ISDE Digital Earth Initiative for Climate Implementation and Accountable Finance

From evidence to decision, from finance to measurable outcomes

International Society for Digital Earth | Statement for COP31, Antalya, Türkiye, 9–20 November 2026

Executive overview

Ten years after the Paris Agreement entered into force, Parties have been submitting new nationally determined contributions and have agreed a new goal for climate finance. At COP30 in Belém, they launched a Global Implementation Accelerator and adopted indicators for the global goal on adaptation. The world still lacks the practical means to show, country by country, whether these plans and pledges are being carried out, paid for and made to work. The COP31 Presidencies have made this the measure of success, writing that climate action must be judged by the outcomes that decisions enable as well as by the decisions themselves.

The International Society for Digital Earth (ISDE) is a non-governmental, not-for-profit scientific society, founded in Beijing in 2004 and a member of the International Science Council. Its symposia, held since 1999, and its journals serve the international Digital Earth research community. Digital Earth, as we use the term, is a federated scientific and institutional infrastructure, owned by many institutions but connected through common standards and governance, that links Earth observation, in-situ measurement, models, local and Indigenous knowledge, governance and public participation across places and scales. A simple example is a satellite flood map combined with tide-gauge records and with local knowledge of where the water rises. ISDE argues that implementation depends on evidence of this kind that governments, investors and communities all trust, and that the multilateral climate process has never fully built that capability.

Governments need an open way to compare options and to record the reasons for their choice, and funders and citizens need a trusted link from that choice to the money that pays for it and the results it delivers. ISDE organises Digital Earth into twelve thematic frameworks (Figure 1 and Annex A), and this statement draws on the two that meet these needs. Framework 12, Strategic Intelligence and Decision Theatre, supports decision theatres in which officials, scientists, financiers and communities test options against shared evidence and record what they chose and why. Framework 6, Value Exchange Infrastructure, links that choice to finance, incentives and assurance under any financing instrument, and to the values a

community wishes to protect. Together they form one pathway from evidence to decision, from decision to finance and from finance to measurable outcome.

The same evidence serves wider United Nations goals, including interoperable data governance under the Global Digital Compact and the Early Warnings for All initiative's aim of protecting everyone on Earth with an early warning system by 2027. ISDE proposes an indicative programme beginning in November 2026, built around one hosted pilot. It asks Parties, the COP31 Presidencies and implementation partners to draw on these methods in the Global Implementation Accelerator, the Climate Implementation Bridge, the work on the Belém Adaptation Indicators and the second Global Stocktake, with particular attention to small island developing States and least developed countries. In practice, a host government might use a decision theatre to choose how to protect a stretch of its coast, publish the decision record and track the funded results against it. Technical terms are explained in Annex B.



Figure 1. Digital Earth: vision, thematic frameworks and Enablers. ISDE groups its twelve thematic frameworks in three tiers, covering foundational systems (Frameworks 1–5), enabling infrastructures (6–9) and human-centric applications (10–12). The outer ring shows the six clusters of Digital Earth Enablers that put the frameworks into practice, and the band between them marks the cross-framework orchestration that connects the two. Frameworks 6 and 12, the focus of this statement, are highlighted. Different combinations of the twelve frameworks support each Enabler cluster, so angular alignment does not indicate exclusive pairings. Source: International Society for Digital Earth, after an original design by K. Finn and R. Simpson (2025).

Preamble

The World Meteorological Organization reports that 2025 was 1.43 ± 0.13°C warmer than the 1850–1900 average and that the eleven years from 2015 to 2025 were the

warmest on record. It finds that concentrations of carbon dioxide, methane and nitrous oxide in 2024 were the highest in at least 800,000 years and that, since 2012, the sea has risen almost twice as fast as it did between 1993 and 2011 [1]. Holding warming to any level requires carbon dioxide emissions to reach at least net zero, along with strong reductions in other greenhouse gases. Strong, rapid and sustained cuts in methane would also limit the additional warming expected as air pollution from aerosols, which has a cooling effect, declines [2].

The United Nations Environment Programme finds that full implementation of current national pledges would still lead to warming of 2.3–2.5°C this century, and current policies point to about 2.8°C [3]. Several climate tipping points may be triggered within the Paris range of 1.5°C to below 2°C, with many more likely at 2–3°C [4]. Warm-water coral reefs are already crossing their thermal tipping point [5]. In Europe, Hungary's national meteorological service judged the 2026 drought the most severe in 126 years of records [6], and critically low Danube levels disrupted navigation, water supply and farming in Hungary and Romania, while low flows on the Danube and Rhine reduced hydropower and nuclear electricity output [7]. Risks of this kind cascade through water, food, energy, health and public finances, and they cannot be managed by each project or ministry in isolation[1].

At COP29, Parties set a goal of at least USD 300 billion a year by 2035 for climate action in developing countries, with developed countries taking the lead. They also called on all actors to scale up finance from all public and private sources to at least USD 1.3 trillion a year by 2035 [8]. Neither goal amounts to funding already secured. The COP29 decision also names the obstacles plainly, including high costs of capital, unsustainable debt, high transaction costs and conditionalities for access [8]. Developing countries will need USD 310–365 billion a year for adaptation by 2035, yet international public adaptation finance reached only USD 26 billion in 2023, less than a tenth of that need [9]. In 2024 developing countries paid a record USD 921 billion in net interest on their public debt. Since 2020 their sovereign bonds have yielded on average 9.8 per cent in Africa and 7.1 per cent in Latin America and the Caribbean, against 2.8 per cent on ten-year United States Treasury bonds [10]. At such rates the same project, whether a seawall or a solar farm, costs a vulnerable country far more to finance than it costs a wealthy one (Figure 2).

1 For the Paks Nuclear Power Plant in Hungary, Gábor Remetey-Fülöpp clarifies that three of the station's four reactors shut down, rather than all four, and that emergency intervention prevented a complete station shut-down (personal communication).

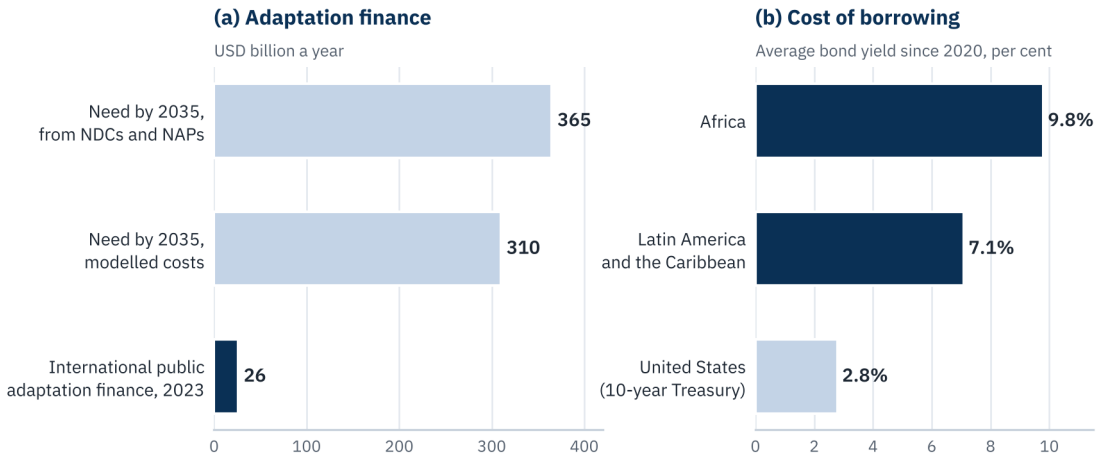


Figure 2. The finance gap and the cost of capital. (a) Developing countries' estimated adaptation finance needs by 2035, against international public adaptation finance in 2023, in USD billion a year [9]. The two estimates of need come from different methods, one modelling costs and the other extrapolating from nationally determined contributions (NDCs) and national adaptation plans (NAPs). (b) Average bond yields since 2020 for sovereign borrowers in Africa and in Latin America and the Caribbean, compared with the ten-year United States Treasury yield [10].

Whether the goals are met will depend on political will, but whether the money achieves its purpose will depend on the more practical question of whether governments, investors and communities share evidence they trust about where finance is needed, what it is meant to change and whether it has changed it. More than USD 16 billion in climate finance has been committed to Pacific countries since the Paris Agreement, and more than USD 5 billion of it is yet to be disbursed [11]. Finance that is committed but not yet spent protects no one.

This is where implementation often falters, and where Digital Earth can help. The idea began with Al Gore's 1998 vision of a multi-resolution, three-dimensional representation of the planet [12]. Scientists have since argued that Digital Earth should be a dynamic framework of connected views, governed across many stakeholders [13], and that it will be not a single system but multiple connected infrastructures, open to participation and honest about uncertainty instead of displaying false precision [14]. Progress has been uneven. In ISDE's 2020 survey of the field, only one respondent in five considered the original vision implemented and most saw it as only partly realised, while a later review found a proliferation of unconnected, non-interoperable single-use platforms [15]. Digital twins of the Earth system, virtual replicas used to test options before acting, aim to combine simulation and observation in a qualitatively new way [16], and they too need governance above the level of any single platform [17]. In ISDE's architecture, digital twins belong to Framework 2, Cyber-Physical Continuum, which keeps digital representations in step with the physical systems they describe, and they rely on Framework 3, Supersense and Perception, for the observations that keep them current.

From Belém to Antalya

COP30 moved the UNFCCC process from rule-making towards delivery. The Global Mutirão decision launched the Global Implementation Accelerator, a cooperative, facilitative and voluntary initiative under the guidance of the COP30 and COP31 Presidencies, to accelerate implementation and support countries in delivering their nationally determined contributions and national adaptation plans. Alongside it came the Belém Mission to 1.5, named for the Paris Agreement's 1.5°C goal and aimed at enabling ambition and implementation of national climate and adaptation plans, and a call to at least triple adaptation finance by 2035 [18]. Parties also adopted 59 Belém Adaptation Indicators and began the two-year Belém–Addis Vision to guide their use. The decision on the global goal on adaptation describes the indicators as voluntary, non-prescriptive, non-punitive and country-driven, states that they must never be used as a condition for developing countries to access funding, and requests further work on their metadata and methods for 2027 [19].

COP31 meets in Antalya, Türkiye, from 9 to 20 November 2026. Türkiye holds the COP31 Presidency, hosts the conference and leads the Action Agenda. Australia serves as President of Negotiations and convened the pre-COP with Pacific partners in Fiji and Tuvalu [11, 20, 21]. The two Presidencies have described COP31 as an "Implementation COP", aimed at "translating commitments into tangible and trackable progress" [21]. The Action Agenda, a voluntary platform beside the negotiations, sets ten themes, from electrification and zero waste to resilient cities, food security, oceans, health and a Climate Implementation Bridge, several of them with proposed global milestones for 2035 that are not intended to create new obligations for individual countries [22].

The Presidencies' joint letter of 5 October 2026 sets the standard: "Climate action must be judged not only by the decisions we take, but by the outcomes those decisions enable" [23]. The letter looks to COP31 to establish a technical taskforce on metadata and methodologies for the Belém Adaptation Indicators and recognises the start of the second Global Stocktake, adding that science, including the work of the IPCC, "must remain central". It presents the Climate Implementation Bridge (BRIDGE), which "is not a new climate fund", as a way to connect country-owned priorities with project pipelines and finance along a pathway "from ambition to investment, from investment to projects, and from projects to implementation and measurable impact". It encourages Parties to submit their second biennial transparency reports by 31 December 2026, and it expects the Fund for responding to Loss and Damage to approve its first funding requests this year [23]. By July 2026, 119 countries had submitted 176 requests to that Fund, totalling about USD 2.8 billion, more than eight times the USD 342 million allocated for its start-up phase [24].

Leaders gathered for the pre-COP set out their own terms in the *Taku Pakasoa Declaration* of 6 October 2026, which states that deep, rapid and sustained reductions in greenhouse gas emissions are required to minimise the magnitude and duration of

overshoot. It calls for reform of the international finance architecture, welcomes a statement and action plan on access to climate finance for small island developing States and least developed countries, and commends the establishment of the Pacific Resilience Facility. It asks that the best available science inform the second Global Stocktake and recognises the need to strengthen ocean science [25].

Small island developing States in the Caribbean and in the Atlantic, Indian Ocean and South China Sea region share these concerns. Their economies depend on oceans that are warming and rising, and income-based measures, which still govern much concessional finance, may not fully reflect their vulnerability. In 2024 the United Nations General Assembly decided to advance a Multidimensional Vulnerability Index, noting the weak correlation between income and vulnerability, and invited development banks to consider using it alongside existing practice [26]. Only 43 per cent of small island developing States report having multi-hazard early warning systems, against 60 per cent of countries worldwide [27].

Progress can be tracked only where there is agreed evidence, an accountable institution and a record of what was decided and why. Finance can move faster when funders and recipients see the same facts and agree on the benefits that action should deliver. Digital Earth can help build those conditions.

ISDE's road to Antalya began in 2025 with two public initiatives. Its *Digital Earth Initiative for the Sustainable Development Goals* proposed Strategic Intelligence and Decision Theatres for key development domains [28]. Its COP30 statement, the *Digital Earth Initiative for Climate Governance and Regenerative Economics*, set out the twelve-framework architecture summarised in Annex A and committed ISDE to remain instrument-agnostic [29]. At its 20th International Lecture, on climate change risk and regenerative economics (13 May 2026), ISDE drew the lesson that better measurement is worth little unless it changes how value is recognised, financed and governed. ISDE now proposes to bring this programme together within a single Framework 6 Task Force, subject to Council approval.

Vision

The implementation problem

Today, a government implementing its climate plan must choose among options under uncertainty, justify the choice to citizens and financiers, pay for it and then show whether it worked. At each step, the relevant evidence is usually held by different institutions, in different places and in incompatible forms. Finance then flows through channels that cannot see what is happening where the money is spent, and decisions are taken with little memory of why earlier ones succeeded or failed.

Scientific information shapes action when the people who must use it find it credible, salient and legitimate, and when institutions actively manage the boundary between knowledge and action [30]. A model that experts admire and decision-makers distrust

will not be used. A study that applied these criteria to an immersive decision theatre found that water managers questioned a simulation model's validity, relevance and bias, and its authors concluded that such tools must be developed iteratively with their users [31]. The European Space Agency's Climate Change Initiative applies the same principle at scale. Each of its projects works closely with users to produce open climate data records for essential climate variables, from aerosols and greenhouse gases to sea level, glaciers and land cover, and a climate modelling user group brings data producers and modellers together [32]. Elinor Ostrom argued that global environmental problems call for polycentric arrangements, in which local, national and international institutions act and learn alongside one another [33], and Digital Earth has to be designed for that reality.

A common failure runs the other way, when digital initiatives adopt the look of innovation, with dashboards, three-dimensional twins and immersive simulations, but lack the feedback, treatment of uncertainty and accountability that decisions require. ISDE calls this performative digitalism, and it can erode public trust and waste public money. The measure of a Digital Earth capability is whether a responsible institution uses it to make, fund and review a real decision, and the two frameworks described below are built around that measure.

Choosing and justifying action (Framework 12)

A decision theatre, as Framework 12 defines it, is a structured process for deliberation. Officials, scientists, financiers and affected communities examine shared data and models, compare alternatives across plausible futures and test how each option performs under severe but credible outcomes as well as central estimates. It can run through online tools and ordinary workshops as well as dedicated facilities, which matters for small island administrations, least developed countries and cities with few specialists.

The principal output of a decision theatre is a decision record, which states which options were considered, what evidence and assumptions were used, where uncertainty and disagreement remained, why one option was chosen and what conditions should trigger a review. It also names who took the decision, because a shared display does not confer shared authority [34], and it keeps observed conditions distinct from modelled scenarios. Such a record lets a ministry defend its choice, a financier see why one project was preferred to its alternatives and a successor government learn from it. Because the triggers for review are written down before results arrive, it is also the basis for adaptive follow-up.

Linking action to finance and results (Framework 6)

Framework 6 sets the conditions under which evidence becomes legitimate value. Its premise is not that the Earth should become a monetary object, but that finance, investment and infrastructure should become answerable to the Earth. It addresses the evidence-to-value gap, ISDE's term for the distance between what can be observed and what economic, legal and financial institutions are prepared to recognise, by

connecting trustworthy evidence to resources, incentives, assurance and stewardship. For each funded action, an evidence record identifies the baseline, the expected benefits, the measurement method and its uncertainty, the rights and consents that apply and the institution responsible. Where funder and recipient have agreed results-based terms, it links disbursements and milestones to observed performance during implementation, so that funders and the public can see what was paid for, what changed and who benefited. Evidence requirements should be proportionate to the investment and use national systems wherever possible, so that measurement lowers transaction costs instead of adding to them.

Framework 6 reaches well beyond carbon markets, to adaptation grants, results-based procurement, public investment, insurance and stewardship payments, and to carbon-market cooperation where the rules permit. Its result need not be a price, since the same evidence may support a reward, a disclosure, a planning decision or a public investment. A restored mangrove may reduce flood risk, support fisheries, sustain cultural practice and store carbon. Each benefit needs its own measure, so that it can be recognised without double counting or reduction to a single price, and some values a community will choose to keep outside exchange altogether. Some of the most valuable results are losses that never happen, such as a flood that does less damage. Measured against credible baselines, with uncertainty stated, avoided harm can be recognised and financed before the loss occurs.

The COP30 initiative was instrument-agnostic, and this statement remains so. Published proposals for new instruments deserve rigorous, independent assessment. Chen, van der Beek and Cloud, for example, proposed in 2017 a complementary currency that would pay a financial reward for mitigation and internalise what they term a Risk Cost of Carbon [35], and a 2026 working paper by Chen develops the idea as a carbon reward paid as conditional grants for greenhouse gas removal, emission reductions and emission avoidance [36]. Chen presented the carbon reward at ISDE's 20th International Lecture [37], and a September 2026 pre-print describes it as a sovereign-backed, tradeable instrument whose price floor central banks would guarantee [38]. Whether such instruments are feasible is a question for further research and for Parties. Every instrument, from carbon markets to adaptation funds and results-based programmes, first needs evidence that is traceable, honest about its uncertainty and governed fairly, and meeting that shared need is ISDE's principal offer, which the programme set out under Our commitments is designed to develop and test.

Two frameworks, one cycle

Framework 12 selects and justifies action, and Framework 6 links that action to resources and to accountable results, so each needs the other (Figure 3). Without the first, finance tends to follow whoever writes the most persuasive proposal; without the second, sound decisions remain unfunded or unaccountable. Outcomes measured under Framework 6 return to the decision theatre and inform the next round of

choices. This is adaptive management in practice, and it is what “trackable progress” requires.

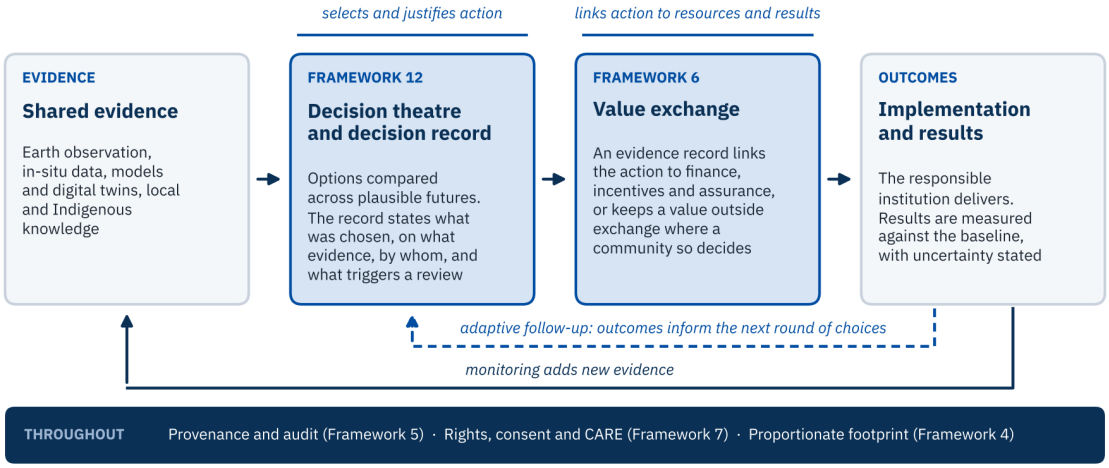


Figure 3. One cycle from evidence to outcome. Shared evidence enters a decision theatre (Framework 12), where options are compared and a decision record states what was chosen, on what evidence, by whom and what should trigger a review. Value exchange infrastructure (Framework 6) links the chosen action to finance, incentives and assurance, or keeps a value outside exchange where a community so decides. Measured results return to the decision theatre for the next round of choices, and monitoring adds to the shared evidence. Provenance (Framework 5), rights and consent (Framework 7) and a proportionate computing footprint (Framework 4) apply at every step.

Both frameworks rest on the wider three-tier Digital Earth architecture, which runs from Earth observation, computing and trust infrastructure, through ethical governance and knowledge federation, to learning, cultural memory and decision support [29]. In practice the tiers are connected by Digital Earth Enablers, such as standards, provenance profiles, indicator crosswalks and decision-record templates. ISDE groups them in six clusters covering interoperability, trust and traceability, foresight and planning, learning and participation, implementation and meta-governance (Figure 1). Data should be findable, accessible, interoperable and reusable [39]. Where data concern Indigenous peoples, the CARE principles of collective benefit, authority to control, responsibility and ethics apply, so that openness never overrides consent, sovereignty or cultural authority [40].

Scientific discipline

Satellites routinely retrieve atmospheric carbon dioxide and methane from their distinct spectral absorption features [50]. For methane, broad-coverage instruments such as TROPOMI support regional emission estimates, while finer-resolution imagers map individual plumes [41]. Nitrous oxide is also retrieved from satellite spectra, although resolving its near-surface emission sources remains more difficult [51]. Translating atmospheric measurements into emission estimates requires transport or plume models and checks against independent observations [41, 50]. Detection limits, sampling gaps and uncertainty must therefore be stated for each gas, instrument and application. The roughly 100–10,000 kilograms an hour detection

thresholds reported for methane point-source imagers in a 2022 review are instrument- and condition-dependent [41]. Observations alone cannot establish additionality, which depends on what would have happened without a project, nor can they by themselves attribute a loss to climate change or give exact carbon stocks (Figure 4).

A digital ledger, such as a blockchain registry, can show that a claim was recorded and has not since been altered, but not that the claim is true, so ledgers and tokens belong at the end of the evidence chain. Digital twins and artificial intelligence inform judgement, while policy and eligibility for finance remain with the responsible institutions. A twin is only as current as the observations that update it, and Frameworks 2 and 3 therefore treat stale updates and gaps in coverage as limits to be shown, because a missing measurement is not evidence that risk is absent [34]. Where AI, which the COP31 Presidencies list among their areas for practical initiatives [23], helps assemble evidence for a decision, a named person should remain accountable for it. Under Framework 4, Sustainable Computational Substrate, Digital Earth must also answer for its own footprint, keeping the energy, water and upkeep that its sensing, models and data centres demand proportionate to the decisions they serve and within the means of the institutions that sustain them [34]. Article 6.4 credits are issued under rules adopted by the Parties and supervised by the mechanism's Supervisory Body [42], and ISDE does not, and will not claim to, approve, issue or cancel any unit.



Figure 4. What each link in the evidence chain can and cannot establish. Each link adds information, but none settles on its own what the next decision needs, which is why ledgers and tokens sit at the end of the chain. The methane point-source detection limits shown are illustrative, instrument-specific ranges reported in 2022 [41], and Article 6.4 credits are issued under the rules adopted by the Parties [42].

Where Digital Earth adds value at COP31

The applications in the table below connect COP31 priorities to specific decisions. They are candidate demonstration pathways, to be selected with willing hosts, and national authorities retain responsibility for their inventories, biennial transparency reports and national commitments.

COP31 priority	Decision supported	Initial evidence and output
National climate plans, transparency and the second Global Stocktake	Select measures and track delivery against national targets	Indicator crosswalk linking observations, activity data and policy records to biennial transparency reports
Climate Implementation Bridge and climate finance	Turn national priorities into a project pipeline and assess the evidence behind funding or crediting claims	Decision record and traceable evidence record, with methods, uncertainty and independent review
Adaptation, oceans and coastal risk in small island developing States	Compare coastal, water, settlement and marine options	Country-led decision theatre using selected Belém Adaptation Indicators and ocean observations
Zero waste, methane and resilient cities	Prioritise waste, building and infrastructure interventions	Satellite and facility data linked to a funded action and its follow-up
Food security, water and ecosystems	Compare land-use, water and restoration choices	Scenarios showing emissions, resilience, water and livelihood effects

A pilot demonstration led by a small island developing State could connect coastal hazards, freshwater security, marine ecosystems, critical infrastructure and community priorities, drawing on national and regional Earth observation services such as the Pacific Community's Digital Earth Pacific. Framework 12 would support comparison of protection, nature-based measures and planned relocation. Framework 6 would link the chosen response to finance and outcomes, including through regional instruments such as the Pacific Resilience Facility [25], while communities control how their knowledge is used. The pilot should be judged by whether the evidence shortens the path from pledge to disbursement. Digital Earth can also help countries prepare their own loss-and-damage assessments. After Storm Daniel struck Libya in September 2023, for example, night-time imagery from the SDGSAT-1 satellite was used to detect where Derna and Al Bayda had lost light [43]. Such evidence can inform an assessment without settling it, and neither Digital Earth nor the Belém Adaptation Indicators should ever become an additional hurdle to finance [19].

Waste offers a short, visible demonstration of the full cycle. Zero waste and methane reduction is an Action Agenda theme [22], and the Istanbul Platform sets participating cities a direction of travel towards diverting at least 70 per cent of waste from landfill by 2030 and 90 per cent by 2040 [44]. A municipal partner could combine regional methane mapping and targeted plume observations, where available, with facility records and emission inventories, check the evidence against field measurements,

compare interventions, finance the chosen response and assess the result, with detection limits, sampling gaps and uncertainty kept visible [41]. Food, land and water decisions call for the same approach, because sustainable development requires integrated transformations planned across sectors [45]. An emissions reduction that deepens water stress or shifts costs to poor households is not a success.

ISDE as a scientific partner

Trustworthy climate evidence is a global public good, whose value grows as more institutions use it and which no single government or investor has enough incentive to build alone. Weather forecasting shows how such goods are sustained, through shared observations, common standards and a scientific community that maintains them. Climate implementation needs a similar arrangement, and scientific convenors to help hold it together.

Parties addressed the observational foundations of such an arrangement at the November 2025 session of the Subsidiary Body for Scientific and Technological Advice, which recognised "the vital importance of robust Earth observation systems and related long-term data records" and noted with concern the decline in support for sustained observation networks. That body also noted the need to promote open science and to improve access to interoperable data sets while respecting national data sovereignty, and acknowledged the role of artificial intelligence in early warning together with the challenges of using it in developing countries [46]. Earth Information Day in Antalya offers a place to continue that work [46]. ISDE's contribution is to carry the observation effort through to the decisions and finance that depend on it.

Wider United Nations commitments point the same way. In the Global Digital Compact, Member States set the objective of responsible, equitable and interoperable data governance. They also committed, by 2030, to increase investment in digital public goods and digital public infrastructure, to aim for a 50 per cent increase in the data available to monitor the Sustainable Development Goals, and to develop open and accessible data systems to support disaster early warning, early action and crisis response [47]. SDGSAT-1, launched by China in November 2021 as the first science satellite programme dedicated to the 2030 Agenda, has offered free access to its thermal, night-time light and multispectral imagery since 2022, and researchers in more than 105 countries, together with UN agencies and international organisations, have used it [43]. The UN's Early Warnings for All initiative aims to protect every person on Earth with an early warning system by 2027 [27]. A forthcoming study in the *International Journal of Digital Earth* maps ISDE's twelve frameworks onto early warning and disaster risk governance and sets out what must travel with a warning, from its provenance and uncertainty to the authority to act on it [34]. Digital Earth methods can apply these commitments to evidence about the physical planet, so that evidence built for climate decisions can also serve the 2030 Agenda, disaster risk reduction and water management.

ISDE brings a global scientific community, two journals, the *International Journal of Digital Earth* and *Big Earth Data*, the *Manual of Digital Earth* [48] and an architecture that spans observation, governance, finance and participation. Its place is beside national institutions, the Group on Earth Observations, in which ISDE is a Participating Organization, and the United Nations Committee of Experts on Global Geospatial Information Management (UN-GGIM), whose Integrated Geospatial Information Framework guides national geospatial information management [49]. As a non-governmental scientific convenor working across disciplines and regions, ISDE aims to complement these bodies by connecting their open data, observations, standards and frameworks to decisions and finance. ISDE seeks no role in the negotiations and no authority over any UNFCCC process.

Our commitments

The programme below is indicative. Each commitment needs separate approval by the ISDE Council, partner agreement and the resources it identifies, and delivery will run through ISDE's Framework 6 Task Force, subject to Council approval of its mandate. Taken together, the commitments form one sequence that carries forward those ISDE made at COP30.

1. **Convene a dialogue on decision theatres and value exchange (November 2026).** Use the 10th Digital Earth Summit in Melbourne, 24–26 November 2026, to review COP31 outcomes with practitioners from science, government and finance, test the scope of the reference architecture and publish a summary of the evidence needs identified. Led by the ISDE President and the Summit convener within the existing Summit programme; subject to ISDE Bureau approval, reporting to Council.
2. **Publish an open reference architecture for consultation (by March 2027).** Describe the pathway from observation to decision record and, where relevant, to a funding claim, covering evidence sources, gas- and instrument-specific detection limits where applicable, spatial and temporal coverage, quality controls, model assumptions, rights and consents, assurance and the responsible authority. Success will be an open draft, tested against one worked case and independently reviewed. Led by the Framework 6 Task Force, with in-kind expert and Secretariat support; subject to Council approval of the Task Force mandate.
3. **Undertake one hosted pilot demonstration (scoped by mid-2027).** Work with a willing host that owns a real climate decision, such as a coastal adaptation choice in a small island developing State or a municipal zero-waste programme, and can provide data access, community involvement and a plan for maintenance. Success will be a documented baseline, options, decision and implementation responsibilities. Led by the Framework 6 Task Force with the

host, funded by partners and, where it wishes, the host, with no financial liability for ISDE; any host agreement requires Council approval.

4. **Publish findings, open methods and training (from late 2027).** Report independently on performance, uncertainty, costs, participation and limits, and release reusable methods and training through ISDE's lectures, journals and regional networks, claiming environmental and financial outcomes only where the methods and observation period support them. Interim findings are expected by late 2027, with a full report when the pilot ends. Led by the Framework 6 Task Force with ISDE's education working group and journal editors; released after Bureau review.

As research separate from this core programme, ISDE will continue exploratory study of how Digital Earth evidence could support carbon incentives. This initiative has previously been named the Digital Earth Carbon Incentive Protocol. This work will be subject to partner agreements and will be tested as a workstream of the Framework 6 Task Force. Any findings will be published for independent review and with no presumption in favour of a particular instrument.

Our call for action

ISDE calls on Parties and the COP31 Presidencies to recognise shared, trustworthy evidence as enabling infrastructure for implementation. We ask them to draw on Digital Earth methods, where Parties and the relevant bodies find them useful, in the Global Implementation Accelerator, the Climate Implementation Bridge, the technical work on the Belém Adaptation Indicators, the second Global Stocktake and the work of the Subsidiary Body for Scientific and Technological Advice on research and systematic observation.

We call on finance ministries, multilateral development banks, climate funds and investors to work with recipient countries and the scientific community on simpler, more consistent evidence requirements that build on and strengthen national systems, combine satellite and ground-based observations, and are traceable, proportionate and affordable for developing countries. Evidence should never become an additional condition for access. Used well, it can help lower perceived risk and the cost of capital and shorten the time from approval to disbursement.

We call on scientific institutions, space agencies, statistical offices and standards bodies to develop open, interoperable methods that state their uncertainty and can be scrutinised and reproduced, to share the underlying data and algorithms openly, and to build this capability in partnership with institutions in developing countries.

We call on communities and Indigenous knowledge holders to help define the questions, interpret the results and govern the use of their information, and we commit to respecting their authority to do so.

Pathways for engagement

ISDE will seek engagement with the institutions below through its events, consultations and publications, and through formal channels where invited. Naming an institution signals intent to engage, not an existing partnership or endorsement.

COP31 Presidencies and UNFCCC processes. Technical input to the Global Implementation Accelerator, the Climate Implementation Bridge and the work on the Belém Adaptation Indicators, and relevant findings for the second Global Stocktake, offered through open calls and consultations, together with contributions to Earth Information Day where invited.

Wider United Nations processes. Subject to Council approval, ISDE proposes to bring the argument of this statement to the Third United Nations World Geospatial Information Congress (Jeddah, 16–19 November 2026) and findings from COP31 to the 2026 UN Water Conference (Abu Dhabi, 8–10 December 2026), whose dialogues cover climate and disaster risk reduction. It also proposes to contribute, where invited, to follow-up on data governance under the Global Digital Compact.

Small island developing States and their regional bodies. An invitation to the Alliance of Small Island States and to regional bodies, including the Pacific Islands Forum Secretariat, the Pacific Community, the Caribbean Community Climate Change Centre and the Indian Ocean Commission, to help shape a country-led demonstration in which communities decide how their knowledge is used.

Cities. An invitation to cities in the Istanbul Platform on zero waste, and to others facing a live waste, heat or flood decision, to propose a host case.

Finance institutions. A request to finance ministries, multilateral development banks, the Green Climate Fund and the Adaptation Fund to review the evidence specifications in the reference architecture before it is finalised.

Science and data institutions. Joint work on open, interoperable methods with the Group on Earth Observations, UN-GGIM, the World Meteorological Organization, the Copernicus programme, national statistical offices, space agencies and meteorological services.

Communities, Indigenous knowledge holders and early-career researchers. An invitation to help frame the demonstration and to review the consent and data-governance provisions of the reference architecture under the CARE principles [40].

A shared future

The climate crisis tests whether humanity can govern a shared planet on the basis of shared knowledge. The science is settled enough to act on, and the finance goals have been set. Governments still need the connective infrastructure that lets them see their options, choose among them in the open, attract finance at a fair cost and show their

citizens what that action achieved. For a small island State facing rising seas, that infrastructure can determine whether protection arrives before the next storm.

Digital Earth offers a practical route to that infrastructure, provided it is developed with scientific integrity and governed with the people whose futures are at stake. Many of the scientific tools already exist, and the task now is to connect them to the institutions that decide and the funds that pay. ISDE invites the Parties, the COP31 Presidencies and every institution responsible for delivery to join in that work. An Implementation COP needs evidence that everyone can trust and use. ISDE is ready to help build it.

Further information

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Annex A. The twelve thematic frameworks of Digital Earth

ISDE twelve thematic frameworks served as lenses into an evolving vision of Digital Earth. These frameworks help organise the capabilities that a working Digital Earth needs. These frameworks are grouped into three tiers (Figure 1) [29]. Frameworks 6 and 12, the focus of this statement, rely on the others, in particular Framework 5 for provenance and audit, Framework 7 for rights and consent, Framework 8 for joining scientific and Indigenous knowledge, Framework 9 for scenario design, Framework 10 for capacity building and Framework 4 for keeping the footprint of computing in check. The practical standards and tools that connect the frameworks are known as Digital Earth Enablers.

Framework	What it contributes
Tier 1. Foundational systems	
1. Dynamic Complex Adaptive System	Treats the planet as a coupled natural, built and social system shaped by feedbacks, thresholds and uncertainty.
2. Cyber-Physical Continuum	Links digital representations, including digital twins, with the physical systems they describe, so that observation, simulation and operation inform one another.
3. Supersense and Perception	Combines satellite, airborne, in-situ and community observations to detect change across space, time and scale.
4. Sustainable Computational Substrate	Keeps the energy, water and material footprint of planetary-scale computing within limits.
5. Trust and Compliance Infrastructure	Records provenance, consent and audit trails so that data, models and claims can be checked across jurisdictions.
Tier 2. Enabling infrastructures	
6. Value Exchange Infrastructure	Connects trusted evidence to finance, incentives, assurance and stewardship, including values a community chooses not to price.
7. Ethical Governance System	Builds rights, participation and oversight into how data, algorithms and decisions are governed.
8. Knowledge Federation	Joins scientific, Indigenous, technical and civic knowledge while respecting the protocols of each.
9. Meta-Design Space for Planetary Futures	Supports the joint design and testing of future scenarios and transition pathways.
Tier 3. Human-centric applications	
10. Learning and Empowerment Platform	Builds the Earth-system literacy and skills that people and institutions need to use Digital Earth.
11. Cultural Memory and Storytelling Hub	Keeps place-based memory and narrative so that cultural values can inform decisions.
12. Strategic Intelligence and Decision Theatre	Brings evidence, models and stakeholders together to compare options, deliberate and record decisions.

Annex B. Glossary

Short, plain definitions of terms used in this statement. Where a term is defined in a UNFCCC decision, that definition prevails.

Term	Meaning
Additionality	Whether a result would have happened without the project or finance in question. It depends on a counterfactual, so it cannot be observed directly.
Article 6.4 mechanism	The Paris Agreement mechanism through which emission reductions and removals are credited under rules adopted by the Parties and supervised by a Supervisory Body.
Belém Adaptation Indicators	The 59 indicators adopted at COP30 to track progress towards the global goal on adaptation. They are voluntary, non-prescriptive and country-driven, and must never be used as a condition for developing countries to access funding.
Biennial transparency report	The report each Party submits under the Paris Agreement on its greenhouse gas inventory, its progress in implementing and achieving its NDC, and the financial, technology and capacity-building support provided, mobilised, needed or received. It may also cover climate impacts and adaptation. Second reports are due by 31 December 2026.
Climate Implementation Bridge (BRIDGE)	A COP31 Presidency initiative to connect country-owned priorities and project pipelines with finance, technical expertise and implementation partners. It is not a new climate fund.
Cost of capital	The return that lenders and investors require. It largely decides how expensive a seawall, solar farm or other project is to finance.
Decision record	A written account, which may be published, of the options considered, the evidence and assumptions used, the uncertainty that remained, the choice made and the conditions that should trigger a review.
Decision theatre	A structured setting, online or in person, in which decision-makers and affected communities compare options against shared data and models. The basis of ISDE's Framework 12.
Digital Earth	Federated scientific and institutional infrastructure that links Earth observation, in-situ measurement, models, local and Indigenous knowledge, governance and public participation across places and scales.
Digital Earth Enablers	The practical standards, templates and tools that let the frameworks work together, such as provenance profiles, indicator crosswalks and decision-record templates. ISDE groups them in six clusters (Figure 1).
Digital twin	A computer representation of a physical system, updated with observations, used to simulate conditions and test options. In ISDE's architecture it belongs to Framework 2 and draws its observations from Framework 3.
Evidence record	For a funded action, a record of the baseline, expected benefits, measurement method and its uncertainty, the rights and consents that apply and the institution responsible.
Evidence-to-value gap	ISDE's term for the distance between what can be observed and what economic, legal and financial institutions are prepared to recognise as legitimate value.

Term	Meaning
FAIR and CARE principles	FAIR: data should be findable, accessible, interoperable and reusable. CARE: collective benefit, authority to control, responsibility and ethics, for data concerning Indigenous peoples.
Federated	Owned and run by different institutions but connected through shared standards and governance.
Global Implementation Accelerator	A cooperative, facilitative and voluntary initiative launched at COP30, under the guidance of the COP30 and COP31 Presidencies, to accelerate implementation and support countries in delivering their nationally determined contributions and national adaptation plans.
Global Stocktake	The Paris Agreement's assessment, every five years, of collective progress towards its goals. The second begins at COP31.
Indicator crosswalk	A mapping that links one set of data or indicators to another, for example observations to the categories used in transparency reports.
Interoperability	The ability of different systems and datasets to work together without manual conversion.
Nationally determined contribution (NDC)	Each Party's national climate plan and targets under the Paris Agreement.
Performative digitalism	ISDE's term for digital initiatives that look innovative but lack the feedback, treatment of uncertainty and accountability that real decisions require.
Provenance	The record of where data came from and how it was processed, so that others can check it.
Small island developing States (SIDS)	A group of developing countries recognised by the United Nations as facing specific social, economic and environmental vulnerabilities, in the Pacific, the Caribbean and the Atlantic, Indian Ocean and South China Sea region.
Value exchange infrastructure	The evidence records, standards, assurance and governance through which evidence becomes legitimate value, whether it is priced, rewarded, disclosed, used to guide public investment or kept outside exchange. The basis of ISDE's Framework 6.

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