

S&P Global Country and Subnational Climate Physical Risk Dataset

Addendum

S&P Global Sustainable1 – September 2026



This addendum has been prepared in response to ESMA's public disclosure requirements and is intended for a public audience. It provides supplementary information related to the methodology and supports analytical integrity, consistency, and transparency by offering additional clarity on the methodology's design, application, and governance.

ESMA Disclosure	Sustainable1's Response
an overview of the rating methodologies used and changes thereto, including whether analysis is backward-looking or forward-looking and the time horizon covered;	The rating methodology is titled "Physical Risk: Country & Subnational Data – Methodology".
	The methodology applies to geographic entities, specifically 201 countries and 2,117 subnational regions globally. It assesses climate change physical hazard exposure affecting sovereigns and sub-sovereign jurisdictions, including longer-term (chronic) hazards—extreme heat, extreme cold, drought, water stress—and acute event hazards—tropical cyclone, wildfire, coastal flood, fluvial flood, and pluvial flood.
	The dataset evaluates decadal average physical risk exposure from the 2020s through the 2090s, under four climate change scenarios (SSP1-2.6, SSP2-4.5, SSP3-7.0, SSP5-8.5). Exposure scores are point-in-time representations relative to global conditions across all scenarios and all decades considered.
	Supporting models: CMIP6 global climate models (35 GCMs) downscaled using NASA NEX-GDDP; hazard-specific models including GTSR hydrodynamic surge (coastal flood), HydroATLAS and WRI Aqueduct (fluvial flood and water stress), statistical-stochastic tropical cyclone model, SPEI (drought), Fire Weather Index (wildfire), and Generalized Extreme Value modeling (pluvial flood).
	Key assumptions: Use of multi-model CMIP6 averages as representative future pathways; hazards modeled independently (no correlation); GDP-weighted exposure reflects economic materiality; population and GDP spatial distributions are held constant over future scenarios; expert judgment is used to define hazard materiality thresholds.
	Data quality & reliability: Input data validation, model unit testing, output validation, benchmarking against existing Sustainable1 physical risk solutions, and delivery-channel validation form part of a documented quality assurance process.
	Physical risk exposure is expressed through Exposure Scores ranging from 1 (lowest exposure) to 100 (highest exposure) for each hazard. Scores are relative values, normalized globally across all countries, subnational, scenarios, and decades. Composite Exposure Score: An equally-weighted additive combination of all nine hazard exposure scores for a given scenario and decade, rescaled to a 1–100 range using an exponential scoring curve. Interpretation: Higher scores indicate greater relative exposure to climate physical hazards. Relative comparisons are global, not industry- or geography-specific, enabling ranking of countries and subnational against all global peers.
	Most recent update: Version 1.3 – 31 October 2024. Changes introduced: Incorporation of standard Sustainable1 formatting. Prior updates: v1.2 (29 July 2024) – added discussion of assumptions,

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	dependencies, and appendix; v1.1 (20 June 2024) – added quality assurance discussion; v1.0 (15 May 2024) – initial version.
the industry classification used;	Not applicable. The methodology does not reference or apply any industry classification system. The analysis is conducted at country and subnational geographic levels, not by industry or economic sector.
an overview of data sources, including whether data is sourced from sustainability statements required under Directive 2013/34/EU or from information disclosed under Regulation (EU) 2019/2088 and whether sources are public or non-public, and an overview of data processes, estimation of input data in case of unavailability and frequency of data updates;	The dataset draws exclusively on publicly available, non-entity-specific data sources and does not rely on sustainability statements prepared under Directive 2013/34/EU nor on disclosures made under Regulation (EU) 2019/2088 (SFDR). Instead, data inputs are sourced from globally recognized scientific and institutional datasets, including CMIP6 climate models downscaled via NASA NEX-GDDP for temperature and precipitation, the World Resources Institute Aqueduct database for water stress and flood extents, GTSR hydrodynamic surge models and Kopp et al. sea-level rise projections for coastal flooding, HydroATLAS for river basin characteristics, SPEIbase for drought metrics, and satellite-derived land-use and land-cover data from Copernicus and ESA for wildfire modeling. Socioeconomic exposure weighting is based on public gridded datasets for GDP (Kummu et al., 2018) and population (NASA SEDAC GPW v4). The data process involves preprocessing hazard variables into decadal averages from the 2020s through the 2090s across four IPCC-aligned climate scenarios, followed by spatial overlay with administrative boundaries, GDP and population grids, and conversion into absolute hazard metrics, relative exposure scores, and composite exposure measures. Where input data are unavailable or incomplete, the methodology applies defined estimation and alignment approaches, such as interpolation across scenarios or decades, nearest-available projections, ensemble averaging across multiple global climate models, and expert-judgment-based materiality thresholds. Data quality and reliability are supported through formal validation, model testing, benchmarking against existing Sustainable1 solutions, and ongoing quality assurance processes. Updates to the dataset occur through versioned methodology releases as enhancements or refinements are introduced, rather than on a fixed annual update cycle.
the ownership structure of the ESG rating provider;	Ownership structure of the ESG rating provider
information on whether and how the rating methodologies are based on scientific evidence;	The rating methodology is explicitly grounded in scientific evidence and established climate science. It is built on the latest generation of CMIP6 global climate models, which underpin the Intergovernmental Panel on Climate Change (IPCC) assessments, and uses downscaled CMIP6 data (NASA NEX-GDDP) to ensure spatial and temporal consistency across hazards and geographies. The methodology applies peer-reviewed, hazard-specific scientific models and indices, such as Tx95p and Tn5p temperature extremes, the Standardized Precipitation–Evapotranspiration Index (SPEI) for drought, the Fire Weather Index for wildfire, hydrodynamic surge modeling for coastal flooding, and statistical–stochastic simulations for tropical cyclones, with inputs derived from recognized scientific institutions including NASA, WRI, CSIC, and Copernicus. Climate scenarios are aligned with IPCC Shared Socioeconomic Pathways and Representative Concentration Pathways, consistent with TCFD technical guidance. Scientific evidence is further operationalized through ensemble averaging across multiple climate models to manage uncertainty, empirically defined hazard metrics, and transparent assumptions documented in the

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	methodology. While expert judgment is applied in specific areas—such as defining materiality thresholds for exposure metrics—the overall framework remains science-based, transparent, and traceable to widely accepted climate research and data sources, with documented validation, benchmarking, and quality assurance processes supporting methodological robustness.
information on the ESG rating’s clearly defined objective and marking whether the rating is assessing risks, impacts, or both, according to the double materiality principle, or any other dimensions, and in the case of double materiality the proportion of the risk and impact materiality;	The methodology assesses climate change physical risks faced by countries and subnational regions. These include chronic risks arising from long-term shifts in climate patterns—extreme heat, extreme cold, drought, and water stress—and acute event risks associated with extreme weather events, namely tropical cyclones, wildfires, coastal flooding, fluvial flooding, and pluvial flooding. Risks are evaluated under four IPCC-aligned climate scenarios and across decadal time horizons from the 2020s to the 2090s, with exposure expressed through absolute hazard metrics, relative exposure scores, and composite exposure scores.
	The methodology captures the potential physical impacts of climate hazards on socioeconomic systems by quantifying exposure of GDP and population within country and subnational boundaries to material levels of each climate hazard. Impacts are reflected through metrics such as percentage of GDP exposed and percentage of population exposed, indicating potential economic impacts on productive activity and social impacts on populations and public welfare, rather than direct measurement of realized damage.
	The methodology primarily operationalizes financial materiality (outside-in perspective) by focusing on how climate physical hazards may materially affect the economic activity and populations of geographic entities, using GDP-weighted exposure metrics and defined hazard thresholds to identify material exposure. While population exposure metrics provide insight into societal impacts, the methodology does not explicitly frame or assess inside-out impacts of entities on the environment. As such, the double materiality principle is only partially addressed, with a clear emphasis on risk to economic and social systems rather than environmental impact caused by the entities.
	In addition to financial risk materiality, the methodology incorporates relative materiality by expressing exposure scores on a global relative scale (1–100), allowing comparison across all countries and subnational regions, scenarios, and decades. It also applies threshold-based materiality, where expert-defined hazard thresholds determine whether GDP or population exposure is considered material. No industry-specific, entity-specific, or stakeholder-driven materiality dimensions are applied, as the analysis is geographically focused.
the ESG rating’s scope, namely, whether it covers an individual E, S, or G factor or whether it is an aggregated rating aggregating E, S and G factors, or whether it covers specific issues such as transition risks;	The ESG rating’s scope is narrowly focused on the Environmental (“E”) pillar, specifically on climate change physical risk, and does not represent an aggregated ESG rating combining Environmental, Social, and Governance factors. The methodology assesses physical climate risks—both chronic (such as extreme heat, extreme cold, drought, and water stress) and acute (such as tropical cyclones, wildfires, and coastal, fluvial, and pluvial flooding)—as they affect countries and subnational regions under multiple climate scenarios and time horizons. While the dataset incorporates GDP and population exposure metrics, which provide insight into potential economic and social consequences of physical hazards, these are used solely to contextualize environmental risk exposure rather than to construct standalone Social or Governance scores. The methodology does not cover transition risks (such as policy, technology, or market risks associated with the low-carbon transition) and does not aggregate E, S, and G dimensions into a single composite ESG rating; instead, it delivers a targeted, science-based assessment of environmental physical risk exposure at the geographic level.

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any limitation in data sources and methodologies used for the construction of ESG ratings;	Several limitations in data sources and methodology are acknowledged in the construction of the ESG physical risk ratings. The analysis relies on complex climate models (CMIP6) that are inherently subject to scientific uncertainty, and the methodology assumes that averages across available global climate models are broadly representative of future climate pathways, without explicitly modelling the full range of possible outcomes. Physical hazards are modelled independently, meaning potential correlation, compounding, or cascading effects between hazards (for example, tropical cyclones contributing to coastal flooding) are not explicitly captured. The exposure metrics apply GDP-weighted averages, which emphasize economically productive areas and may underrepresent risks in non-productive or sparsely populated regions; population-weighted alternatives are not currently used. In addition, materiality thresholds for defining GDP and population exposed are based on expert judgment rather than universally established scientific standards, reflecting significant hazard levels but potentially overlooking impacts occurring below these thresholds. The methodology also uses historical and infrequently updated gridded GDP and population datasets, and these distributions are held constant in future projections, meaning changes in economic structure, development patterns, or population growth over time are not reflected. Finally, limitations in spatial resolution and the availability of consistent global input data require interpolation or nearest-available projections in some cases, which may affect the precision of localized results.
the main risks of conflicts of interest and the steps taken to mitigate them;	Conflict of Interest Management Policy
if an ESG rating of a rated item covers the E factor, information on whether that rating takes into account the targets and objectives of the Paris Agreement	The ESG rating takes into account the targets and objectives of the Paris Agreement indirectly through its use of IPCC-aligned climate scenarios, but it does not explicitly benchmark performance against international agreements. The methodology applies four future climate change scenarios—SSP1-2.6, SSP2-4.5, SSP3-7.0, and SSP5-8.5—which are derived from the Intergovernmental Panel on Climate Change (IPCC) Shared Socioeconomic Pathways and Representative Concentration Pathways. In particular, the SSP1-2.6 scenario is explicitly described as an aggressive mitigation pathway consistent with the goals of the Paris Agreement, which seeks to limit global average temperature increases to well below 2°C above pre-industrial levels, pursuing efforts to limit warming to 1.5°C. These scenarios are relevant to the ESG rating because they frame the range of potential future physical climate hazards and enable assessment of how climate risks evolve under different global mitigation trajectories. Beyond the Paris Agreement, the

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or any other relevant international agreements;	methodology also references alignment with Task Force on Climate-Related Financial Disclosures (TCFD) technical guidance, which informs the scenario-based approach to physical risk analysis. However, the ESG rating does not assess alignment of commitments or policies against the objectives of the Paris Agreement or any other international agreements. Rather than evaluating whether countries or subnational entities are aligned with, or contributing toward, international climate targets, the methodology focuses solely on measuring projected physical climate risk exposure under alternative scientifically defined scenarios. As such, there is no assessment of transition alignment, policy ambition, or commitment consistency relative to the Paris Agreement or other international frameworks; the scenarios are used as analytical reference pathways, not as benchmarks for compliance or alignment.
if an ESG rating of a rated item covers the S and G factors, information on whether that rating takes into account any relevant international agreements;	The ESG rating does not cover Social (S) or Governance (G) factors and therefore does not take into account any international agreements relevant to those dimensions. The scope of the methodology is explicitly limited to the Environmental pillar, focusing on climate change physical risks affecting countries and subnational regions, assessed through projected exposure to chronic and acute climate hazards. While the methodology incorporates population and GDP exposure metrics, these are used solely to contextualize the environmental physical risk exposure and to reflect potential socioeconomic consequences, rather than to construct standalone Social or Governance assessments. As a result, no international agreements related to social standards, human rights, labor practices, governance, or institutional frameworks are considered, and no alignment with such agreements is evaluated within this ESG rating.

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