COMMUNICATION ON ENGAGEMENT (COE)

Period covered by this Communication on Engagement
From 2018 to 2022

Part I. Statement of Continued Support by the Chief Executive or Equivalent

To our stakeholders:

I am pleased to confirm that CIMA Research Foundation reaffirms its support to the United Nations Global Compact and its Ten Principles in the areas of Human Rights, Labour, Environment and Anti-Corruption. This is our Communication on Engagement with the United Nations Global Compact. We welcome feedback on its contents.

In this Communication of Engagement, we describe the actions that our organization has taken to support the UN Global Compact, its principles and also its commitment to the implementation of the 2030 Agenda with its 17 Sustainable Development Goals, as suggested for an organization like ours. We also commit to sharing this information with our stakeholders using our primary channels of communication.

Sincerely yours,

Luca Ferraris

President of CIMA Research Foundation

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Part II. Description of Actions

The scientific research conducted by the Foundation focuses on disaster risk mitigation. Since its inception, CIMA Research Foundation has been dedicated to hydrometeorological risk mitigation, developing mathematical models to improve the forecasting and prevention of flood phenomena, and wildfire forecasting and prevention. Over the years, its areas of research have expanded to include wildfire forest biodiversity conservation, satellite data analysis, risk assessment and damage data analysis. An important branch of the foundation is also dedicated to marine ecosystems. A line of research is also dedicated to regulatory review activities, legal compliance, legal risk analysis in risk management and forensic investigation.

Our research activities are anchored on the principles of the UN Global Compact, and we are committed to contributing to the achievement of the Sustainable Development Goals (SDGs) through our work. In this regard, we would like to highlight our research programs related to capacity development for resilience and climate adaptation, emerging nexus of risk resilience, green deal, and UN Ocean Decade actions, governance, and responsibility in civil protection systems, impact-based early warning systems on climate threats, intelligent data use in a changing climate, multi-risk assessment, and data-informed policies, and technological development in the digital-twin era.

The present climate crises is changing the frequency and the magnitude of natural events, with direct consequences in the development efforts implemented by countries - mainly those with low and medium level economies. Disasters are on the rise, with an increasing number of people being affected and growing economic losses being felt across all sectors. Under this lens, CIMA's multi-disciplinary researchers are investigating growing links between disasters, climate change, social vulnerability, environmental conservation and development performances in low and middle income countries. Such research is leading to the development of technological tools designed to provide wider and longer-term social protection and development benefits.

As CIMA Research Foundation activities are expanding both scientifically and geographically, with implemented and ongoing projects in low and middle income countries in Africa, Asia and South America, an internal concern towards the effective impact of our projects is also

increasing. To this end, research and project's outputs are gradually converging to the global efforts being made towards the implementation of the post - 2015 international agendas: the Paris Agreement, the 2030 Agenda for Sustainable Development and the Sendai Framework for Disaster Risk Reduction. These three agendas collectively provide the foundation for sustainable, low-carbon and resilient development under a changing climate. Considering its relevance to our core activities, CIMA's reseachers more and more give a focus is given to the priorities of the Sendai Framework for Disaster Risk Reduction when they draw up projects and actions.

Our projects are not just about spreading scientific knowledge, but also about applying it to sustainable development. It is just to support this approach; CIMA strongly cares about being part of the UN Sustainable Development Solutions Network (SDSN). Being part of this network is giving us the possibility to accelerate joint learning and promote integrated approaches that address actual worldwide challenges.

In order to provide clear examples of what projects are carried out by CIMA Foundation and to demonstrate the matching of our studies topic with the strategic development goals, some project sheets are attached. From the table below, it can be seen how the efforts are addressed.

Projects Title	Description	SDGs
Promoting climate change adaptation processes through transdisciplinary tools and approaches to engage society: this is the main goal of the AGORA (A Gathering place to cO-design and co-cReate Adaptation	The project that aims to support the European Union's Mission on Adaptation to Climate Change by contributing to the construction of a roadmap for climate change adaptation based on a transdisciplinary approach, promoting citizen and stakeholder participation and engagement in the co-design and co-creation of innovative solutions, in synergy with experts from different sectors, while promoting climate justice and gender equality, as well as increasing adaptive capacity and citizen empowerment to actively support decision-making processes. CIMA Research Foundation is involved in the dissemination of the results and objectives of AGORA, creating synergies with other EU projects dedicated to similar issues. In addition, CIMA will contribute to the review and updating of citizen engagement initiatives and the methodologies employed, elements that will underpin the implementation of Digital Agora. We are also directly involved in the implementation of the latter and one of the two Digital Academies planned within it – specifically, the one dedicated to climate data and risk monitoring.	*SDG 4 – Quality Education; SDG 11 – Sustainable cities and Communities; SDG 13 – Climate Action*
Support to flood and drought risk management in Sudan through Early Warning System Implementation	CIMA Research Foundation will provide technical assistance on several fronts, such as the development of a risk profile for flood and drought, the integration of data collected from monitoring stations installed in 2020-21, the analysis of the regulatory framework for risk management in order to analyze good practices and weaknesses and, finally, support the definition of operational procedures for the warning system and the assessment of the ability to involve voluntary groups in civil protection operations.	*SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities*
ARIMA Strengthen the assessment and mitigation of risk arising from natural phenomena in the Marrakech-Safi region (Morocco) by building a multi-risk platform that allows simulations into	The ARIMA project, aimed to strengthen risk assessment capacities and systematically integrate risk information within planning and decision-making processes. Despite being the third richest region in the country, Marrakech-Safi is particularly exposed to risks such as drought, flooding, and soil erosion. Climate change could further worsen these risks. In particular, experts expect rising temperatures to be accompanied by decreasing precipitation; together, these phenomena could exacerbate the risk of drought in the region. In addition, rising seas could lead to greater coastal erosion. CIMA Research Foundation was responsible for developing modeling for the creation of hazard maps for flood risk.	*SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 5 – Gender Equality; SDG 8 Decent Work and Economic Growth*

Building inclusive resilient communities and schools to face rapid-onset hazards in risk-prone areas in Mozambique affected by cyclone Idai, strengthening the link early warning to early action	The project was aimed to strengthen resilience and risk management capacity in the country's most vulnerable communities, working in particular on Early Warning Systems and coordination mechanisms in the areas affected by Cyclone Idai in 2019. The project focused on the central provinces of Manica and Sofala and especially on the Buzi river basin, whose overflow in 2019 (caused by Cyclone Idai) led to the flooding of a large area and considerable damage. The activities of the project were carried out at both the operational-local and technical-central level. At the local level, the project was aimed to improve resilience by working with communities and with a particular focus on schools, which are both flood vulnerable infrastructures and a strategic node for raising awareness and spreading information among the population. As far as the technical-central component is concerned, the project intended to activate an operational system for flood forecasting, calibrated on local data and based on hydraulic and hydrological models able to work in real time.	*SDG 4 – Quality Education; SDG 11 – Sustainable cities and Communities; SDG 13 – Climate Action*
Definition of the Climate Change Adaptation Strategy for Liguria Region	Between 2020 and 2022, CIMA Research Foundation provided scientific support for the implementation of the Regional Strategy for Adaptation to Climate Change (RSACC) of the Liguria Region, collaborating with the Architecture and Design Department of the University of Genoa and the Service Center for Western Liguria (CENVIS). The objective was to support Liguria region in building the regional climate change adaptation strategy by identifying strategic and priority measures and areas of intervention. CIMA Research Foundation was responsible for analyzing the state of the art of scientific information regarding climate change and adaptation policies already planned and/or implemented by region in regional planning or ad hoc projects. A review of existing climate scenarios for Regione Liguria was then conducted and a climate change scenario to 2038-68.	*SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 5 – Gender Equality; SDG 8 Decent Work and Economic Growth*
Disaster Risk Reduction Capacity Building in Ethiopia: development of an information management system for Early Warning for Forest Fires in Ethiopia	The project, was dedicated to mitigating forest fire impacts by acting on the systems and procedures of forecasting and warning. In the framework of the project, CIMA Research Foundation has been responsible for the adaptation of two open-source technological tools that allow to support local authorities in risk mitigation. During the project, our researchers also conducted technical training and education periods for operators and developed standard procedures to collect information to establish alert thresholds and disseminate EW messages and mitigation measures to be implemented.	*SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 15 – Life on Land*
Flagship Report on Disaster and Climate Change Infrastructure	The project aims to produce a periodic high-level report dedicated to global infrastructure resilience and criticality, which can be supportive and focus attention on risks by policy and research community as well as policy makers. The goal project is promoting the rapid development of resilient infrastructure to meet the imperatives of the Sustainable Development Goals. CIMA Research Foundation is responsible for t the implementation of the first fully probabilistic risk assessment for critical infrastructure) at the global level.	*SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 5 – Gender Equality; SDG 8 Decent Work and Economic Growth*

Support to Bolivia Civil Protection System	CIMA Research Foundation started working in Bolivia in 2012 with a project funded by the Italian Cooperation and managed by Bolivia's FAO division with the aim of implementing an Early Warning System at national level. In the past, in case of extreme events, the army was the only to intervene and only in the post-event phase. Thanks to this project, an awareness operation was carried out throughout the disaster cycle and mainly in the pre-event phase where CIMA Research Foundation has partnered with the Bolivian National Hydro-meteorological Service to reinforce their meteorological forecasting capabilities. In a second phase, a full forecast system has been implemented in four hydrological basins.	*SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 15 – Life on Land*
I-CHANGE	A project to involve citizens and promote their active participation on issues of climate change, sustainable development and environmental protection Funded under the European Horizon 2020 program, the I-CHANGE project addresses the challenge of involving and promoting active participation of citizens on issues of climate change, sustainable development and environmental protection.	*SDG 4 – Quality Education; SDG 11 – Sustainable cities and Communities; SDG 13 – Climate Action*
Integrating Flood and Drought Management and Early Warning for Climate Change Adaptation in the Volta Basin	As part of the project, CIMA Research Foundation was hired by the World Meteorological Organization to evaluate the warning systems of the six countries and to formulate recommendations and a work plan for their improvement. CIMA Research Foundation will also be responsible for the implementation of tan integrated system developed by CIMA for the Italian Civil Protection Department, which allows for the real-time forecasting, monitoring and surveillance of risks of natural origin, so as to make it usable for the areas of interest.	*SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 5 – Gender Equality; SDG 8 Decent Work and Economic Growth*

Sustainability = Coherence

We believe that sustainability is above all coherence based on principles of human dignity, equality, environmental responsibility and economic prosperity. For this reason, our sustainability path started in 2011 from "within": our aim was/is to be sustainable, firsthand, at the microlevel, starting from each one of our human resources for which we have special work conditions and wellbeing programs and with whom we design strategies for further sustainability through non-formal and participatory approaches.

Nowadays, our international profile allows us to be an advocator for sustainable development through science-based information for disaster risk reduction, however, our commitment is to be an actor of change across all levels, never forgetting our People. Since 2011 our Sustainability Strategy was designed to be applied at four main scales: Internal, Local, Regional/National and International.

INTERNAL - LOCAL - NATIONAL - INTERNATIONAL

Internal

Internal sustainability measures includes:

i)   dedicated research programs to better understand the nexus between disasters and development and to improve CIMA's performance internationally,

ii)   anti-corruption administrative procedures for all CIMA suppliers,

iii)   gender policy (Gender Equality Plan approved by board of Directors),

iv)   Code of Ethics,

v)   responsible choice of suppliers and consumables based on ecological standards (FSC paper, vegetable inks, fair-trade and geographic proximity),

vi)   canteen for employees with policies to ensure waste reduction, waste recycling, lower energy consumption geographic proximity of food provided,

vii)   above the average working conditions with dedicated welfare programs,

viii)   Sustainable organized event management, ix)

Local

Dedicated educational programs for local elementary schools on environmental awareness and the dissemination of 2030 Agenda. Programs are designed in collaboration with teachers and tailored for

each age group in line with the curricula activities.

National

Partnership with Regione Liguria (Administrative area of reference with respect to the headquarters of the Foundation) aimed at creating a Regional Hub for the promotion of the 2030 Agenda with local institutions, schools and civil society. CIMA is also partner of Regione Liguria to develop the baseline analysis of a regional climate change adaptation strategy.

International

Partnership with our international partners like UNDRR, WMO, World Bank among others to advocate for Sustainable Development through the implementation of Disaster Risk Reduction measures as promoted by the Sendai Framework for Disaster Risk reduction.

An extract of the three-year programs of the CIMA Foundation is attached. Description of the programs highlights that strategies and actions are aligned with the universal principles on human rights, the environment and the evolution towards the achievement of the Sustainable Development Goals (SDGs).

Our **capacity development** program focuses on building the capacity of local communities, civil society organizations, and government institutions to plan, implement and monitor climate adaptation and disaster risk reduction measures. We believe that strengthening the capacity of local actors is key to achieving sustainable and resilient development.

In the **emerging nexus** program, we examine the linkages between climate change, environmental risks, and socio-economic development. Our aim is to support the transition towards a more sustainable and resilient future by providing evidence-based recommendations on how to manage emerging risks.

Our **governance and responsibility** program focuses on assessing the effectiveness of civil protection systems in responding to disasters and emergencies. We also provide guidance on how to enhance accountability and transparency in disaster risk management.

Our **impact-based early warning system** program seeks to develop innovative and effective early warning systems that can provide timely and accurate information to communities and decision-makers. Our approach is based on the use of impact-based forecasting and risk communication strategies, and is concretely contributing to the EW4ALL UN initiative.

In the **intelligent data use** program, we explore the potential of new data sources and digital technologies to support climate adaptation and disaster risk reduction efforts. We also investigate how to ensure that the use of data is ethical and inclusive.

Our **multi-risk assessment** program aims to provide a comprehensive understanding of the risks faced by communities and ecosystems. We develop risk models that integrate various hazards, including climate change, to support risk-informed decision-making.

Finally, our **technological development** program explores the potential of digital twin technology to support sustainable and resilient development. We investigate how to use digital twins to simulate and optimize the performance of systems and infrastructure under different climate scenarios.

We believe that our research programs align with the objectives of the UN Global Compact and contribute to the achievement of the SDGs. We are committed to sharing our findings and recommendations with stakeholders, including governments, civil society organizations, and the private sector. We look forward to working with the UN Global Compact and other partners to advance sustainable development and build a more resilient future.

Below the match

Programs	SDGs
Capacity Development for Resilience & Climate Adaptation	SDG 4 – Quality Education; SDG 11 – Sustainable cities and Communities; SDG 13 – Climate Action
Emerging Nexus: Risk Resilience, Green Deal & UN Ocean Decade Actions	SDG 13 – Climate Action; SDG 14 – Life Below Water; SDG 15 – Life on Land

Governance & Responsibility in Civil Protection Systems	SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 16 – Peace, Justice and Strong institutions
Impact-based Early Warning Systems on Climate Threats	SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities
Intelligent Data Use in a Changing Climate	SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 5 – Gender Equality
Multi-Risk Assessment & Data-Informed Policies	SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 5 – Gender Equality; SDG 1 – no poverty; SDG 2 – Zero Hunger; SDG 8 Decent Work and Economic Growth
Technological Development in the Digital-Twin Era	SDG 13 – Climate Action; SDG 11 – Sustainable cities and Communities; SDG 8 Decent Work and Economic Growth

Part III. Measurement of Outcomes

Although we are still lacking a proper method to measure and monitor our impacts on the achievement of The Ten Principles and the Global Goals, it is clear that both are intertwined with most of CIMA's research projects, activities and overall mission. Efforts will be made, in the years to come, on the structuring of an effectively methodology to measure the impact of our research and activities, making use of the international reporting standards such as the GRI (Global Reporting Initiative). This will be made possible initially though an external audit process to assure the full compliance with the international standards.

PROGRAMMES

Capacity Development for Resilience & Climate Adaptation

The program aims to develop expertise in risk reduction, increasing resilience and adaptive capacity to climate-related disasters, civil protection, and safeguarding terrestrial and marine ecosystems.

Since its inception in 2007, CIMA Research Foundation has engaged in partnership and consulting activities with foreign countries to share its know-how acquired through years of research. Underlying this commitment was the awareness that it could transmit and adapt to other contexts the capabilities built for the Italian civil protection system, particularly on the system of alerting, forecasting and preventing risks from floods, droughts and forest fires. To this have been added, more recently, the themes of resilience and adaptation to climate change, in synergy, above all, with the Governace & Responsibility in Civil Protection System program.

Building on the experiences already gained in several foreign centers for emergency management, based mainly on the training and implementation of the models and platforms developed by CIMA Research Foundation, the main objective of the program is to structure an advanced capacity development process based on national and cross-national projects and characterized, among other elements, by co-design with the main beneficiaries, verification of the impacts achieved, scientific approach and the presence of an "exit strategy" that allows to consolidate and maintain effective capacities beyond the life of the project.

In addition, projects carried out by the program must have the capacity to accompany in an integrated and seamless manner all the major phases of risk management systems development and the necessary related capacity development. This implies an analysis of the implementation context (from social, scientific-technical, governance, and gender equality perspectives); the use of inclusive and participatory approaches; ongoing training and learning; and, finally, medium- to long-term monitoring of the capacity developed.

Emerging Nexus: Risk Resilience, Green Deal & UN Ocean Decade Actions

Building on the already established excellence in marine and forest ecosystem studies, the program aims to give further impetus to the development of projects that address cross-cutting issues to the challenges of sustainable economic development and climate change.

With regard to the marine environment, the program intends to continue research on marine megafauna in the Mediterranean, strengthening its connections with the cross-cutting themes of risk mitigation and ecosystem protection. Some ongoing research is already positioned in this perspective: this is the case of studies on the impact of ship traffic on cetacean populations, observation and mapping of marine ecosystem biodiversity with innovative technologies (such as satellite tagging, biologging and eDNA) and the role of cetaceans as bioindicators.

Regarding the forest environment, with a view to a close link with fire risk, the program is pursuing projects based on the dual axis of modeling-satellite monitoring (relying on CIMA Research Foundation's RISICO and PROPAGATOR models) of the ignition conditions to investigate the connections between risk reduction strategies and productive management of the forest resource. Initial research on forest biodiversity patterns, which can be analyzed through machine learning techniques, originating from different forest management strategies but clearly impacting fire spread dynamics, is already promising.

The program welcomes within it projects with visible actions and results on the use of Nature Based Solutions in risk reduction and on quantifying the benefits of risk reduction within a broader quantification of ecosystem services. This may open new research fronts on the issues of risk, environmental sustainability and resilience of urban environments. Finally, in synergy with the Multi-Risk Assessment and Data Informed Policies program, the connections between natural hazards and crisis phenomena such as conflict, migration and pandemics are investigated.

Governance & Responsibility in Civil Protection Systems

Civil protection must relate, on the one hand, to a complex social and environmental context characterised by multiple risks and, on the other, to a regulatory framework that is constantly evolving. For CIMA Research Foundation, approaching the subject by means of governance and responsibility means continuing to develop the interdisciplinary study of risks and their assessment and management processes, but it also means opening up to social research and the elaboration and experimentation of innovative forms of governance.

Starting from the analysis of judicial cases regarding legal responsibility, doctrinal studies on liability in civil protection activities and best practices, the programme Governance&Responsibility in Civil Protection Systems contributes to the establishment of a status of "Model Agent – and System – that is able to account for the reasons for its actions. Moreover, the programme aims to develop within CIMA Research Foundation the ability to account and be accountable for collective and individual action, both in the legal and social spheres.

The programme also deals with the issue of climate change adaptation processes, with the aim of identifying innovative governance pathways that can increase the resilience of communities to natural hazards and improve decision-making capacity in a context of increasing uncertainty and large time scales. A challenge in this field is the need to improve the processes of defining adaptation strategies through a better dialogue between scientific knowledge and local territories' development priorities, identifying solutions to bring out the specific knowledge, skills and needs of the communities we will be working with in the near future.

On the basis of the methodologies applied during the studies on legal responsibility carried out on the Civil Protection System, the programme attempts to define an initial framework of the regulatory instruments for adaptation envisaged in the Italian context from the national to the local level, trying to identify recurring patterns of integration between the different administrative levels and, where they exist, the responsibilities assigned to the different actors, comparing the Italian case with other systems at a European level.

Impact-based Early Warning Systems on Climate Threats

Early Warning Systems (EWS) are one of the most effective tools for risk reduction and one of the most urgent measures to be implemented to limit damage to people and property, as the UN Secretary General himself recently explained during the celebration of World Meteorological Day (23 March 2022):

> *Today, one third of the world's people, mainly in least developed countries and small island developing states, are still not covered by early warning systems. This is unacceptable, particularly with climate impacts sure to get even worse. Early warnings and action save lives. To that end, today I announce the United Nations will spearhead new action to ensure every person on Earth is protected by early warning systems within five years*

The idea behind an Early Warning System is based on the ability to identify precursors capable of anticipating the event and its impacts, so that the affected population can be warned and appropriate mitigation actions can be activated. However, the forecasting and monitoring techniques currently in use are based on a few hazard indicators, and rarely provide a quantification of the impacts of the event. However, the forecasting and monitoring techniques currently in use are based on a few hazard indicators, and rarely provide a quantification of the impacts of the event.

The programme aims to develop complete operational chains for real-time observation and forecasting of the main weather-related hazards (floods, forest fires and droughts), starting from meteorological prediction and ending with the quantification of impacts.

With regard to flood risk, the programme refines the tools for two-dimensional hydraulic modelling, expanding them to consider not only flash-floods but also localised flooding events (pluvial flooding). It is also intended to integrate existing nowcasting tools into the forecast chain, possibly adapting them to the need for impact forecasting. The extension of the forecasting chain envisages the characterisation of the exposed areas not only in terms of their vulnerability, so as to allow the economic quantification of losses as well, but also in terms of their functionality, whose unavailability triggers dangerous cascading effects (e.g. food security, displacement, etc).

For forest fire risk, the transition from hazard to risk is tackled: in the forecast phase, by integrating the elements of exposure and vulnerability in the forecast of hazard indices; during the event, starting from the point of ignition through real-time propagation modelling for the delimitation of the potentially affected area.

For the drought risk, a monitoring chain must be completed that correlates the anomaly indices of some hazard parameters with greater precursive capacity with those closest to the impact in the different sectors, starting with agriculture.

Such tools find a natural application not only in the forecasting and monitoring phases, but also in the immediate post-event phase for quantitative damage estimation (early assessment).

CIMA Research Foundation's expertise in real-time sensing (open-source Acronet stations) together with the use of drones and satellite data (detection of burned/flooded areas, estimation of exposure, vulnerability and damage, phenological status, etc.) integrate the modelling chains favouring the promotion and implementation of 'all inclusive' solutions.

Finally, there are plans to extend, albeit experimentally, the range of forecasting (from nowcasting to seasonal forecasting), toward the creation of "seamless prediction systems," to meet the needs of different sectors and users, in addition to civil defense, including the agricultural, hydropower, insurance and transportation sectors.

Intelligent Data Use in a Changing Climate

The program aims to develop a cross-cutting data-centered approach that will complement and reinforce, through specific projects, other programs with more vertical thematic aims. The need to structure a program on this theme stems from the enormous and continuing growth in the availability of data, even from nontraditional sources, which, together with AI techniques, can be used even if not directly concerning the primary variables of interest. In addition, many policies define a new paradigm on the use and sharing of data, which are no longer considered an aid to achieve certain ends but become a goal in their own right.

The program builds on both existing know-how, such as modeling capabilities and process knowledge at a level of spatial detail far beyond that typical of the earth system modeling communities, and know-how of more recent interest to CIMA Research Foundation. These include fundamental AI techniques, particularly machine learning.

The first new field of action to be explored for the characterization of the program is based on the use of techniques that combine AI with data assimilation methodologies (e.g., Deep Data Assimilation), with potential for application both on the topic of impact-based forecasting in real time and on that of multi-hazard profiles with a probabilistic approach. This action may make it possible to solve some critical issues that still prevent the operational use of advanced data assimilation techniques in some elements of the modeling chain or the use of data not directly linked to the main predictive variables. Specifically, the first objectives to be pursued (in part already included in recently activated projects) are the coupling of 4DVAR and Ensemble Kalman Filter techniques; the application of deep neural networks in statistical downscaling to improve the prediction of air quality and wind energy production; the exploration of the topic of selection of observations for data assimilation and feature engineering with deep learning techniques; and, finally, the 'execution of bias corrections for climate scenarios with machine/deep learning techniques.

Multi-Risk Assessment & Data-Informed Policies

The program aims to create knowledge useful in informing policies for managing climate-related risks.

There is an increasing need to quantify risk in a multi-hazard context with quantitative methodologies that remain valid from local to national and global scales. The program aims to expand risk analysis tools to applications that are increasingly shown to be influenced by and related to risk itself, such as food and health security, disaster- and climate change-induced migration, and interactions between natural hazards and conflict. The program will also focus cross-cuttingly on the role of gender disparities in determining exposure and vulnerability to risk and related specific risks related to post-disaster conditions.

The program aims to push projects capable of combining the experience gained in the development of probabilistic risk assessment models, so far mainly focused on capturing the dynamics of hazard factors, with new techniques for dynamically formulating future scenarios that take into account both the interactions between different types of risk and the deeper impacts on social functioning and the evolutionary dynamics of the exposed and their vulnerability.

The methodologies developed and implemented in the program must also combine physically based models with data and information of heterogeneous origin and quality, particularly those obtainable through participatory approaches and direct community involvement, ensuring a knowledge of risk that enhances both scientific information and that derived from direct experience on the ground. In this sense, metrics derived from risk assessments must be linkable to concrete and feasible risk reduction and mitigation measures and, when possible, be articulated in cost-benefit analyses that support stakeholders in evaluating them.

Technological Development in the Digital-Twin Era

The program is concerned with raising the level of CIMA Research Foundation high-tech services already available and creating new ones, so as to create an advanced back-bone for end-to-end solutions, from monitoring networks to platforms for sharing data and modeling results.

Therefore, the program intends to harmonize the work done on the architectures of all platforms, consolidating them in operational use among existing stakeholders, but also increasingly disseminating them. Regarding the more strictly ICT part, the program aims to increase knowledge and capabilities on a variety of fronts, in synergy with the programs Intelligent Data Use in a Changing Climate and Impact-Based Early Warning Systems on Climate Threats programs, by carrying out technology scouting and research on new IT architectures that can respond better and with greater speed and security to the needs of stakeholders in the different projects. In addition, we will pursue research and activities in the area of Artificial Intelligence, starting with the development and training of simple machine learning models that flank physically based models (meteorological and hydrological) to make their data assimilation processes more efficient.

The program also carries forward the Acronet paradigm, which brings together activities aimed at the implementation of technological solutions for local monitoring of environmental parameters, proposing itself as a model for the design, implementation, deployment, and field installation of environmental monitoring systems, based on Open Hardware concepts. In this area, it is intended both to improve the hardware equipment and software systems necessary for measurements and data fruition, and to extend the scope beyond simple monitoring, in order to also allow access to remote environmental monitoring, to all those to whom this is not possible today.

Project support on the monitoring front also includes further development of 'expertise' and specialized solutions in the use of drone-taken imagery and video, particularly for damage estimation from floods, fires and other natural disasters.