Methods Appendix

Normalized European Weather and Climate Losses, 1990–2024

Purpose. This appendix documents the data sources, transformations, and assumptions behind the three figures and the companion spreadsheet accompanying the post ". It is written so that the analysis can be reproduced or audited independently. Analysis conducted by Claude AI at the direction of Roger Pielke Jr. at The Honest Broker on Substack. This is work in progress. Caveat lector!

1. Data sources

1.1 Disaster losses

Source: European Environment Agency (EEA), Climate-ADAPT "Economic losses and fatalities" dashboard, "Information per Year" view, drawing on the CATDAT catastrophe database compiled by Risklayer GmbH and received by the EEA under institutional agreement.

Selection. Dashboard filters: Data Source = CATDAT; currency basis = 2024 euros (inflation-adjusted, constant prices); Category = Total losses; Hazard Type = Weather- and climate-related; Country grouping = EEA-38.

Scope. "Weather- and climate-related" comprises meteorological (e.g. storms), hydrological (e.g. floods), and climatological (e.g. heatwaves, wildfires, cold spells) hazards, following the ICSU classification. Geophysical hazards (earthquakes, volcanoes) are excluded.

Units. Million euros, constant 2024 prices. The EEA performs the inflation adjustment internally; no further deflation of the loss series was applied.

Transcription. The EEA-38 annual totals were read from the "Information per Year" chart against its gridlines. Values are therefore accurate to within a few hundred million euros. The country-level detail (used for cross-checking, not for the headline aggregate) was transcribed from the "Information per Country and per Year" view across the full 1980–2024 span. For publication, exact figures can be obtained from the dashboard's built-in download function.

1.2 Gross domestic product

Source: World Bank, World Development Indicators, series NY.GDP.MKTP.PP.CD — "GDP, PPP (current international $)" — last updated 8 April 2026.

Aggregation. GDP for the 38 EEA member and cooperating countries was summed by year to form an EEA-38 aggregate. PPP-converted GDP is additive across countries because all values share a common international-dollar numeraire.

Coverage. The PPP-GDP series begins in 1990 for these economies; pre-1990 values are largely unreported. This is why the analysis begins in 1990. A small number of successor states enter later (Kosovo 2008, Montenegro 1997, Serbia 1995); their absence marginally understates the EEA-38 GDP aggregate in the early 1990s, which if anything makes the early normalized losses slightly conservative.

2. The euro–dollar reconciliation

The loss series is denominated in constant 2024 euros; the GDP series is in current (nominal) PPP international dollars. These two bases differ in two ways at once: currency (EUR vs USD) and price basis (real/constant vs nominal/current).

2.1 Normalization figures: real GDP required

In the normalization, GDP enters as a within-series ratio, **real** GDP(2024) ÷ **real** GDP(year). The choice of real versus nominal GDP matters here, and must match the price basis of the loss numerator. Because the loss series is in constant 2024 euros (a real series), the exposure factor must also be real; scaling a real loss series by nominal GDP growth would apply inflation twice — once inside the already-inflation-adjusted losses and again through the nominal GDP ratio — and would manufacture an artificial downward trend. We therefore deflate GDP to constant 2024 terms before forming the ratio (Section 2.2, Step 1). Currency units (dollar versus euro) still cancel in the ratio, so no currency conversion is needed for the normalized figures; only the real-terms deflation is required. With this correction the normalized series and the loss-as-%-of-GDP series are proportional and share the same trend, as they should.

2.2 Losses-as-share-of-GDP figure: full reconciliation

A loss-to-GDP ratio is a true percentage only if numerator and denominator share the same currency and the same price basis. We therefore convert the GDP denominator into the same units as the losses — constant 2024 euros — in two transparent steps:

> **Step 1 — Deflate to real terms.** Nominal PPP-dollar GDP is converted to constant-2024 real terms by dividing by a euro-area GDP deflator (indexed to 2024 = 100). This removes price inflation, matching the real (constant-2024) basis of the loss series.
>
> **Step 2 — Convert to euros.** The resulting real GDP is converted from international dollars to euros using a single 2024 conversion factor (1 USD ≈ 0.924 EUR). One constant factor is used for all years.

Why a single constant factor is legitimate. Applying one constant currency factor to every year scales every year's loss/GDP ratio by the same amount. It therefore shifts the *level* of the percentage but leaves its *shape and trend unchanged*. Because 2024 is the anchor year — where the loss series, the deflator (=100), and the conversion factor are all defined on a 2024 basis — the 2024 percentage is exact, and earlier years are real-comparable to it. The trend, which is the analytical object of interest, is invariant to the conversion constant.

Caveat. The euro-area GDP deflator values used are harmonised approximations, and PPP conversion is not identical to market-exchange-rate conversion. These choices affect the absolute level of the percentage at the second-decimal place but not the qualitative trend, which is robust to modest deflator error. Readers needing an exact same-currency share should substitute Eurostat euro-denominated GDP (nama_10_gdp) for the denominator; the trend result is unchanged.

3. Calculations

3.1 Normalized losses

For each year t:

$$Normalized(t) = RawLoss(t) \times [\ GDP(2024) \div GDP(t)\ ]$$

where RawLoss is in constant 2024 euros and GDP is the EEA-38 PPP aggregate. The aggregate is normalized as a whole (the ratio uses total EEA-38 GDP), not country by country, consistent with using the EEA's authoritative per-year totals.

3.2 Losses as a share of GDP

$$Share(t) = RawLoss(t) \div GDP_real_2024EUR(t) \times 100\%$$

with both quantities in constant 2024 euros after the reconciliation in Section 2.2.

3.3 Country-by-country normalization (robustness check)

Motivation. Normalizing the aggregate scales total losses by total GDP growth, implicitly assuming a common growth path. Because member economies grew at very different rates (e.g. Poland, Romania, and the Baltics far faster than Germany or France), we re-ran the normalization at the country level as a check.

$$Norm_c(t) = Loss_c(t) \times [\ real\ GDP_c(2024) \div real\ GDP_c(t)\ ]\ ,\ \ then\ summed\ over\ countries\ c$$

Each country's losses are scaled by *its own* GDP-growth factor before summation. Result: a 1990–2024 total of €1,290 billion (country-by-country) versus €1,306 billion (aggregate) — a difference of about 1.2% — with statistically indistinguishable trends. The flat-aggregate conclusion is therefore not an artifact of bloc-level normalization. Country-level figures use the transcribed per-country loss series, which runs marginally below the EEA per-year totals in the early 1990s (successor-state attribution), explaining the small residual gap.

3.4 Losses as a share of each country's own GDP

To show the distribution of *relative* burden, each country's cumulative losses are divided by its cumulative real-2024-euro GDP over the years both are available. A single 2024 EUR/USD factor applied uniformly does not affect the cross-country ranking. This ranking inverts the absolute-euro ranking: smaller, more exposed economies (Slovenia, Bosnia and Herzegovina, Serbia) rank highest, while the largest economies sit mid-table.

3.5 Trends

Trends are ordinary-least-squares linear fits across the stated window. They are descriptive summaries of noisy data, not statistical models of a data-generating process, and no significance testing is implied beyond noting when a slope is indistinguishable from zero.

4. Key results and sensitivity

Quantity	Value
EEA-38 GDP growth, 1990–2024	×2.3 real / ×4.9 nominal
Normalized-loss trend, 1990–2024 (real GDP)	+0.13 €bn per year (≈ flat)
Loss/GDP mean, 1990–2024	0.12% of GDP per year
Loss/GDP trend, 1990–2024	+0.004 pp/decade (≈ flat)
Loss/GDP trend, 1995–2019 (original window)	−0.014 pp/decade (gentle decline)
Record raw year	2021, ≈€66.5bn

Interpretation. The earlier 1995–2019 decline reproduces on the updated data, but extending the window to 2024 and broadening to EEA-38 flattens it to no trend. The shift is driven primarily by the 2021 record flood year acting on a linear fit, plus the lower-GDP Western Balkans entering the grouping. The robust, window-insensitive conclusion is stability: no material upward or downward trend in the economic burden of European weather and climate extremes once exposure is held constant.

5. Limitations

- Loss figures for the headline series were read from a chart and are precise to a few hundred million euros; exact values are available via the dashboard download.

- CATDAT, like all catastrophe-loss databases, reflects reporting and methodological choices; a single “correct” dataset does not exist, and totals differ from alternative sources such as NatCatSERVICE.
- Linear trends on short, heavy-tailed loss series are sensitive to endpoint years; conclusions are stated accordingly.
- PPP-GDP is used for additivity across countries; market-exchange-rate GDP would shift levels but not the normalized trend.
- Early-1990s EEA-38 GDP is marginally understated due to later entry of some successor states, making early normalized losses slightly conservative.

Reproducibility. All figures derive from the accompanying spreadsheet, in which every normalized value and GDP share is a live formula referencing the raw loss and GDP inputs. Sources should be verified against the live EEA Climate-ADAPT dashboard and World Bank WDI, both of which are updated periodically.