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# D5.5-Data Management Plan Document, updated release

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## LIST OF ACRONYMS AND ABBREVIATIONS

Acronym / Abbreviation	Meaning / Full text
API	Application Programming Interface
CA	Consortium Agreement
CAS	Central Authentication Service
CC	Creative Commons
CCLL	Coastal City Living Labs
CSV	Comma-Separated Values
CSW	Catalog Service for the Web
DB	Data Base
DMP	Data Management Plan
Dn.m	Deliverable number
DOI	Digital Object Identifier
EBA	Ecosystem Based Approach
ESRI	Environmental System Research Institute
FAIR	Findable, Accessible, Interoperable, Reusable
FROST	FRaunhofer Opensource Sensor Things
GA	Grant Agreement
GDPR	General Data Protection Regulation
GIS	Geospatial Information System
GML	Geography Markup Language
GRIB	GRIdded Binary
GUI	Graphical User Interface
HTML	HyperText Markup Language
HTTP	HyperText Transfer Protocol
ICT	Information and Communication Technology
INSPIRE	INfrastructure for SPatial InfoRmation in Europe
IPR	Intellectual Property Rights
ISO	International Standards Organization
JSON	JavaScript Object Notation
JWT	JSON Web Tokens
KML	Keyhole Markup Language
MQTT	Message Queuing Telemetry Transport
NetCDF	Network Common Data Form
NIC	Network Interface Card
OGC	Open Geospatial Consortium
PDF	Portable Document Format
RDF	Resource Description Framework
RDMS	Relational Database Management System
SCORE	Smart Control of the climate Resilience in European coastal cities
SDI	Spatial Data Infrastructures
SEP	Standard Ethics Protocol
SIP	SCORE ICT Platform





TIFF	Tagged Image File Format
WCS	Web Coverage Service
WP	Work Package
WPn	Work Package number
XML	eXtensible Markup Language





## BACKGROUND: ABOUT THE SCORE PROJECT

SCORE is a four-year EU-funded project aiming to increase climate resilience in European coastal cities.

The intensification of extreme weather events, coastal erosion and sea-level rise are major challenges to be urgently addressed by European coastal cities. The science behind these disruptive phenomena is complex, and advancing climate resilience requires progress in relevant data at adequate time scales, forecasting techniques, and understanding of the potential risks and impacts for real-scenario interventions. The Ecosystem-Based Approach (EBA) supported by smart technologies has potential to increase climate resilience of European coastal cities. SCORE outlines a co-creation strategy, developed via a network of 10 coastal city 'living labs' (CCLs), to enhance coastal city climate resilience rapidly, equitably, and sustainably through EBAs and sophisticated digital technologies.

The 10 coastal city living labs involved in the project are: Sligo and Dublin, Ireland; Barcelona/Vilanova i la Geltrú, Benidorm and Oarsoaldea, Spain; Oeiras, Portugal; Massa, Italy; Piran, Slovenia; Gdansk, Poland; Samsun, Turkey.

SCORE will establish an integrated coastal zone management framework for strengthening EBA and smart coastal city policies, creating European leadership in coastal city climate change adaptation in line with The Paris Agreement. It will provide innovative platforms to empower stakeholders' deployment of EBAs and smart technologies to increase climate resilience, business opportunities and financial sustainability of coastal cities.

The SCORE interdisciplinary team consists of 28 world-leading organizations from academia, local authorities, RPOs, and SMEs encompassing a wide range of skills including environmental science and policy, climate, ocean, and hydrogeological modelling, citizen and social science, data management, coastal management and engineering, security, and technological aspects of smart sensing research.





## EXECUTIVE SUMMARY

This document is an update of the Initial Data Management Plan of the SCORE project, funded under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003534.

Objective of SCORE is to develop and evaluate solutions based on Ecosystem Based Approaches, Citizen Science, and cutting-edge digital solutions, such as digital twins that equitably and sustainably enhance coastal city climate resilience. A co-design approach will be pursued in the 10 European coastal city living labs (CCLL) set up in the project to devise and demonstrate the SCORE solutions. In implementing its workplan, SCORE will collect and generate data obtained from different sources and it is expected to provide datasets useful for research beyond the project itself. Most of research data will be managed and processed, within the project life, through the SCORE Information System (SIP), although permanent and certified public repositories will be preferred for long-term storage to facilitate the re-use of consolidated datasets.

In this context, the Data Management Plan (DMP), outlining the way that data are collected or generated within the project, how they will be organized, stored, and shared according to the FAIR (Findable, Accessible, Interoperable, Reusable) principles, is a critical element of the project. It specifies which data will be publicly available through public repositories and which will be available only to the consortium (confidential), as far as this is possible, from the project's initial stage. The present document updates the Initial version of the DMP document released at Month 6 as SCORE Deliverable 5.2. The DMP is a living document that must be updated along the project life. As outlined in the GA, the complex structure of the project, the heterogeneity of the living labs, and the complexity of the workplan require frequent updates of the DMP that are consolidated in this deliverable D5.5 and, at the end of the project, in the deliverable D5.6, at project's mid-term and at the end of the project, respectively. The SCORE grant agreement foresees updates with a frequency of 6 months although some updates are not contractual deliverables. One update of the Initial DPM was released at Month 18, following the release of the SCORE ICT Platform (SIP) described in the SCORE deliverable D5.3. The design and implementation of SIP has followed the FAIR concepts drafted in the D5.2. On the other hand, interactions with ICT developers have allowed to specify which solutions and standards are adopted by SIP to follow FAIR guidelines. Since the platform implements the technical solutions required for FAIR management, it is fundamental for the project to adopt FAIR data management procedures. This document presents the mid-project update and is a contractual deliverable. With respect to the previous versions, the present DMP includes a detailed description of research data used by the technical WPs, the description of the "prior notice" procedure to enforcing and monitoring the adoption of FAIR management concepts before uploading datasets to permanent repositories. Finally, drafted are specific strategies to disseminate SCORE datasets with the general SCORE dissemination plan in charge of WP9.

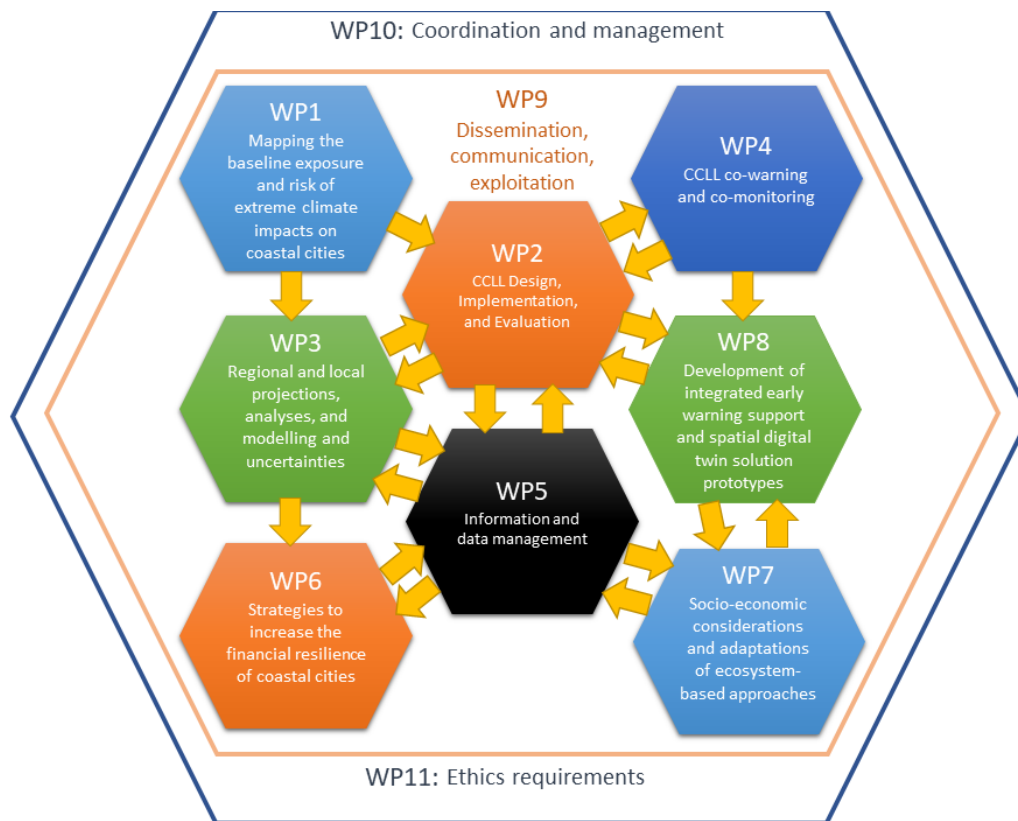
This document is structured following the H2020 DMP template. The *Data Summary* section provides general information about the data usage in the project and its work packages, namely the purpose and sources of data collection/generation in relation to the achievement of project and work packages' goal and the role of SIP. A specific subsection has been added to describe the characteristics of SIP that are relevant to the DMP. The Section on FAIR data describes the general methodologies that the project will follow to ensure that data will be managed according to the FAIR principles and recommended FAIR practices. Next sections explain other aspects, such as the *Allocation of resources* for the management of research data, *Data security* and *Ethical aspects*, the latter being crucial in SCORE because significant living lab activities involve dealing with citizens and stakeholders. The concluding section anticipates forms that will be used to document the datasets to be created and, optionally, retained for archiving in permanent repositories in SCORE.





## LINKS WITH OTHER PROJECT ACTIVITIES

This document updates the initial version of the Data Management Plan released as the deliverable 5.2 of the SCORE project at month 6. The Data Management Plan (DMP) is a key element of good data management, describing the life cycle for the data to be collected, processed and/or generated along the project life and made available to make SCORE research data findable, accessible, interoperable, and re-usable (FAIR). Updating the DMP between the contractual releases is a good practice to ensure proper data management along the project life, which is a critical aspect for success of a large and complex project like SCORE. The work program of SCORE is structured along 11, interconnected work packages as sketched in the *Figure 1* that highlights where general interactions between WPs (Hexagonal tides refer to research work packages).



*Figure 1: SCORE WP structure*

The development and management of the DMP along the project duration is part of Work Package 5 (*Pre/post EBA interventions evidence collection and knowledge marketplace*) that deals with the design, development, and management of a dedicated ICT platform (termed SIP, SCORE ICT platform), which supports all the data and models generated from all the WPs of SCORE, implementing relevant interfaces allowing to collect, store and share the heterogeneous data acquired and processed during the SCORE project. It should be noted that the WP8, whose main objective is to develop Digital Twin (DT) of CCLLs for EBAs co-design and Early Warning Support (EWS) systems, will use such platform as interface to data sources, that can be static data, institutional sensors, and citizen science sensors developed (or recommended) by WP4 to be selected and installed by the CCLLs core teams. It is expected that, in additions, SIP will be suitable to ensure long-term data storage and will therefore represent an efficient tool for sharing knowledge on EBAs. For this reason, it has been designed to implement typical solutions allowing for findability, accessibility, interoperability, and reusability of data, although certified repositories, such as *Zenodo*,







providing DOIs to the datasets uploaded and has a secured a long-term EU support, are recommended for long term deposit of datasets of general interest. To increase the visibility of SCORE products in *Zenodo*, all the datasets, but also publications and software package will refer to a single SCORE community.

Although the Data Management Plan is part of the of WP5, it has connections with all the remaining research WPs that all collect and/or generate data. This release of the DMP, has considered the ongoing and completed SCORE tasks and their associated deliverables. Developing a DMP implies a structured way of thinking about project data (how data are collected, processed and/or generated) and monitoring the implementation of the plan is an important factor for the success of a project.

An important aspect of the DMP is the description of measures that are taken to safeguard and protect sensitive data. To address this issue of relevance is *D11.1- Ethics requirement: Standard Ethical Protocol*, which has established standards to deal with the management of the data gathered from citizens and stakeholders that are involved in the Costal City Living Labs.





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# 1. INTRODUCTION

The intensification of adverse phenomena hitting coastal areas under climate change, such as coastal erosion, sea-level rise, storm surge and intense precipitation could make living near the coast high-risk. Adaptation actions are therefore necessary, but their design and implementation require progress in acquisition of relevant data and forecasting models with the level of detail and timing useful for real-scenario interventions. The 4-years SCORE H2020 project aims to reduce and mitigate the impacts of sea level rise, coastal erosion and extreme weather events related to climate change on European coastal cities and their settlements by means of co-designed, co-developed, deployed, tested, and demonstrated innovative Ecosystem Based Approaches (EBA), smart and digital technologies, while facilitating also financial sustainability, thus enhancing coastal city climate resilience. A co-design approach will be pursued along the 10 European coastal city living labs (CCLL) set up in the project to devise and demonstrate appropriate solutions. In implementing its workplan, SCORE will both collect and generate data making use of data from many different heterogeneous sources and is expected to provide datasets useful for research beyond the project conclusion itself. Most of research data will be managed, within the project life and beyond, through the SCORE ICT Platform (SIP), although permanent public repositories (*Zenodo*, but also Figshare, Dryad, PANGAEA, GitHub, and Bitbucket) can be selected by project partners for facilitating the re-use of consolidated datasets.

In this context, the Data Management Plan (DMP), outlining the way that data are collected or generated within the project, how they will be organized, stored, and shared, is a critical element of the project. It specifies which data will be publicly available through public repositories and which will be available only to the consortium (confidential), as far as this is possible, from the project's initial stage. The DMP also provides motivations when versions or parts of the project research data cannot be openly shared; for SCORE, it is expected that this can occur in relation to third-party copyright issues (in particular, for data collected at Coastal City levels), confidentiality, or personal data protection requirements.

The first audience to which this report is addressed is the internal partnership. SCORE partnership is made of 28 partners and the DMP will support them in considering all the relevant aspects of data management and stewardship, by establishing consistent practices to increase the efficiency and robustness of data handling along the project. The second audience of the different DMP releases is the community of researchers, engineers, practitioners, city planners, policy makers, interested in re-using research data and datasets produced by SCORE.

This document is the update of DMP to be delivered at Month 24 (contractual deliverable D5.5). The complex structure of the project, the heterogeneity of the experimentation sites, requires DMP to be updated, tentatively on a 6-month basis, although the deliverables D5.5 (this document) and D5.6, to be delivered at the end of the project (month 48) respectively. New versions DMPs should reflect changes such as those due to modifications in consortium composition or implementation of new regulations, external factors such as the emergence of new data standards, new releases of external datasets reused by SCORE, and, finally, the inclusion of new data sources and the documentation of new datasets produced by the project. For example, depending on WP, the 10 CCLLs can act as "frontrunners" or "followers", where frontrunners are expected to be the first to experiment solutions (e.g., citizen science sensors to be co-designed along the project) and the followers are expected to adapt and implement solutions following outcomes of activities conducted in frontrunners CCLL. It is therefore expected that "followers" can provide data at a later stage and, consequently, it is expected that the DMP will evolve in time accordingly.





This deliverable is structured according to the H2020 template<sup>1</sup>.

Section 2 (*Data Summary*) provides general information about the data usage in the project, namely the purpose and sources of data collection/generation in relation to the achievement of the project's goal. The description of the initial implementation of SIP is provided along with technical information about data formatting and size. Tables listing the data used by WPs are reported, while a specific subsection explains the strategies to support dissemination of datasets drafted in agreement with the general dissemination strategy in charge of WP9.

The Section 3 (*Fair data*) describes the general methodologies that the project will follow to ensure that data will be managed according to the FAIR principles<sup>2</sup> and recommended FAIR practices<sup>3</sup>, with subsections specifically targeting the basic elements of FAIR principles. A specific section illustrates strategies to monitor the implementation of the FAIR approach by the SCORE project. In this update, specific solutions for FAIR compliancy within the SIP will be described. Subsequent sections will deal with the *Allocation of resources*, *Data security* and *Ethical aspects*, the latter following the ethical principles established for SCORE in the D11.1 deliverable<sup>4</sup>.

Section 4 (*Allocation of resources*) details how project resources are allocated to the management of research data. Following sections deal with the solutions adopted for *Data security* (Section 5), and for compliance with *Ethical aspects* (Section 6) crucial in SCORE because significant project activities involve dealing with citizens and stakeholders. Finally, Section 7 provides a Summary of SCORE research data. For each dataset that is released, relevant information will be provided highlighting specific methods adopted to be compliant with FAIR objectives. It is expected that this section will be enriched with the description of new datasets as the SCORE progresses in implementing its work plan. The template adopted to describe the datasets used by the project is provided in the Section 7.

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<sup>1</sup> [https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management\\_en.htm](https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-data-management/data-management_en.htm)

<sup>2</sup> Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* 3, 160018 (2016). <https://doi.org/10.1038/sdata.2016.18>

<sup>3</sup> *Guidelines on FAIR Data Management in Horizon 2020 (Version 3.0, 26 July 2016)*, [http://ec.europa.eu/research/participants/data/ref/h2020/grants\\_manual/hi/oa\\_pilot/h2020-hi-oa-data-mgt\\_en.pdf](http://ec.europa.eu/research/participants/data/ref/h2020/grants_manual/hi/oa_pilot/h2020-hi-oa-data-mgt_en.pdf)

<sup>4</sup> Gharbia and Hawke, *Ethics requirement: Standard Ethical Protocol, SCORE Deliverable D11.1, 31 august 2021.*







## 2. DATA SUMMARY

The aim of SCORE is to increase climate resilience of European coastal cities, targeting phenomena like the intensification of extreme weather events, coastal erosion, and sea-level rise. SCORE focuses on Ecosystem Based Approach (EBA) supported by smart technologies that have potential to increase climate resilience of European coastal cities. Moreover, SCORE will enable smart instant monitoring and control of the climate resilience in European Coastal Cities through spatial Digital Twin (DT) solution prototypes, to assist local and national governance in effective resilience management. SCORE uses a wide range of inter-disciplinary methods, which includes nature-based solutions, architectural and city planning, and participatory engagement of citizen scientists. The primary project methods are the Life-Cycle Approach and the Coastal City Living Labs formation and implantation. CCLLs are user-centered, open-innovation urban ecosystems, where both public and private partners interact to address different issues. Specifically, CCLLs will be implemented to tackle specific challenges related to sea level rise, coastal erosion and extreme flood events, and the effectiveness of proposed solutions will be assessed by the different agents through innovative monitoring systems, citizen science and cutting-edge numerical modelling. SCORE will develop a CCLL network in 10 cities located in 8 different countries namely Sligo and Dublin, Ireland; Barcelona/Vilanova i la Geltrú, Benidorm and Oarsoaldea, Spain; Oeiras, Portugal; Massa, Italy; Piran, Slovenia; Gdansk, Poland; Samsun, Turkey. They will establish a network of cities learning from one another so that one city (“frontrunner”) can mentor other cities (“follower”) for specific actions. At the same time, a CCLL acting as frontrunner for a specific application can mentor other cities for other actions.

The SCORE work plan is developed through 11 Work Packages over a 48-month period built around an iterative approach, where the next steps are defined by and based on the feedback of involved (end-)users and stakeholders. The Life-Cycle method (Iterative Approach) drives the overall SCORE project, from: a) Ideation and Exploration, b) Co-Creation and Co-Design, c) Real-Life Experiment and Testing, d) Evaluation and validation by end users and stakeholders. In the Living Lab approach, the next steps in a project are defined by and based on the feedback of involved (end-) users and stakeholders in each CCLL. To reach their objectives, all the research WPs use data that can be originated by external data sources generating other data that, in turn, can be used by other WPs. The section 2.1 describes in detail the use of data across research WPs, facilitated by the SCORE ICT Platform (SIP) which was designed to acts as marketplace of whatever concerns pre/post-EBA interventions evidence collection and knowledge. Tables indicates the origin of data, and their licensing, and the fact that they can be made available to SCORE partners trough a restricted access through SIP: Alternatively, they can be downloaded to partners’ platform according to licensing restrictions and can be used for development purposes.

### 2.1. Origin and purpose of data

This subsection provides an overview of the origin and purpose of the data collected/generated and used by each research WPs. The role of WP5 in facilitating the flux of data through the development and management of SIP will be finally described. Considering the work plan of SCORE, based on co-design activities carried out at CCLLs level, this collection of data at CCLLs can be considered a continuous activity undergoing a rolling review. At project’s mid-term, however, some source datasets have been clarified.





## WP1: Mapping the baseline exposure and risk of extreme climate impacts on coastal cities

Based on literature, climate data, models, and information obtained from each CCLL, WP1 maps the baseline exposure and risks of climate change impacts on Coastal Cities. Global, European, national, and regional hazard datasets will be used along with local data concerning critical infrastructures, public residential commercial assets, and human exposure. This baseline risk will be defined as the integration of hazard, exposure, and vulnerability under existing climatic conditions. The final output will be the mapping of vulnerability, exposure, and hazard, which together can provide stakeholders with an initial understanding of the baseline. Such maps will help identify risk hot spots across the various CCLLs, which will be further investigated using quantitative risk approaches in WP6. Table 1 summarizes the main characteristics of data sources used by WP1.

*Table 1 - Summary of data sources used by WP 1*

Data source	Website	Data owner/author	Licensing
WorldPop	<a href="https://www.worldpop.org">https://www.worldpop.org</a>	University of Southampton	CC BY 4.0
Urban Atlas 2012 / CORINE Land Cover Urban Atlas 2012	<a href="https://land.copernicus.eu/">https://land.copernicus.eu/</a>	Copernicus Programme	© European Union, Copernicus Land Monitoring Service 2022, European Environment Agency (EEA)
Pan-European landslide susceptibility mapping: ELSUS Version 2	See: <a href="https://doi.org/10.1080/17445647.2018.1432511">https://doi.org/10.1080/17445647.2018.1432511</a>	European Soil Bureau Network,	European Soil Boureau joint with the European Commission
River flood hazard maps for Europe and the Mediterranean Basin region	<a href="https://doi.org/10.2905/1D128B6C-A4EE-4858-9E34-6210707F3C81">https://doi.org/10.2905/1D128B6C-A4EE-4858-9E34-6210707F3C81</a>	Dottori, F., Alfieri, L. Bianchi, A., Skoien, J., Salamon, P.	<a href="https://data.jrc.ec.europa.eu/access-rights/no-limitations">https://data.jrc.ec.europa.eu/access-rights/no-limitations</a>
Daily dataset of 20th-century surface air temperature and precipitation series for the European Climate Assessment.	<a href="http://eca.knmi.nl/ensembles">http://eca.knmi.nl/ensembles</a>	Tank et al.	N.A.
EuroSION Database	<a href="http://www.euroSION.org/databases/index.html">http://www.euroSION.org/databases/index.html</a>	<a href="http://www.euroSION.org">http://www.euroSION.org</a>	N.A.
EU-DEM	<a href="https://land.copernicus.eu/image/ry-in-situ/eu-dem/eu-dem-v1.1">https://land.copernicus.eu/image/ry-in-situ/eu-dem/eu-dem-v1.1</a>	(Copernicus Land Monitoring Service)	© European Union, Copernicus Land Monitoring Service 2022, European Environment Agency (EEA)
Merit DEM:	<a href="http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/">http://hydro.iis.u-tokyo.ac.jp/~yamadai/MERIT_DEM/</a>	Dai Yamazaki	CC-BY-NC 4.0

## WP2: CCLL Design, Implementation, and Evaluation

WP2 acts as the focal point for all SCORE activities as it will manage and structure the CCLLs design, implementation, and evaluation activities. CCLLs, supported by SCORE partners, follow a user-centric paradigm, allow academia, public actors, private actors, and civil groups to play a relevant and appropriate role in the different phases of the project. In a co-creation process, these parties are stimulated to interact on equal footing, ensuring collaboration within all the CCLL life cycle including all the co-design activities related to EBA and Citizen science. The set-up of CCLLs has taken place during the first 12 months of the project following an enrolment procedure that requires signing a





Consent Form after receiving the Information Sheet and a briefing informative meeting/workshop about the project. Being WP2 results based on input from citizen volunteers, this information will be anonymised (or at least referred to by the name of the CCLL) before its upload on the SCORE information system (and later as collected dataset uploaded to a permanent repository) to be used by project partners, avoiding the disclosure of identity and insufficient protection of participants private information. Non-anonymized data will not be shared neither within SCORE partnership nor with the public unless an explicit permission is given by CCLLs. In general uploading of such identifiable information to the portal is only possible with explicit consent of the participant and SCORE Ethical Committee approval<sup>5</sup>.

CCLLs has been also the primary mean for identifying data that are locally relevant and available, for example, for WP8 in developing CCLLs tailored DT-EWS systems. Preliminary surveys have identified cartographic information available and sources for oceanic, meteorological, and hydrological observations and models, that typically are weather and environmental protection agencies, and other sources of data that can be used at evaluation stage, such as aerial photographs. Such process is still ongoing, and data selected CCLLs and used by WPs are listed in the tables concerning each WPs. Now, CCLLs, under guidance of WP2 and WP5 are involved in the creation of *Geostories* part of the SIP that will use SIP stored information, and this is supposed also to be promote FAIR data management at CCLLs.

### **WP3: Regional and Local Projections, Analyses, Modelling and Uncertainties**

WP3 will build on previous initiatives to produce reliable dataset of climate and sea level projections downscaled<sup>6</sup> to the high temporal and spatial resolution applicable to all CCLLs. Selection criteria and procedures to identify projection data are described in detail in deliverables D3.1 and D3.2<sup>7</sup> delivered in month 6. In general, data for this task are time series, remote sensing data, short term forecast, climatic projections related to the impact of climate change on coastal cities in terms of *i)* sea levels, *ii)* coastal waves, *iii)* wind and precipitation extremes, *iv)* sea temperatures, *v)* river level extremes. Also, data and models available at each CCLLs will be used. From a practical point of view, data gathered from different climate services (e.g., Copernicus Climate Service CCS, Copernicus Marine Service CMEMS, EURO and MED CORDEX) have been considered, although for implementation, CORDEX<sup>8</sup> has been taken as the main data source (see Table 2). The data retrieved from identified service will be analyzed and downscaled by means of ready-to-use tools and models to be used for local-scale impact assessment (Task 3.2) and then will be analyzed and processed in Task 3.3 for the implementation of statistical analysis tools for local urban-

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<sup>5</sup> Gharbia and Mckenzie, *Ethics requirement: Standard Ethical Protocol, SCORE Deliverable D11.1, 31 august 2021. So far, three activities have requested and obtained approval from the Ethical committee, subject to several condition.*

<sup>6</sup> LAMMA, *Package of downscaling analysis tools, SCORE Deliverable D3.3, 30 December 2022, ATU, User document for the statistical downscaling analysis tools and data, SCORE Deliverable D3.4, 30 December 2022*

<sup>7</sup> Paranunzio, Anton, Ahmed, *Package of procedures for baseline characterization SCORE Deliverable D3.1, 31 December 2021; Anton, Paranunzio, Ahmed, Data usage document for the Reference datasets for baseline characterization and projections, SCORE Deliverable D3.2, 31 December 2021*

<sup>8</sup> Following CORDEX nodes have been considered in particular [ <https://esgf-data.dkrz.de/search/cordex-dkrz/> ], [ <https://esgf-index1.ceda.ac.uk/search/cordex-ceda/> ], [ <https://esg-dn1.nsc.liu.se/search/cordex/> ], [ <https://esgf-node.ipsl.upmc.fr/search/cordex-ipsl/> ]





scale hazards and long-term evolution of the coastline modelling (Task 3.5)<sup>9</sup>. Data from Task 3.1 and subsequent will be finally exploited in the testing phase (Task 3.6) in which citizen science data, institutional network of sensors and data from satellites for Earth surface observation will be used for validation under appropriate licenses.

*Table 2 - Summary of data sources used by WP 3*

Data source	Website	Data owner/author	Licensing
CORDEX	<a href="https://www.euro-cordex.net/index.php/en">https://www.euro-cordex.net/index.php/en</a>	World Climate Research Programme's Working Group on Regional Climate (WRCP)	<a href="#">CORDEX license</a>
European Digital Elevation Model (EU-DEM), version 1.1	<a href="https://land.copernicus.eu/image-ry-in-situ/eu-dem/eu-dem-v1.1/view">https://land.copernicus.eu/image-ry-in-situ/eu-dem/eu-dem-v1.1/view</a>	European Union (European Environment Agency (EEA) under the framework of the Copernicus programme)	Free and open access policy as defined in the European Union's Copernicus regulation (N° 377/2014 of 3 April 2014) and Commission Delegated Regulation (N° 1159/2013)
Leaf Area Index	<a href="https://land.copernicus.eu/global/products/LAI">https://land.copernicus.eu/global/products/LAI</a>	European Union (Copernicus Land Monitoring Service)	Free and open access policy as defined in the European Union's Copernicus regulation (N° 377/2014 of 3 April 2014) and Commission Delegated Regulation (N° 1159/2013)
Land Cover	<a href="https://land.copernicus.eu/global/products/lc">https://land.copernicus.eu/global/products/lc</a>	European Union (Copernicus Land Monitoring Service)	Free and open access policy as defined in the European Union's Copernicus regulation (N° 377/2014 of 3 April 2014) and Commission Delegated Regulation (N° 1159/2013)

#### WP4: CCLL co-warning and co-monitoring

WP4 aims at leveraging citizen science and participatory GIS activities to collect data to complement institutional data and models for the SCORE early warning system and for the assessment of CCLLs' EBAs. WP4 aims at empowering citizens with low-cost sensors for citizen science activities, some of which will be developed along the project through dedicated events like DIY activities in schools or hackathons and raising their awareness on the topic of EBAs. Recruitment of volunteer citizen scientists will take place in the first 12 months of the project following the Ethics guidelines already summarized for WP2. Citizen science sensors are also expected also to fill gaps left by institutional sensors in terms of space and time resolution. The resulting citizen science sensor network will be complemented with institutional environmental monitoring networks or remote sensing retrievals available at CCLLs that will also be used to validate data coming from low-cost sensors. Citizens will be directly involved in design (e.g.,

<sup>9</sup> Brandini, Ortolani, Caparrini; Cucco; Taddei, Perna, Bendonì; Baia, Anton, Gharbia, User document for the downscaling analysis tools and data, SCORE Deliverable 3.4, 30 June 2023; Anton, Sudha-Rani Nalakurthi, Paranunzio, Bendonì. Caparrini, Ortolani, Brandini, Messeri Vallorani, Package for the statistical analysis tools for urban-scale hazards, SCORE Deliverable 3.5, 30 June 2023







through hackathon events), implementation and operation of sensor networks and will be able to monitor in real-time data collected by the network. Some aspects of citizen science will raise ethical issues that will be treated according to the requirements described in D11.1. For example, it is likely that the citizen sensor network will provide in situ data that would require the location of the sensor with a certain degree of accuracy. Sensor data collected in form of images (e.g., webcams or photos of seashore collected by citizens for monitoring waves and sea level) will need to be anonymized. A catalogue of sensors has been produced and can be accessed via authentication <sup>10</sup> and the process of selection is ongoing at forerunner CCLLs <sup>11</sup>.

Once in place, sensor data will be managed through SIP, where the data will be stored and used to monitor each CCLLs geophysical parameter of interest, associated with metadata that must include information on data processing and data quality, through the FROST protocol (see section 2.3).

### WP6: Strategies to increase the financial resilience of coastal cities

WP6 will build upon the data and knowledge produced in other WPs to assess the efficiency of the EBA interventions and to develop risk assessment tools. Among the results, along with the financial guidelines, there will be an assessment of the residual risk, i.e., the risk the CCLLs still face after infrastructural improvements and EBAs, measured through a set of risk indicators assessing economic, environmental, and human risk. This WP will be largely based on outcomes delivered from the datasets generated by WP1, WP2, and WP3 and made available through the SCORE information system. A financial categorization will be conducted to identify the different situations each CCLL finds itself in terms of risk management (whether a CCLL is subject to a low-frequency high-loss risk and should therefore look for risk transfer schemes or if the risk is mostly high-frequency low-loss and therefore it should preferentially be managed internally). Within this task's framework, data, including financial data, will be collected from the CCLLs through specific workshops managed by WP2 (Task 2.3). Relevant outputs will be in the form of georeferenced maps handled through the SIP. Table 3 lists the data used by WP6.

*Table 3 - Summary of data sources used by WP 6*

Data source	Website	Data owner/author	Licensing
CORDEX	<a href="https://www.euro-cordex.net/index.php.en">https://www.euro-cordex.net/index.php.en</a>	World Climate Research Programme's Working Group on Regional Climate (WRCP)	<a href="#">CORDEX license</a>
WorldPop	<a href="https://www.worldpop.org">https://www.worldpop.org</a>	University of Southampton	CC BY 4.0
Eurostat	<a href="https://ec.europa.eu/eurostat/databrowser//DEMO_R_PJANIND3/default">https://ec.europa.eu/eurostat/databrowser//DEMO_R_PJANIND3/default</a>	European Union	Eurostat copyright notice and free re-use of data policy
ESRM20	<a href="https://gitlab.seismo.ethz.ch/efehr/esrm20_exposure">https://gitlab.seismo.ethz.ch/efehr/esrm20_exposure</a>	Crowley et al.	CC BY 4.0
CORINE Land Cover	<a href="https://land.copernicus.eu/pan-european/corine-land-">https://land.copernicus.eu/pan-european/corine-land-</a>	European Environment Agency	Copernicus data and information policy

<sup>10</sup> <https://sensors.score-eu-project.eu/#/>; *catalogue of low-cost sensors.xlsx* (Registration is required)

<sup>11</sup> S. Crowley, C. Cocco, F. Pilla, *Citizen science DIY framework Score Deliverable D4.3*





	cover/clc2018		
OpenStreetMap	<a href="https://www.openstreetmap.org/">https://www.openstreetmap.org/</a>	OpenStreetMap contributors	Open Data Commons Open Database License (ODbL)
JRC/EFAS	<a href="https://data.jrc.ec.europa.eu/dataset/1d128b6c-a4ee-4858-9e34-6210707f3c81">https://data.jrc.ec.europa.eu/dataset/1d128b6c-a4ee-4858-9e34-6210707f3c81</a>	Dottori et al.	European Commission reuse policy
Aqueduct	<a href="https://www.wri.org/data/aqueduct-floods-hazard-maps">https://www.wri.org/data/aqueduct-floods-hazard-maps</a>	Ward et al.	CC BY 4.0
GPEX	<a href="https://data.4tu.nl/datasets/9c547b34-f9d0-410c-be38-f0bdb46318cf/4">https://data.4tu.nl/datasets/9c547b34-f9d0-410c-be38-f0bdb46318cf/4</a>	Gründemann et al.	CC BY 4.0
ELSUS	<a href="https://esdac.jrc.ec.europa.eu/content/european-landslide-susceptibility-map-elsus-v2">https://esdac.jrc.ec.europa.eu/content/european-landslide-susceptibility-map-elsus-v2</a>	Wilde et al.	n/a
LHASA	<a href="https://gpm.nasa.gov/landslides/projects.html#LHASA">https://gpm.nasa.gov/landslides/projects.html#LHASA</a>	Stanley and Kirschbaum	n/a
ERA5-HEAT	<a href="https://cds.climate.copernicus.eu/cdsapp#!/dataset/derived-utci-historical">https://cds.climate.copernicus.eu/cdsapp#!/dataset/derived-utci-historical</a>	Di Napoli et al.	Copernicus products use license
EUROSION	<a href="https://www.eea.europa.eu/data-and-maps/data/geomorphology-geology-erosion-trends-and-coastal-defence-works">https://www.eea.europa.eu/data-and-maps/data/geomorphology-geology-erosion-trends-and-coastal-defence-works</a>	Directorate-General for Environment (DG ENV)	n/a
GEOscopio	<a href="https://www.regione.toscana.it/-/geoscopio">https://www.regione.toscana.it/-/geoscopio</a>	Regione Toscana	CC BY 4.0
Spatial Data Infrastructure of Gipuzkoa	<a href="https://b5m.gipuzkoa.eus/web5000/en">https://b5m.gipuzkoa.eus/web5000/en</a>	Gipuzkoa Provincial Council	CC BY-SA 4.0
INSPIRE Services of Cadastral Cartography	<a href="http://www.catastro.minhap.gob.es/webinspire/index_eng.html">http://www.catastro.minhap.gob.es/webinspire/index_eng.html</a>	General Directorate of Cadastre of Spain	License of access and use of INSPIRE datasets and services of the Directorate General for Cadastre

## WP7: Socio-economic assessment of adaptation strategies and policy recommendations

WP7 will focus on the socio-economic assessment of EBA interventions in the CCLLs, and the formulation in documents of policy recommendations to assist decision making in climate change adaptation of coastal cities at local, national, and EU levels. WP7 makes use of the outcomes from WP1, WP2, WP3, and of WP6 to evaluate the EBAs and other types of interventions, to evaluate CCLL climate resilience and formulate adaptation strategies and policy recommendations. WP7's main sources of information until the current period of the project are described as follows. Task 7.1 (Analysis of socio-economic assessment methods, databases, and studies addressing EBA and other adaptation strategies; M1-M8) performed a systematic literature review followed PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analysis) 2020 methodology<sup>12</sup>. The literature search performed in this task was applied to the following databases: Web of Science (WoS)<sup>13</sup>; Scopus<sup>14</sup>; Zenodo<sup>15</sup>; the European Climate

<sup>12</sup> <https://www.prisma-statement.org/>.

<sup>13</sup> <http://www.webofscience.com>.

<sup>14</sup> <https://www.scopus.com/home.uri>.

<sup>15</sup> <https://zenodo.org/>.





Adaptation Platform Climate-ADAPT<sup>16</sup>; and the Community Research and Development Information Service (CORDIS)<sup>17</sup>. The full list of selected studies from the previous databased is available in Deliverable 7.1. Another relevant source of information for the development of this task was the inventory of ecosystem services is the Common International Classification of Ecosystem Services (CICES)<sup>18</sup>. Task 7.2 (Development of a framework for the socio-economic assessment of adaptation measures to climate change; M5-M12) relied mostly on the technical and scientific studies analyzed in the previous task, and with less relevance on CICES. Ongoing Tasks 7.3 (Participatory socio-economic assessment of EBA interventions) and 7.4 (Expert-based socio-economic assessment of EBA interventions), both framed within the period M13-M42, have been developed so far with the support of technical and scientific literature selected in Task 7.1 as well as new references associated with multi-criteria and cost-benefit analyses.

### WP8: Development of integrated early warning support and spatial digital twin solution prototypes

WP8 develops GIS-based DT and Early Warning Support (EWS) Systems that will be built with a dual objective: a) to provide a virtual environment in which different climate change scenarios and actions can be visualized and optimum solutions identified and b) to support early warning related to adverse conditions. Data needed for digital twin solutions will be available by means of SIP and include the baseline and climate projection models (WP1, WP3) properly downscaled, risk assessment tools (WP6) and information and models available from CCLLs. In fact, it is expected that DT can use resources available at each CCLLs, made available through SIP interfaces. Such resources include data (especially in terms of geographic information, risk and vulnerability maps where exist), models (weather, hydrological, hydraulic, wind and wave models), and sensor networks monitoring the geophysical parameters of interest. The release of the prototypes is expected by Month 26, although some data have been used for the development phase Table 4.

*Table 4 - Summary of data sources used by WP 8*

Data source	Website	Data owner/author	Licensing
WorldPop	<a href="https://www.worldpop.org">https://www.worldpop.org</a>	University of Southampton	CC BY 4.0
Geoscopio Web Portal (Cartoteca Regione Toscana)	<a href="http://www502.regione.toscana.it/geoscopio/cartoteca.html#">http://www502.regione.toscana.it/geoscopio/cartoteca.html#</a>	Regione Toscana	CC BY 3.0 Italia License
Web site of Northern Apennines District Basin Authority (Autorità di bacino distrettuale dell'Appennino Settentrionale)	<a href="https://geodataserver.appenninosetentrionale.it/portal/apps/webappviewer/index.html?id=5df4e2dc9f79431ea89eef064912c45a">https://geodataserver.appenninosetentrionale.it/portal/apps/webappviewer/index.html?id=5df4e2dc9f79431ea89eef064912c45a</a>	Autorità di bacino distrettuale dell'Appennino Settentrionale	Open
Website of Tuscany Regional Hydrological Service (Servizio Idrologico)	<a href="http://www.sir.toscana.it/consistenzarete">http://www.sir.toscana.it/consistenzarete</a>	Regione Toscana	Open

<sup>16</sup> <https://climate-adapt.eea.europa.eu/>.

<sup>17</sup> <https://cordis.europa.eu/es>.

<sup>18</sup> <https://cices.eu/>. <https://climate-adapt.eea.europa.eu/>.

<sup>18</sup> <https://cordis.europa.eu/es>.

<sup>18</sup> <https://cices.eu/>.





Regionale – SIR)			
Portale Comuni	<a href="http://map.portalecomuni.net/mapguide/wgis/ddd.html?Cfg=f094d6e2-7235-4d71-a077-c8ca9a3fbc67">http://map.portalecomuni.net/mapguide/wgis/ddd.html?Cfg=f094d6e2-7235-4d71-a077-c8ca9a3fbc67</a>	Agenzia delle Entrate	Open

### WP5: Pre/post-EBA Interventions Evidence Collection and Knowledge Marketplace

While along the project duration, a SharePoint<sup>19</sup> site will be used as the online working and collaboration platform, accessible to project participants for the management of administrative, and technical management of the project, the overall management of research data flux through life of the project is expected to be carried out by dealing with the systematic collection and management of the data collected, processed in the different WPs during the SCORE project and shared within SCORE partners to eventually play the role of marketplace for knowledge and evidence collection for EBA intervention.

To this purpose, a SCORE ICT Platform (SIP) (<https://platform.score-eu-project.eu/#/>) has been developed and complemented by an Application Programming Interface (API) middleware allowing interfacing between the SCORE databases and existing sources. The SCORE ICT platform shall:

- i) Provide unified access to climate service data and products generated from them by the SCORE WPs.
- ii) Facilitate the access to data resources available at CCLLs.
- iii) Collect, store and share with other WPs data acquired from both SCORE sensors and Citizen Science kits.
- iv) Store and share the models generated in SCORE WPs and the knowledge about EBA efficacy against extreme events, sea level rise and coastal erosion risks.
- v) Ensuring data storage during the project funded life and, hopefully, beyond it, to make the SIP an efficient tool for sharing knowledge on EBAs (it should be noted that although the feature of assigning a DOI is not included so far in the SIP, it provides a DOI metadata field)<sup>20</sup>.

The flux of data between external sources and SCORE, facilitated through the SIP is shown in *Figure 2* where the role of interface to heterogeneous input data (reused or collected) is highlighted. SCORE formatted data (in red and blue solid arrows) will be treated according to standards and methods highlighted in Section 3 (Fair data).

<sup>19</sup> <https://atlantictu.sharepoint.com/sites/SCORE-H2020/>

<sup>20</sup> Note that an automated mechanism to generate DOIs would require the integration with a third-party service, like the one offered to DataCite members which is not foreseen at the moment.





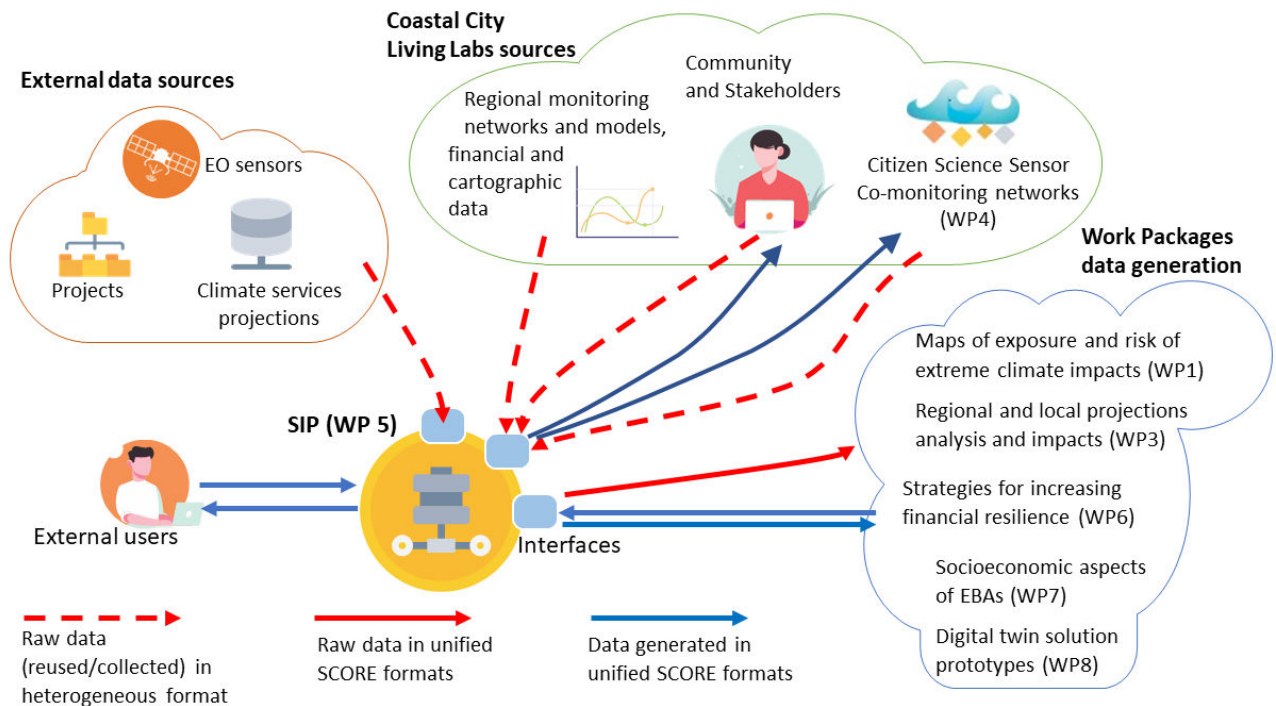


Figure 2: Flow of data managed through the SCORE Information System (SIP).

As highlighted by the previous description and by Figure 2 as well, SCORE work packages will make use of different and heterogeneous external sources of data, to achieve their goals, which has been summarized in the initial version of DMP be summarized as:

- a) **Climate service data:** Most of them will be collected through the Copernicus Climate Data store. SIP will facilitate the access although they can be downloaded by single partners to carry out their research. SIP, instead, will manage downscaled data and other data generated by SCORE WPs based on climate service data. Such data include also land coverage services, DEMs and other datasets.
- b) **Earth observation data and global observation systems:** Satellite data will be collected from different data providers (Eumetsat, Copernicus, NASA, Italian Space Agency). Typically, such data, that can be obtained with different levels of processing applied by the data providers, are of property of data providers and will be stored and shared at SIP only when necessary and will not be provided outside of partnership. They will be used at least in WP3 and WP8.
- c) **Citizen Science Data:** Sensors deployed at CCLLs within WP4 will be interfaced to SIP for further processing and use in other SCORE WP, such as the WP8, where they will represent current environmental condition in Digital Twin.
- d) **Data available at CCLLs**
  - a. **Observational data:** at each CCLL, data from institutional observations network, typically managed by weather services or Environmental agencies are available to relevant authorities. Not necessarily these data are open and therefore will be used in SCORE after specific agreements with data provider and will not be shared outside the consortium. Typically, they are in situ measurements in the form of time series, although imaging sensors can be used for example, for precipitation mappings usually made available in HDF5 or GRIB formats. Such data will be used in the project according to the policy



of the data providers that usually do not include the possibility of sharing outside the consortium. They will be used mainly in WP3, WP8, and WP4.

- b. Output of weather, hydrological, hydraulic, and marine models are available at CCLs at least to allow authorities to perform their planning and emergency management duties. Output of such models (if not the models themselves) will be necessary for the “early warning support” module of WP8. Models will be used in SCORE after specific agreements with data provider and will not be shared outside the consortium.
- c. High resolution cartographic data: such data are necessary for exposure and vulnerability studies (WP1, WP6, WP7) and digital twin (WP8).
- d. Financial data. Obtained from WP2 and WP6, to be used in WP6.

These general concepts are still valid as confirmed by the tables on data origin in Section 13.

Based on these sources and through WP activities, SCORE is expected generate higher level datasets which will be considered SCORE products. The partners (or the partner) that have contributed to each product will be considered as shared owners of the products. The different formats used are summarized in Table 5 - Summary of data formats, where those used in internal data processing are separated from those adopted for facilitating re-use through deposit in permanent repositories.

*Table 5 - Summary of data formats*

Type of data	Formats used during data processing and in SIP	Formats for sharing reuse and preservation
Numerical or \textual tabular data	Microsoft Excel (.xls/.xlsx)	Comma-separated values (.csv)
Qualitative textual data	Microsoft Word (.doc/.docx)	Rich Text Format (.rtf) or text (.txt)
Audio data	mp3 format (.mp3)	Typically, they are destroyed after transcription
Video data	mpg format (.mp4)	Video are destroyed unless they are used to detect environmental features. Mpg will be used in this case
Raster data	Hdf5, NetCDF 4, GeoTiff	Hdf5, NetCDF 4, GeoTiff
Vector data	ESRI shapefile, DBF, GeoJSON, KML	ESRI shapefile, DBF, GeoJSON, KML
Images	png, jpeg	png, jpeg
Software code	m, py, r	py, r

## 2.2. Data utility

The aim of SCORE is to increase climate resilience in European coastal cities, targeting phenomena like the intensification of extreme weather events, coastal erosion, and sea-level rise. SCORE pursues scientific evidence for the application of EBAs, and best practice for their design, replication, and scalability in the context of smart coastal cities. Furthermore, SCORE promotes digital and smart technologies and innovation to increase climate resilience.





Data collected/generated by the project will be important to evaluate the effectiveness of these tools for climate resilience. SCORE aims at establishing an integrated coastal zone management framework for implementing EBAs, smart coastal city policies, coastal resilience plans and management, and dynamic adaptation pathways according to local legislation, also providing tools for assessing the financial viability of EBAs. Sharing of relevant database will be an important mean to achieve this goal.

The datasets produced can be of interest to different categories of potential users.

Interested **research communities** are those focused on:

- a) Climate studies with specific reference to mitigation/adaptation strategies based on EBAs
- b) Citizen science: sensor co-creation, development, end evaluation.
- c) Environmental observational methods

**Public authorities and policy makers** operating in coastal cities are expected to use SCORE data to improve:

- d) Urban Planning, to consider EBA mitigation/adaptation strategies.
- e) Engaging citizen in co-design and environmental co-monitoring activities.
- f) Co-design and set up of environmental monitoring systems, for the possible promotion of network citizen science sensors and smart technologies.
- g) Early warning and management of emergency with the use of the innovative Digital Twin solutions

Finally, **industries and developers** can be interested in developing and testing products based on SCORE outcomes.

## Strategies for disseminating datasets among stakeholders

Research data produced by SCORE are a tangible product of the project and their dissemination at various level will increase the impact of the project and are part of the dissemination activities in charge of the WP9 of SCORE. To disseminate datasets produced by SCORE, general recommendations and specific strategies are devised considering the nature of data and target users/stakeholders for which some datasets can be relevant or not. Following FAIR approach contributes to dissemination increasing findability of data, along with the set-up of a *Zenodo* community (*Figure 3*), although partners can consider other repositories, is, for example, the size of a datasets is exceeds 50 GB. However, FAIR put emphasis on machine readability and machine discovery while to disseminate data among sapiens, further precautions are needed to improve. Dissemination of research data at the European level will be done through the participation in conferences, publication of deliverables and through the involvement of the Advisory Board, while at the regional and local level, CCLs will be much involved in disseminating these data (through the organization of local workshops, meetings with stakeholder etc., as scheduled by WP2) since they are better placed to reach local stakeholders. Recommendations for an effective dissemination are the following:

### General recommendations

- It is recommended to use as much as possible the reference to datasets (and in general research data) publicly available to the public using the DOI or SIP link if DOI is not available,
- Research data stored both in SIP or in permanent data repository should contain a description (or an abstract) the well describe their nature and make datasets attractive for reuse outside SCORE thus promoting the general value of the SCORE research data.

Considering the categories defined above, the following specific recommendations are formulated:



**Research communities:**

- Pay attention to FAIR rules for increasing the findability and interoperability (i.e., the possibility to use data in a different context to improve the attractiveness of the research data) described in the DMP,
- Identify datasets worth to be published in data journals, es. Earth System Science Data (ESSD), Scientific Data, from Nature Publishing Group, the GeoScience Data Journal, from the Royal Meteorological Society, and try to publish a data paper,
- Publish journal papers based on SCORE datasets and properly cite them using DOI.

**Public authorities and policy makers:**

- Include citation of SCORE datasets and research products also in material used for promotion and in material used for citizens and stakeholders' involvement at CCLLs.
- Demonstrate the vulnerability and exposition to risks related to climate change to CCLLs through SCORE research data.
- Use SCORE datasets data to promote data-based evidence of adopting EBAs in climate adaptation strategies at local, national and EU levels.
- Use of SCORE datasets to demonstrate effectiveness of network citizen science sensors and smart technologies in monitoring environmental parameters related to CCLLs risks.

**Industries and developers**

- Promote use of SCORE datasets to test products based on SCORE outcomes in different development phases.





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## SCORE : Smart control of the climate resilience in European coastal cities

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**SCORE D3.5 - Package for the statistical analysis tools for urban-scale hazards**

Julia Anton, Sudha-Rani Nalakarthy, Roberta Paranzio

This document is a deliverable of the SCORE project, funded under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003534. The aim of this document is to develop a set of local-scale analysis tools to help analyse historical data and projections

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December 30, 2022 (v1) Other Open Access View

**SCORE D6.3 - Exposure database and vulnerability curves for the frontrunners CCLs.**

Rui Figueiredo, Raymundo Rangel

The present demonstrator (D6.3), together with the corresponding exposure and vulnerability assessment methodology report (D6.2), were developed in the context of WP6's Task 6.2. These outputs will be used in the development of Task 6.3, where quantitative risk assessments will be performed for

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**SCORE D3.3 - Package of downscaling analysis tools**

Carlo Brantini; Alberto Ortolani; Francesca Caparini; Andrea Cuomo; Stefano Taddei; Massimo Perna; Michele Bendoni; Michele Baia; Julia Anton; Salem Gharbia

This document is a deliverable of the SCORE project, funded under the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003534. The D3.3, related to Task 3.2 and entitled "Package of downscaling analysis tools", is the third WP3 repo

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Community

**SCORE : Smart control of the climate resilience in European coastal cities**

SCORE is a Horizon 2020 project aiming to increase climate resilience in European coastal cities.

Bringing together 28 partners coordinated by the Atlantic Technological University Sligo - ATU (Ireland), the project will tackle specific challenges related to sea levels, coastal erosion and extreme weather events.

To tackle these challenges, SCORE outlines a comprehensive strategy developed via a **network of 10 coastal city 'living labs' (CCLs)** addressing water and climate-related hazards to enhance coastal city climate resilience through an **Ecosystem-Based Approach (EBA)**, smart technologies and hybrid Nature Based Solutions (NBSs), while facilitating financial sustainability.

SCORE has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 101003534.

For more information: <https://score-eu-project.eu/>

Curated by: SCORE

Curation policy: Documents, scientific articles and datasets generated or collected within the framework of the SCORE H2020 project.

Created: May 26, 2023

Harvesting API: OAI-PMH Interface

Figure 3: Home page of the SCORE community on Zenodo

## 2.3. The SCORE ICT Platform

The 1st working version of the SCORE ICT Platform was developed as part of WP5 Task 5.3. It is accessible from <https://platform.score-eu-project.eu> and is described by the deliverable D5.3<sup>21</sup>. It was implemented on a cloud server provided by UNIPI and only aspects relevant to DMP are mentioned and discussed here. SIP consists of two macro-subsystems, namely i) *the Data Hub*, and ii) *the Sensor Services*.

The *Data Hub* provides the data management services, the data and metadata catalogue, the client applications (WebApp and Web GIS clients) and the APIs to access and manage the catalogue. It was developed using *GeoNode* and *GeoServer* and includes the SCORE database which will host all the project data, plus the relevant services (metadata, spatial data, etc.) and user interfaces.

<sup>21</sup> Giannetti and Chatzikamaris, *SCORE ICT Platform, 1st version, SCORE Deliverable 5.3, 24/12/2022*





- *GeoNode* is a web-based application and platform for developing geospatial information systems (GIS) and for deploying spatial data infrastructures.
- *GeoServer* is an open-source server for sharing geospatial data and designed for interoperability. It publishes data from any major spatial data source using open standards and implements industry standard OGC (Open Geospatial Consortium) protocols.

The *Sensors Services*, dedicated to the collection, cataloguing and publishing of sensors, sensors data, and climate time series is based on the *FROST* Server, developed by the Fraunhofer Institute of Optronics, System Technologies and Image Exploitation.

- *FROST* (FRaunhofer OpenSource SensorThings) is a server implementing the OGC SOS and STA protocols to store and query real-time sensor data and sensor data time series. The offered sensor data consists of data collected directly from the sensors, which are encoded in specific formats.

The text below details main submodules (see Figure 4) that are described in detail in the SCORE Deliverable D5.3.

The *Data Hub* is built around the concept of *resource*, an item with a connected data source, metadata information, owner and a shared/published status that can be created by uploading, importing, or harvesting (i.e. registered). Different types of resources are handled, but all shared a common set of features. As a new resource is recorded in SIP, a set of predefined complex attributes qualifies its nature and status within the SIP catalogue. Metadata, providing descriptive information about the resource, are used for discovery and identification purposes, and include elements (such as title, abstract, author, and keywords) derived from the Dublin Core<sup>22</sup> standard, but also administrative metadata which drive the management of the resource lifecycle (resource type, permissions/sharing options, when and how it was created). SIP adopts the following resources:

- *Document*: generic resource representing unstructured data,
- *Spatial Dataset*: generic resource representing structured data,
- *Timeseries*: a dataset with temporal support.

The simple resources mentioned map to specific data source but can be combined. Combined resources do not have a direct relationship with a data source, but it has its own metadata and sharing options, but its existence and lifecycle is connected to the underlying simple resources.

Downstream resources, created with the micro-applications implemented by the frontend client are:

- *Maps*: multiple spatial datasets can be combined and styled to compose a rich interactive map that can also host “widgets” overlaid on the map, such as charts, tables, texts, etc,
- *Dashboards*: a virtual board where multiple widgets and maps can be positioned to create live views on specific datasets, tailored to create reports, decision support tools, and so on;
- *Geostories*: a vertically scrolling composition of media, maps and documents that can communicate an organic representation of a story based on geographical features.

The 1st version of the SIP is ready for use by the partners for the project activities as outlined by the SCORE workplan. It is expected that SIP will be populated and upgraded in the future within WP5 Task 5.3 considering the feedbacks from its main users, i.e. the SCORE WPs. In particular, WP4 is expected, through cooperation with WP2 and CCLLs,

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<sup>22</sup> <https://www.dublincore.org/>







to define within month 20 and install citizen sensors that should be interfaced with SIP and WP8, which is expected to build Digital Twin Solution based on data made available through the SIP interfaces. At the end of the project (M48), WP5 Task 5.3 will eventually output the final version of the SIP system as SCORE Deliverable D5.7.

## Data formats

The set of formats handled by SIP exceeds those indicated in the Table 5 - Summary of data formats, of the Initial DMP as requirement for FAIR data management. In particular, handled formats are:

- *spatial data*
  - ESRI Shapefile (.shp)
  - GeoJSON (.Geojson, .json)
  - CSV with point coordinates
  - KML
  - GeoPackage (.gpkg)
  - GeoTiff
  - NetCDF
  - GRIB
- *tabular data*
  - spreadsheets (.ods, .xls, .xlsx)
  - CSV
- *documents*
  - documents (.odt, .docx)
  - presentations (.odp, .ppt, .pptx)
- *multimedia*
  - image (.jpeg, .png)
  - audio (.wav, .mp3)
  - video (.mp4, .ogg)
- *generic files*
  - compressed (.zip, .tar)

## Metadata

SIP features specialized editors, including a metadata editor. Two views of this editor will be available: the Metadata Wizard is a simple editor to easily fill the basic and mandatory information, and the Advanced Metadata editor which supports the full list of metadata elements. This feature allows to input metadata describing also the processing adopted to obtain usable data from sensors' raw data. The current release of SIP implements a generic model that can be mapped to concrete metadata specifications. The Table 6 lists the most relevant set of attributes available inside the resource metadata model.





Table 6 - List of metadata currently available in the SIP

Field	Description	Type
Title	name by which the cited resource is known	Text
Abstract	brief narrative summary of the content of the resource	Text
Creator	resource owner	SIP user
Attribution	authority or function assigned, as to a ruler, legislative assembly, delegate, or the like	Text
Date	reference date for the cited resource	Date
Created	datetime at which the resource was submitted to SIP	Date
Last updated	last time the resource was modified	Date
Organization	resource owner's organization	SIP user attribute
Publisher	resource PoC	SIP user
Contributor	resource metadata author	SIP user
Contacts	one or multiple SIP users having a specific role for this resource	User with contact role 'author', 'processor', 'publisher', 'custodian', 'appropriate care and maintenance of the resource', 'pointOfContact', 'distributor', 'user', 'resourceProvider', 'originator', 'owner', 'principalInvestigator',
Edition		Text
Purpose	summary of the intentions with which the resource(s) was developed	Text
Maintenance Frequency	frequency with which modifications and deletions are made to the data after it is first produced	'unknown', 'continual', 'notPlanned', 'daily', 'annually', 'asNeeded', 'monthly', 'fortnightly', 'irregular', 'weekly', 'biannually', 'quarterly'
Restriction	limitation(s) placed upon the access or use of the data	It should reflect a list of codes from TC211. See: <a href="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml">http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml</a> <CodeListDictionary gml:id="MD_RestrictionCode">
Constraints	other restrictions and legal prerequisites for accessing and using the resource or metadata	Text
License	license of the dataset	reference to License entry
Spatial Representation	method used to represent geographic information in the dataset	It should reflect a list of codes from TC211. See: <a href="http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml">http://www.isotc211.org/2005/resources/Codelist/gmxCodelists.xml</a> <CodeListDictionary gml:id="MD_SpatialRepresentationTypeCode">
Temporal Extent	time period covered by the content of the	Date (start and end)





	dataset	
Supplemental Information	any other descriptive information about the dataset	Text
Data Quality Statement	general explanation of the data producer's knowledge about the lineage of a dataset	Text
Language	language used within the dataset	Reference to one code from <a href="http://www.w3.org/WAI/ER/IG/ert/iso639.htm">http://www.w3.org/WAI/ER/IG/ert/iso639.htm</a>
Category	high-level geographic data thematic classification to assist in the grouping and search of available geographic data sets	reference to or more Category entries
Keywords	commonly used word(s) or formalised word(s) or phrase(s) used to describe the subject (space or comma-separated)	Text
Regions	keyword identifies a location (hierarchical structure)	Text
DOI	a DOI will be added by Admin before publication	Text
Published	resource is published	Boolean
Approved	resource is approved	Boolean

The metadata associated with a resource can be represented and downloaded in multiple, configurable, formats including Dublin Core<sup>23</sup> and ISO 19139:2007<sup>24</sup>. Metadata can either be downloaded from the UI as XML files or searched, queried, and retrieved through the Catalogue Service<sup>25</sup>, which implements the OGC CSW standard. The current SIP does not support RDF-based representations of metadata. Along with the implementation of the DataCite format, will possibly be considered for improved FAIR compliancy of the SCORE Platform.

## Access / Security

Security in SIP is implemented at several levels. The main access control functionality is provided by several middleware components that analyze the incoming requests. They can either protect the entire application from unauthorized access if needed (for instance the *LockDownMiddleware*, when activated, requires a login to access any page of the application), or try authenticating the subject that issued the request.

Users can authenticate themselves either through a standard login form, in which case username and password are used as credentials, or through OAuth2 tokens<sup>26</sup> that can be issued internally by the SCORE application or from third party authentication services (Google, Microsoft AD, etc). Access tokens can be used to authenticate REST API and OGC requests for protected services or resources.

<sup>23</sup> <https://www.dublincore.org/>

<sup>24</sup> <https://www.iso.org/standard/32557.html>

<sup>25</sup> <https://www.ogc.org/standards/cat>

<sup>26</sup> <https://oauth.net/2/>





Authorizations are enforced per service and resource. Users and groups of users can be selectively granted different level of privileges on resources, with a fine-grained control over the actions that they can perform (visualization, download, editing). Only the GeoNode and Geoserver services expose publicly available interfaces through and AuthN/AuthZ<sup>27</sup> is enforced in both the software components, with a shared database of permissions that ensure consistency in access rules that, of course, can change over time. All the other software components communicate internally over protected sockets that are not exposed to the Internet.

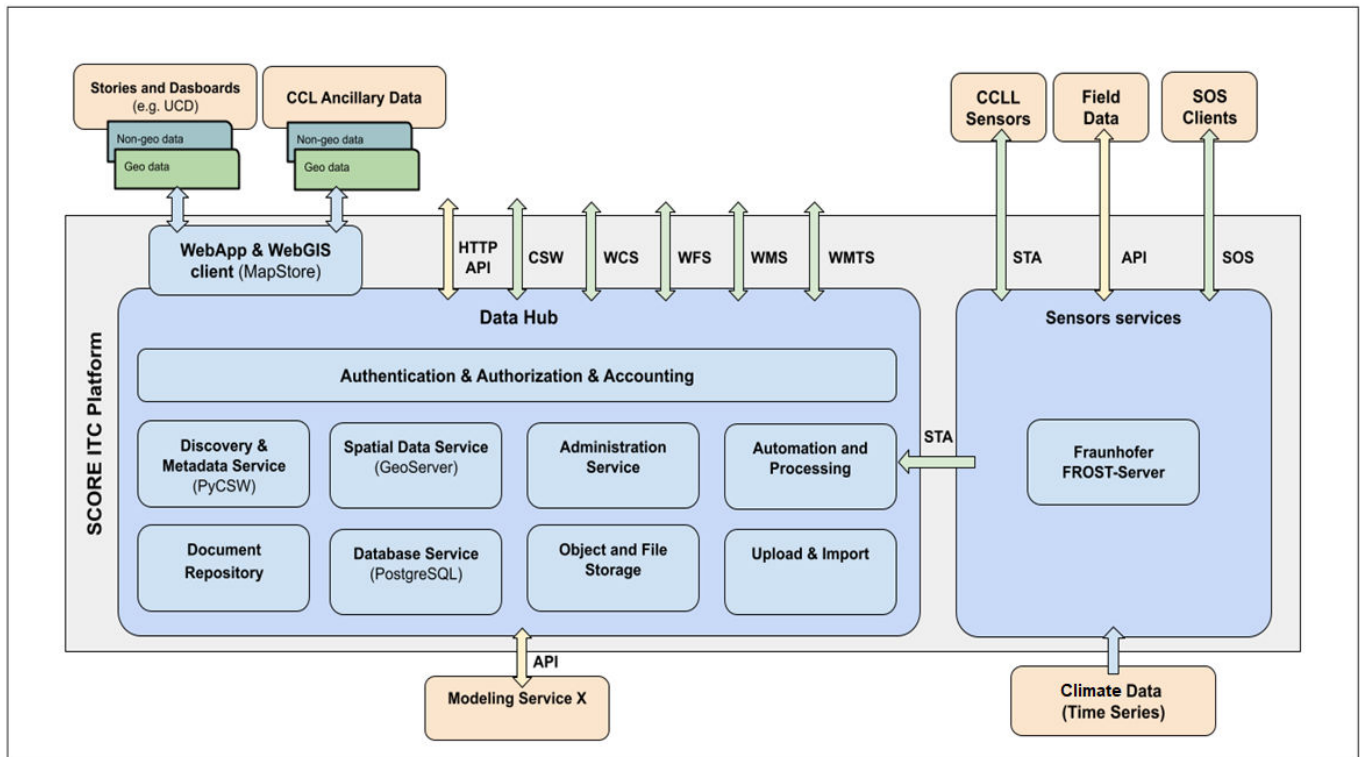


Figure 4: SCORE high level architecture

<sup>27</sup> AuthN/AuthZ: Authentication/Authorization. Authentication is the verifying the identity of a user, Authorization is the defining, granting, and enforcing specific privileges of the user.





## 3. FAIR DATA IN SCORE

This DMP describes the data management procedures that are followed according to the FAIR principles<sup>28</sup> and the H2020 guidelines for their implementation<sup>29</sup>. The acronym FAIR identifies the main features that the project research data must have to be *findable*, *accessible*, *interoperable*, and *re-useable*, allowing thus for maximum knowledge circulation and return of investment.

### 3.1. Making SCORE data *Findable*

Although during the project life data will be managed through the SIP, at the publication of project results each research teams will deposit and describe the relative underlying dataset(s) (see Table 8 - Example of dataset description form) in the identified public data repositories, but also their Institutional repositories, if existing, provided that they can attribute persistent unique identifiers to the deposited items. Valid and machine readable DOIs (Digital Object Identifiers) allow other repositories to find and identify the datasets deposited by SCORE. Moreover, all partners are strongly recommended to make use of DOI to make datasets produced by SCORE citable for publication. The chosen data repositories need to support standard descriptive metadata to ensure datasets indexing and discoverability also by machines. A repository like Zenodo<sup>30</sup> satisfies these important requirements. In fact, (meta)data are assigned a DOI issued to every published record. Metadata of Zenodo are compliant with DataCite Metadata Schema minimum and recommended terms. Metadata of each record is indexed and searchable directly in Zenodo search engine immediately after publishing and sent to DataCite servers during DOI registration and indexed there. However, other repositories, including SIP and institutional partners' repositories, need to support Dublin Core and DataCite Metadata Schema<sup>31</sup>. The project datasets will be made visible through the OpenAIRE portal<sup>32</sup>

All relevant documentation explaining data collection procedures and analysis (such as codebooks, methodologies, etc.) will be made available along with the data, to guarantee intelligibility, reproducibility, and the validation of the project findings through specific information (textual information) or code.

SCORE research data will be organized in datasets, which are collections of data units with the same focus and scope. This DMP identifies the following common rules for **dataset naming** and versioning to improve data visibility, discoverability, citation, and permanent online tracking. The recommended title for each dataset consists of:

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<sup>28</sup> Wilkinson, M., Dumontier, M., Aalbersberg, I. et al. The FAIR Guiding Principles for scientific data management and stewardship. *Sci Data* 3, 160018 (2016). <https://doi.org/10.1038/sdata.2016.18>

<sup>29</sup> [https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-dissemination\\_en.htm](https://ec.europa.eu/research/participants/docs/h2020-funding-guide/cross-cutting-issues/open-access-dissemination_en.htm)

<sup>30</sup> <https://zenodo.org/>; Compliancy with FAIR principle is described at. <https://about.zenodo.org/principles/>

<sup>31</sup> <https://schema.datacite.org/>

<sup>32</sup> <https://www.openaire.eu/>





*PROJECT ACRONYM: WPn: WP title or short description of WP aims: Taskn.m: Task title or short description of specifying Task aims: additional information specifying coverage and nature of data (optional): version number (in case of revisions or updates)*

Example:

*SCORE: WP3: Regional and Local Projections Analyses Modelling and Uncertainties: Task1.1: Reference datasets for baseline characterization and projections: v.1*

The version number of the dataset will be added at the end of the title in case of data revisions to help identifying the dataset updates especially in repositories that do not track versioning automatically.

This DMP strongly recommend, although enforcing such rules is not among the functionalities of SIP) also the following rules for **file naming** (WPn means “work package number” Tn.m is the “task number”, and ver identifies the “version number” (in case of data revisions or updates):

- for dataset file(s)

*DATASET\_SCORE\_WPn\_Tn.m\_coverage or other content specifications\_date (YYYYMMDD)\_vn.file extension*

- associated to datasets, relevant documentation explaining data collection procedures and analysis (such as codebooks, users’ manuals, methodologies, etc.) are provided in the form of a human readable README file

*README\_SCORE\_WPn\_Tn-m\_coverage or other content specifications\_date (YYYYMMDD)\_vn.file extension*

Specific keywords derived, when possible, from Thesauri and controlled vocabularies will be associated to each dataset to enhance semantic discoverability<sup>33</sup>.

In case of geographical data, the SCORE DMP will:

- Use a GIS framework based on the requirements of the INSPIRE Directive 2007/2/EC,
- Comply with standards and specifications relevant to spatial data, such as the ones set by the Open Geospatial Consortium (OGC) aiming to make location information FAIR,
- Apply the OGC standards for the interoperability of sensor data: Sensor Observation Service (SOS) defines a web service interface which allows querying observations, sensor metadata, as well as representations of observed features,
- Standardize the spatial data produced by models (WP3, WP6, WP7, WP8) and sensors (WP4), which will also include the new knowledge generated in the CLLs about the performance of the co-designed EBA interventions (WP6), following geospatial standards of ISO/TC211: ISO 19136:2007 Geographic information - Geography Markup Language (GML), ISO 19156:2011 Geographic information - Observations & Measurements (O&M),
- Ensure that metadata linked to the datasets enable standardized organization and discovery of geospatial data, in line with the INSPIRE directive: ISO 19115-1:2014 Geographic information - Metadata - Part 1: Fundamentals, ISO 19139:2007 Geographic information - Metadata - XML Implementation.

In all the other cases, “community” standards will be searched. Otherwise, metadata compliant to general purpose standards, such as Dublin Core will be adopted (see section 2.3).

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<sup>33</sup> Nothe that SIP is not automatically populated neither with vocabularies nor with Annex II categories. It is up to users to communicate which categories and terms are required for their reports to the SIP administrator.







## 3.2. Making SCORE data *Accessible*

As a guiding principle, SCORE seeks to make research data openly available, whenever possible, to allow for dissemination and validation, and to increase the re-use potential of research results. To this purpose, all the files will be converted to standard and well-documented open formats and the datasets that will be deposited will include all relevant documentation and explanation.

According to the principle expressed as "**as open as possible, as closed as necessary**" restrictions on data access or impossibility to share them will be considered only in the following cases:

- when collected data belongs to third party which have denied permission for sharing them on account of confidentiality and proprietary issues,
- protection of personal data of key informants involved in surveys, focus groups, interviews, and case studies as drafted in SCORE D11.1 deliverable.
- when availability of the data would mean that the project's main aim might not be achieved (reasons will be explained in the accessibility details relating to each dataset described in Section 7),
- other legitimate reasons (that will be explained in the accessibility details relating to each dataset described in Section 7).

All possible and legitimate actions and strategies will be adopted to allow data sharing including:

- obtaining explicit copyright permissions from third party data owners (this can happen at CCLLs level) to be allowed to re-use, reproduce, and distribute the collected data when necessary; in this case specific agreement with data owner will be sought,
- privilege the used of standard open formats or self-descriptive formats for data intended for external users and for internal purposes,
- providing all relevant documentation and explanation for the data and the datasets, including the procedures adopted to obtain them, versioning, and software for reading data in case of non-standardize formats,
- obtaining the consent of citizens and stakeholders involved in focus groups and anonymizing and aggregating the data of interviews or brainstorming or in evaluation activities, typically carried out within CCLLs,
- in case of copyright on raw data derived, collected, or elaborated from pre-existing databases or from other original sources (i.e., papers, journal articles, book chapters, reports, video, and audio sources), collected data will be made available if the reproduction and sharing are allowed by expressed permission of the right holders or by applicable copyright exceptions and exemptions.

In case of data that fall under some of the restrictions described above and for which it is not possible to take any action to make them shareable, EU allows complete closure or restricted access to them. The SCORE DMP indicates the versions or parts of the datasets that cannot be freely shared providing the specific motivations as per GA.

During project life, data will be managed through SIP which will manage the access to project partners and their members. At the time of presentation of results in scientific peer-reviewed publications, researchers will deposit the project data that can be shared in a data repository, to guarantee their discoverability, access, and preservation beyond the project end. Such repositories support open licenses and different access levels. Finally, they adopt descriptive metadata standards as required by the OpenAIRE Guidelines and allow cross-linking between publications





and the relevant datasets. The specific teams responsible for a specific dataset is responsible for the management in the repository of their choice. As a rule, *Zenodo* can be recommended for open dissemination and preservation of research data (provided that the maximum of 50 GB is not exceeded) by all research teams that do not have suitable institutional, national, or disciplinary data repositories or are not bound to use their institutional repositories. Moreover, *Zenodo* should be adopted for the harvesting of (meta) data products from OpenAIRE.

*Table 7 - Summary of tools and software for enabling re-use of the datasets*

Tools/software
open spreadsheet and document editors, such as <i>OpenOffice</i> <sup>34</sup> or <i>LibreOffice</i>
free CSV file viewers, such as <i>CSV viewer</i> <sup>35</sup>
open or free image viewers <sup>36</sup>
VLC <sup>37</sup> for mp3 and mpg
Free hdf, netCDF, grib readers <sup>38</sup>
Qgis <sup>39</sup> for Vector and Raster GIS formats

Considering formats listed in *Table 5*, there will be no need to use specifically tailored software to access project dataset, since prior the deposit researchers will convert the data into open formats. In case of software packages used in data processing, full explanation, instructions and code (preferably in Python or R) will be included in the deposited documentation (a summary of the tools and software necessary to reuse of datasets is described in *Table 7*) or in specialized repositories such as GitHub<sup>40</sup>, or also *Zenodo* where some software produced by SCORE has already been deposited.

In case agreements with third parties will restrict the access to specific users, the access will be managed through the permission system allowed by the service upon which the SIP will be built.

### 3.3. Making SCORE data Interoperable

For geographic data, the INSPIRE directive and related standards are adopted as specified in Section 2. If not applicable, datasets will be described using other metadata standard or metadata based on general purpose descriptive metadata, such as Dublin Core and DataCite Metadata Schema to ensure metadata interoperability for indexing and discoverability or will follow the convention of the hosting research data repository. All relevant documentation explaining codebooks, users' manuals, data collection procedures, processing (including software when necessary), and data quality information will be made available along with the data to guarantee intelligibility,

<sup>34</sup> [www.openoffice.com](http://www.openoffice.com)

<sup>35</sup> <https://csvviewer.com/>

<sup>36</sup> <https://www.xnview.com>

<sup>37</sup> <https://www.videolan.org>

<sup>38</sup> <https://opengrubs.org>; <https://www.giss.nasa.gov/tools/panoply/>

<sup>39</sup> <https://www.qgis.org>

<sup>40</sup> <https://github.com/>





reproducibility, and the validation of the project findings. An example of the set of information that will be used to describe data is shown in Table 8 - Example of dataset description form. In case of SCORE specific ontologies will be used, a mapping exercise to other ontologies will be undertaken.

### 3.4. Making SCORE data Re-usable

SCORE is committed to permit the widest use of collected/generated data that will be shareable by distributing them and by adopting licenses that allow their re-use by other researchers and stakeholders. It is envisaged that datasets will be made available mainly under Creative Commons license CC BY 4.0 and Open Data Commons ODC-BY<sup>41</sup>. The first gives permission to users to freely share, modify, and use the data, subject only to full credit to the author(s) of the dataset. Note that ODC-BY is a license specifically drafted for Open Data projects that works under condition of compatibility with Open Access requirements, interoperability, and re-use. The CC BY NC 4.0<sup>42</sup>, requiring full credit but limiting the re-use for commercial purposes, can be instead chosen in case of data collected from sources that pose limits to re-use. In general, data will be made openly available to validate the research results immediately at the time of the publication of the corresponding scientific peer-reviewed papers, although some datasets can be made publicly available without the need of publishing a related article, but providing a full description, including quality assurance processes. If datasets are underlying data of public deliverables, an embargo period will be applied to allow full exploitation of research results by the SCORE partners. Full citation of datasets will be given in SCORE dissemination means as they will be made available through institutional or public data repositories for long-term/permanent deposit will be given also in the SCORE.

### 3.5. Enforcing FAIR approach in SCORE

The previous sections have described the general concepts of FAIR approaches and the technical solutions to enforce FAIR management in SCORE. However, since feeding of SIP and creation of datasets, and data formats chosen as well for generated data, some supervision is needed. In particular:

- ❑ Support and training provided by WP 5 to partners and CCLs about SIP and its usage<sup>43</sup>,
- ❑ Periodical (2 months) verification through specific API the content of SIP, to highlight possible deficiencies in terms of usage and correctness of metadata,
- ❑ Periodical (3) months verification with WP leaders of the sources of data used at WPs level (i.e., through the table listed in Section 2.1). Their usage through the SIP is recommended, especially for datasets used by different WPs and to make partners familiar with FAIR approach for data management. Verification of description of data sources used to feed SIP: it is important to clarify the adoption, when appropriate, of the list of metadata of Table 6 with reference to data restriction and licensing,

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<sup>41</sup> Creative Commons Attribution (CC BY) 4.0 International, <https://creativecommons.org/licenses/by/4.0/legalcode>; Open Data Commons Attribution License (ODC-BY) v1.0, <https://opendatacommons.org/licenses/by/1-0/>

<sup>42</sup> Creative Commons Attribution-NonCommercial (CC BY NC) 4.0 International, <https://creativecommons.org/licenses/by-nc/4.0/legalcode>

<sup>43</sup> An action to stimulate CCLs to write Geostories have been launched also with the aim of training CCLs to the used of SIP





- ❑ Prior notice for deposited datasets is required, like publications or software. The proposal was approved by the 5th SCORE board of 25/02/2023<sup>44</sup>.

The procedure applies when a dataset is proposed by a partner for uploading to a permanent repository and consists of the following steps:

1. Notify publication dataset to SCORE partners via email to partner through the mailing list [score-h2020@atu.ie](mailto:score-h2020@atu.ie).
2. Partners can notify justified objections if:
  - ✓ It adversely affects protection of results/background of the objecting party,
  - ✓ Legitimate interests of the objecting party would be significantly harmed,
3. The dataset will be inspected by task 5.2 for compliancy with DMP rules, in particular for those concerning naming, and the dataset description of *Table 8* based on ARGO.
4. If the dataset involve data derived for questionnaire, or other data possibly involving ethical issues, explicit compliancy with D11.1 must be declared and consent of WP11 must be obtained.

In addition, list of datasets and their characteristics will be tracked in the DMP (Table 9)

The key indicator to monitor the implementation of FAIR principles is the usage of SIP and the correct deposit on *Zenodo* or other permanent repositories. In particular:

- 1) Number of datasets correctly uploaded to SIP,
- 2) Percentage of datasets uploaded to SIP needed corrections (minor or major) to format and metadata (to achieve 90% in the last six months,
- 3) Number of SCORE-generated datasets
- 4) Percentage of datasets successfully passing (directly, after minor corrections, or after major corrections) the prior notice procedures (90% in the last 6 months)

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<sup>44</sup> [https://atlantictu.sharepoint.com/:w:/r/sites/SCORE-H2020/Shared%20Documents/WP10/Meetings/EB/5th%20EB%20Meeting\\_15022023/SCORE\\_EB\\_minutes\\_15022023.docx?d=w4660948e3e6e4f16b5baf0110eb3f8ac&csf=1&web=1&e=EMU8sg](https://atlantictu.sharepoint.com/:w:/r/sites/SCORE-H2020/Shared%20Documents/WP10/Meetings/EB/5th%20EB%20Meeting_15022023/SCORE_EB_minutes_15022023.docx?d=w4660948e3e6e4f16b5baf0110eb3f8ac&csf=1&web=1&e=EMU8sg)





## 4. ALLOCATION OF RESOURCES

During SCORE, a specific storage (SIP) is set up and adopted to share data among partners and, for specific data, to CCLs and external users. The cost to activate and maintain it for the duration of the project will be covered by the WP5 project budget which also includes the FAIR cost. Making data FAIR requires a certain amount of researchers' time and investments in infrastructures although, there are no costs for long term deposit and preservation of public shareable data because the chosen repositories (e.g., *Zenodo*, whose expected life is at least 20 years) do not apply fees for archiving and data curation.

Costs related to data management and documentation, including the conversion of proprietary data files into open formats, are also covered in WP5 and by other WPs. Moreover, the cost of activities related to the DMP (such as providing guidance on data management and open access issues, coordinating the Partners, and preparing the different releases of DMP) is specified in the WP5.2 budget.

Responsible of SCORE ICT platform is the WP5 leader. However, responsible for management of individual datasets are the dataset creators who are generally the team leaders directly involved in research data organization and collection. In doing this, researchers, or in general, personnel involved in dataset creation will identify themselves with the unique persistent identifier ORCID<sup>22</sup>. Besides being free of charge for researchers, it automatically links researcher identity with their research activities and research products. A specific table summarizing contacts of the research team leaders responsible for each dataset will be added in the future release of DMP. In order to identify different roles in the creation/management of datasets, and to give proper credit to all the personnel involved in data creation and management activities, a list of roles will be adopted in the project. A provisional list is the following: Data Collector (such as survey conductors, interviewers, or a person who run and manage sensor or a model), Producer (person responsible for the preparation of data to be shared in a specific format), Project Member (a researcher indicated in the GA), Researcher (person assisting co-authors with research, data collection, processing and analysis but is not part of team indicated in the GA), Research Group (the name of a research institution or a research group that contributed to the dataset).





## 5. DATA SECURITY

During the duration of the project, relevant research data will be managed through the SIP that adopts the specific solutions for data security and access described in Section 2.3.

At each partner institution, research data will be stored in computers, laptops, intranets or hard-drives accessible through institutional password periodically modified according to national law provisions for data security and protected by regularly updated antiviruses. None of the project data will be left inadvertently available.

All the research materials stored in computers are subject to regular backup to safeguard them from accidental losses and protected using password and systems are protected through firewalls.

Long term preservation of public data is ensured by the chosen data repositories that have specific preservation policies. For example, *Zenodo* policy ensures that the items will be retained for the lifetime of the repository and in case of closure, best efforts will be made to integrate all content into suitable alternative institutional and/or subject based repositories. Handling of sensitive data is described Section 6.







## 6. ETHICAL ASPECTS

The SCORE project involves human participants through CCLLs particularly in WP2, WP4, WP7, and WP8, the latter for assessment studies. As part of the recruitment process and when working with participants, the SCORE project follows key principles regarding respect, participation, consent, and anonymity for the best interests of all voluntary participants drafted in D11.1.

Institutional ethics and governance policies and guidelines for the SCORE project will be under regular review by the SCORE ethics committee to maintain the standards imposed by current legislation and codes of conduct of relevant professional bodies. All personal data collected within the SCORE project from questionnaires, interviewers, surveys and focus groups are carefully protected in compliance with relevant national data protection legislation of the EU member states implementing the European Directive 95/46/EC and with the procedures defined by the European Code of Conduct for Research Integrity.

CCLL volunteers will be recruited in the first 12 months of the project through different means, like by public events such as hackathons. The procedure to recruit them is defined by three elements: i) Recruitment protocol requirement and application; ii) The information sheet; iii) written consent/assent.

International Codes of Ethics such as those developed by ESOMAR (International Code on Market, Opinion and Social Research Data Analytics) will be adhered to. A Consent Form for some activities will be requested to participants except in the instance that the research constitutes a minimal risk to participants (see AAPOR definition of minimal risk research).

All citizen scientists and participants recruited will receive an Information Sheet translated into their local language before being invited to sign on as participant citizen scientists. The sign-on document is called Written Consent/Assent<sup>45</sup>. This will ensure understanding of contributions, responsibilities, outputs, transfer of knowledge production and lessons learned once the initial framework and methodology have been designed and implemented.

These information sheets will include:

- A brief outline of the aims of the research and its intended purposes,
- The duration and extent of involvement
- Information on their rights and the nature of informed consent. In particular, the right to withdraw from the research at any time, even after they have been recruited as a participant,
- A guarantee for confidentiality and anonymity and an explanation of how data will be processed and stored,
- An explanation regarding incidental findings,
- Contact details of CCLL leaders, where study participants could request further information,
- Explanation on who is funding the research and for what purpose,
- Explanation on who will have access to any data that participants provide,
- Brief explanation on where research findings will be published,

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<sup>45</sup> D 11.1 Appendix 1: Information Sheet and Consent Forms in all languages involved





- Clarification of possible uses to which data may be put in future.

Information sheets are adapted to different CCLLs background and language if necessary. Volunteers are requested to sign a Written Consent form which will include:

- an acknowledgement that they understand their rights,
- an explicit and unambiguous statement of informed consent for participation in the research,
- an understanding about their component of the research data being anonymised and kept confidential.

Written Assent is signed by parents, guardians, or educators if willing minors become involved in the research. In the instance of engaging minors, Informed Assent should contain all the relevant information for a child to understand the meaning of assent/consent and that participation is voluntary can be withdrawn at any stage.

All information will include notes on anonymity, recording, data use, voluntary participation, the possibility of withdrawal, availability of research results and principal research contacts. For the different groups of participant citizen scientists' confidentiality and anonymity will be always guaranteed, unless the written agreement with the respondent is different.





# 7. SUMMARY OF SCORE RESEARCH DATA

The DMP releases provide an overview of the research data or datasets produced or being produced, by SCORE. During the process of creating dataset, curators are asked to provide or update a sample table following the example and guidance, developed following ARGOS<sup>46</sup> templates shown in Table 8. A summary through a table that will be filled and updated in (Table 9). Each entry corresponds to a dataset that will be described with specific information such as those requested in ARGO templates.

*Table 8 - Example of dataset description form*

#	Status: Available	SCORE: WPn: .....: (title of the dataset following naming in sect.3.1)		
ID [ID type]		Provide DOI or url		
Filename(s)		Specify name(s) according to filename rules written in section 3.1		
Team in charge		Partner(s) name(s), orcid(s)		
Description		This dataset contains data on [...in case of geophysical data, please describe the geophysical parameters ]  The dataset is organized as follows [...]		
Purpose of the data collection/generation in relation to the project/WP/Task objectives		Add appropriate description, including collection/generation process		
To whom might data be useful?		Add appropriate description		
Accessibility		Please provide Licensing information (see section 3.4)		
Creator/s		"Creator" is the team in charge of curating the dataset		
Contributor/s		"Contributors" are people contributing in different ways to create the dataset		
Contact Person/s		(name, organization, email, and ORCID of contact person)		
Related publications		Specify Project deliverable(s) or OA publication(s) related to the dataset		
Type of data		Primary/Secondary	Collected/Generated	Qualitative/Quantitative
Data format		Describe the data format; if in the format is not in Table 7, please describe it and provide a link a software to read such format.		
Data reused for generating the dataset		Leave empty for primary data or specify the dataset(s) providing identifier or url or other sources and evidence of right to reuse (licensing)		
Data Volume		Final volume of data is/ is expected to be [XXX] (in the appropriate unit).		
How do you intend to ensure data reuse after your project finishes?		Data will be/are made available in YYY repository under a (CC BY 4.0) or (ODC-By) license.		

<sup>46</sup> <https://argos.openaire.eu/home>





	<p>or: Data will not be available for reuse because of [...please specify ...]</p> <p>or: Data are of limited use kept on secure, managed storage for the limited time of [specify] years</p> <p>or: Accessible via SIP</p>
Legal issues that can have an impact on sharing this dataset	<p>Not applicable</p> <p>or: Explain legal issues eventually referring to D11.1 if related to use of personal data</p>
What are the methods used for processing sensitive/personal data?	If applicable, describe the specific method used for processing sensitive/personal data (see section 6)
Will you use metadata to describe the data ?	<p>If yes, please specify them and if they (and at what extent):</p> <ul style="list-style-type: none"> <li>- use standardized vocabularies</li> <li>- be available free of charge</li> <li>- be harvestable</li> </ul>
Will you provide persistent identifiers for your data?	Provide DOI or not, in case data are not finalized for repositories
Are services used to provide searchable metadata?	SIP, Registry/Catalogue, OpenAIR
Will/Do your metadata describe the quality of the data?	Recommended for sensors data
Are there ethical or legal issues that can impact sharing the data?	See section 3.4 and section 6
Will your data be openly accessible?	Please specify. If not, please explain why
How will the data be made available?	e.g. SIP, project website, repositories, etc ...
Will/do you use a controlled vocabulary for your data?	Please specify
Do you have documented procedures for quality assurance of data?	These should be included also in metadata
Will/Do the team provide any support for data reuse?	Through readme and descriptive files and/or offering curator(s) contacts
How long the team will support data reuse?	Up to [please specify] years





*Table 9 - list of research data of SCORE project (acronyms and abbreviations: # = dataset progressive number ID, Project phase (starting month-ending month), "Creator team" is the team in charge of curating the dataset; Source: C=collected/ G=generated; Status: A=available, P=in progress, NYA=not yet available, CNYA=completed but not yet available.*

#	WP	Lead Beneficiary	Task	Project Phase	Curator Team	DATASET Title	SOURCE (C/G)	STATUS (A/P/NYA/CNYA)
1	3	Lamma	3.2	M18	Carlo Brandini; Alberto Ortolani; Francesca Caparrini; Andrea Cucco; Stefano Taddei; Massimo Perna; Michele Bendoni; Michele Baia; Iulia Anton; Salem Gharbia	SCORE D3.3 - Package of downscaling analysis tools (SOFTWARE)	G	A
2	6	RED	6.2	M17	Rui Figueiredo; Raymundo Rangel	SCORE D6.3 - Exposure database and vulnerability curves for the frontrunners CCLs (DATASET)	G	A
3	3	Lamma	3.3	M23	Iulia Anton, Sudha-Rani Nalakarurthi, Roberta Paranunzio, Michele Bendoni, Francesca Caparrini, Salem Gharbia, Alberto Ortolani, Carlo Brandini, Roberto Vallorani, Gianni Messeri	SCORE D3.5 - Package for the statistical analysis tools for urban-scale hazards (SOFTWARE)	G	A

