Collaborative Development of Knowledge Discovery Approaches for Spatio-Temporal Prediction of Dry Spell to Predict Water Deficit Risk

APEC Policy Partnership on Science, Technology and Innovation

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1. PROJECT OVERVIEW

1.1 Background

Water security has become one of the most critical challenges facing APEC economies. Agriculture, energy production, industrial activities, and urban water supply depend on the availability and reliability of water resources. Increasing climate variability, prolonged dry periods, recurrent droughts, and heatwaves are placing growing pressure on water systems and affecting the resilience of productive sectors across the Asia-Pacific region.

Annual precipitation patterns are strongly influenced by the frequency and duration of dry days. Changes in the occurrence of dry spells contribute significantly to interannual climate variability and may severely affect water availability, agricultural productivity, energy generation, and ecosystem services. Understanding the spatial and temporal dynamics of dry spells is therefore essential for developing effective adaptation strategies and supporting evidence-based decision making.

The project "Collaborative Development of Knowledge Discovery Approaches for Spatio-Temporal Prediction of Dry Spell to Predict Water Deficit Risk" (PPSTI 01 2023) was developed to address these challenges by strengthening the capacity of APEC economies to visualize, analyze, and forecast dry spells, droughts, heatwaves, and water needs through innovative digital technologies and data-driven approaches. The project builds upon the outcomes of APEC Project PPSTI 05 2019 on Integrated Water Resources Management and extends previous efforts by incorporating advanced climate analytics, forecasting methodologies, and decision-support tools.

The project promoted collaboration among researchers, policymakers, government agencies, private sector representatives, and technical experts from APEC economies. Through the development of a digital platform, capacity-building activities, and knowledge exchange mechanisms, the project sought to improve regional preparedness and resilience to climate-related water risks.

1.2 Project Objectives

The overarching objective of the project was:

"To develop capacity-building opportunities for APEC economies through visualization tools for spatial-temporal planning based on dynamic mapping of dry spells and forecasting of dry spells, droughts, heatwaves and water needs, supporting industrial sectors and governments in decision making for water risk management and Integrated Water Resources Management."

1.3 Project Outputs

The project was designed to deliver three main outputs:

1. A digital platform (DryViz[1]) for visualization, analysis, and forecasting of dry spells, droughts, heatwaves, and water-related risks.
2. An international capacity-building workshop and practical training activities involving APEC economies.
3. A final project report and supporting training materials, including user guidance and knowledge dissemination products.

1.4 Project Achievements

The project successfully achieved its planned objectives through the development, implementation, and validation of the DryViz platform, together with a comprehensive capacity-building and knowledge-transfer programme involving stakeholders from APEC economies.

The principal technological outcome of the project was the development of DryViz, a web-based platform designed for the analysis, visualization, and forecasting of hydroclimatic variables

[1] https://dryspells.cl

associated with water deficit risk. The platform integrates processed ERA5 climate datasets and provides tools for analyzing dry spell duration, precipitation, evaporation, runoff, water balance, temperature variability, and climate anomalies across spatial and temporal scales.

Beyond the original scope of dry spell forecasting, the platform evolved into a comprehensive hydroclimatic decision-support system incorporating advanced analytical capabilities, including statistical trend analysis, Support Vector Regression (SVR) forecasting, global raster climate layers, customized climate indices, data export functionalities, and multilingual support.

To promote technology transfer and practical application of the developed tool, an international APEC workshop entitled “Spatio-Temporal Prediction of Dry Spells and Water Deficit Risks” was organized in Santiago, Chile. The workshop brought together representatives from APEC economies, public institutions, private companies, academia, and sectoral organizations. Participants received hands-on training using the platform and explored applications related to water resources, agriculture, energy, mining, and governance sectors.

The workshop also served as a mechanism for collecting user feedback and validating the platform under real-world conditions. Recommendations provided by participants resulted in additional platform improvements, including the incorporation of GeoJSON spatial layers, new user-defined climate indicators, and the ongoing integration of ENSO-related information.

Overall, the project delivered all planned outputs, strengthened technical capacities among participating stakeholders, promoted regional cooperation, and established a foundation for future collaboration on climate-risk forecasting and water-resource management across APEC economies.

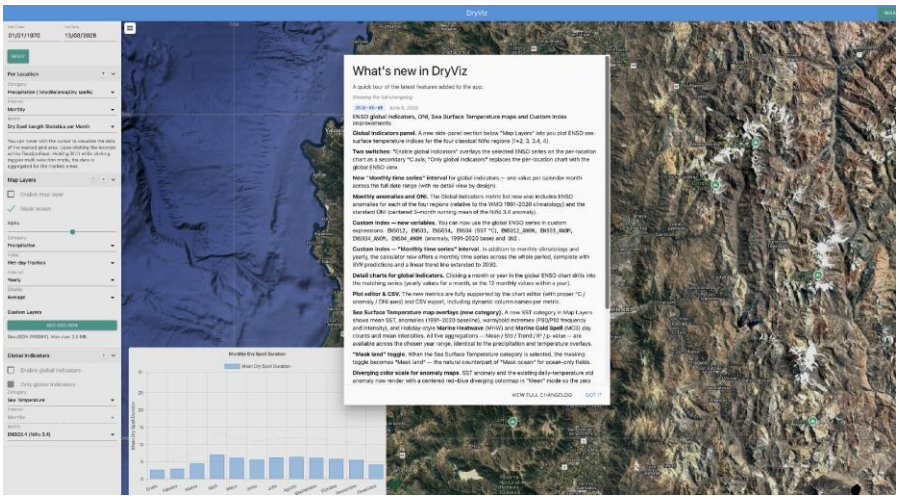
2. DEVELOPMENT OF THE DRYVIZ PLATFORM

2.1 Overview

The main technological outcome of the project was the development of DryViz, an interactive web-based platform designed to support the analysis, visualization, and forecasting of hydroclimatic variables associated with water deficit risk.

The platform was conceived as a decision-support tool aimed at strengthening the capacity of APEC economies to understand and anticipate the impacts of climate variability on water resources, agriculture, energy systems, and other climate-sensitive sectors. Through the integration of climate datasets, statistical methods, and visualization tools, DryViz enables users to explore historical conditions, identify trends, and assess future scenarios related to dry spells, droughts, heatwaves, and water availability.

Figure 1. Platform DRYVIZ



DryViz was developed as an accessible and scalable platform capable of supporting both technical specialists and decision-makers through intuitive visualizations and analytical functionalities.

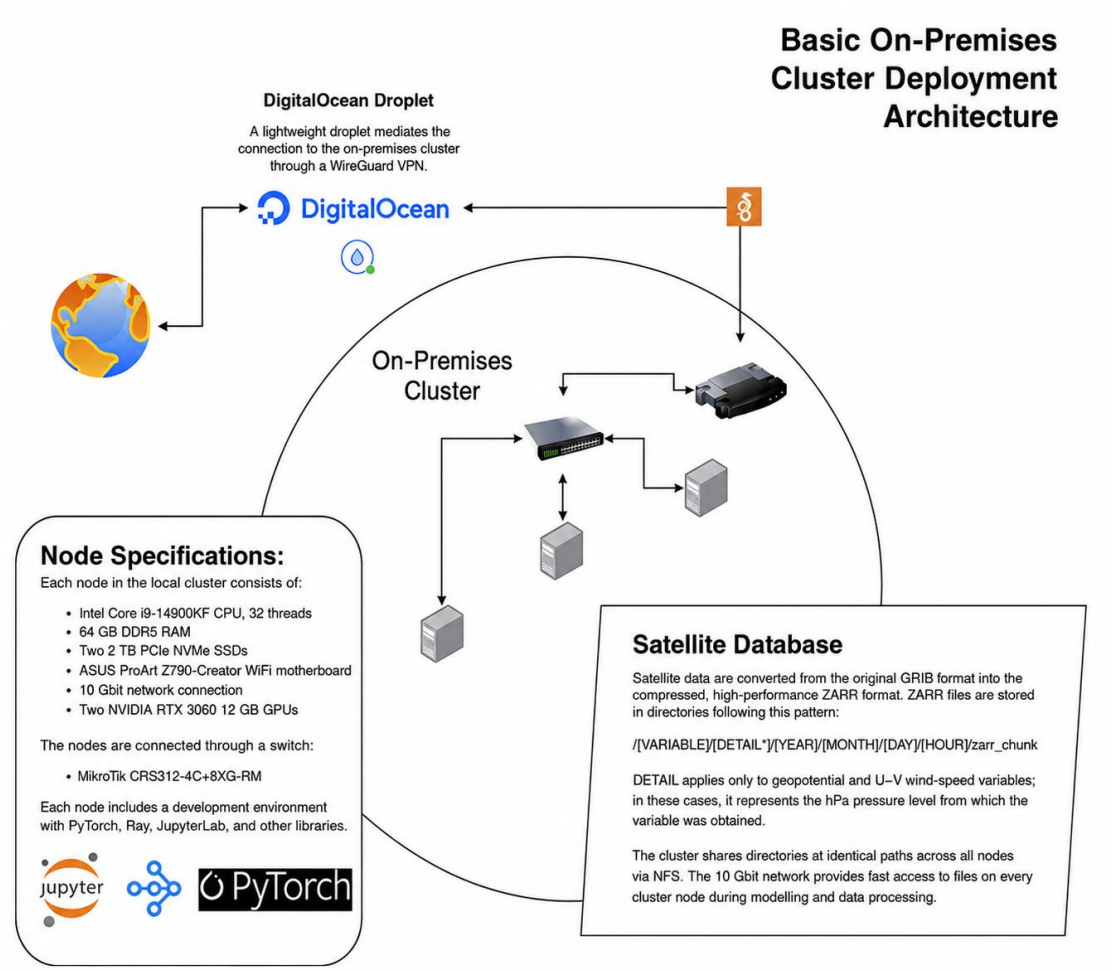
2.2 Platform Architecture and Data Sources

The platform integrates a Python-based backend architecture with a modern web interface that allows users to interact dynamically with climate information across spatial and temporal scales.

The system is built upon processed ERA5 reanalysis datasets, statistical processing modules, forecasting algorithms, geospatial visualization tools, and export functionalities integrated within a single environment. Additional technical specifications are presented in Annex A.

The architecture combines climate databases, statistical processing modules, forecasting algorithms, geospatial visualization tools, and export functionalities within a single integrated environment.

Figure 2. General architecture of the DryViz platform



2.3 Main Functionalities

DryViz incorporates a comprehensive suite of analytical tools designed to evaluate hydroclimatic conditions and support climate-risk assessment.

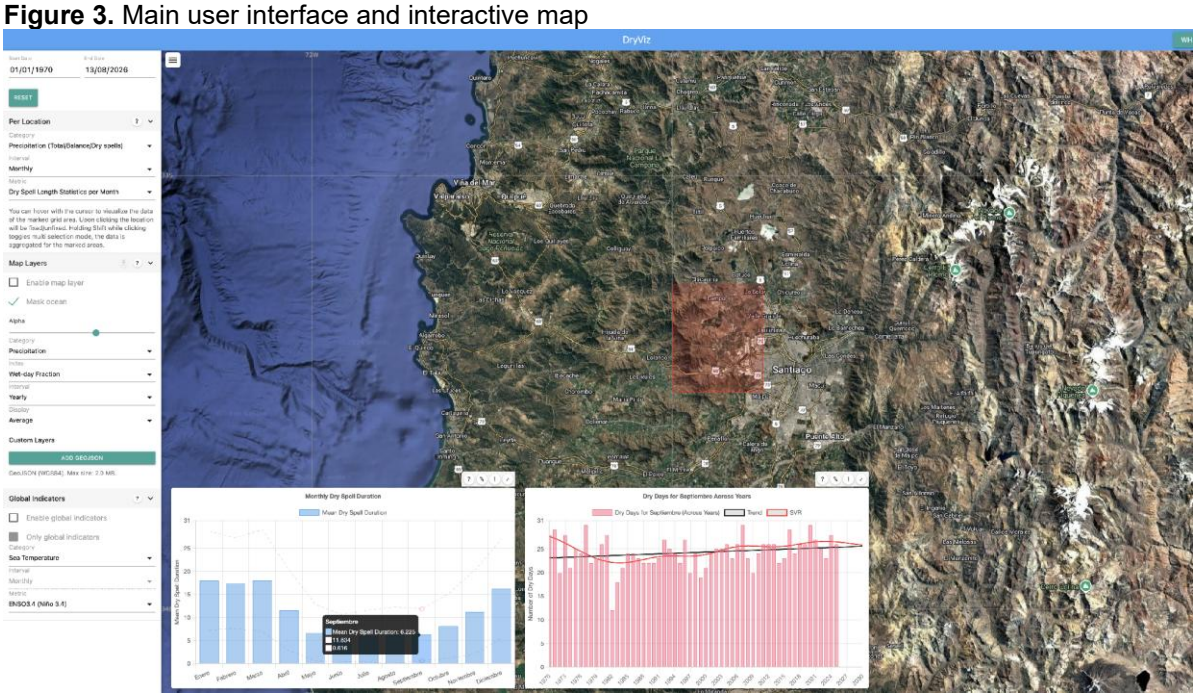
The platform allows users to:

- Analyze dry spell duration and frequency;
- Explore precipitation variability and long-term trends;

- Assess evaporation and runoff dynamics;
- Evaluate water balance conditions;
- Analyze temperature variability and anomalies;
- Visualize climate indicators through interactive maps;
- Generate historical and projected trend analyses;
- Export data and graphical outputs for further analysis.

The platform supports both local-scale assessments and regional analyses through interactive spatial visualization and multi-location aggregation capabilities.

Figure 3. Main user interface and interactive map



2.4 Forecasting and Analytical Capabilities

A key innovation of DryViz is the incorporation of forecasting and trend-analysis functionalities.

The platform includes statistical and machine-learning-based tools that allow users to identify long-term trends and generate projections of hydroclimatic variables. Among these capabilities are:

- Linear trend analysis;
- Polynomial regression models;
- Support Vector Regression (SVR);
- Harmonic and frequency-based analysis;
- User-defined analytical functions.

These tools provide users with the ability to evaluate potential future changes in climate conditions and water deficit risks, supporting evidence-based planning and adaptation strategies.

Figure 4. Example of dry spell visualization

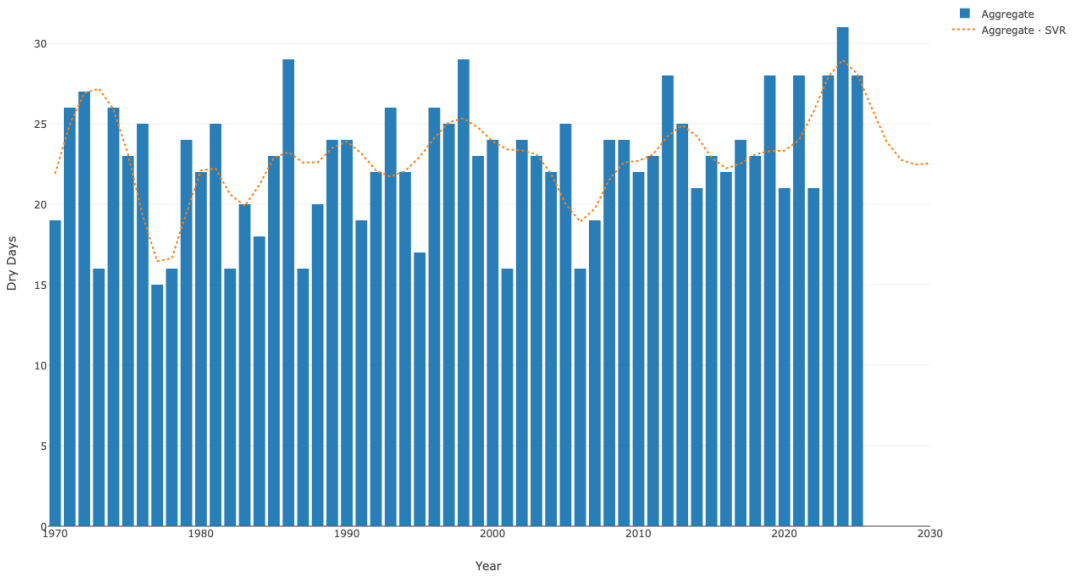
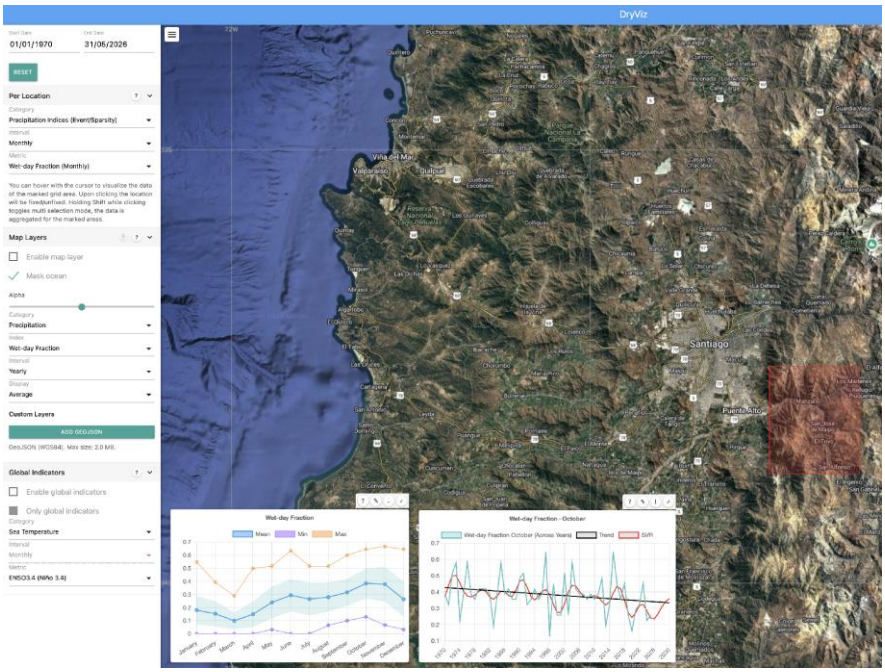
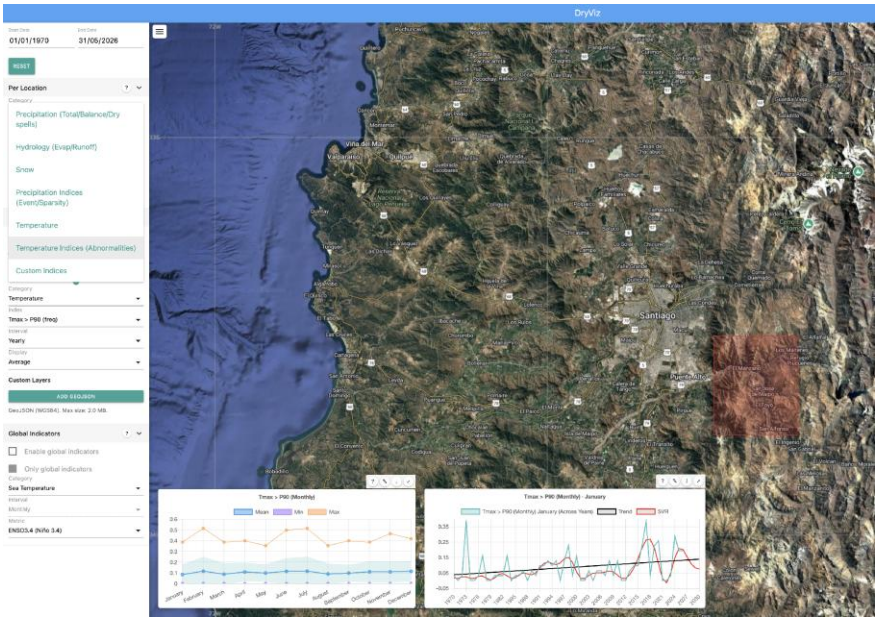


Figure 5. Climate indicators and analytical modules available in DryViz

(a)



(b)



Description: (a) Precipitation indices (event/sparsity); (b) Temperature indices (abnormalities)

2.5 Visualization and User Interaction

The platform was designed to facilitate intuitive exploration of complex climate datasets.

Users can interact with dynamic maps, time series, statistical charts, and comparative visualizations. The system allows the selection of geographic areas, time periods, climate variables, and analytical methods through an integrated graphical interface.

Additional functionalities include:

- Multi-location analysis;
- Interactive chart editing;
- Downloadable datasets;
- Export of figures and graphics;
- Bilingual operation in English and Spanish.

These features enhance accessibility and facilitate the use of the platform by diverse stakeholders across APEC economies.

2.6 Contribution to Project Objectives

The development of DryViz directly addressed the primary objective of the project by providing a practical digital tool for capacity building, climate-risk assessment, and decision support.

By integrating visualization, forecasting, and analytical functionalities within a single platform, DryViz contributes to improving understanding of climate variability and water-related risks, while supporting informed decision-making processes in sectors vulnerable to droughts, dry spells, heatwaves, and water scarcity.

The platform establishes a foundation for future collaboration, knowledge exchange, and technological innovation among APEC economies in the field of climate resilience and water-resource management.

3. INTERNATIONAL WORKSHOP AND CAPACITY BUILDING ACTIVITIES

3.1 Workshop Overview

As part of the project's capacity-building and knowledge-transfer strategy, the APEC International Workshop entitled "Spatio-Temporal Prediction of Dry Spells and Water Deficit Risks" was conducted at Universidad del Desarrollo (UDD), Santiago, Chile, on January 22–23, 2026.

The workshop represented a key milestone of the project, serving as the principal mechanism for disseminating the technological outcome developed under PPSTI 01 2023 and promoting collaboration among APEC economies. The event provided participants with direct exposure to the DryViz platform and its application to climate-risk assessment, drought monitoring, forecasting, and water-resource management.

The workshop was designed to combine technical understanding, practical application, and science-policy integration through a combination of expert presentations, platform demonstrations, hands-on exercises, and collaborative discussions.

Table 1. Workshop Summary

Item	Description
Workshop Title	Spatio-Temporal Prediction of Dry Spells and Water Deficit Risks
Dates	22–23 January 2026
Venue	Universidad del Desarrollo, Santiago, Chile
Duration	Two-day international workshop
Main Themes	Technical Understanding and Benchmarking; Science–Policy Integration and Digital Capacities
Practical Activities	4
APEC Speakers	4
National Speakers	2
Main Sectors Addressed	Water, Agriculture, Energy, Mining, Governance

Figure 6. Official invitation to the APEC International Workshop

3.2 Participation and Stakeholder Engagement

The workshop brought together representatives from APEC economies, academia, government agencies, private companies, and sectoral organizations interested in climate adaptation, water security, and digital decision-support tools.

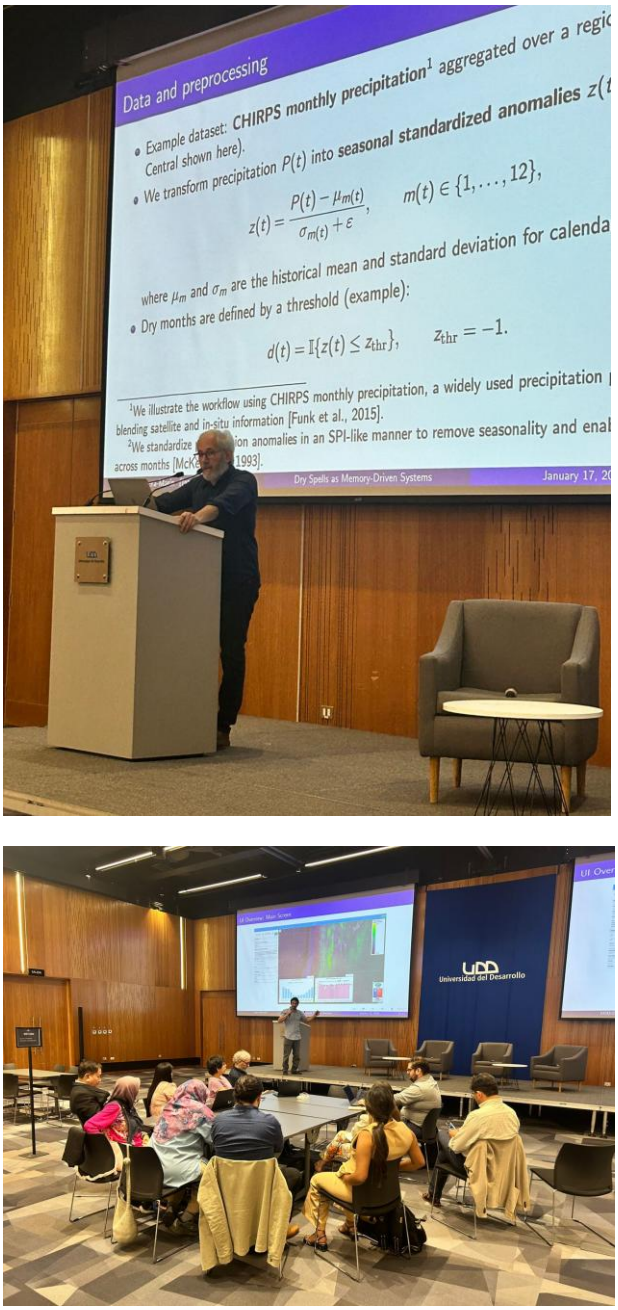
Representatives from four APEC economies participated in the workshop, with international speakers contributing technical presentations and sharing experiences related to climate-risk management, forecasting methodologies, and climate resilience strategies.

Figure 7. Participation for representatives from APEC economies during the workshop

The workshop also included active participation from Chilean institutions and private-sector organizations, including Hortifrut, ACADES, Chile Alimentos, and the Santiago-Maipo Water Fund. Their participation enriched the discussions and demonstrated the practical relevance of the platform for productive sectors affected by climate variability and water scarcity.

The diversity of participants promoted multidisciplinary dialogue and strengthened networks among researchers, policymakers, technical experts, and end users.

Figure 8. Participation of companies and national institutions in workshop sessions



3.3 Technical Programme and Practical Training Activities

The workshop programme was organized over two consecutive days, progressing from technical understanding and benchmarking exercises toward science-policy integration and decision-support applications.

The first day focused on technical understanding and benchmarking, including presentations from national and international experts, introduction to the DryViz platform, and practical training activities aimed at familiarizing participants with the platform's functionalities.

The second day emphasized science-policy integration and digital capacities. Activities focused on future climate scenarios, interpretation of forecasting outputs, sectoral discussions, and policy-oriented simulations designed to support evidence-based decision making.

The programme combined expert presentations, platform demonstrations, collaborative discussions, and practical exercises, creating an interactive learning environment that facilitated knowledge transfer and stakeholder engagement.

A central component of the workshop was the implementation of four practical training activities designed to provide participants with direct experience using the DryViz platform.

Activity 1: Basic Platform Exploration
Participants learned how to navigate the platform interface, select locations, explore climate variables, interpret visualizations, and compare historical climate conditions across different periods.

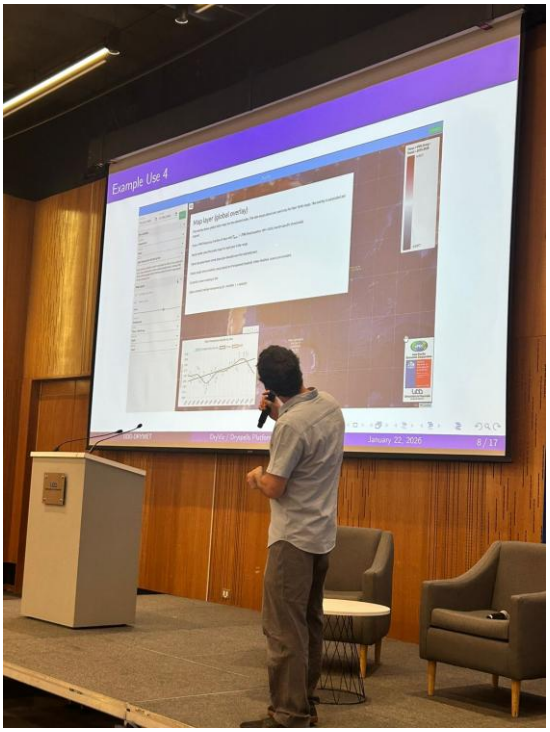
Activity 2: Sectoral Working Groups
Participants were organized into thematic groups representing five strategic sectors: Water Resources; Energy; Agriculture; Mining; Governance

Each group applied DryViz functionalities to analyze sector-specific climate risks and identify potential adaptation strategies.

Activity 3: Future Scenarios and Trend Analysis
Participants explored forecasting tools available within the platform, including trend analysis and projections to 2030. Particular emphasis was placed on dry spell dynamics, climate variability, and future water-deficit risks.

Activity 4: Policy Simulation Exercise
Participants used platform outputs to develop hypothetical adaptation measures and policy responses for different sectors and ministries. The exercise demonstrated how scientific information and forecasting tools can support strategic planning and evidence-based decision making.

Figure 9. Use of the platform



The direct use of the platform by participants enabled the transfer of technical capacities in climate and hydrological data analysis, facilitated the validation of platform functionalities, and provided valuable feedback from end users. This feedback was considered in the evaluation of the pilot platform and informed subsequent improvements.

The workshop combined expert presentations, platform demonstrations, hands-on training activities, sectoral discussions, and policy simulation exercises. This progressive structure enabled participants to move from technical understanding of climate-risk assessment concepts toward the practical application of DryViz in decision-making contexts.

3.4 Participant Evaluation and Learning Outcomes

To assess the effectiveness of the workshop and measure capacity-building outcomes, participants were invited to complete pre- and post-workshop evaluation surveys.

The pre-workshop survey indicated that participants already possessed a relatively strong technical background. Half of the respondents reported a high level of prior knowledge regarding droughts, dry spells, and water-deficit risks, and a similar proportion indicated previous experience using climate-information or visualization tools. Participants also expressed strong interest in expanding their analytical capabilities, learning new forecasting methodologies, and establishing collaborative networks with experts from other APEC economies.

Table 2. Pre-Workshop Assessment Results (n = 8)

Indicator	Result
Total respondents	8
Participants reporting high prior knowledge on dry spells and droughts	4/8 (50%)
Participants familiar with digital visualization tools	4/8 (50%)
Participants considering the topic highly relevant to their role	5/8 (63%)
Participants considering the topic mostly relevant	3/8 (37%)
Participants interested in learning the DryViz platform	6/8 (75%)
Participants interested in networking opportunities	5/8 (63%)

Despite this relatively advanced baseline, post-workshop survey responses demonstrated meaningful learning gains, high levels of satisfaction, and strong interest in maintaining future collaboration activities associated with the DryViz platform.

Table 3. Post-Workshop Evaluation Results and Perceived Learning Outcomes (n = 5)

Evaluation Item	Positive Responses
Workshop objectives were clearly defined	5/5
Project achieved its intended objectives	5/5
Agenda items were relevant	5/5
Technical content was well organized	5/5
Trainers were knowledgeable and well prepared	5/5

Materials distributed were useful	5/5
Training duration was sufficient	5/5
Participants rating the project as highly relevant	5/5
Participants interested in continued collaboration	4/5
Participants identifying opportunities to apply acquired knowledge	5/5

Qualitative feedback further reinforced the positive outcomes of the workshop. Participants highlighted DryViz as a “powerful tool” with potential applications in drought monitoring, policy development, early warning systems, and institutional decision-making. Several respondents emphasized the importance of sustaining collaboration among APEC economies, continuing knowledge-exchange activities, and further enhancing the platform through the incorporation of additional indicators, including ENSO-related information. These observations demonstrate not only the perceived usefulness of the platform but also its potential to support long-term regional cooperation and science-based decision-making processes within the APEC region.

3.5 Science–Policy Integration

One of the distinguishing features of the workshop was its emphasis on connecting scientific information with policy and planning processes.

The practical exercises encouraged participants to translate climate information into actionable decisions related to water security, agricultural adaptation, infrastructure resilience, energy management, and environmental protection.

Through scenario analysis and policy simulation activities, participants explored how forecasting tools can support strategic planning and strengthen preparedness for climate-related risks.

3.6 Platform Validation and User Feedback

Feedback collected during and after the workshop indicated a high level of satisfaction among participants regarding the organization, technical content, and practical activities.
Participants highlighted:

- usefulness of DryViz;
- quality of presentations;
- applicability in decision-making;
- opportunities for collaboration.

The workshop also served as a validation exercise for DryViz under operational conditions. Participants recommended:

- additional spatial layers;
- customized indicators;
- ENSO-related information.

These recommendations were incorporated into subsequent platform developments, including GeoJSON layers, customized climate indicators, and the ongoing implementation of ENSO modules.

The validation process demonstrated the practical applicability of DryViz across different institutional contexts and confirmed its potential to support climate-informed decision-making processes within APEC economies.

3.7 Regional Cooperation and Long-Term Impact

Beyond its technical objectives, the workshop contributed to strengthening collaboration among APEC economies and promoting knowledge exchange across sectors and disciplines.

The event created opportunities for future cooperation, encouraged the adoption of digital climate-risk management tools, and reinforced the role of science-based decision support in addressing climate challenges.

The workshop successfully positioned DryViz as a practical and scalable tool for climate-risk assessment and water-resource management, establishing a foundation for continued collaboration and future capacity-building initiatives across the APEC region.

Beyond the immediate outcomes of the workshop, the collaborative networks established during the event continue to support new research initiatives, technology-transfer opportunities, and interdisciplinary applications of DryViz.

4. PROJECT RESULTS AND IMPACT

4.1 Overview of Project Results

The project successfully achieved its planned objectives and delivered the outputs established in the approved project proposal.

Through the development of the DryViz platform, the implementation of capacity-building activities, and the organization of the international workshop, the project strengthened technical capabilities related to climate-risk assessment, forecasting, and water-resource management among stakeholders from APEC economies.

The project generated technological, institutional, and knowledge-transfer outcomes that contribute to improving preparedness and resilience to climate-related water risks.

Table 4. Achievement of Planned Outputs

Planned Output	Status	Evidence
DryViz digital platform	Completed	Operational web-based platform developed, tested, and demonstrated during the international workshop
User Manual and Technical Documentation	Completed	User Manual and Technical Annex prepared and distributed
International Capacity-Building Workshop	Completed	Two-day workshop conducted on 22–23 January 2026
Practical Training Activities	Completed	Four hands-on exercises successfully implemented
Final Project Report	Completed	Final report prepared for submission to APEC

The supporting materials associated with these outputs, including the technical documentation of DryViz, the user manual, the workshop programme, and the practical training activities, are provided in Annexes A, B, C and D, respectively.

The successful completion of these outputs provided the basis for achieving the project's broader capacity-building and knowledge-transfer objectives.

4.2 Technological Outcomes

The development of DryViz represents the principal technological achievement of the project. Beyond its initial purpose of supporting dry-spell forecasting, the platform evolved into an integrated decision-support environment capable of analyzing multiple hydroclimatic variables, generating forecasts, visualizing climate trends, and supporting evidence-based decision-making.

- Dry-spell and drought analysis;
- Climate monitoring anomaly detection;
- Water-balance assessment;
- Forecasting and trend analysis;
- Interactive geospatial visualization.

The scalability and modular architecture of DryViz facilitate its adaptation to different institutional and sectoral contexts, increasing its potential applicability across APEC economies.

4.3 Capacity-Building Outcomes

The project contributed to strengthening technical capacities among participants through direct engagement with the platform and practical training activities.

Capacity-building outcomes were evidenced through the pre- and post-workshop evaluations presented in Chapter 3. Participants reported meaningful improvements in their understanding of dry-spell analysis, climate-data interpretation, forecasting methodologies, and hydroclimatic risk assessment. Survey responses also demonstrated high levels of satisfaction with the workshop activities and a strong interest in applying the acquired knowledge within their respective institutions.

These findings confirm that the project successfully strengthened technical capacities and facilitated knowledge transfer among participants from different sectors and APEC economies.

4.4 Regional Cooperation and Long-Term Impact

The project strengthened collaboration among stakeholders from different APEC economies and sectors, fostering knowledge exchange and the dissemination of methodologies and best practices related to climate adaptation, water security, and hydroclimatic risk assessment.

The participation of international experts, government representatives, researchers, and private-sector organizations created opportunities for sharing experiences, discussing common challenges, and identifying potential areas for future collaboration. The project also promoted dialogue between scientific and policy communities, contributing to stronger connections between climate-information providers and decision-makers.

These interactions established a foundation for sustained engagement beyond the duration of the project, supporting future interdisciplinary initiatives, collaborative research activities, and sector-specific applications within the APEC region.

Beyond the immediate outcomes achieved during project implementation, the availability of the DryViz platform, combined with the technical capacities strengthened through the workshop activities, provides a basis for continued use, future collaborations, and the expansion of climate-risk assessment capabilities across APEC economies.

The project contributes to:

- Strengthening climate resilience;
- Improving water-risk management;
- Supporting evidence-based policy development;
- Expanding access to climate information;
- Promoting regional scientific cooperation.

These outcomes align closely with APEC priorities related to sustainable development, innovation, climate adaptation, and capacity building, while providing a foundation for the continued evolution and application of DryViz in addressing shared climate-related challenges across the Asia-Pacific region.

5. SUSTAINABILITY AND FUTURE ACTIONS

5.1 Long-Term Sustainability and Continuous Platform Development

The DryViz platform was conceived as a long-term technological asset capable of supporting research, decision-making, capacity building, and innovation activities beyond the duration of the APEC project.

The sustainability of DryViz is supported through a combination of institutional commitment, industry collaboration, competitive research funding, and continuous reinvestment in

technological infrastructure. This approach ensures that the platform remains operational, updated, and capable of responding to emerging challenges associated with climate variability, water security, and climate adaptation.

The research team at Universidad del Desarrollo will continue maintaining and expanding the platform, ensuring the availability of climate information, forecasting tools, and analytical capabilities for researchers, public institutions, private-sector stakeholders, and decision-makers.

An important component of this sustainability model is the continuous technological improvement enabled through projects and initiatives that utilize the platform. As DryViz becomes integrated into new research, innovation, and technology-transfer activities, additional resources are generated to support the enhancement of its infrastructure and analytical capabilities. This creates a virtuous cycle in which new projects directly contribute to the continuous evolution of the platform.

Given the large volume of hydroclimatic information processed and stored by DryViz, ongoing investments in computational infrastructure are essential. Resources associated with new projects contribute to upgrading hardware and software components, expanding data-storage capacity, improving computational performance, and increasing system reliability.

Particular emphasis is placed on strengthening the physical server infrastructure hosted at Universidad del Desarrollo. As new datasets, analytical modules, and users are incorporated, the platform requires additional computational resources to ensure efficient performance and long-term scalability.

This reinvestment model allows DryViz to continuously expand its capabilities while maintaining high standards of performance, accessibility, and reliability for its users.

Future developments will focus on strengthening forecasting capabilities, incorporating new environmental indicators, improving visualization tools, and expanding interoperability with external information systems.

5.2 Technology Transfer, Research and Interdisciplinary Applications

Beyond its direct use as a decision-support tool, DryViz has evolved into a strategic technological infrastructure supporting technology transfer, competitive research initiatives, interdisciplinary collaboration, and evidence-based decision-making processes.

Industry Engagement

One of the principal mechanisms supporting the long-term sustainability of DryViz is its application within productive sectors that are highly exposed to climate variability and water-related risks.

The platform is currently positioned as a strategic tool within collaborative initiatives involving the agro-industrial sector through the cooperation framework established between Universidad del Desarrollo and Chile Alimentos. This collaboration provides opportunities to apply DryViz in areas such as climate-risk assessment, drought monitoring, water-resource management, and adaptation planning for agricultural and food-production systems.

Through these interactions, the platform contributes to improving the resilience of productive sectors while generating valuable feedback for future technological development. The continued engagement of private-sector stakeholders is expected to support the identification of new applications, promote technology adoption, and strengthen links between scientific knowledge and operational decision-making.

Research and Innovation Initiatives

DryViz is currently being incorporated into research proposals and innovation projects submitted to competitive funding programmes, including FONDEF, CORFO, and other national and international funding mechanisms.

Its ability to integrate climate information, forecasting methodologies, geospatial analysis, and visualization tools provides a robust technological foundation for initiatives focused on climate adaptation, water security, sustainability, environmental management, and digital transformation.

The use of DryViz as a supporting asset for new projects contributes to maximizing the long-term value generated by the APEC investment while facilitating the development of new scientific knowledge, technological innovations, and collaborative networks.

Interdisciplinary Applications
An important outcome of the project has been the expansion of DryViz beyond its original scope as a hydroclimatic analysis platform.

The platform has become a collaborative tool supporting interdisciplinary initiatives across different academic units within Universidad del Desarrollo. New collaborations have emerged involving researchers from engineering, environmental sciences, health sciences, governance, public policy, and sustainability-related disciplines.

In particular, DryViz is currently being used as a source of environmental and climate information in projects exploring the interactions between climate variability, environmental conditions, public health, governance systems, and decision-making processes. These initiatives seek to better understand the impacts of climate change on society and to develop evidence-based responses to emerging environmental and health challenges.

This interdisciplinary expansion demonstrates the versatility of the platform and highlights the growing importance of climate information as a cross-cutting component of research, planning, and public policy development.

5.3 Future Development Roadmap
Building upon the experience gained during the APEC project and the feedback received from workshop participants and stakeholders, future development efforts will focus on:

- Incorporating additional climate and environmental indicators;
- Expanding forecasting and predictive modelling capabilities;
- Integrating ENSO-related indicators and climate teleconnection analyses;
- Enhancing geospatial visualization functionalities;
- Improving interoperability with external databases and decision-support systems;
- Developing sector-specific applications for agriculture, water resources, health, governance, and public policy;
- Strengthening user support and training resources;
- Expanding the international user community.

These improvements will increase the applicability of the platform across diverse sectors and contribute to broader adoption of climate-informed decision-making practices.

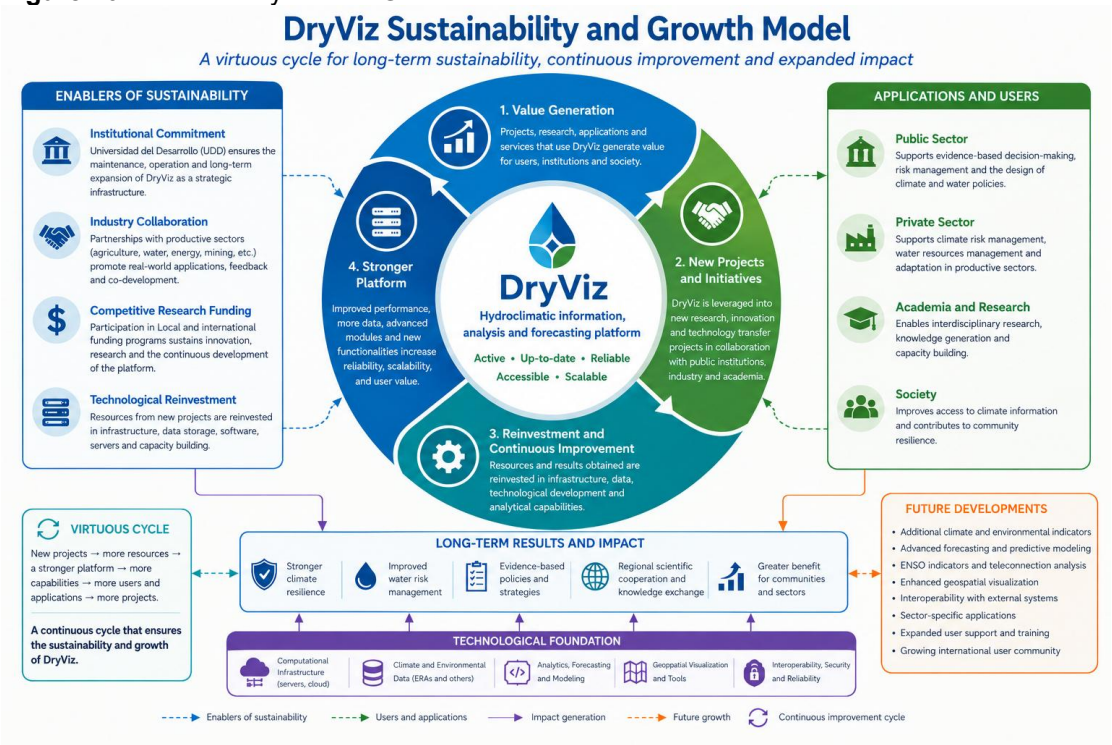
5.4 Future Opportunities for Regional Collaboration
The project established a foundation for continued cooperation among researchers, institutions, public agencies, private-sector organizations, and APEC economies interested in climate adaptation and water-resource management.

Future collaboration opportunities include joint research initiatives, regional capacity-building programmes, collaborative pilot projects, and knowledge-exchange activities focused on climate-risk assessment and forecasting.

The continued evolution of DryViz provides an opportunity to strengthen regional scientific cooperation and facilitate access to climate information and analytical tools capable of supporting resilient and sustainable responses to climate-related challenges across the Asia-Pacific region.

The long-term vision for DryViz is to consolidate its role as a regional platform that supports research, innovation, policy development, and evidence-based decision-making, contributing to the resilience of communities, productive sectors, and institutions facing increasing climate uncertainty.

Figure 10. Platform DryViz and Growth Model



6. CONCLUSIONS

The project *"Collaborative Development of Knowledge Discovery Approaches for Spatio-Temporal Prediction of Dry Spells to Predict Water Deficit Risk"* successfully achieved its objectives and delivered all planned outputs, contributing to the strengthening of climate-risk assessment and water-resource management capacities across APEC economies.

The principal outcome of the project was the successful development and implementation of the DryViz platform, a web-based system that integrates climate information, visualization tools, forecasting methodologies, and analytical capabilities within a single decision-support environment. Through the incorporation of hydroclimatic indicators, geospatial visualization, trend analysis, and forecasting functionalities, the platform provides users with practical tools for understanding and managing climate-related risks associated with dry spells, droughts, heatwaves, and water scarcity.

The project also successfully fulfilled its capacity-building objectives through the organization of the APEC International Workshop *"Spatio-Temporal Prediction of Dry Spells and Water Deficit Risks"*. The workshop enabled the transfer of technical knowledge, promoted direct interaction with the platform, and facilitated the exchange of experiences among representatives from APEC economies, government institutions, academia, and the private sector. The practical activities demonstrated the applicability of the platform across multiple sectors, including water resources, agriculture, energy, mining, and governance.

An important achievement of the project was the successful integration of scientific information with decision-making processes. By combining forecasting tools, climate indicators, and policy-oriented exercises, the project demonstrated how digital technologies can support evidence-based planning and strengthen resilience to climate variability and water-related risks.

Beyond the delivery of its planned outputs, the project generated additional value through the establishment of new collaborative networks and the expansion of DryViz into areas that extend beyond the original scope of the initiative. The platform has evolved into a strategic technological asset supporting research, innovation, technology transfer, and interdisciplinary collaboration. Its application in partnerships with the productive sector, its incorporation into new research proposals, and its use in interdisciplinary projects involving climate, health, governance, and sustainability demonstrate its long-term relevance and potential impact.

The project further contributed to strengthening regional cooperation within the Asia-Pacific region by facilitating knowledge exchange among experts and institutions facing common challenges related to climate change, water security, and sustainable development. The participation of stakeholders from different economies and sectors reinforced the importance of collaborative approaches for addressing increasingly complex environmental challenges.

Looking forward, the continued development of DryViz, together with the collaborative networks established through this project, provides a strong foundation for future innovation, capacity-building activities, and regional cooperation initiatives. The platform is expected to continue evolving through new research projects, partnerships with public and private organizations, and the incorporation of additional analytical and forecasting capabilities.

In conclusion, the project successfully demonstrated how the integration of climate science, digital technologies, and international collaboration can contribute to improving preparedness, strengthening adaptive capacity, and supporting evidence-based decision making in response to climate-related water risks. The outcomes achieved through PPSTI 01 2023 provide a lasting contribution to APEC's goals of promoting innovation, sustainable development, capacity building, and regional cooperation in addressing shared environmental challenges.

7. TECHNICAL SUPPORTING DOCUMENTATION

The APEC project Collaborative Development of Knowledge Discovery Approaches for Spatio-Temporal Prediction of Dry Spell to Predict Water Deficit Risk (PPSTI 01 2023) generated a series of technical documents that provide the methodological, operational, and analytical basis supporting the activities, results, and technological developments presented in this report.

These documents constitute an independent technical documentation package developed as part of the project outputs and are intended to facilitate the understanding, reproducibility, transferability, and potential replication of the methodologies, tools, and capacity-building activities implemented during the project.

The technical documentation is available for download through the DRYSPELL website and is provided in Portable Document Format (PDF). All documents were prepared using LaTeX to ensure consistency in formatting, document reproducibility, and long-term accessibility.

The technical documentation includes:

- **Annex A. Technical documentation of DRYVIZ**
  Comprehensive technical documentation of the DryViz platform, including system architecture, data sources, analytical modules, forecasting capabilities, geospatial functionalities, and implementation details.
- **Annex B. User Manual**
  Technical guidance for navigating and operating the platform, including examples of analytical workflows, visualization options, data extraction procedures, and available user functionalities.
- **Annex C. Workshop Programme**
  Official programme of the international APEC workshop, including session descriptions, invited speakers, agendas, and training activities.
- **Annex D. Description of Practical Activities**
  Methodological documentation of the hands-on exercises conducted during the workshop, including objectives, instructions, sectoral applications, and expected learning outcomes.
- **Annex E. Survey Results**
  Compilation and analysis of the pre-workshop and post-workshop surveys used to assess participant profiles, learning outcomes, satisfaction levels, and participant feedback regarding the DryViz platform and workshop activities.