

Contribution to: Sustainable Places 2025 8 – 10 October 2025
Milan, Italy
Climate & policy strategies

Strategies for climate adaptation and mitigation: Results and lessons from the Horizon Europe DISTENDER project

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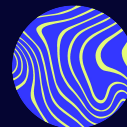
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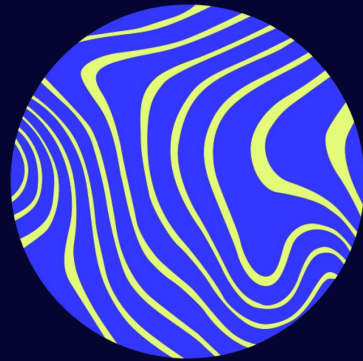


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Developing STRatEgies by integrating mitigationN, aDaptation and participation to climate changE Risks



DISTENDER

<https://distender.eu>

- **Project Duration:** 06/2022-11/2025 (42 months)
- **Partners:** 30 partners from 13 countries: Austria, Germany, Greece, Hungary, Italy, Lithuania, Netherlands, Poland, Slovenia, Portugal, Spain, Ukraine and United Kingdom
- **Funding budget for EU partners:** 6.4 M EUR + United Kingdom contribution (0.6 m EUR).
- **Climate sciences and responses** (HORIZON-CL5-2021-D1-01-05)



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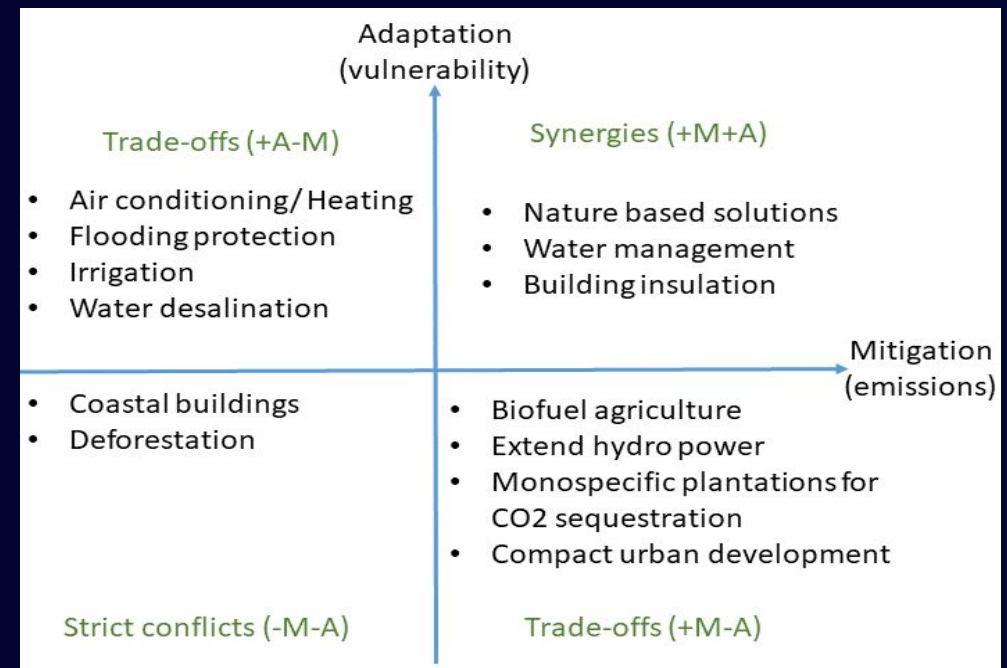
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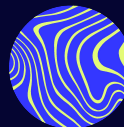
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CALL TOPIC: Better understanding of the interactions between climate change impacts and risks, mitigation and adaptation options

- Integrating the analysis of the **impacts and risks of climate change, mitigation pathways and adaptation strategies** into a single framework to help understand and quantify their numerous interactions.
 - Actions should also improve the general **understanding of the synergies, conflicts and trade-offs between mitigation and adaptation strategies**.
 - Actions should formulate a set of technical and policy recommendations, including sector-specific ones, targeting both public and private stakeholders, to **reduce the tensions between mitigation and adaptation strategies**.
- Adaptation (A) : Local scale, bottom-up approaches.
 - Mitigation (M): Global scale, top-down approaches.

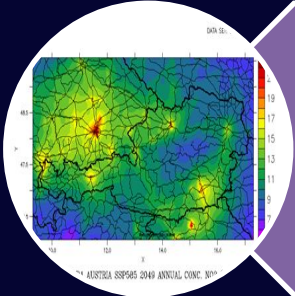


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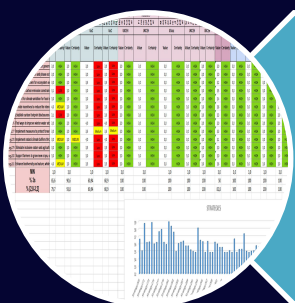
DISTENDER KEY ELEMENTS



Quantitative and qualitative analyses tools to evaluate the risks and vulnerability of the climate change under different **local (high resolution) climate and socio-economic scenarios**.



Employ participatory methods to collaboratively develop strategies and assess their robustness across various future scenarios and sectors, including air pollution, health, water, agriculture, and energy demand.



Design a DSS to assist policymakers in optimizing use of knowledge generated by DISTENDER and in selecting the most favorable strategies aligned with their preferences, based on various bio-physical and robustness indicators.

ADAPTATION AND MITIGATION STRATEGIES CONSIDERING SYNERGIES AND TRADE-OFFS

Advanced integration of climate projections:

combination of dynamic downscaling techniques with previously developed statistical projections has provided localised climate data that could be used in sectoral impact analyses.

Stakeholder participation:

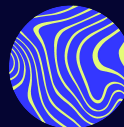
significant contributions from local actors and external experts in the co-creation of socio-economic scenarios, climate strategies and transformation pathways.



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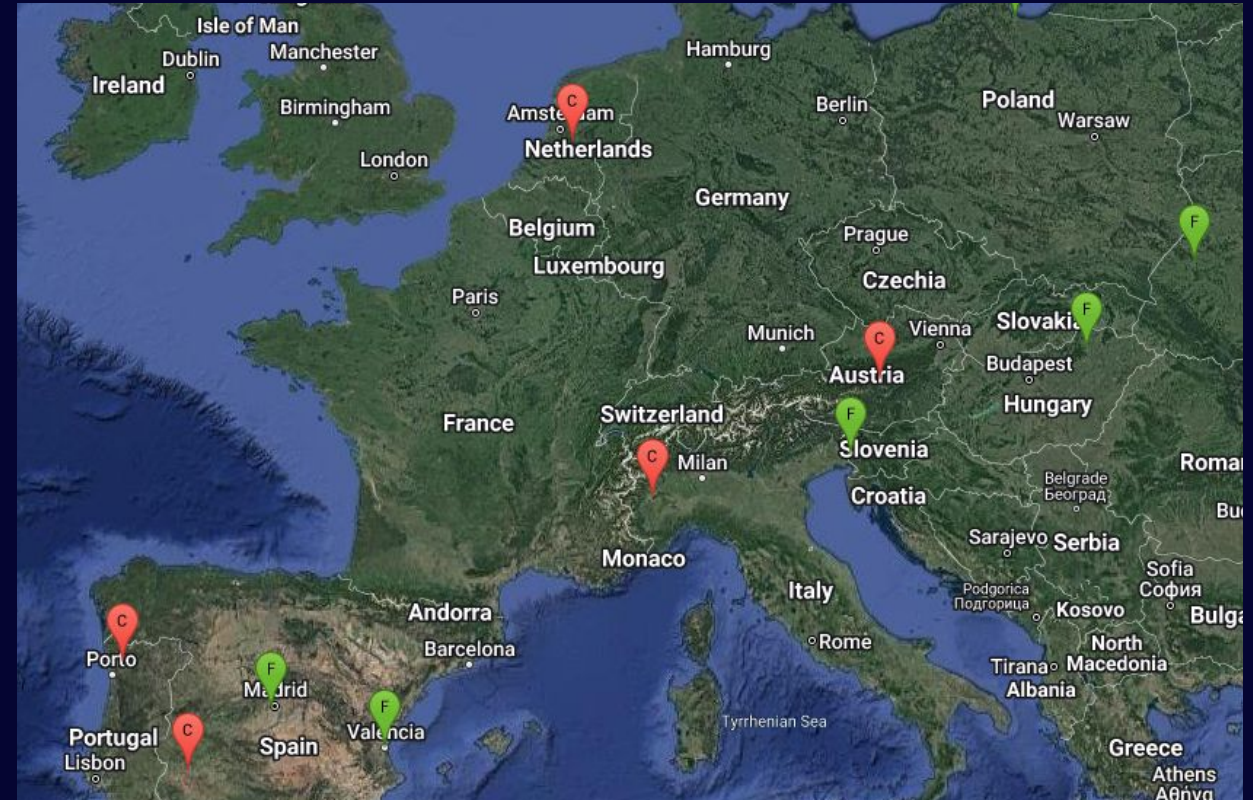
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CASE STUDIES

□ Core Case Studies:

- **Austria** (national scale); Federal Ministry For Climate Protection, Environment, Energy, Mobility, Innovation And Technology (BMK)
- **North-east of The Netherlands** (regional scale); The Netherland Water Management Authority represented by Hanze University (HUAS)
- South-West Iberian Peninsula, **Dehesa-Montado** (regional scale) European Agroforestry Federation (EURAF)
- **Metropolitan City of Turin** in Italy (regional/urban scale)
- **Guimaraes** City in Portugal (urban scale)

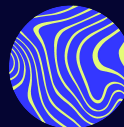
- **Follower case studies:** Alcorcón (Spain), LVIV (Ukraine), Miskolc (Hungary), Nova Gorica represented by GOLEA (Slovenia), and Valencia represented by VCE (Spain).



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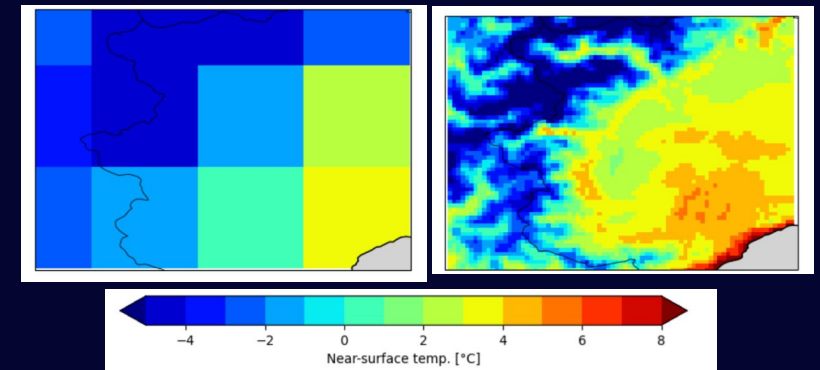
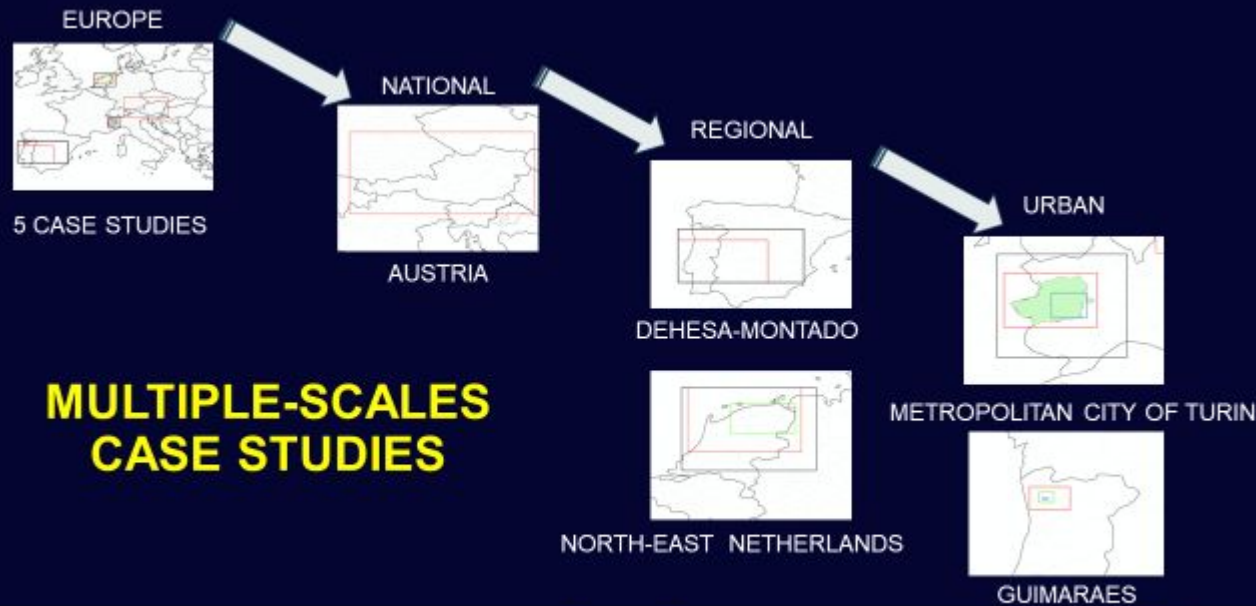
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DISTENDER: LOCAL SCALE

- ✓ **Localized scenarios** based on indirect drivers (socio-economic) and direct drivers (climate change) to understand **climate change risks** at local scales and for examining **robustness** of integrated (adaptation and mitigation) strategies.
- ✓ **Localized future climate scenarios**: dynamical and statistical downscaling methods from global climate models
- ✓ **Localized future socio-economic scenarios** based on **stakeholders workshops and existing SSPs**: narrative, trend indicators, land use changes and current climate policies.



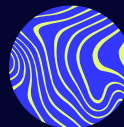
Example downscaled temperature from global model 1° (left) to CS scale 3 km (right). Source: WP4



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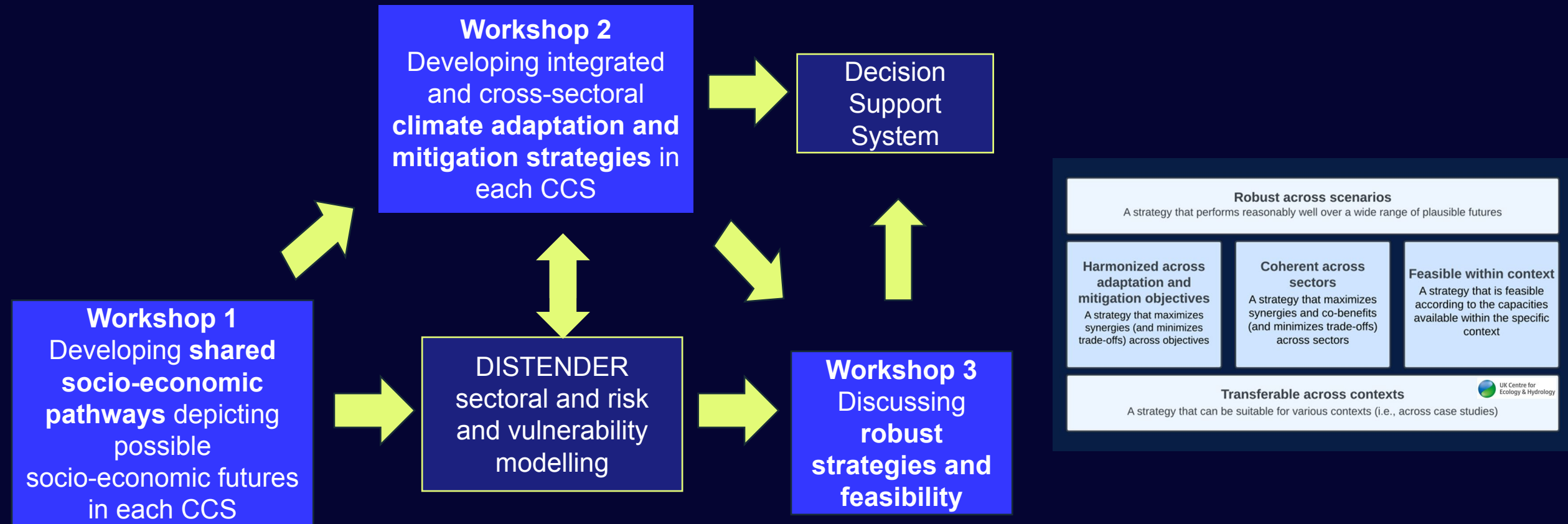


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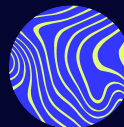
DISTENDER: PARTICIPATORY APPROACH



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ROUND 1 “Future climate over current socio-economic scenario”

Local climate scenarios
(2015-2049) from global
SPPs-Radiative forcing levels ⁽¹⁾

Local socio-economic scenario
Current
(2018)

Future – Present: Impacts of future climate on the current local SSP

ROUND 2A “Future climate over future local socio-economic scenarios”

Local climate scenarios
(2015-2049) from global
SPPs-Radiative forcing levels ⁽¹⁾

Local socio-economic scenarios
(CCS-SSPs) *Future*
(2015 - 2049)

Simulations have been run to isolate the local impact of climate and socio-economic scenarios over multiple sectors: air quality, human health, urban heat, agroforestry, energy, and water resources.

Impacts (Round2a – Round1) of the local socio-economic scenarios on the future climate projections

Participatory
(stakeholders
engagement)



Decision
Making

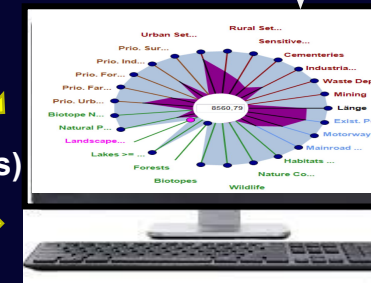
**OVERALL
DISTENDER
METHODOLOGY**

Adaptation & Mitigation Strategies

Evaluation of strategies: Round2b

Robust Strategies

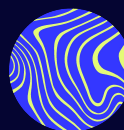
DSS
(Multicriteria Analysis)



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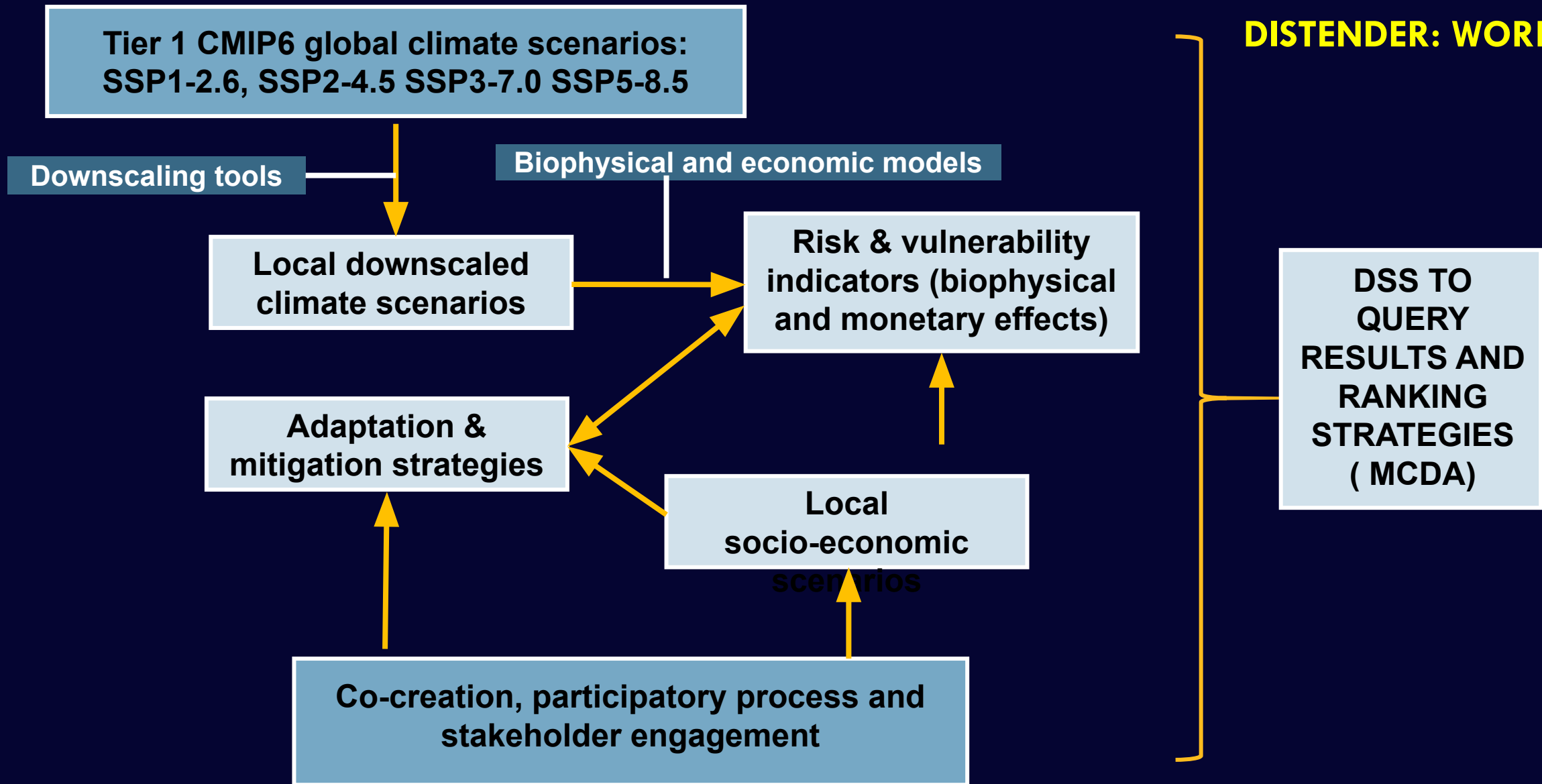


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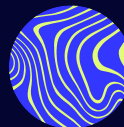
DISTENDER: WORK FLOW



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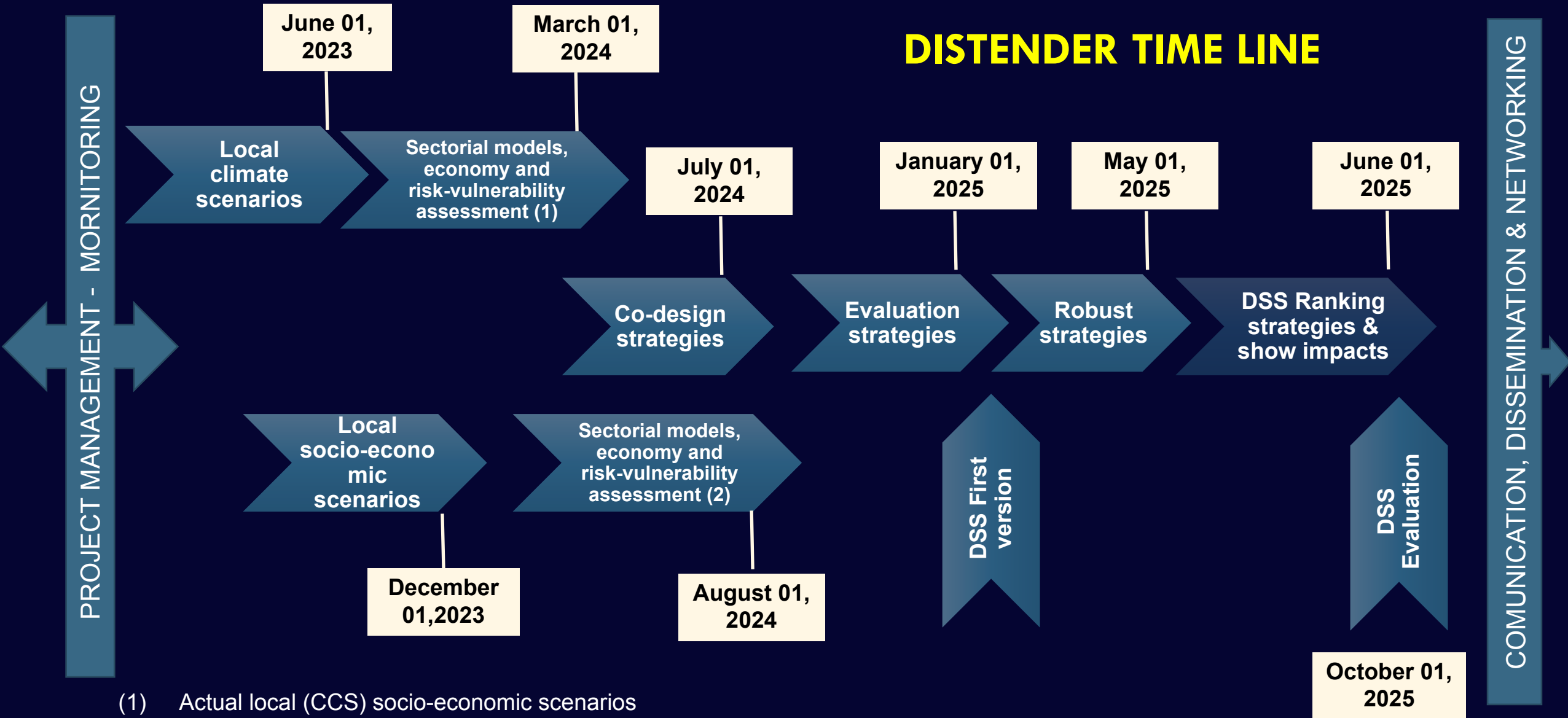


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DISTENDER TIME LINE



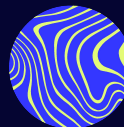
- (1) Actual local (CCS) socio-economic scenarios
(2) Future local (CCS) socio-economic scenarios



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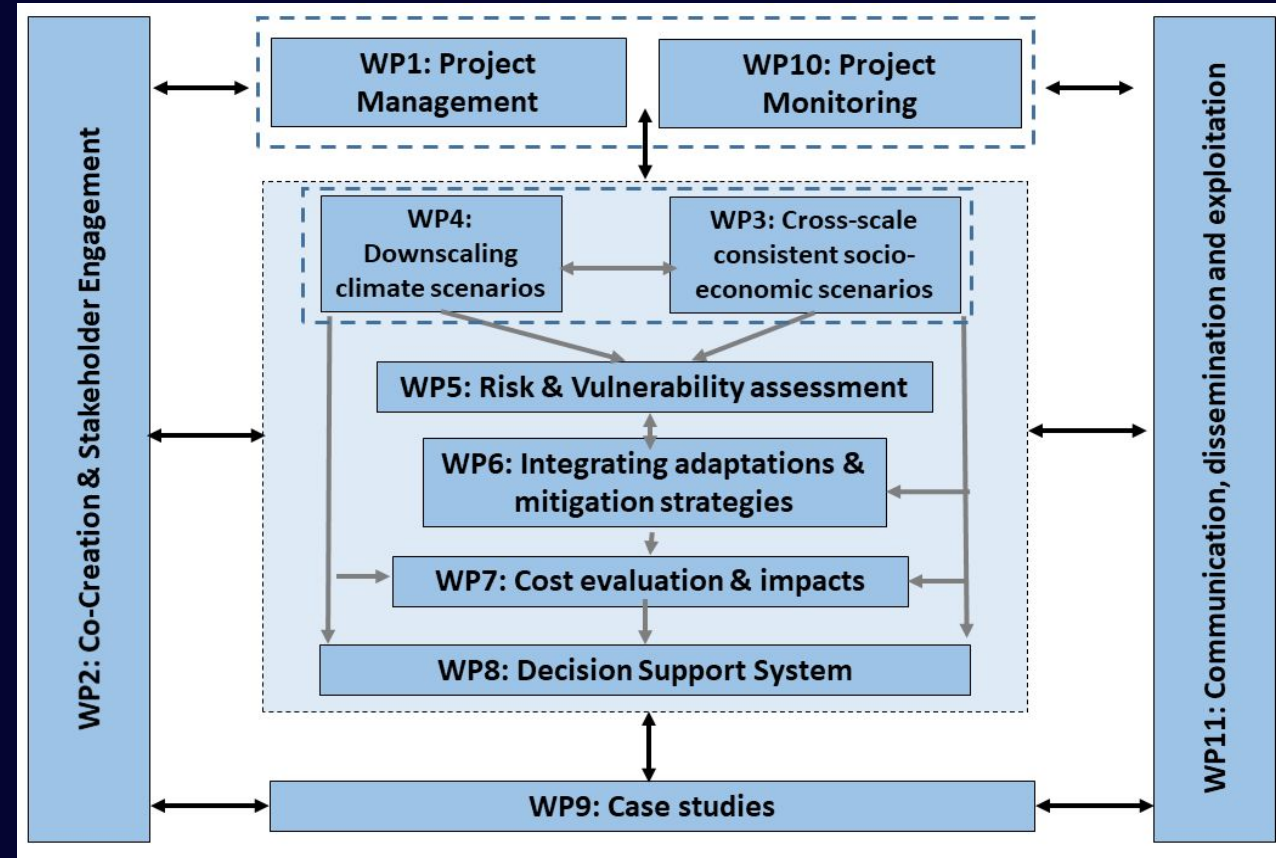
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IMPLEMENTATION

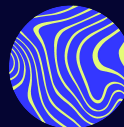
- The explorative scenarios will integrate local socio-economic scenarios (WP3) and downscaled climate scenarios (WP4).
- Participatory co-creation methods (WP2) will be utilized in the development of the socio-economic scenarios (WP3) and strategies (WP6) for the CCS (WP9).
- The scenarios will be evaluated in WP5 (risk and vulnerability) and WP7 (economic evaluation).
- The DSS (WP8) will allow the replication and upscaling of the DISTENDER methodologies and tools in other cities and regions.
- Outcomes will be communicate, disseminate and exploit in WP11.
- The project will be managed in WP1 and monitored (progress and impact) by WP10,



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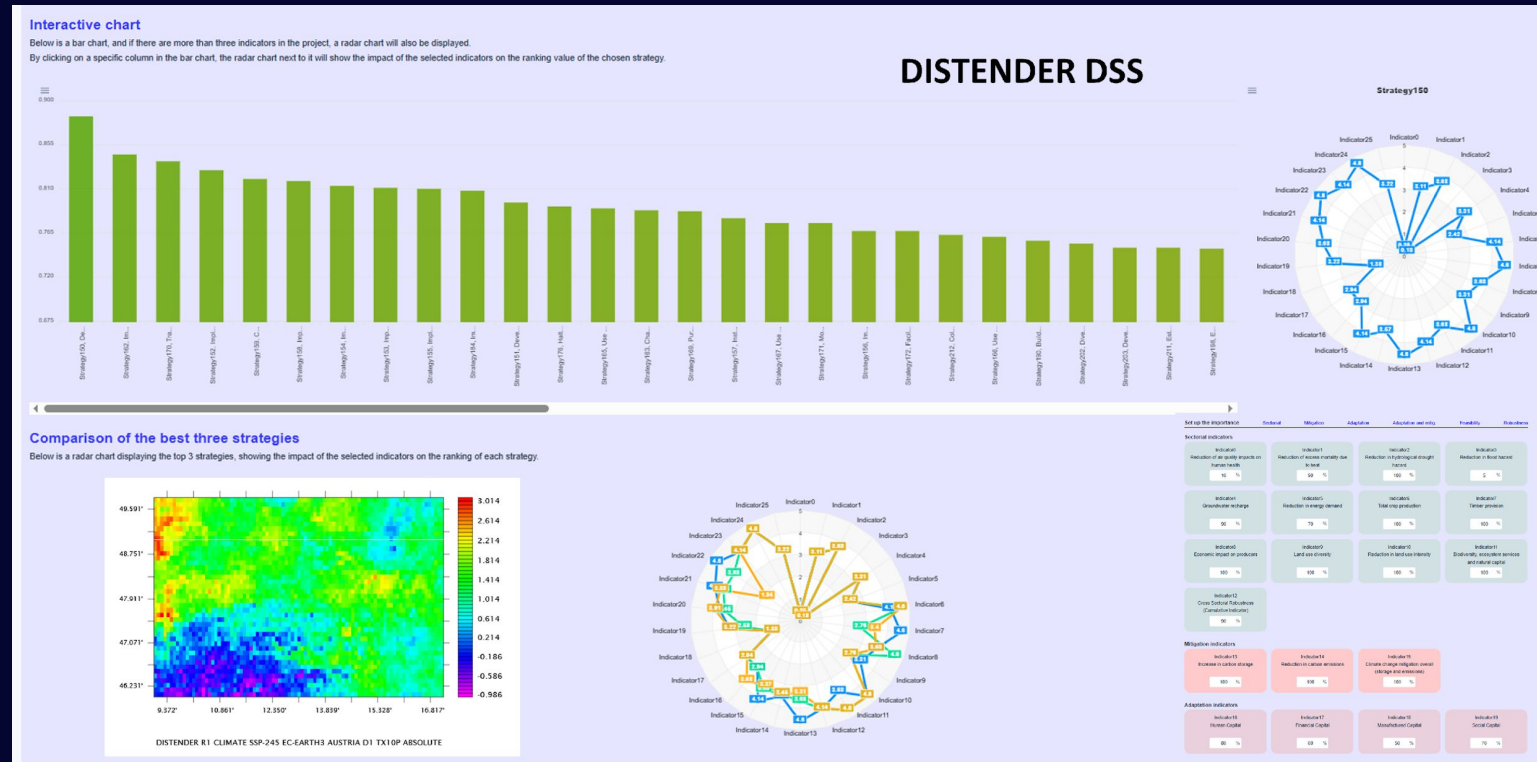


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DISTENDER DSS: CONCEPTUAL OVERVIEW

“A tool designed to assist decision-makers in evaluating and prioritizing climate change adaptation and mitigation strategies within their own regional or local priorities”

Ranking adaptation and mitigation strategies based on a Multi-Criteria Decision Analysis (MCDA).



Decision-makers can assign **weights to the indicators** according to their preferences, enabling the generation of a ranked list of strategies based on their specific criteria.

Maps or tables of indicators to analyze the impact and risk of the local climate and socio-economic scenarios under different socioeconomic pathways and climate scenarios

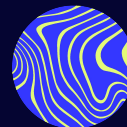
Analysis of strategies against a set of indicators



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DISTENDER DSS: RANKING STRATEGIES

DECISION MATRIX (STRATEGIES & INDICATORS)

Columns: DISTENDER has setup a 26 **indicators** (sectorial and economic impacts, adaptation, mitigation and robustness) as reference. The user can add own indicators and make its evaluation

Rows: DISTENDER has co-designed more than 350 **strategies** for the DISTENDER CCS. The user can add own strategies and make its evaluation

Decision matrix

Strategy title	Indicator0	Indicator1	Indicator2	Indicator3	Indicator4	Indicator5	Indicator6	Indicator7	Indicator8	Indicator9	Indicator10	Indicator11	Indicator12	Indicator13	Indicator14	Indicator15	Indicator16	Indicator17	Indicator18	Indicator19
Strategy150	[-3.1+] [Yellow]	[-3.0+] [Yellow]	[-4.0+] [Red]	[-4.0+] [Red]	[-4.0+] [Red]	[-3.0+] [Green]	[-4.5+] [Green]	[-5.0+] [Green]	[-4.0+] [Green]	[-3.6+] [Green]	[-5.0+] [Green]	[-4.0+] [Green]	[-5.0+] [Yellow]	[-5.0+] [Green]	[-3.1+] [Yellow]	[-4.1+] [Yellow]	[-4.0+] [Yellow]	[-4.0+] [Yellow]	[-3.0+] [Green]	[-5.0+] [Green]
Strategy151	[-3.1+] [Yellow]	[-3.0+] [Yellow]	[-3.0+] [Red]	[-3.0+] [Red]	[-3.0+] [Red]	[-3.0+] [Green]	[-4.0+] [Yellow]	[-4.0+] [Green]	[-5.0+] [Green]	[-4.2+] [Green]	[-5.0+] [Green]	[-5.0+] [Green]	[-5.0+] [Yellow]	[-4.0+] [Green]	[-3.1+] [Yellow]	[-3.6+] [Yellow]	[-5.0+] [Green]	[-4.0+] [Yellow]	[-3.0+] [Green]	[-4.0+] [Yellow]
Strategy152	[-3.0+] [Green]	[-3.0+] [Green]	[-3.0+] [Red]	[-3.0+] [Red]	[-3.0+] [Red]	[-3.0+] [Green]	[-4.0+] [Green]	[-4.0+] [Green]	[-4.0+] [Green]	[-3.5+] [Green]	[-4.0+] [Green]	[-4.0+] [Green]	[-5.0+] [Yellow]	[-5.0+] [Green]	[-3.0+] [Yellow]	[-4.0+] [Yellow]	[-4.0+] [Yellow]	[-3.0+] [Green]	[-3.0+] [Green]	[-5.0+] [Green]
Strategy153	[-3.0+] [Green]	[-3.0+] [Green]	[-4.0+] [Yellow]	[-4.0+] [Yellow]	[-4.0+] [Yellow]	[-3.0+] [Green]	[-2.0+] [Green]	[-5.0+] [Green]	[-5.0+] [Green]	[-3.0+] [Green]	[-5.0+] [Green]	[-5.0+] [Green]	[-4.0+] [Green]	[-5.0+] [Green]	[-3.0+] [Green]	[-4.0+] [Green]	[-4.0+] [Red]	[-1.0+] [Red]	[-4.0+] [Yellow]	[-5.0+] [Green]
Strategy154	[-3.0+] [Green]	[-3.0+] [Green]	[-4.0+] [Yellow]	[-4.0+] [Yellow]	[-4.0+] [Yellow]	[-3.0+] [Green]	[-4.0+] [Green]	[-4.0+] [Green]	[-5.0+] [Green]	[-4.0+] [Green]	[-5.0+] [Green]	[-5.0+] [Green]	[-5.0+] [Green]	[-4.0+] [Green]	[-3.0+] [Green]	[-3.5+] [Green]	[-4.0+] [Red]	[-1.0+] [Red]	[-3.0+] [Green]	[-5.0+] [Green]
Strategy155	[-3.1+] [Yellow]	[-3.0+] [Green]	[-3.5+] [Red]	[-3.5+] [Red]	[-3.5+] [Red]	[-3.0+] [Green]	[-4.0+] [Green]	[-4.0+] [Green]	[-5.0+] [Green]	[-3.0+] [Yellow]	[-5.0+] [Green]	[-3.8+] [Green]	[-5.0+] [Yellow]	[-5.0+] [Green]	[-4.0+] [Yellow]	[-4.5+] [Yellow]	[-4.0+] [Red]	[-1.0+] [Red]	[-3.0+] [Green]	[-5.0+] [Green]
Strategy156	[-3.0+] [Green]	[-3.0+] [Green]	[-3.0+] [Green]	[-3.0+] [Green]	[-3.0+] [Green]	[-3.0+] [Green]	[-2.0+] [Green]	[-5.0+] [Green]	[-3.0+] [Yellow]	[-3.6+] [Green]	[-4.0+] [Green]	[-3.4+] [Green]	[-4.0+] [Green]	[-5.0+] [Green]	[-3.0+] [Green]	[-4.0+] [Green]	[-4.0+] [Green]	[-2.0+] [Yellow]	[-3.0+] [Green]	[-4.0+] [Yellow]
Strategy157	[-3.0+] [Green]	[-3.0+] [Green]	[-4.0+] [Green]	[-4.0+] [Green]	[-4.0+] [Green]	[-3.0+] [Green]	[-3.8+] [Red]	[-3.0+] [Yellow]	[-3.0+] [Yellow]	[-5.0+] [Yellow]	[-3.0+] [Green]	[-3.0+] [Yellow]	[-5.0+] [Yellow]	[-3.0+] [Yellow]	[-3.0+] [Green]	[-3.0+] [Yellow]	[-4.0+] [Yellow]	[-4.0+] [Yellow]	[-4.0+] [Red]	[-5.0+] [Green]
Strategy158	[-3.0+] [Green]	[-3.0+] [Green]	[-3.5+] [Yellow]	[-3.5+] [Yellow]	[-3.5+] [Yellow]	[-3.0+] [Green]	[-3.0+] [Yellow]	[-5.0+] [Yellow]	[-3.0+] [Yellow]	[-5.0+] [Green]	[-5.0+] [Green]	[-4.0+] [Yellow]	[-5.0+] [Yellow]	[-4.0+] [Green]	[-3.0+] [Green]	[-3.5+] [Green]	[-4.0+] [Yellow]	[-4.0+] [Yellow]	[-3.0+] [Green]	[-5.0+] [Green]

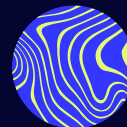
Each strategy is assessed by project experts, who will assign a real number score (with the associated uncertainty) to its potential impact on the reference indicators based on the following reference scale: **1. Strong negative effect; 2. Negative effect; 3. No effect; 4. Positive effect; 5. Strong positive effect**



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DISTENDER DSS: DECISION MATRIX (INDICATORS)

Reference set of indicators

Sectorial and economic indicators

Reduction of air quality impacts on human health
Reduction of excess mortality due to heat
Reduction in hydrological drought hazard
Reduction in flood hazard
Groundwater recharge
Reduction in energy demand
Total crop production
Timber provision
Economic impact on producers
Land use diversity
Reduction in land use intensity
Biodiversity, ecosystem services and natural capital
Cross-sectoral robustness

Mitigation indicators

Increase in carbon storage
Reduction in carbon emissions
Climate change mitigation overall (storage and emissions)

Adaptation indicators

Human Capital
Financial Capital
Manufactured Capital
Social Capital
Climate change adaptation overall (coping capacity)

Robustness indicators

Adaptation-mitigation synergies
Current feasibility
Future feasibility across socio-economic scenarios
Effectiveness across climate scenarios
Transferability across contexts

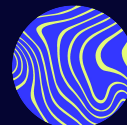
Policy-makers will assign weights to the indicators according to their preferences, enabling the generation of a ranked list of strategies based on their specific criteria.



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DISTENDER DSS: DECISION MATRIX (STRATEGIES) (WP6)

Approximately **70 strategies** have been developed for each **CCS** encompassing the following types and subtypes of strategies.

Each strategy will be assessed by project experts, who will assign a real number score to its potential impact on the selected indicators based on the following reference scale:

1. Strong negative effect
2. Negative effect
3. No effect
4. Positive effect
5. Strong positive effect

Governance, politics, and economy/wellbeing

1. Institutional structures and processes
2. Economic incentives and economic development
3. Policy/regulatory instruments
4. Codes, standards, certifications

Infrastructure, technology, nature/environment

5. Green Infrastructure
6. Hard/grey Infrastructure
7. Nature/Environment
8. Technology

Knowledge, capacity and innovation

9. Capacity building/skills
10. Data, monitoring, early warning systems
11. Research innovation and the science-policy interface
12. Entrepreneurship

Lifestyle, behaviour, and culture

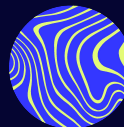
13. Daily routines & choices
14. Health, wellbeing, and social security
15. Changes in values/culture more broadly



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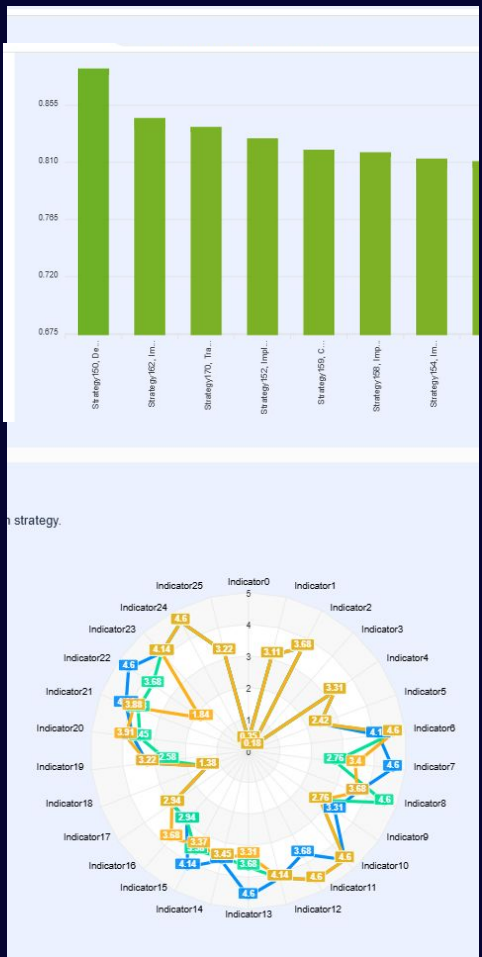
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DISTENDER DSS: INDICATORS WEIGHTS



Decision matrix

Strategy title	Indicator0	Indicator1	Indicator2	Indicator3	Indicator4	Indicator5	Indicator6	Indicator7	Indicator8	Indicator9	Indicator10	Indicator11	Indicator12
Strategy150	3.1	3.0	4.0	4.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Strategy151	3.1	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Strategy152	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Strategy153	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Strategy154	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Strategy155	3.1	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5
Strategy156	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0	3.0
Strategy157	3.0	3.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0	4.0
Strategy158	3.0	3.0	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5	3.5



Decision-maker introduce the **weights (w_j) (degree of importance)** for each of the indicators. Ranging from 0 (not important at all) to 100 (very important)

a_{ij} represent the **score of strategy i** respect to **indicator j** (how is the effect on the indicator j when we apply the strategy i)

Simple Additive Weighting (SAW) Algorithm

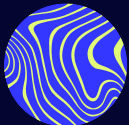
Ranking of strategies



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DISTENDER TEAM

□ DISTENDER is bringing together the **critical mass** of scientific leading institutions in the fields:

- 1. Earth Observation
- 2. Atmospheric/climate modelling
- 3. Economics
- 4. Urban thermal environment
- 5. Urban and spatial sustainable planning
- 6. Social behavior
- 7. Active nation/association/cities

with experience in adaptation/mitigation plans

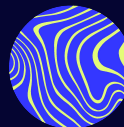
- 20 public-body and 10 non-public body



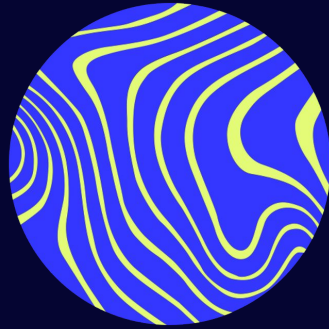
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