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Tracking progress on the economic costs of disasters under the indicators of the sustainable development goals

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ABSTRACT

The Sustainable Development Goals indicator framework identifies as an indicator of progress the objective of reducing disaster losses as a proportion of global gross domestic product. This short analysis presents data on this indicator from 1990. In constant 2017 US dollars, both weather-related and non-weather related catastrophe losses have increased, with a 74% increase in the former and 182% increase in the latter since 1990. However, since 1990 both overall and weather/climate losses have decreased as proportion of global GDP, indicating progress with respect to the SDG indicator. Extending this trend into the future will require vigilance to exposure, vulnerability and resilience in the face of uncertainty about the future frequency and magnitude of extreme events.

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Disaster losses; sustainable development goals; GDP

Introduction

The Sustainable Development Goals (SDG) of the United Nations are supported by a global indicator framework comprised of 232 indicators.[1] Included under SDG Goal 1 to 'end poverty in all its forms everywhere' and Goal 11 'Make cities and human settlements inclusive, safe, resilient and sustainable' is an indicator focused on disaster losses.

There are two specific goals under the SDGs with an explicit focus on disaster losses. First, 1.5 states: 'By 2030, build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters.' An associated indicator is (1.5.2) 'Direct economic loss attributed to disasters in relation to global gross domestic product (GDP).' Second, 11.5:

> By 2030, significantly reduce the number of deaths and the number of people affected and substantially decrease the direct economic losses relative to global gross domestic product caused by disasters, including water-related disasters, with a focus on protecting the poor and people in vulnerable situations.

An associated indicator (11.5.2) is: 'Direct economic loss in relation to global GDP, damage to critical infrastructure and number of disruptions to basic services, attributed to disasters.'

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To date, there has been no formal analysis of progress with respect to this particular indicator in the peer-reviewed literature. This short analysis has one narrow objective: to identify and share data that allows the tracking of progress with respect to global direct economic losses in relation to global GDP for all disasters and for the subset which is related to weather or climate.

Data and analysis

To track disaster losses as a proportion of global GDP is straightforward. GDP data is available from the World Bank, expressed in US dollars at market exchange rates.[2] Disaster loss data is tabulated by several companies in the reinsurance industry, most notably Munich Re and Aon Benfield (Hoeppe, 2016; Podlaha, Bowen, Darbinyan, & Lörinc, 2017). The data reported here come from Munich Re and Aon Benfield.[3]

According to Munich Re, since the mid-1990s, 'there has been a distinct improvement in the reporting of overall losses' (Munich Re Group, 2006). Thus, the analysis presented here utilizes the Munich Re dataset from 1990, recognizing that there may be some degree of under-reporting in earlier years of the time series (Mohleji & Pielke, 2014). Table 1 shows the data and the calculated proportion of global GDP of overall and weather disasters.

Figure 1(a,b) show weather-related and non-weather-related disaster losses from (a) Munich Re, 1990 to 2017 and (b) Aon Benfield, 2000 to 2017. The data is shown in constant 2017 U.S. dollars. There are some differences in loss estimates between Munich Re and Aon Benfield, but the data sets are highly correlated, with a correlation coefficient of 0.95 (Pearson). In the Munch Re data set annual weather-related catastrophe losses (in constant 2017 dollars) increased by ~74% from 1990 to 2017, from about $91 billion in 1990 to $158 billion in 2017 (calculated via linear trend). Annual non-weather-related catastrophe losses (in constant 2017 dollars) increased by about 182% from 1990 to 2017, from about $17 billion in 1990 to about $48 billion in 2017 (calculated via linear trend).

Figure 2 shows the Munich Re (1990–2017) and Aon Benfield (2000–2017) data as a proportion of global GDP, with a linear fit to the Munich Re data (in red). This indicator shows a linear decline over the period from about 0.3% of global GDP to about 0.25%, with a range of ~0.1% to ~0.5% of global GDP. In 2017 0.05% of global GDP equated to about $400 billion.

Figure 3 shows the subset of data which are classified as weather (or climate)-related disasters. Here as well there is a declining trend during the period 1990 to 2017, from more than 0.25% of global GDP to below 0.20%.

Discussion

Since 1990 the world has seen a decrease in overall and weather-related disaster losses as a proportion of global GDP. This trend has occurred even as disaster losses have increased in absolute terms. The primary factor driving the overall increase in disaster losses is societal, mainly growth in populations and settlements at risk to the consequences of extreme events (IPCC, 2012). While some weather and climate extremes are expected to increase in frequency and/or intensity in the future, to date there is

Table 1. Data on global and weather-related disaster losses since 1990.

Year	Global GDP in 2017 $ (billions, World Bank)	Munich Re overall disaster losses in 2017 $ (billions)	overall Munich Re disaster losses as a percentage of global GDP	Aon Benfield overall disaster losses in 2017 $ (billions)	overall Aon Benfield disaster losses as a percentage of global GDP	Munich Re weather disaster losses in 2017 $ (billions)	weather disaster losses as a percentage of global GDP (Munich Re)	Aon Benfield weather disaster losses in 2017 $ (billions)	weather disaster losses as a percentage of global GDP (Aon Benfield)
1990	38582	92	0.24%	–	–	86	0.22%	–	–
1991	39459	106	0.27%	–	–	100	0.25%	–	–
1992	40902	126	0.31%	–	–	119	0.29%	–	–
1993	40659	148	0.36%	–	–	141	0.35%	–	–
1994	42727	157	0.37%	–	–	87	0.20%	–	–
1995	46519	208	0.45%	–	–	106	0.23%	–	–
1996	46673	120	0.26%	–	–	121	0.26%	–	–
1997	45693	83	0.18%	–	–	67	0.15%	–	–
1998	44998	171	0.38%	–	–	170	0.38%	–	–
1999	46096	187	0.41%	–	–	131	0.28%	–	–
2000	46623	71	0.15%	86	0.18%	67	0.14%	85	0.18%
2001	45246	60	0.13%	68	0.15%	44	0.10%	58	0.13%
2002	46236	122	0.26%	109	0.24%	119	0.26%	106	0.23%
2003	50946	103	0.20%	111	0.22%	94	0.18%	98	0.19%
2004	55992	203	0.36%	193	0.34%	153	0.27%	138	0.25%
2005	58778	294	0.50%	301	0.51%	283	0.48%	294	0.50%
2006	61649	81	0.13%	78	0.13%	74	0.12%	74	0.12%
2007	67610	124	0.18%	105	0.16%	102	0.15%	96	0.14%
2008	72649	267	0.37%	262	0.36%	151	0.21%	165	0.23%
2009	68087	83	0.12%	95	0.14%	75	0.11%	85	0.12%
2010	73983	187	0.25%	271	0.37%	131	0.18%	206	0.28%
2011	80563	395	0.49%	486	0.60%	181	0.23%	230	0.29%
2012	80856	189	0.23%	225	0.28%	163	0.20%	204	0.25%
2013	81744	148	0.18%	212	0.26%	133	0.16%	192	0.23%
2014	82422	110	0.13%	138	0.17%	100	0.12%	132	0.16%
2015	77038	107	0.14%	132	0.17%	82	0.11%	122	0.16%
2016	77238	186	0.24%	234	0.30%	136	0.18%	162	0.21%
2017	78500	340	0.43%	353	0.45%	317	0.40%	344	0.44%

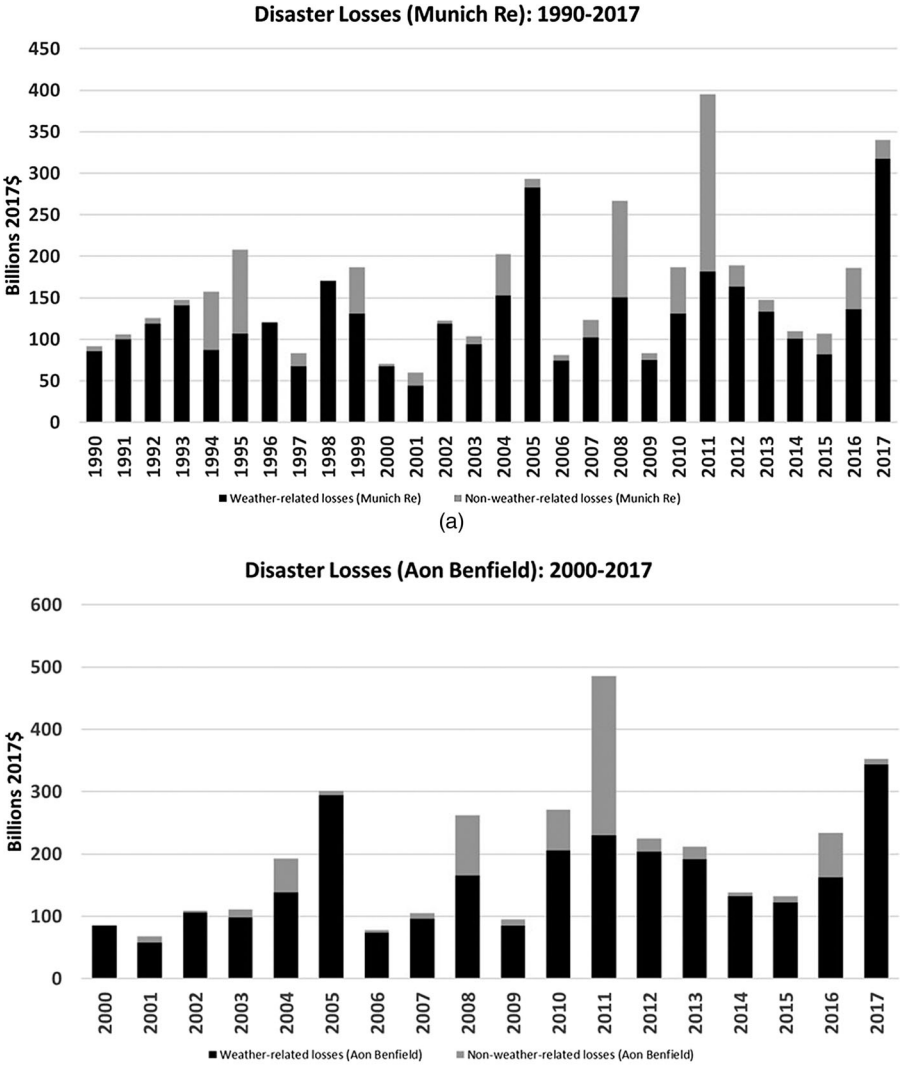

Figure 1. Weather and non-weather-related disaster losses from Munich Re (1990–2017) and Aon Benfield (2000–2017) in constant 2017 U.S. dollars.

not strong evidence of such increases in tropical cyclones, floods, drought or tornadoes on climate time scales (IPCC, 2018; Pielke, 2018). Of course, any calculation of trends in catastrophe losses is sensitive to choice of start and end date, so caution is urged in their interpretation.

With such caution noted, the world has over almost thirty years experienced a decrease in disaster losses as a proportion of GDP. However, there is no guarantee that this trend continues into the future. It could reverse for multiple reasons, including a greater frequency or intensity of extreme events, the occurrence of rare major events of the sort which has been seen in the past (such as the great San Francisco

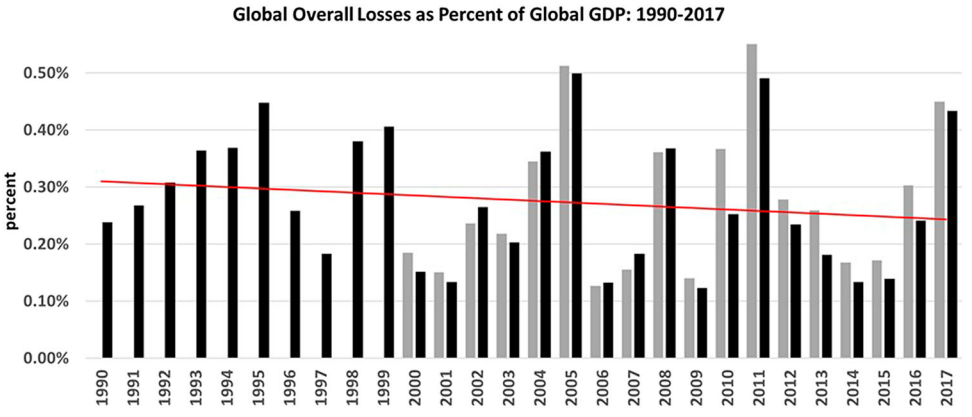

Figure 2. Overall global disaster losses as a percentage of global GDP.

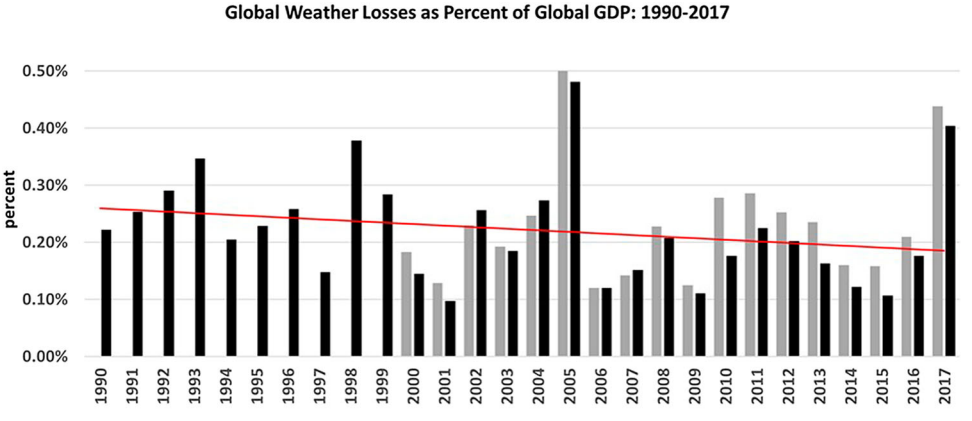

Figure 3. Weather disaster losses as a percentage of global GDP.

earthquake of 1906), or unwise decisions related to development and characteristics of human settlements.

Annual losses have been observed in a relatively narrow range of ~0.1% to ~0.5% of global GDP. However, research suggests that much larger loss potentials currently exist. For instance, a $1 trillion earthquake is conceivable (Vranes & Pielke, 2009), which would represent more than ~1.2% of global GDP in 2017. The progress in reducing disasters as a proportion of global GDP from 1990 to 2017 is not predictive of the future. Continued policy attention is needed, as well as good fortune.

The data presented here offer welcome good news under an indicator of the SDG, however, continued vigilance is needed on vulnerability, exposure and resilience. Indicators related to such characteristics associated with patterns of development will be more relevant for policy planning than an outcome indicator such as losses/GDP to understanding opportunities for mitigating the impacts of future extreme. Of course, outcome data provides one important perspective on how well we have been doing and is thus worth tracking.

Notes

1. https://unstats.un.org/sdgs/indicators/indicators-list/.
2. https://fred.stlouisfed.org/series/NYGDPMKTPCDWLD.
3. Data for years more recent than that reported in Hoeppe (2016) come from Munich Re online data at http://natcatservice.munichre.com. Aon Benfield data for losses are reported from 2000 (Aon Benfield, 2018).

Disclosure statement

No potential conflict of interest was reported by the author.

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