SEARCHING FOR A SAFE PLACE ON THE EARTH. EUROPE IN SELECTED STATISTICS OF NATURAL DISASTERS IN 21ST CENTURY

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Abstract

The article discusses the issue of placing Europe in various international statistical analyses of natural disasters in the 21st century. The analysis includes the subject of the relative safety (or danger) of inhabiting this region (compared with other continents) of the world for the occurrence of natural disasters. According to a variety of statistical sources for the researched period the Old Continent seemed a relatively safe area, free of the most destructive disasters. This was reflected in the relatively low percentages of human losses and material ones in Europe. The study benefits by a number of sources, but mainly was based on "Annual Disaster Statistical Review. The Number and Trends" published by the Centre for Research on the Epidemiology of Disasters in Brussels.

Keywords: Natural disasters, statistics of disasters, Europe

Introduction:

The primary objective of the study is to compare Europe with other continents in various combinations incorporating the most destructive effects of natural disasters. The analysis enables formulation of assessments as to the participation of Europe in various rankings of disasters on a global scale. In this way it is possible to answer the question about the relative "safety" or "danger" (in terms of natural disasters) of living on the Old Continent. The authors have adopted the idea that this area is one of the safest locations in the world in the 21st century.

Sources

The study uses multiple sources of evidence. The primary one was the "Annual Disaster Statistical Review. The Number and Trends" (the ADSR) published by researchers of the Centre for Research on the Epidemiology of Disasters (CRED) at the Institute of Health and Society (IRSS) at the Université Catholique de Louvain in Brussels[64]. Publishing activities of the Centre have dated back to the early 1970s. An important turning point took place in May 2007, when CRED began to issue an annual edition – ADSR (made also available on-line). The first release was based on data for 2006, and the last so far published, on data from 2011[65]. Therefore, and in view of the consistent test methods, definitional order and, in consequence facilitated ability to track trends in the statistics of accidents, years 2006-2011 marked a time frame in this study. In some cases however it was necessary to extend the time frame from the beginning of the third millennium.

[64] CRED was established in 1973 achieving in seven years the status of the partner of World Health Organization (WHO) and other organizations (e.g. Red Cross). See more: www.cred.be/ history.
[65] The article was finished on August 11th 2013.

Aside from the six ADSR reports other statistical studies were also valuable. In particular, reports (between 2006-2011) prepared by the Office of Foreign Disaster Assistance (OFDA), formed in 1964 and operating under the United States Agency for International Development (USAID). The reports prepared by USAID/OFDA and ADSR are based largely on a similar source material but the supplier is American institution[66]. The studies of American government organization focused primarily on a US government spending on humanitarian aid, but also contained a register of the disasters as for the world and the various continents. Although basing on similar data, reports from Brussels and Washington use them in a different way, emphasizing slightly different aspects. ADSR, as a scientific publication, devotes more space on statistical methods, the subtleties of the definition of disasters, various comparisons. On the other hand in USAID/OFDA reports, in addition to the characteristics listed above, a reader can find presentations of the problems of residents of areas affected by disasters and daily effects of the shortages. The works of USAID/OFDA are rich in numerous illustrations documenting the practical manifestations of disasters and ways of eliminating their effects. It should not be a surprise highlighting the United States and the role of this state in many humanitarian operations. Among other things, for this reason, priority studies on which we based while concluding statement were CRED works.

Since 1988 (with the sponsorship of the USAID/OFDA) CRED has maintained an international disaster database (EM-DAT). EM-DAT collections include more than 19 thousand disasters of all kinds, dating from 1900, drawing on data from UN agencies, non-governmental organizations, insurance companies, research institutes and press agencies. Given the universal nature of the data and the requirement of the lack of political influence on the creation the founders gave priority to the statistics of UN, then USAID/OFDA, the government and the coming of the International Federation of Red Cross and Red Crescent Societies[67]. Information from various sources have been formatted and standardized, so that the administrators of EM-DAT managed to create a number of registers regarding disasters, taking into account a variety of criteria. The most important were: geography, time, economic and human losses. Database is updated on a regular basis (every day), but it is made public on a quarterly basis. Its yearly summary is the ADSR.

Extensive and reliable source background, the universal nature of the data (disasters on all continents) and a clear way of presenting which facilitates its further processing determined the choice of the center of Brussels as a basis for further discussion. In addition, useful publications were also MünichRe/Geo Risks Research Department operating at the insurance group of Münchener Rückversicherungs-Gesellschaft, as well as the European Environment Agency (EEA), and – to a lesser extent – the US National Weather Service.

Remarks on definitions and methodology

Inconsistency of definitions used in the reports on the various types of disasters required a more precise framework and consistent nomenclature to be used in a prepared analysis. The study assumed that the basic category of study subject is a "disaster", defined as "a situation or event which overwhelms local capacity, necessitating a request to a national or international level for external assistance; an unforeseen and often sudden event that causes great damage, destruction and human suffering"[68]. For an event to be qualified as the disaster, at least one of the following criteria must be fulfilled:

- 10 or more people reported killed;
- 100 or more people reported affected;

[66] „The data upon which this report is based are maintained through the long-term support of the US Agency for International Development's Office of Foreign Disaster Assistance (USAID/OFDA)". (*Annual Disaster Statistical Review 2011*, Brussels 2012, s. ii. From now on: ADSR 2011).
[67] Ibidem, p. 7.
[68] ADSR 2011, p. 7.

• declaration of a state of emergency;
• call for international assistance[69].

In this study the classification of CRED (used in EM-DATA and ADSR) was followed. It distinguishes two branches of disasters: technological and natural ones. The technological disasters are among the events related to human activity, and to a lesser extent, due to the forces of nature. This group includes, for example: transport disasters, collapse of buildings, contamination arising as a result of factories failures, etc. Among the natural disasters – that were the subject of the analysis – 4 subgroups can be listed[70]:

• Geophysical – events related directly to the solid earth;
• Meteorological – events associated with short-term (hours, days) effects of atmospheric processes;
• Hydrological – events associated with anomalous states of water;
• Climatological – events associated with long-term (time of year, decade) actions of atmospheric processes[71].

A more detailed breakdown of natural disasters is presented in **Table 1.**

Table 1: Natural disasters in accordance with the classification of CRED

Natural disasters			
Geophysical	Meteorological	Hydrological	Climatological
Earthquake Volcano Landslide Subsidence	Storm Local Storm Tropical cyclone	Flood Coastal flood	Extreme temperature Cold wave Drought Wildfire

Source: Annual Disaster Statistical Review 2011, Brussels 2012, p. 9.

The study pursuing the objective of stating the incidence of disasters in the relations: Europe-World and Europe-other continents was realized by taking into account the number of inhabitants of particular geographical regions. So the aim of the paper is not only to compare the number of disasters occurring, the number of fatalities and casualties as a result of disasters, the scale of damage to property, but also a statement of these numbers with the factor of population. The data used based on estimates provided by UN. It should be considered that the total population figures for the period 2006-2011 underwent some fluctuations and, therefore, for simplicity, the following data from 2011were utilized: Asia 4,2 billion (60% of the global population), Africa 1 billion (15%), Europe 0,74 billion (11%), Central and South America 0,6 billion (8,5%), North America 0,38 billion (5%), Australia and Oceania 0,037 billion (0,5%)[72].

Natural disasters in Europe in the 21st century. General look and comparison with other regions of the world

Trying to find a place of Europe compared with other regions in terms of the prevalence and consequences of natural disasters the statistics provided by ADSR were also used. Therefore, we studied 10 different classifications in the period 2006-2011 and basing on them, we tried to draw conclusions. **Table 2** presents a concise participation of European countries in the following rankings:

1. 10 major natural disasters in terms of the number of deaths;
2. 10 major natural disasters in terms of the number of victims (killed, injured, homeless, displaced, evacuated, requiring immediate assistance);
3. 10 major natural disasters in terms of economic damages (in billions of dollars);

[69] Ibidem, p. 16.
[70] Biological disasters are excluded from the analysis (although present in some studies of CRED).
[71] ADSR 2011, p. 16-17.
[72] Socio-economic situation in the world in 2011, GUS 2012, p. 2. See more: stat.gov.pl/cps/rde/xbcr/gus/publ_opr_sytuacja_spol_gosp_na_swiecie_w_2011_r.pdf

4. 10 most affected countries in the number of natural disasters occurring;
5. 10 most affected countries in the number of deaths due to natural disasters;
6. 10 most affected countries in the number of deaths as a result of natural disasters in 100 thousand people;
7. 10 most affected countries in the number of victims due to natural disasters;
8. 10 most affected countries in the number of victims due to natural disasters as a percentage of the total population;
9. 10 countries most affected by losses (billion of USD) as a result of natural disasters;
10. 10 countries most affected by losses due to natural disasters as a percentage of GDP.

Table 2: Places and share of European countries in ten basic summaries ADSR most destructive disasters and the most affected countries in the period 2006-2011

	2006	**2007**	**2008**	**2009**	**2010**	**2011**
1.	5. Netherlands 1000 6. Belgium 940 9. Ukraine 801	X	X	9. Italy 295	2. Russia 55844	X
2.	X	X	X	X	X	X
3.	X	2.Northern Europe 9 4. UK 4 5. UK 4	9. Northern Europe 1,8	1. France, Italy, Spain 5,1 2. Italy 2,5	6. Western Europe 6,1 9. Central Europe 3,6	X
4.	10. Romania 8	X	X	X	7. Russia 8	X
5.	5. France 1393 6. Netherlands 1000 8. Belgium 940 9. Ukraine 803	2. Hungary 500	X	X	2. Russia 55844	X
6.	1. Belgium 9,1 2. Netherlands 6,1 5. France 2,3 6. Latvia 1,8 7. Ukraine 1,7	2. Hungary 5	X	X	2. Russia 39 5. Slovakia 2,3	X
7.	X	X	X	X	X	X
8.	X	X	X	X	X	X
9.	X	2. UK 9,6 5. Germany 5,5	5. Germany 2,7 9. Ukraine 1	3. France 3,2 5. Italy 2,6 7. Spain 1,9	9. France 5,7 10. Russia 5,7	X
10.	3. Lithuania 1,5	X	10. Ukraine 0,7	X	X	X

Source: Selection based on data from: ADSR 2006, Brussels 2007, p. 32-34; ADSR 2007, Brussels 2008, p. 6-9; ADSR 2008, Brussels 2009, p. 8-10; ADSR 2009, Brussels 2010, p. 12-14; ADSR 2010, Brussels 2011, p. 13-16; ADSR 2011, p. 14-17.

After analyzing **Table 2** some basic lessons can be derived. As for the period under study, 2010 was the most tragic year: 55 thousands people died in Russia as a result of extreme temperatures (from June to August 2010), floods and fires. Only the earthquake in Haiti in January 2010 caused the deaths of more people in that year. The largest number of European countries has been affected by natural disasters in 2006, also as a result of the occurrence of high temperatures. For the same reason the Hungarians suffered in 2007. Among countries with a high number of deaths in Europe Italy should also be mentioned – victims of the earthquake in 2009.

European countries were not included even once in the rankings containing the largest number of victims (categories 2, 7, 8). This is a proof that people in the other continents were under bigger threat form the impact of natural hazards. Rescue teams were also acted less effectively in those (non-European) areas. It can be assumed that indeed natural disasters occurred in Europe, but the scale of their negative impact was smaller than in other regions.

The frequency of disasters in different European countries was lower than in most Asian countries and the US[73]. In the years 2006-2011 only Romania and Russia were considered as the most affected countries in terms of the occurrence of disasters. It is worth noting that the size of the territory does matter. In countries with a larger surface area the risk of disaster is generally higher, although climatic zone, geological condition, and many other factors played also important roles.

In the years 2006-2011, European countries were enlisted most often in the rankings including the largest material losses. In 2007 damages were caused by hurricanes and flooding, and the countries with the greatest losses (in top 10 most affected countries) were UK and Germany. High damages were also caused by disasters in France, Germany, Italy and Russia in 2007-2010 (as a result of the cyclones Kyrill and Emma, winter storms Klaus and Xynthia, but also earthquakes and floods). Considerable material losses in Europe (among other regions) were also due to the high density of infrastructure (unlike for example desert areas). It was also easier to estimate the loss of damaged buildings or broken cars than calculate damages as result of forest fires.

Natural disasters do hit Europe, but they are not as destructive as in other regions. They usually cause material losses but do not result in huge numbers of deaths or injured.

Table 3: Average yearly number of disasters, casualties and material losses, and the percentage of each region in these disasters in 2001-2010

	Africa	Americas	Asia	**Europe**	Oceania	Total
Average yearly number of disasters	65	92	153	**58**	16	384
Share %	16,9	24	39,8	**15,1**	4,2	100
Average yearly number of affected (mln)	14,91	8,27	207,92	**0,74**	0,12	231,95
Share %	6,4	3,6	89,65	**0,3**	0,05	100
Average annual losses (billion of USD)	1,1	50,27	41,61	**13,4**	2,97	109,35
Share %	1	46	38	**12,3**	2,7	100

Source: ADSR 2011, s. 29.

Basing on **Table 3** it was possible to compare the incidence and impact of disasters in Europe with other regions. Average, in the first decade of the 21st century, the number of disasters ravaging Europe was 58 per year, which was the only higher score than in Oceania (including Australia)[74]. The specification of the number of accidents, however, says little, if one disruptive event can cause the death of one man, and another one 100 thousand people. A more meaningful statement giving the image of relative safety or risk can be submitted by using the data of the number of victims (not only just deaths) as a result of disasters. In this classification 90% of the victims lived in Asia (recall that population of this continent makes up about 60% of world's population). On the other hand, 740 thousand people in Europe were suffering which meant 0,3% of the global or nearly 40 times less than the participation of its population of the globe. In the case of Oceania, it was 10 times less, and in both Americas – 4 times. Considering the material losses Europe's share of losses in the world was more important. Losses per capita on the continent caused by natural disasters in the first decade of the 21st century were average 18 USD. There were significantly higher in the Americas (mainly in the North) – 50 and Oceania – 80; smaller in Asia – 10 and Africa 6.

[73] Detailed statistical data for the United States (including individual states) can be found on webpage of the National Weather Service Office of Climate, Water and Weather Services: www.nws.noaa.gov/om/hazstats.shtml

[74] See more: *Office of US Foreign Disaster Assistance. Annual Report for Fiscal Year 2011*, p. 130-132.

Table 4: Average number of disasters, casualties and material losses, and the percentage of each region in these disasters in 2011

	Africa	Americas	Asia	**Europe**	Oceania	Total
Number of disasters	64	93	146	**18**	11	332
Share %	19,3	28	44	**5,4**	3,3	100
Number of affected (in million)	22,55	10,6	211,16	**0,04**	0,31	244,65
Share %	9,2	4,3	86,3	**0,0002**	0,1	100
Material losses (billion of USD)	1,02	67,32	276,03	**1,19**	20,56	366,12
Share %	0,3	18,4	75,4	**0,3**	5,6	100

Source: Based on: ADSR 2011, s. 29. See also: Office of US Foreign Disaster Assistance. Annual Report for Fiscal Year 2011, p. 11-13.

A special year in terms of safety on the Old Continent was 2011, where there were only 18 registered natural disasters, so 3 times less than the average in the first decade of the 21st century. Only in Australia and Oceania there were fewer accidents, but statistical inhabitant of the area was more exposed to the elements (shown in percent share of those disasters compared with other regions). Even more fortunate was the year 2011 in terms of the number of victims in the Old Continent – recorded their "only" 40 thousand which was the lowest score of all regions (the number of victims in Asia at that time reached more than 200 million). Even the losses of property in 2011 were small – just over 1 billion USD – only losses in Africa were valued slightly lower, but one should take into consideration a huge discrepancy in terms of infrastructure in these continents.

The data gathered from the ADSR were also partly compared with the combinations of other institutions. Only six times did Europe (including incorporated widely understood region of Northern Europe – see **Table 5**) figure in ranking of 50 most destructive disasters prepared by experts of the insurance holding MunichRe/Geo. As far as the number of disasters is concerned, the Old Continent was far ahead of Asia and North America, but the occurrence of disruptive events in Africa, South America and Australia was similar. There were the lowest number of deaths in 2011 in Europe, and the material losses were approximately 10-fold lower than in the Pacific, about 20-fold lower than in North America and 60 times lower than in Asia. It should be noted that the data from Africa and South America were not released. **Table 5** confirms the greater security of Europe in 2011 than in other continents.

Table 5: 50 major disasters in 2011 in different continents (in the number of accidents, fatalities and property damages)

	States/regions covered by disasters	Number of disasters	Number of deaths	Material losses (bln USD)
Europe	**Northern Europe, Denmark, France, Spain, Italy**	**6**	**25**	**3,75**
Asia	Saudi Arabia, China, Philippines, India, Japan, Cambodia, North Korea, Pakistan, Rep. Korea, Sri Lanka, Thailand, Turkey, Vietnam	17	20.305	227
Africa	Angola, Djibouti, Ethiopia, Kenya, Madagascar, Nigeria, Somalia	4	More than 50 000	No full data
North America	Canada, Mexico, United States, Caribbean states	13	812	61
South America	Argentina, Bolivia, Brazil, Chile, Colombia, Uruguay	5	1269	No full data
Australia	Australia, New Zealand	5	203	33

Source: Based on: Münchener Rückversicherungs-Gesellschaft: 50 major events in 2011. www.munichre.com/app_pages/www/@res/pdf/media_relations/press_releases/ 2012/2012_01_04_munich_re_natural-catastrophes-2011_en.pdf

In this context it is not surprising that in the statement of the safest places in the world – taking into account the category of susceptibility to the effects of natural disasters – Estonia leads the way[75]. World Bank report of 2005 states that among the 15 most vulnerable

[75] *The Safest Countries in the World*, „the Slate", 24.03.2011, www.slate.com/articles/news_and_politics/ explainer/2011/03/the_safest_countries_in_the_world.html

countries in the world none is placed in Europe. Rank opened Taiwan, the following countries were Costa Rica, Vanuatu, Philippines and Guatemala[76].

Conclusion:

The analysis confirmed the initial assumptions about the relative security of Europe. However, in the period under research Europe was of course not an area free of natural disasters, but their nature and scale does not result in such dramatic effects as in other parts of the world. Two aspects should drawn attention. Despite 15% share in the number of disasters for the years 2001 to 2010, and therefore comparable with Africa (16,9%), the average annual number of disaster victims for the Old Continent was only 0,74 million, while in the case of Africa, it was up to 20 times more. With high probability it can be assumed that it was the result of both a lower intensity (the impact) of natural disasters, as well as better prevention system against their effects in a richer region. The latter factor caused, however, that an even smaller adverse weather phenomena entailed relatively greater loss of property (mainly infrastructure).

It is worth to underline that the study of trends of natural disasters has only some statistical values. It facilitates to point the most vulnerable and safest areas to live. Higher criticism and skepticism sets in, however, the weather factor would be included which is characterized by considerable volatility and occasional (not cyclical) emergence of adverse weather phenomena. Therefore, the projections of their occurrence should take into account not only historical data, but also the random elements. Availability of reliable and comparable statistics for the issue under researched decisively influenced the choice of turning points from 2006 to 2011. In another case, the analysis could include a wider range of time, which would have accounted for the occurrence of unusual weather phenomena.

Examination of the trends of natural disasters must therefore be based on a large dose of caution and confidence especially in the context of a possible repetition of the occurrence of adverse weather events (or lack thereof) in subsequent years. It should also be noted that – depending on the assumed horizon of the study – a single or very rare events can significantly affect the statistical illustration of the object of study, suggesting that the area is particularly often plagued by natural disasters. In fact, the event can be highly distinctive and extraordinary.

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