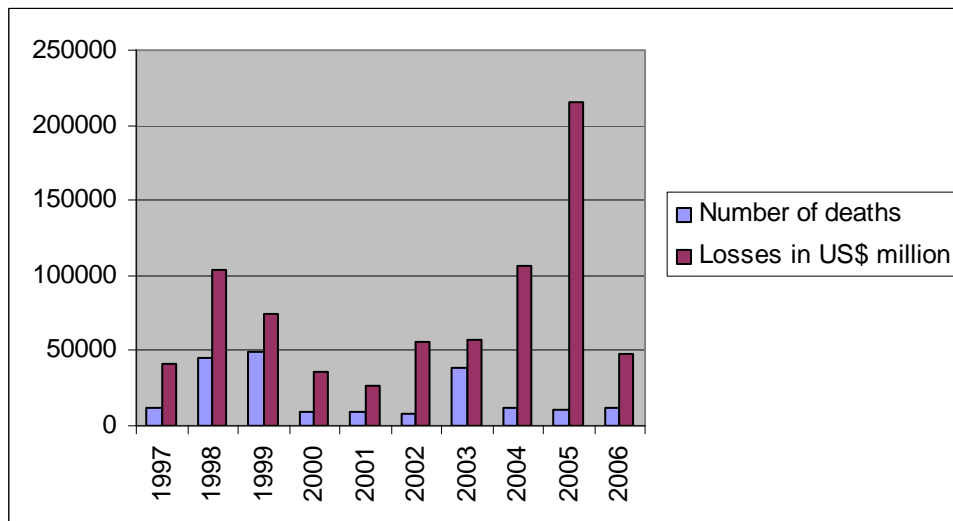
Figure 8: Annual deaths and losses from 1997-2006

Source: Germanwatch based on Munich Re NatCat*SERVICE*®

4.2 Deaths caused by extreme weather events from 1997 to 2006

Table 8 shows the countries with the highest average numbers of deaths in absolute and relative (deaths per 100,000 inhabitants) terms in the years 1997 to 2006. Three of these countries affected most in relative terms also appear in the list of the ten countries most affected in absolute terms, namely Venezuela, France and Honduras. Due to the enormous size of its population, India, the country with the highest number of absolute deaths, is less affected in relative terms. The same holds for China. Among the countries hit hard in relative terms, there is a significant number of countries from the Caribbean region and of small island states.

Table 8: Average absolute and relative numbers of deaths from 1997 to 2006 in 10 countries

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

Rank	Country	Average annual number of deaths	Rank	Country	Average annual number of deaths per 100,000 inhabitants
1	India	4,376	1	Venezuela	12.15
2	Venezuela	3,012	2	Honduras	8.68
3	France	1,534	3	Nicaragua	5.62
4	China	1,462	4	Federated Islands of Micronesia	5.55
5	Germany	729	5	Haiti	4.95
6	Bangladesh	673	6	Dominican Republic	4.91
7	Honduras	578	7	Papua New Guinea	4.86
8	Philippines	472	8	Cook Islands	4.29
9	USA	455	9	Grenada	3.90
10	Indonesia	453	10	France	2.51

Figure 9 shows how those countries being identified as the Down10 in the overall CRI (see chapter 2) have been affected according to the type of disaster. While Honduras, Nicaragua and the Dominican Republic have almost exclusively suffered from storms, most of the deaths in France and Germany were due to the 2003 heatwave, the biggest natural disaster in Europe for centuries with more than 30,000 deaths. The fact that there was a similar, albeit less intense heatwave in 2006 with only limited impacts may indicate that these countries have made progress in effectively preparing for events of this kind. In Venezuela, almost all deaths were caused by the floodings in 1999. Bangladesh, Vietnam, Haiti and India are among the countries which continuously face the different types of extreme events.
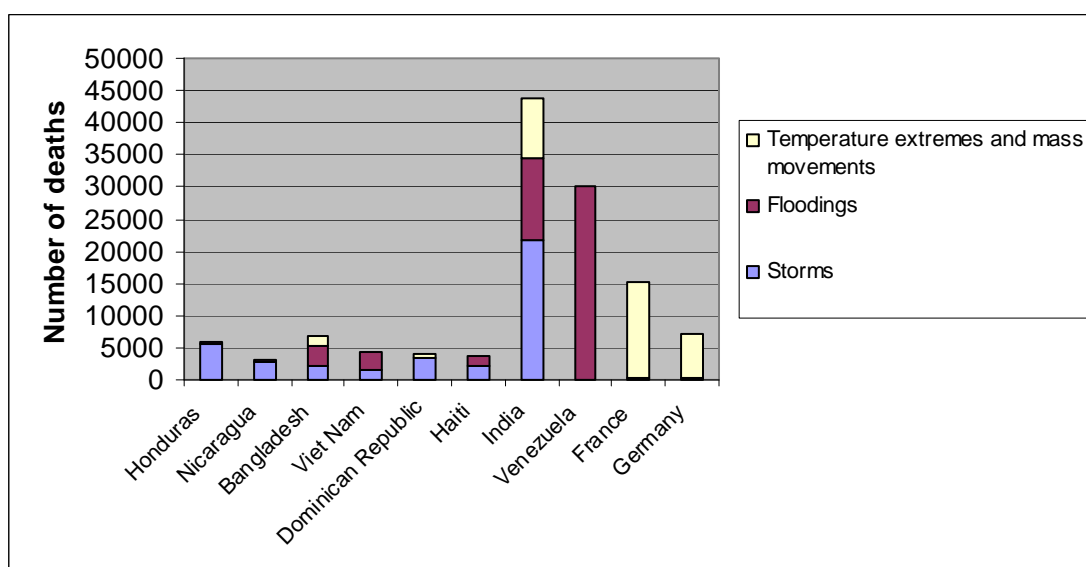
Figure 9: Deaths in the CRI Down10 countries in 1997-2006 by type of disaster events

Source: Germanwatch based on Munich Re NatCat*SERVICE*®

4.3 Losses caused by extreme weather events from 1997 to 2006

Regarding the direct economic impacts of weather events in the past decade, China, the USA and India are the countries which suffered most in absolute terms (in million US$ PPP; left part of table 9). Bangladesh was the only LDC among the ten most affected. However, the picture changes drastically when the relative impacts, compared to the national GDP, are considered (right part of table 9). Countries from the Caribbean region absolutely dominate this ranking.[32] Numerous hurricanes have caused substantial destruction throughout the last ten years.

Table 9: Average absolute and relative losses from 1997 to 2006 in 10 countries

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

| Rank	Country	Losses in US$ million PPP (average 1997-2006)	Rank	Country	Losses per unit GDP in % (average 1997-2006)
1	China	38,139	1	Grenada	21.98
2	USA	34,365	2	Cayman Islands	20.30
3	India	11,900	3	St. Kitts and Nevis	12.19
4	Indonesia	3,666	4	Bermuda	8.63
5	Iran	3,583	5	Honduras	6.25
6	Bangladesh	3,452	6	Belize	5.84
7	Japan	2,692	7	American Samoa	5.03
8	Germany	2,520	8	Bahamas	4.59
9	Korea (Rep.)	2,303	9	Guyana	3.82
10	Vietnam	2,171	10	Nicaragua	2.71

For the ten countries ranking highest in the CRI for the years 1997 to 2006, the economic losses are attributed to the types of disasters in figure 10. Floodings caused most of the losses in Bangladesh and India, while storms were nearly the only source of destruction in Honduras and Nicaragua. In Vietnam, India, Germany and France, the losses were caused by all of the three disaster categories.

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[32] It has to be noted that for a number of small island developing states, e.g. from the Pacific region, no sufficiently reliable data on GDP exist for the past decade. In these cases, calculating the relative economic impacts was not possible.
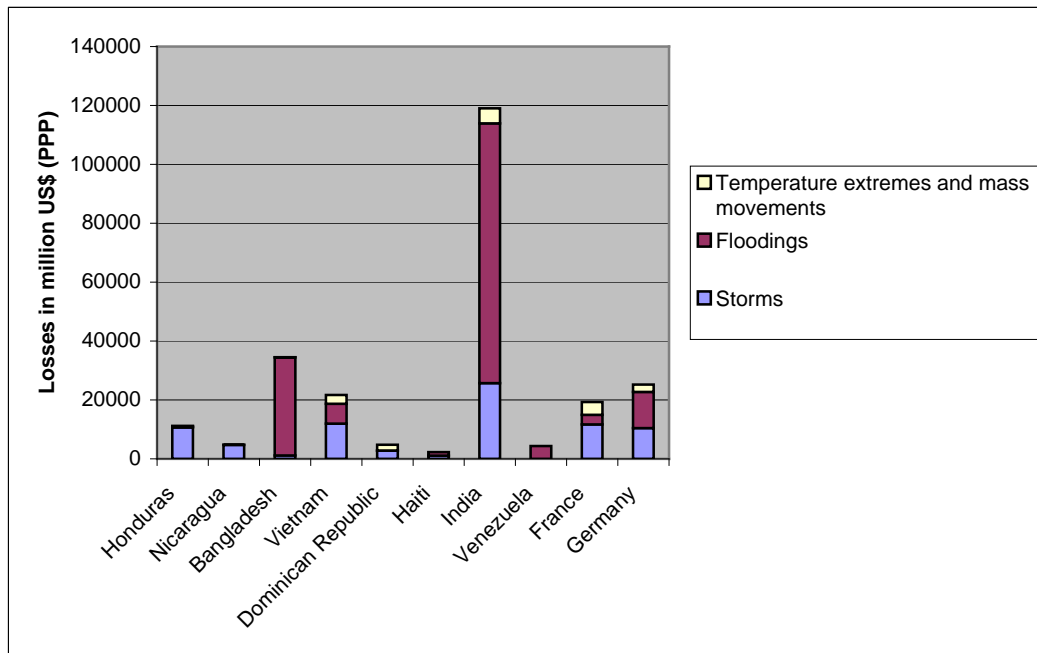
Figure 10: Losses in the CRI Down10 countries in 1997 to 2006 by type of disaster events

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

5 Methodological remarks

The presented examinations are based on the worldwide acknowledged data collection and analysis NatCat*SERVICE*® provided by the Geo Risks Research division of the Munich Re. They comprise "all elementary loss events which have caused substantial damage to property or persons". For the countries of the world, the Munich Re collects data on the amount of total losses caused by weather events, the number of deaths, the insured losses and total economic losses. The last two indicators are stated in million US$ (original values, inflation adjusted).

In the present analyses, only weather related events - storms, floods, as well as temperature extremes and mass movements (heat and cold waves etc.) - are incorporated. Geological factors like earthquakes, volcanic eruptions or tsunamis, for which data are also available, do not play a role in this context because they do not depend on the weather and therefore are not related to climate change. To enhance the manageability of the large amount of data, the different categories within the weather related events were combined. For single cases - for especially devastating events - it is stated whether they concern floods, storms, or another type of event.

It is important to note that this event-related examination does not allow for an assessment of continuous changes of important climate parameters. A long-term decline in precipitation that was shown for some African countries as a consequence of climate change cannot be displayed by the index. Such parameters nevertheless often substantially influence important development factors like agricultural outputs and the availability of drinking water.

The present data does also not allow for conclusions about the distribution of losses below the national level, although this would be interesting with regards to content. However, the data quality would only be sufficient for a small number of countries.

Analysed indicators

For this examination, the following indicators were analysed in this paper:

1. number of deaths,

2. number of deaths per 100 000 inhabitants,

3. sum of losses in US$ in purchasing power parities (PPP) as well as

4. losses in proportion to Gross Domestic Product (GDP).

For the indicators 2. to 4., primarily economic and population data by the International Monetary Fund were included which have in single cases been supplemented by data from i.a. the World Bank's World Development Indicators Database[33]. However, it has to be added that especially for small (e.g. Pacific small island states) or politically extremely

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[33] http://www.worldbank.org/data/

instable countries (e.g. Somalia), the required data are not always available in sufficient quality for the whole observed time period. For those countries, reliable analyses are not possible.

The Climate Risk Index 2008 is based on the figures from 2006 and the decadal analyses 1997 to 2006. This ranking represents the, according to the indicators, most affected countries. Each country´s index value is equal to a country's average ranking in all four analyses.

The current IPCC assessment report reveals the highly dangerous consequences of climate change. Therefore, an analysis of the already observable changes in climate conditions in different regions indicates which countries are particularly endangered. Although examining socio-economic variables in comparison to losses and deaths caused by weather extremes – as was done in the present analysis – does not allow for an exact measurement of the vulnerability, it can at least provide an estimate. In most of the cases, already afflicted countries will probably also be especially endangered by possible future changes in climate conditions.

Despite the value of historic analyses, it is not advisable to simply extrapolate recordings of the past to the future. On the one hand, the probability of future damaging events as a consequence of climate change can only to a limited extent be derived from the statistical past. Additionally, new phenomena can occur in states or regions. In the year 2004, for example, a hurricane was registered in Brazil's South Atlantic offshore coast for the first time ever. Accordingly, the analyses of the Climate Risk Index should not be seen as the only evidence for which countries are already afflicted or will undoubtedly be affected by anthropogenic climate change. After all, people can principally fall back on different adaptation measures. However, to which extent these can be implemented effectively depends on several factors which altogether determine the degree of vulnerability.

The relative consequences of weather extremes also depend on economic and population growth

Identifying relative values in this index represents an important complement to the otherwise often dominating absolute values, because it allows for analysing country specific data concerning losses in relation to real conditions in the countries. It is obvious, for example, that a damage of one billion US$ for a rich country like the USA entails much less economic consequences than for one of the world's poorest countries. This is being backed up by the relative analyses.

It should be noted that values and therefore rankings of countries regarding the respective indicators do not only change due to the absolute impacts of extreme weather events but also due to economic and population growth. If, for example, population grows which is the case in most of the countries, the same absolute number of deaths leads to a relatively lower assessment in the following year. The same applies to economic growth. However, this does not affect the validity of the relative approach. The ability of society to cope with losses, through precaution, mitigation and disaster preparedness, insurances or the improved availability of means for emergency aid, generally rises along with increasing

economic strength. Nevertheless, an improved ability does not necessarily imply enhanced implementation of effective preparation and response measures.

While absolute numbers tend to overestimate populous or economically capable countries, relative values place stronger weight on smaller and poorer countries. To give consideration to both effects, the analysis of the CRI is based on absolute and on relative values.

The indicator "losses in purchasing power parities" allows for a more comprehensive estimation of how different societies are actually affected

The indicator "absolute losses in US$" is measured in purchasing power parities (PPP) because using this figure better expresses how people are actually affected by the loss of one Dollar than using nominal exchange rates. PPP are currency exchange rates which permit a comparison of the GDP that incorporates price differences between countries. In simple terms, this means that a farmer in India can buy more crop with one US$ than a farmer in the USA. Therefore, the real consequences of the same nominal loss are much higher in India. For most of the countries, US$ values according to exchange rates must therefore be multiplied by values bigger than one.

6   Further analyses and data

6.1   Analyses for Austria, Germany and Switzerland

Since Germanwatch is based in Germany and the past year´s experience has shown that there is particular interest in results for Germany and its German-speaking neighbour countries, additional figures for Austria, Germany and Switzerland are provided in the following table and figures.

Table 10: Climate Risk Index rankings and indicator performance in 2006 and 1997 to 2006

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

Rank	Country	Index value[34]	Death toll (annual average)	Deaths per 100,000 in-habitants (annual aver-age)	Total losses in million US\$ (PPP) (annual average)	Total losses in % of GDP (annual average)	Number of regis-tered events
				2006			
17	Germany	27,75	56	0.07	1,969.9	0.08	41
21	Austria	31,25	10	0.12	646.9	0.21	13
24	Switzerland	32,50	29	0.4	37.2	0.01	23
				1997-2006			
10	Germany	26,25	728	0.88	2,520.4	0.11	258
17	Switzerland	30,25	114	1.59	518.3	0.22	169
38	Austria	51,25	17	0.22	553.9	0.21	97

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[34] In case of equal index values, the ranking in casualties per 100,000 inhabitants determines the overall ranking.
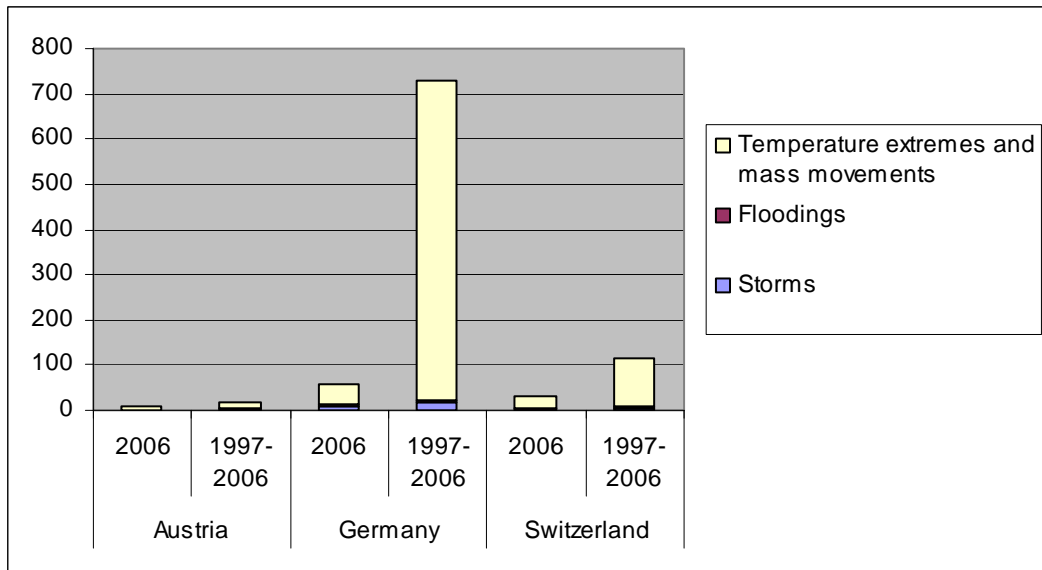
Figure 11: Average number of annual deaths by disaster type in 2006 and 1997-2006
Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007
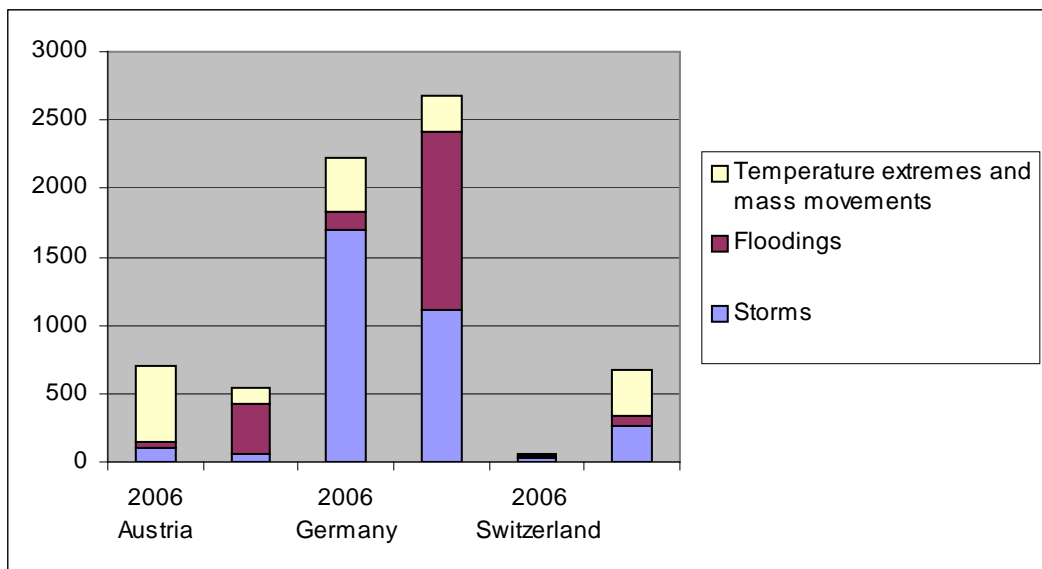
Figure 12: Average number of annual losses in million US$ by disaster type.

Source: Germanwatch based on Munich Re NatCat*SERVICE*®; IMF 2007

6.2 Full country data

Table 11: Analysis of weather-related events: Partial indicators 2006

Country	Events	Deaths	Deaths per 100,000 inhabitants	Losses in million US$ (PPP)	Losses per GDP in $
Afghanistan	12	308	1.15	80.71	0.22
Algeria	2	6	0.02	0.34	0.00
Argentina	4	9	0.02	6.78	0.00
Armenia	2	0	0.00	27.78	0.16
Australia	46	8	0.04	1563.29	0.23
Austria	13	10	0.12	646.88	0.22
Azerbaijan	4	0	0.00	2.86	0.01
Bangladesh	19	265	0.17	55.11	0.02
Belgium	2	0	0.00	0.98	0.00
Bermuda	1	0	0.00	0.48	0.01
Bolivia	2	54	0.56	12.70	0.05
Botswana	1	2	0.13	0.23	0.00
Brazil	5	24	0.01	11.47	0.00
Brunei	1	0	0.00	0.08	0.00
Bulgaria	5	18	0.23	98.21	0.13
Burkina Faso	2	5	0.04	0.38	0.00
Burundi	2	9	0.12	8.52	0.16
Byelarus	1	5	0.05	0.12	0.00
Cambodia	3	19	0.13	5.91	0.01
Cameroon	1	4	0.02	0.11	0.00
Canada	36	19	0.06	381.53	0.03
Chile	1	12	0.07	1.44	0.00
China	43	1692	0.13	24514.63	0.24
Colombia	8	176	0.38	2.08	0.00
Congo, Democratic Rep of the	2	12	0.02	23.67	0.05
Congo, Republic of the	1	6	0.17	0.03	0.00
Costa Rica	1	0	0.00	0.02	0.00
Croatia	4	5	0.11	8.42	0.01
Cuba	4	7	0.06	1.40	0.00
Cyprus	3	1	0.13	0.14	0.00
Czech Republic	7	19	0.19	424.83	0.18
Denmark	1	0	0.00	0.04	0.00
Dominican Republic	2	1	0.01	1.41	0.00
Ecuador	1	16	0.12	7.91	0.01
Egypt	1	5	0.01	0.16	0.00
El Salvador	1	0	0.00	0.11	0.00
Estonia	1	7	0.52	0.08	0.00
Ethiopia	3	1080	1.44	161.76	0.19
Fiji	2	0	0.00	0.16	0.00
Finland	3	0	0.00	2.67	0.00
France	11	172	0.28	3.68	0.00
Gambia, The	1	0	0.00	0.50	0.01
Georgia	4	2	0.05	1.36	0.01
Germany	41	56	0.07	1969.89	0.08
Greece	7	5	0.04	5.19	0.00
Guatemala	3	2	0.02	0.97	0.00
Guinea	1	0	0.00	3.67	0.02
Haiti	2	12	0.14	8.72	0.06
Honduras	5	6	0.08	21.86	0.09
Hungary	3	5	0.05	35.79	0.02
Iceland	1	0	0.00	3.78	0.03
India	28	1437	0.13	31143.97	0.74
Indonesia	21	1297	0.58	2588.16	0.27
Iran	1	14	0.02	10.71	0.00
Iraq	1	18	0.07	1.08	0.00
Ireland	4	1	0.02	6.60	0.00
Israel	3	5	0.07	0.93	0.00
Italy	13	19	0.03	505.88	0.03
Jamaica	1	1	0.04	0.06	0.00
Japan	14	46	0.04	2575.31	0.06
Jordan	1	5	0.09	1.11	0.00
Kazakhstan	3	0	0.00	2.05	0.00
Kenya	7	94	0.28	2.79	0.01
Korea, Democratic People s Republic of	2	549	2.33	667.61	1.67
Korea, Republic	3	36	0.07	825.05	0.07

Country	Events	Deaths	Deaths per 100,000 inhabitants	Losses in million US$ (PPP)	Losses per GDP in $
Kyrgyzstan	1	4	0.08	7.83	0.07
Laos	1	1	0.02	2.05	0.01
Latvia	4	45	1.96	5.59	0.02
Lebanon	1	2	0.05	0.01	0.00
Lithuania	2	8	0.24	0.19	0.00
Madagascar	2	1	0.01	33.28	0.18
Malawi	3	9	0.07	3.52	0.04
Malaysia	18	27	0.10	1445.04	0.46
Malta	1	0	0.00	0.07	0.00
Mauritania	2	7	0.24	0.27	0.00
Mexico	10	47	0.05	75.34	0.01
Moldova	1	13	0.38	0.14	0.00
Morocco	1	6	0.02	0.13	0.00
Mozambique	3	32	0.16	0.58	0.00
Myanmar	4	42	0.07	104.68	0.08
Namibia	5	2	0.10	28.49	0.16
Nepal	8	134	0.57	32.23	0.07
Netherlands	1	0	0.00	0.04	0.00
New Zealand	20	4	0.10	77.98	0.07
Nicaragua	1	0	0.00	0.22	0.00
Niger	1	4	0.03	3.46	0.03
Nigeria	5	52	0.03	1.04	0.00
Norway	4	0	0.00	12.45	0.01
Oman	1	1	0.04	0.07	0.00
Pakistan	15	513	0.33	173.35	0.04
Panama	2	11	0.33	5.03	0.02
Papua New Guinea	4	14	0.24	0.88	0.01
Peru	2	0	0.00	1.12	0.00
Philippines	25	1267	1.46	4459.01	0.96
Poland	5	39	0.10	352.64	0.06
Portugal	7	17	0.16	7.35	0.00
Romania	9	100	0.46	207.97	0.09
Russia	18	126	0.09	1782.86	0.10
Rwanda	1	14	0.15	5.33	0.04
Saudi Arabia	1	8	0.03	0.56	0.00
Serbia and Montenegro	2	0	0.00	70.65	0.14
Singapore	1	0	0.00	11.19	0.01
Slovakia	2	2	0.04	35.27	0.04
Slovenia	1	0	0.00	0.13	0.00
Somalia	4	101	1.15	0.74	0.01
South Africa	16	18	0.04	4.77	0.00
Spain	14	23	0.05	12.81	0.00
Sri Lanka	3	78	0.39	0.79	0.00
St. Vincent and the Grenadines	1	0	0.00	0.18	0.02
Sudan	1	27	0.07	2.69	0.00
Suriname	2	3	0.58	1.69	0.05
Swaziland	1	3	0.26	0.12	0.00
Sweden	5	0	0.00	16.97	0.01
Switzerland	32	29	0.40	37.21	0.01
Syria	1	6	0.03	0.02	0.00
Taiwan	5	9	0.04	92.53	0.01
Tajikistan	3	22	0.34	0.37	0.00
Tanzania, United Republic of	6	4	0.01	4.45	0.01
Thailand	9	299	0.45	170.41	0.03
Turkey	14	91	0.13	28.47	0.00
Uganda	3	0	0.00	3.38	0.01
Ukraine	6	803	1.72	2.78	0.00
United Arab Emirates	1	0	0.00	0.04	0.00
United Kingdom	28	10	0.02	25.00	0.00
United States	150	422	0.14	18765.33	0.14
Uruguay	1	2	0.06	0.10	0.00
Uzbekistan	1	7	0.03	0.04	0.00
Venezuela	1	0	0.00	0.56	0.00
Vietnam	13	296	0.35	6840.59	2.39
Yemen	2	30	0.14	0.21	0.00

Table 12: Analysis of weather-related events: Climate Risk Index 2008

(based on values for 2006, see table 11)

Rank CRI	Country	Index value	Rank total deaths	Rank deaths per population	Rank losses in PPP	Rank losses per GDP
1	Philippines	4.00	4	4	5	3
2	Korea, Democratic People s Republic of	5.75	7	1	13	2
3	Indonesia	5.75	3	8	6	6
4	Vietnam	9.00	12	19	4	1
5	Ethiopia	10.75	5	5	22	11
6	India	11.50	2	39	1	4
7	China	12.25	1	39	2	7
8	Afghanistan	12.75	10	6	26	9
9	United States	16.25	9	36	3	17
10	Romania	18.00	19	13	19	21
11	Pakistan	21.00	8	21	20	35
12	Thailand	21.25	11	14	21	39
13	Nepal	21.50	16	10	35	25
14	Czech Republic	24.50	40	30	16	12
15	Russia	24.75	17	53	9	20
16	Malaysia	25.00	35	49	11	5
17	Bolivia	27.75	24	11	44	32
17	Germany	27.75	23	57	8	23
19	Bulgaria	29.00	44	29	24	19
20	Bangladesh	29.50	13	31	30	44
21	Austria	31.25	57	45	14	9
21	Korea, Republic of	31.25	31	57	12	25
23	Poland	31.50	30	49	18	29
24	Switzerland	32.50	34	15	31	50
25	Latvia	33.00	28	2	58	44
25	Myanmar	33.00	29	57	23	23
27	Japan	34.25	27	74	7	29
28	Ukraine	37.50	6	3	72	69
29	Australia	38.75	63	74	10	8
30	Canada	40.25	40	65	17	39
31	Kenya	41.00	20	23	71	50
32	Somalia	41.50	18	6	92	50
32	Turkey	41.50	21	39	37	69
34	Haiti	41.75	53	36	49	29
35	Burundi	42.00	59	45	50	14
36	France	43.00	15	23	65	69
36	Mexico	43.00	26	68	28	50
38	Colombia	43.75	14	17	75	69
39	Italy	44.25	40	83	15	39
40	Rwanda	44.50	49	35	59	35
41	Panama	45.50	56	21	61	44
42	New Zealand	46.00	83	49	27	25
43	Cambodia	46.50	40	39	57	50
44	Honduras	46.75	70	55	41	21
45	Namibia	47.25	90	49	36	14
46	Ecuador	48.75	48	45	52	50
47	Sri Lanka	49.50	22	16	91	69
48	Portugal	50.75	47	33	54	69
49	Suriname	51.50	88	8	78	32
50	Taiwan	52.00	59	74	25	50
51	Congo, Democratic Republic of the	53.50	53	89	40	32
52	Papua New Guinea	53.75	49	26	90	50
53	Kyrgyzstan	54.00	83	55	53	25
54	Malawi	54.50	59	57	67	35
54	Spain	54.50	38	68	43	69
56	Hungary	54.75	75	68	32	44
57	Croatia	56.00	75	48	51	50
58	Mozambique	56.75	32	33	93	69
58	Tajikistan	56.75	39	20	99	69
60	Slovakia	58.00	90	74	33	35
61	Sudan	58.50	35	57	73	69
62	Yemen	60.50	33	36	104	69
63	Madagascar	60.75	98	99	34	12
64	Moldova	61.75	52	17	109	69
65	South Africa	62.25	44	74	62	69
66	Brazil	62.75	37	99	46	69
67	United Kingdom	63.50	57	89	39	69
68	Iran	63.75	49	89	48	69
68	Iraq	63.75	44	57	85	69
68	Serbia and Montenegro	63.75	105	104	29	17
71	Chile	64.50	53	57	79	69
72	Armenia	65.25	105	104	38	14
73	Mauritania	65.50	66	26	101	69
74	Lithuania	65.75	63	26	105	69
74	Nigeria	65.75	25	83	86	69
76	Estonia	66.25	66	12	118	69
77	Argentina	68.00	59	89	55	69
78	Niger	68.25	83	83	68	39
79	Greece	69.50	75	74	60	69
80	Cuba	70.25	66	65	81	69
80	Jordan	70.25	75	53	84	69
82	Georgia	72.50	90	68	82	50
82	Israel	72.50	75	57	89	69
84	Swaziland	73.75	88	25	113	69
84	Tanzania, United Republic of	73.75	83	99	63	50
86	Congo, Republic of the	74.25	70	31	127	69
87	Botswana	75.00	90	39	102	69
88	Sweden	75.25	105	104	42	50
89	Norway	76.00	105	104	45	50
90	Singapore	76.50	105	104	47	50
91	Saudi Arabia	77.25	63	83	94	69
92	Iceland	78.00	105	104	64	39
92	Ireland	78.00	98	89	56	69
94	Laos	78.25	98	89	76	50
95	Cyprus	78.75	98	39	109	69
96	Burkina Faso	79.00	75	74	98	69
97	Guinea	79.75	105	104	66	44
98	Byelarus	81.25	75	68	113	69
99	Algeria	82.00	70	89	100	69
99	Uganda	82.00	105	104	69	50
101	Azerbaijan	82.25	105	104	70	50
102	Guatemala	84.00	90	89	88	69
103	Morocco	84.75	70	89	111	69
104	Uruguay	85.25	90	65	117	69
104	Uzbekistan	85.25	66	83	123	69
106	Dominican Republic	86.50	98	99	80	69
107	Egypt	87.50	75	99	107	69
107	Syria	87.50	70	83	128	69
109	Finland	88.00	105	104	74	69
110	Kazakhstan	88.50	105	104	76	69
111	Gambia, The	88.75	105	104	96	50
112	Bermuda	89.00	105	104	97	50
112	Cameroon	89.00	83	89	115	69
114	Lebanon	89.25	90	68	130	69
115	St. Vincent and the Grenadines	89.75	105	104	106	44
116	Oman	90.25	98	74	120	69
116	Peru	90.25	105	104	83	69
118	Jamaica	90.75	98	74	122	69
129	Belgium	91.25	105	104	87	69
119	Venezuela	93.00	105	104	94	69
120	Nicaragua	95.25	105	104	103	69
121	Fiji	96.25	105	104	107	69
122	Slovenia	97.25	105	104	111	69
123	El Salvador	98.25	105	104	115	69
124	Brunei	99.00	105	104	118	69
125	Malta	99.50	105	104	120	69
126	Denmark	100.25	105	104	123	69
126	United Arab Emirates	100.25	105	104	123	69
130	Netherlands	100.25	105	104	123	69
128	Costa Rica	101.50	105	104	128	69

Table 13: Analysis of weather-related events: Partial indicators, annual average 1997-2006

Corrigendum: Please note that in a former version of this publication, the number of deaths was given for the complete 10-year-period and not as the average number. This error was corrected here. This does not affect the ranking of the Decadal Climate Risk Index in any way.

Country	Deaths	Deaths per 100,000 inhabitants	Losses in million US$ (PPP)	Losses per GDP in %
Afghanist	254	1.14	15.32	0.06
Albania	2	0.05	14.25	0.11
Algeria	92	0.30	96.18	0.05
American	0	0.70	x	5.03
Angola	12	0.08	0.17	0.00
Anguilla	0	x	x	1.58
Antigua a	1	0.64	13.07	1.53
Argentina	20	0.06	1058.03	0.23
Armenia	0	0.01	42.38	0.44
Australia	21	0.11	916.75	0.17
Austria	17	0.21	553.91	0.23
Azerbaija	3	0.04	75.45	0.28
Bahamas,	2	0.55	249.56	4.59
Bahrain	6	0.83	0.01	0.00
Banglades	673	0.47	3452.95	1.48
Barbados	0	0.04	0.82	0.02
Belgium	2	0.02	126.53	0.04
Belize	3	1.35	97.00	5.84
Benin	1	0.02	0.18	0.00
Bermuda	0	0.06	x	8.63
Bolivia	37	0.42	33.28	0.15
Bosnia He	0	0.01	59.59	0.24
Botswana	1	0.06	1.27	0.01
Brazil	82	0.05	501.21	0.04
Brunei	0	0.00	0.26	0.00
Bulgaria	7	0.09	209.72	0.38
Burkina F	1	0.00	0.06	0.00
Burundi	14	0.20	1.09	0.03
Byelarus	8	0.08	22.68	0.04
Cambodia	52	0.39	147.91	0.51
Cameroon	9	0.05	1.20	0.00
Canada	16	0.05	556.80	0.06
Cayman Is	0	0.24	x	20.30
Central A	1	0.03	0.37	0.01
Chad	1	0.01	2.08	0.02
Chile	9	0.06	121.21	0.08
China	1462	0.11	38139.30	0.61
Colombia	96	0.22	21.77	0.01
Congo, De	15	0.26	5.36	0.01
Congo, Re	1	0.03	0.02	0.00
Cook Isla	1	4.29	x	0.31
Costa Ric	4	0.10	22.52	0.06
Croatia	5	0.11	74.96	0.16
Cuba	5	0.05	1778.06	2.30
Cyprus	6	0.81	3.31	0.02
Czech Rep	12	0.12	1062.01	0.59
Denmark	1	0.02	323.03	0.20
Djibouti	7	1.02	0.14	0.01
Dominica	0	0.42	1.59	0.39
Dominican	399	4.91	479.23	0.83
East Timo	0	0.02	0.09	0.01
Ecuador	39	0.30	162.63	0.33
Egypt	9	0.01	1.31	0.00
El Salvad	38	0.59	103.09	0.33
Eritrea	0	0.00	0.03	0.00
Estonia	1	0.06	38.89	0.24
Ethiopia	160	0.24	23.47	0.04
Federated	6	5.55	x	0.18
Fiji	5	0.54	7.86	0.19
Finland	0	0.01	14.96	0.01
France	1534	2.51	1927.21	0.12
French Gu	0	x	x	x
French Po	2	x	x	x
Gambia, T	7	0.54	1.13	0.04
Georgia	2	0.04	21.01	0.20
Germany	729	0.89	2520.37	0.12
Ghana	7	0.04	2.23	0.01

Country	Deaths	Deaths per 100,000 inhabitants	Losses in million US$ (PPP)	Losses per GDP in %
Greece	13	0.12	236.12	0.10
Grenada	4	3.90	170.30	21.98
Guadeloup	0	x	x	x
Guam	0	0.19	x	x
Guatemala	131	1.05	241.09	0.51
Guinea	3	0.03	0.80	0.00
Guyana	1	0.08	122.81	3.82
Haiti	386	4.95	229.14	1.67
Honduras	578	8.68	1120.57	6.25
Hong Kong	1	0.02	15.45	0.01
Hungary	16	0.15	160.31	0.11
Iceland	0	0.00	0.44	0.00
India	4376	0.42	11900.70	0.42
Indonesia	453	0.21	3666.32	0.51
Iran	91	0.14	3583.99	0.82
Iraq	2	0.01	0.12	0.00
Ireland	3	0.07	56.06	0.04
Israel	3	0.05	19.91	0.01
Italy	441	0.77	1964.78	0.13
Ivory Coa	0	0.00	0.21	0.00
Jamaica	5	0.20	117.52	1.16
Japan	78	0.06	2692.66	0.08
Jordan	2	0.04	3.44	0.02
Kazakhsta	5	0.04	3.55	0.00
Kenya	55	0.18	34.38	0.10
Kiribati	0	0.00	0.04	0.02
Korea, De	81	0.36	78.24	0.25
Korea, Re	137	0.29	2303.64	0.27
Kuwait	0	0.01	0.01	0.00
Kyrgyzsta	11	0.22	5.67	0.07
Laos	2	0.03	5.33	0.05
Latvia	8	0.34	119.59	0.52
Lebanon	1	0.02	0.22	0.00
Libya	0	0.00	7.12	0.01
Lithuania	4	0.12	23.18	0.06
Macedonia	2	0.07	0.86	0.01
Madagasca	86	0.53	28.50	0.20
Malawi	7	0.06	1.64	0.03
Malaysia	25	0.10	292.04	0.13
Mali	2	0.01	0.17	0.00
Malta	0	0.00	6.58	0.09
Marshall	0	x	x	x
Mauritani	5	0.21	1.88	0.04
Mauritius	0	0.03	58.53	0.46
Mexico	195	0.19	1584.81	0.17
Moldova	4	0.11	12.26	0.18
Mongolia	6	0.26	32.70	0.71
Morocco	15	0.05	305.36	0.26
Mozambiqu	118	0.65	211.54	1.08
Myanmar	133	0.26	13.00	0.02
Namibia	1	0.05	3.77	0.03
Nepal	266	1.17	103.37	0.29
Netherlan	101	0.63	131.99	0.03
New Caled	0	0.12	x	0.00
New Zeala	4	0.10	166.96	0.20
Nicaragua	297	5.62	477.90	2.71
Niger	3	0.02	13.46	0.14
Nigeria	58	0.04	24.43	0.02
Niue	0	x	x	x
Northern	0	x	x	x
Norway	1	0.03	19.48	0.01
Oman	3	0.15	2.94	0.01
Pakistan	352	0.25	84.90	0.03
Panama	14	0.45	2.08	0.01
Papua New	260	4.86	56.86	0.44
Paraguay	14	0.26	5.31	0.02
Peru	161	0.61	158.14	0.11
Philippin	473	0.60	699.85	0.20
Poland	40	0.10	982.40	0.23
Portugal	27	0.26	404.74	0.20
Puerto Ri	1	0.03	645.13	0.90
Reunion	0	x	x	x
Romania	61	0.28	863.15	0.55
Russia	194	0.13	1041.83	0.09
Rwanda	11	0.14	1.11	0.01
Saudi Ara	10	0.05	0.23	0.00
Senegal	9	0.08	2.75	0.02
Serbia and Montenegro	0	0.00	8.42	0.03

Country	Deaths	Deaths per 100,000 inhabitants	Losses in million US$ (PPP)	Losses per GDP in %
Seychelle	0	0.25	21.77	1.52
Sierra Le	2	0.04	0.35	0.01
Singapore	0	0.00	1.42	0.00
Slovakia	8	0.14	147.88	0.21
Slovenia	1	0.06	16.16	0.05
Solomon I	0	0.00	0.07	0.01
Somalia	244	x	x	x
South Afr	38	0.08	131.46	0.03
Spain	45	0.11	882.68	0.09
Sri Lanka	43	0.23	9.79	0.01
St. Kitts	0	0.95	64.92	12.19
St. Lucia	0	0.00	0.20	0.02
St. Vince	1	0.75	4.93	0.73
Sudan	35	0.11	11.78	0.02
Suriname	0	0.06	0.21	0.01
Swaziland	1	0.09	0.06	0.00
Sweden	2	0.02	260.98	0.10
Switzerla	115	1.59	518.36	0.23
Syria	3	0.02	0.41	0.00
Taiwan	62	0.28	512.19	0.10
Tajikista	28	0.45	92.33	1.49
Tanzania,	29	0.08	10.81	0.05
Thailand	126	0.20	245.64	0.06
Togo	0	0.00	0.02	0.00
Tokelau	0	x	x	x
Tonga	0	0.10	1.68	0.25
Trinidad	1	0.05	0.36	0.00
Tunisia	3	0.03	0.03	0.00
Turkey	45	0.07	429.88	0.09
Tuvalu	0	x	x	x
Uganda	36	0.14	1.96	0.01
Ukraine	88	0.18	129.99	0.05
United Arab Emirates	0	0.01	0.01	0.00
United Ki	18	0.03	618.13	0.04
United St	455	0.16	34365.18	0.33
Uruguay	9	0.27	52.41	0.17
Uzbekista	20	0.08	16.01	0.04
Vanuatu	0	0.05	0.72	0.12
Venezuela	3012	12.15	436.41	0.30
Vietnam	433	0.55	2171.82	1.14
Virgin Is	0	x	x	x
Western S	0	x	x	x
Yemen	33	0.15	0.16	0.00
Yugoslavi	0	x	x	x
Zambia	2	0.02	0.82	0.01
Zimbabwe	15	0.13	18.84	0.06

Table 14: Analysis of weather-related events: Climate Risk Index 1997-2006

(based on average values 1997-2006, see table 13)

Please note that in a former version of this publication, the table was sorted alphabetically, whereas the sorting is now in the order of index value.

Country	Index value	Rank total deaths	Rank deaths per population	Rank losses in PPP	Rank losses per GDP
Honduras	7.25	7	2	15	5
Nicaragua	15.25	16	3	32	10
Banglades	16	6	35	6	17
Vietnam	17.75	12	30	10	19
Dominican	18	13	6	31	22
Haiti	18.75	14	5	44	12
India	19.5	1	38	3	36
Venezuela	19.75	2	1	33	43
France	24.75	3	10	12	74
Germany	26.25	5	18	8	74
Indonesia	26.5	10	62	4	30
Guatemala	28.5	27	15	42	30
Italy	28.75	11	21	11	72
China	29	4	85	1	26
Philippin	29	8	28	23	57
Mozambiqu	29.5	29	24	45	20
Switzerla	30.25	30	11	28	52
United St	30.5	9	72	2	39
Korea, Re	31.5	25	46	9	46
Papua New	33.25	18	7	74	34
Nepal	34	17	13	62	44
Iran	34.25	34	75	5	23
Romania	34.5	41	47	22	28
Grenada	40	103	9	47	1
Cambodia	41.75	44	41	52	30
Mexico	42.25	21	68	14	66
Tajikista	43.75	57	36	66	16
Peru	44.5	23	27	51	77
Ecuador	45.25	49	44	49	39
El Salvad	45.25	50	29	63	39
Belize	47.25	107	12	64	6
Korea, De	49	38	42	68	48
Taiwan	49	40	47	29	80
Czech Rep	49.5	74	81	16	27
Bahamas	49.75	121	30	40	8
Portugal	50	58	50	35	57
Russia	50.75	22	79	18	84
Austria	51.25	64	62	27	52
Madagasca	52.25	36	34	82	57
Poland	52.5	48	91	19	52
Latvia	54.25	85	43	60	29
Afghanist	55.25	19	14	97	91
Netherlan	55.5	31	26	54	111
Thailand	56.25	28	65	41	91
Australia	57.75	60	85	20	66
Spain	58.75	45	85	21	84
Cuba	59.25	96	117	13	11
Argentina	59.5	61	108	17	52
Algeria	59.75	33	44	65	97
Bolivia	60	52	38	80	70
St. Kitts	60	149	17	71	3
Jamaica	60.5	98	65	61	18
Japan	60.5	39	108	7	88
Mongolia	62	92	50	81	25
Pakistan	62	15	55	67	111
Ukraine	64.5	35	70	56	97
Malaysia	65	59	91	38	72
Hungary	66.5	66	73	50	77
Bulgaria	66.75	87	96	46	38
Ethiopia	66.75	24	57	84	102
Morocco	67	67	117	37	47
Turkey	67.25	46	105	34	84
Slovakia	67.5	86	75	53	56
Uruguay	67.75	80	49	76	66
Kenya	68	43	70	79	80
Greece	69.25	73	81	43	80
Brazil	71.5	37	117	30	102
Antigua and Barbuda	71.75	147	25	101	14
Myanmar	74	26	50	102	118

Country	Index value	Rank total deaths	Rank deaths per population	Rank losses in PPP	Rank losses per GDP
Canada	74.75	65	117	26	91
New Zeala	74.75	103	91	48	57
St. Vince	75.5	141	22	115	24
Fiji	76	101	32	108	63
Colombia	77.25	32	60	88	129
Guyana	77.5	145	98	58	9
Puerto Ri	77.75	130	136	24	21
South Afr	78.75	51	98	55	111
Seychelle	80	162	55	88	15
Croatia	81	100	85	70	69
United Ki	81.5	63	136	25	102
Zimbabwe	83	69	79	93	91
Chile	84.25	82	108	59	88
Kyrgyzsta	84.5	77	60	111	90
Sri Lanka	85.25	47	59	106	129
Cyprus	87.25	92	20	119	118
Azerbaija	87.75	109	128	69	45
Paraguay	88	70	50	114	118
Gambia, T	88.75	87	32	134	102
Tanzania	89	56	98	105	97
Uzbekista	89.25	62	98	95	102
Congo, De	89.5	67	50	112	129
Moldova	89.5	106	85	103	64
Dominica	89.75	155	38	129	37
Lithuania	89.75	102	81	85	91
Panama	89.75	71	36	123	129
Sudan	90.25	54	85	104	118
Byelarus	92.5	84	98	86	102
Nigeria	92.75	42	128	83	118
Costa Ric	93	103	91	87	91
Denmark	93.25	135	145	36	57
Estonia	94.25	141	108	78	50
Uganda	95.5	53	75	125	129
Burundi	95.75	71	65	136	111
Mauritani	96.5	96	62	126	102
Sweden	96.75	123	145	39	80
Mauritius	97.75	149	136	73	33
Djibouti	98	90	16	157	129
Georgia	98.25	118	128	90	57
Ireland	98.75	113	105	75	102
Armenia	103.75	149	155	77	34
Rwanda	103.75	76	75	135	129
Albania	104	123	117	99	77
Senegal	104.5	81	98	121	118
Belgium	106.75	123	145	57	102
Niger	107	112	145	100	71
Oman	107.25	107	73	120	129
Slovenia	107.75	132	108	94	97
Bosnia He	108	155	155	72	50
Bahrain	108.25	95	19	168	151
Malawi	108.5	87	108	128	111
Tonga	108.75	169	91	127	48
Yemen	108.75	55	73	156	151
Israel	111.75	110	117	91	129
Ghana	117.25	90	128	122	129
Laos	117.25	123	136	113	97
Angola	119.5	75	98	154	151
Jordan	120	116	128	118	118
Namibia	120	136	117	116	111
Cameroon	121	83	117	133	151
Norway	121.5	129	136	92	129
Kazakhsta	123.5	98	128	117	151
Saudi Ara	123.5	78	117	148	151
Macedonia	124.75	128	105	137	129
Vanuatu	125.25	169	117	141	74
Hong Kong	125.5	132	145	96	129
Botswana	126.25	136	108	132	129
Egypt	129	79	155	131	151
Sierra Le	130	117	128	146	129

Country	Index value	Rank total deaths	Rank deaths per population	Rank losses in PPP	Rank losses per GDP
Malta	133.25	175	164	110	84
Zambia	133.25	121	145	138	129
Finland	134.25	155	155	98	129
Chad	135	144	155	123	118
Central African Republic	135.25	132	136	144	129
Guinea	135.25	114	136	140	151
Suriname	135.5	155	108	150	129
Swaziland	136.5	138	96	161	151
Syria	137.5	111	145	143	151
Barbados	138.25	169	128	138	118
Serbia and Montene-gro	139.25	175	164	107	111
Trinidad	139.5	145	117	145	151
Tunisia	141.25	114	136	164	151
Libya	144.25	175	164	109	129
Benin	144.75	130	145	153	151
Iraq	145.5	118	155	158	151
Mali	145.75	123	155	154	151
Lebanon	146.5	141	145	149	151
Congo, Re	147.75	138	136	166	151
East Timo	148.75	162	145	159	129
St. Lucia	152.25	175	164	152	118
Kiribati	155	175	164	163	118
Singapore	155	175	164	130	151
Burkina Faso	155.75	147	164	161	151
Ivory Coa	156.75	162	164	150	151
Solomon I	157	175	164	160	129
Iceland	158	175	164	142	151
Kuwait	159	162	155	168	151
United Arab Emirates	159	162	155	168	151
Brunei	159.25	175	164	147	151
Eritrea	163.5	175	164	164	151
Togo	164	175	164	166	151
American	x	149	23	x	7
Anguilla	x	175	x	x	13
Bermuda	x	149	108	x	4
Cayman Is	x	169	57	x	2
Cook Isla	x	138	8	x	42
Federated	x	94	4	x	64
French Gu	x	175	x	x	x
French Po	x	118	x	x	x
Guadeloup	x	149	x	x	x
Guam	x	155	68	x	x
Marshall	x	175	x	x	x
New Caled	x	162	81	x	151
Niue	x	169	x	x	x
Northern	x	162	x	x	x
Reunion	x	155	x	x	x
Somalia	x	20	x	x	x
Tokelau	x	175	x	x	x
Tuvalu	x	175	x	x	x
Virgin Is	x	175	x	x	x
Western Samoa	x	169	x	x	x
Yugoslavi	x	155	x	x	x

X = no figure due to lack of sound data basis

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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

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