SRACC: climatic risk and vulnerability

IL FUTURO DELLE SPIAGGE E DEGLI ECOSISTEMI COSTIERI IN SARDEGNA: QUALI AZIONI PER AFFRONTARE LE SFIDE CLIMATICHE?

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Basic concepts and definitions

RISK

Potential consequences where something of human value (including humans) is at stake and where the outcome is uncertain. Represented as the probability of dangerous events or trends occurring, multiplied by the consequences that would result if those events occurred

The three key **components for assessing and managing climate change risks** are:

1. *hazard*
2. *Exposure*
3. *Vulnerability*

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Basic concepts and definitions

HAZARD -
Potential occurrence of a natural or man-made event or trend, or physical impact, that could cause loss of life, injury or other health impacts, as well as damage to and loss of property, infrastructure, livelihoods, service provision and environmental resources

VULNERABILITY
A propensity or predisposition to be adversely affected.
The term encompasses a variety of concepts, including **sensitivity** or susceptibility to harm, and a lack of **ability to resist and adapt**

EXPOSURE
Presence of people, livelihoods, species or ecosystems, environmental functions, services and resources, infrastructure or economic, social or cultural activities in places and environments that could be adversely affected by physical events and which, therefore, are subject to potential future harm, loss or damage

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Basic concepts and definitions

VULNERABILITY = Sensitivity + Adaptation capacity

- **Sensitivity**: the degree to which a system or species is affected, either negatively or positively, by climate variability or change. The effect may be direct (i.e. a change in crop yield in response to a change in mean or variability of temperature) or indirect (i.e. damage caused by an increase in the frequency of coastal flooding due to sea level rise)

- **Adaptive capacity**: the capacity of systems, institutions, humans, and other organisms to adapt to potential harms, to take advantage of opportunities, or to respond to consequences

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Why Assess the Vulnerability (and Risks) of a System

The need to carry out such assessments has grown in recent decades as a result of the **increased attention paid to adaptation (or risk reduction) policies**, which are based inextricably on the knowledge of the vulnerability of economic sectors, environmental systems and social systems to adverse events.

Assessing vulnerability and risk related to climate change has taken on particular significance for the **preparation of Climate Change Adaptation Plans**

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Why Assess the Vulnerability (and Risks) of a System

An in-depth understanding of how a sector/system/territory behaves in relation to climate change (or an adverse event) contributes to:

- Set objectives and targets (for adaptation or risk reduction)
- Provide the necessary elements for planning the measures to be undertaken
- Increase community awareness
- Monitor and evaluate the policies undertaken

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The example of the Sardinia Region

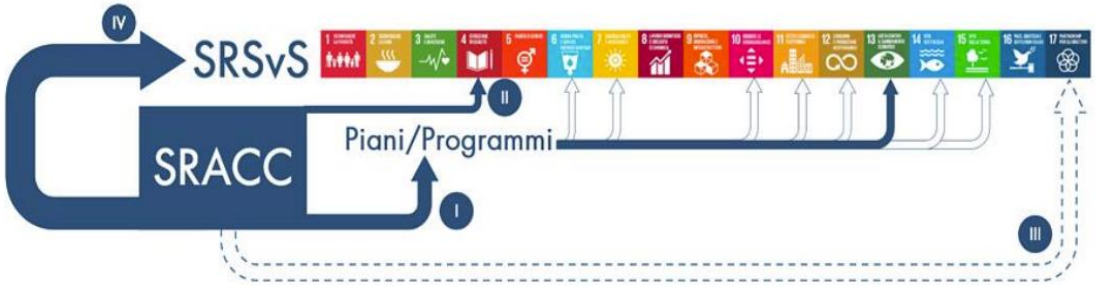
The SRACC is set up as a framework process for the orientation of Plans and Programmes and indicates the methods and procedures for the orientation

2019

- **agro-forestry** with all its territorial, ecological and productive values
- **inland waters** (regulation, conservation and distribution)
- **hydrogeological aspects of the territory** (territorial risk and planning)

2023

- **infrastructure & strategic activities**
- **Health & wellbeing**
- **Costs & transition environment (**including biodiversity, ecosistem services & coastal protection)



Prize «Sustainable Public Administration» as the **best 2019 project** in Italy

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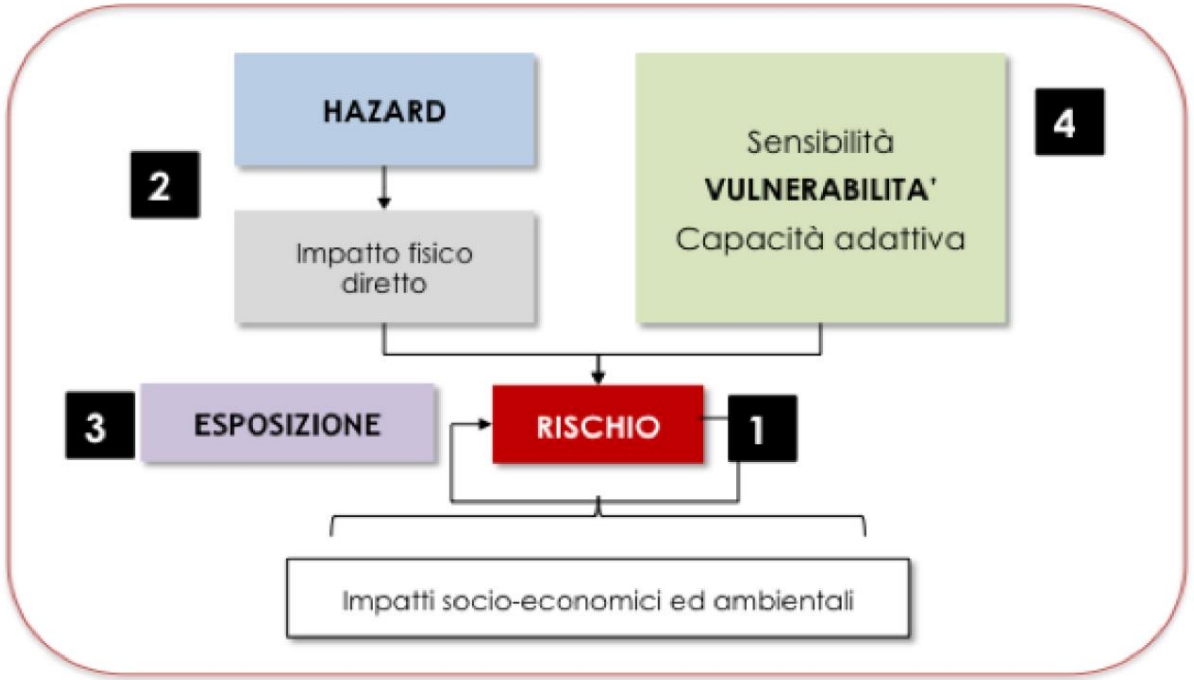
The SRACC – impact chain method

An **impact chain** is an analytical tool that helps to better understand and prioritize the factors that drive risk in the system of interest.



Each indicator has been classified into 5 classes::

Class 1 = Lower level (optimal or low criticality condition)
Class 2 = Medium-low level
Class 3 = Medium level
Class 4 = Medium-high level
Class 5 = High level (high criticality condition)

Hazard: includes factors related to the climate signal and direct physical impact
Exposure: consists of one or more exposure factors
Vulnerability: consists of sensitivity and capacity factors

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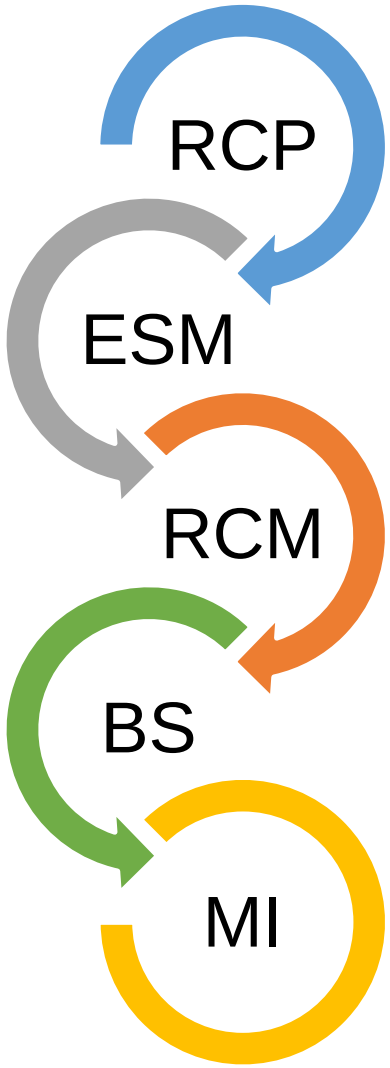
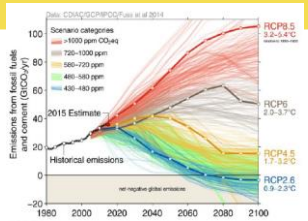
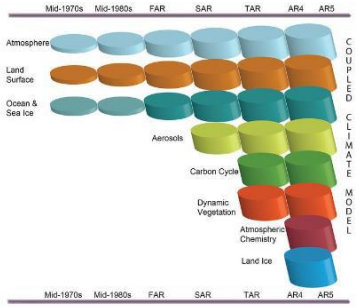
What climate for Sardinia? Tools



REPRESENTATIVE CONCENTRATION PATHWAY



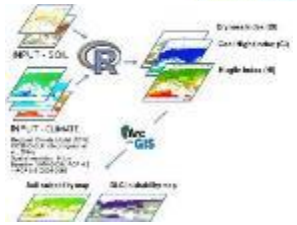
EARTH SYSTEM MODEL



REGIONAL CLIMATE MODELS

BIAS CORRECTION

MODELLING IMPACT



- Climate models with very high spatial (about 2 km) and temporal (hourly) resolution
- Two reference periods: 1981-2010 and 1991-2020
- Two scenarios RCP 4.5 and 8.5 for the period 2021-2050
- Changes in future climate reported in terms of climate indicators.
- Climate indicators represent specific characteristics (average and extreme) of the climate

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Climate indicators

Spatial averages of ERA5-2km indicators for the period 1981-2010

Indicatore	Valore medio spaziale	+/- SD
TG (°C)	15.8	1.6
TX95PRCTILE (°C)	34.4	2.2
TX99PRCTILE (°C)	38.0	2.1
TXX (°C)	40.2	2.1
TN99PRCTILE (°C)	24.5	0.9
TNX (°C)	25.8	0.9
PRCPTOT (mm)	456	122
R20 (giorni)	5	2
RX1DAY (mm/giorni)	51	14
RX5DAY (mm/giorni)	78	22
PR95PRCTILE (mm)	26	4
PR99PRCTILE (mm)	49	12
R99PTOT (%)	8	1
TR100PR (mm)	132	56
CDD (giorni)	64	13
ID (giorni)	1	2*
WSDI (giorni)	4	1
HW (giorni)	18	13
HWN (occorrenza)	3	1
TR (giorni)	46	16

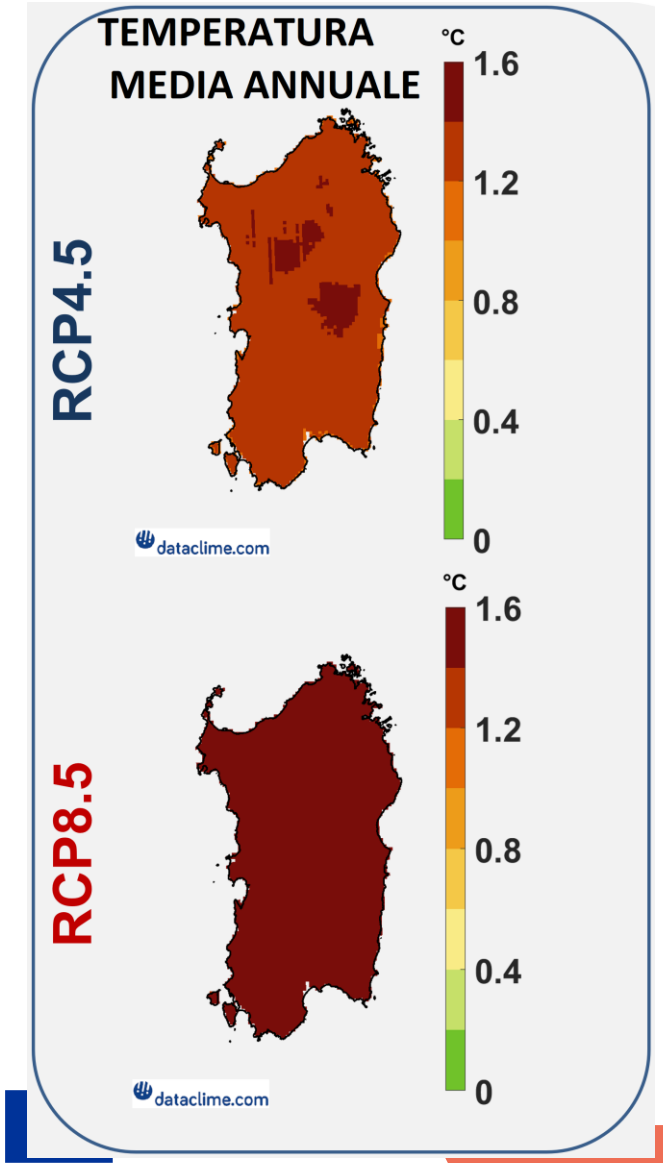
** Tale indicatore è al minimo pari a zero*

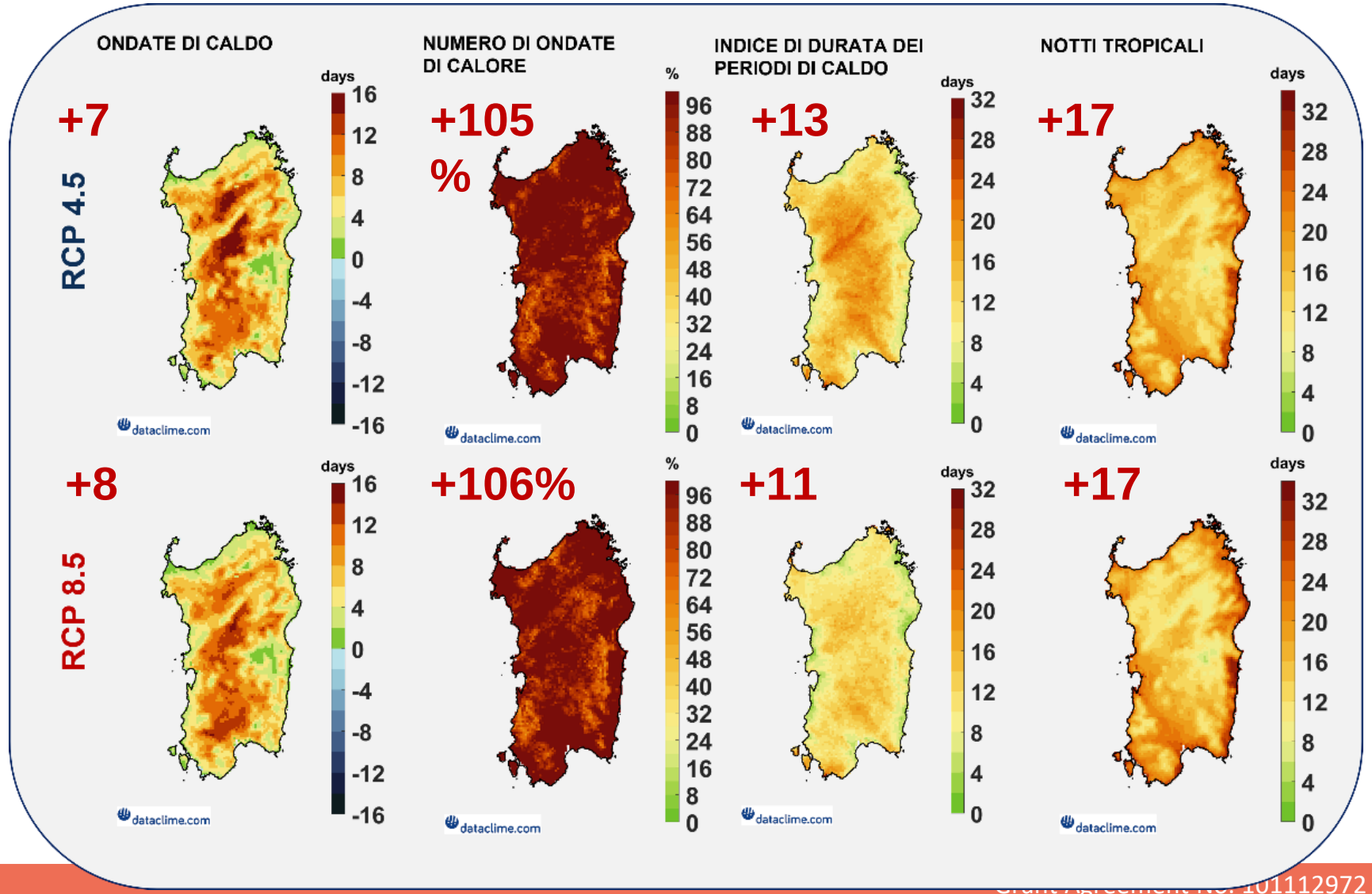
Changes in annual spatial means of indicators. Changes are calculated for the period 2021-2050 compared to 1981-2010 under the IPCC RCP4.5 and RCP8.5 scenarios

Indicatore	RCP4.5		RCP8.5	
	Valore medio spaziale	+/- SD	Valore medio spaziale	+/- SD
TG (°C)	1.3	0.1	1.5	0.0
TX95PRCTILE (°C)	1.5	0.1	1.5	0.1
TX99PRCTILE (°C)	1.4	0.2	1.5	0.2
TXX (°C)	1.2	0.3	1.5	0.4
TN99PRCTILE (°C)	1.6	0.2	1.5	0.2
TNX (°C)	1.5	0.3	1.4	0.2
PRCPTOT (%)	1	6	2	3
R20 (giorni)	0	1	1	1
RX1DAY (%)	23	15	17	11
PR95PRCTILE (%)	15	9	16	6
PR99PRCTILE (%)	26	17	20	11
R99PTOT (%)	5	3	4	2
TR100PR (%)	33	33	22	28
CDD (giorni)	1	4	4	4
ID (giorni)	-1	1	-1	2
WSDI (giorni)	14	4	11	3
HW (giorni)	7	4	7	3
HWN (%)	105	21	105	25
TR (giorni)	17	4	17	5

Temperature

Expected changes in the 2021-2050 thirty-year period compared to the 1981-2010 reference period (RCP4.5 and RCP8.5 scenarios)
Spatial scale: about 2 km; temporal scale: hourly





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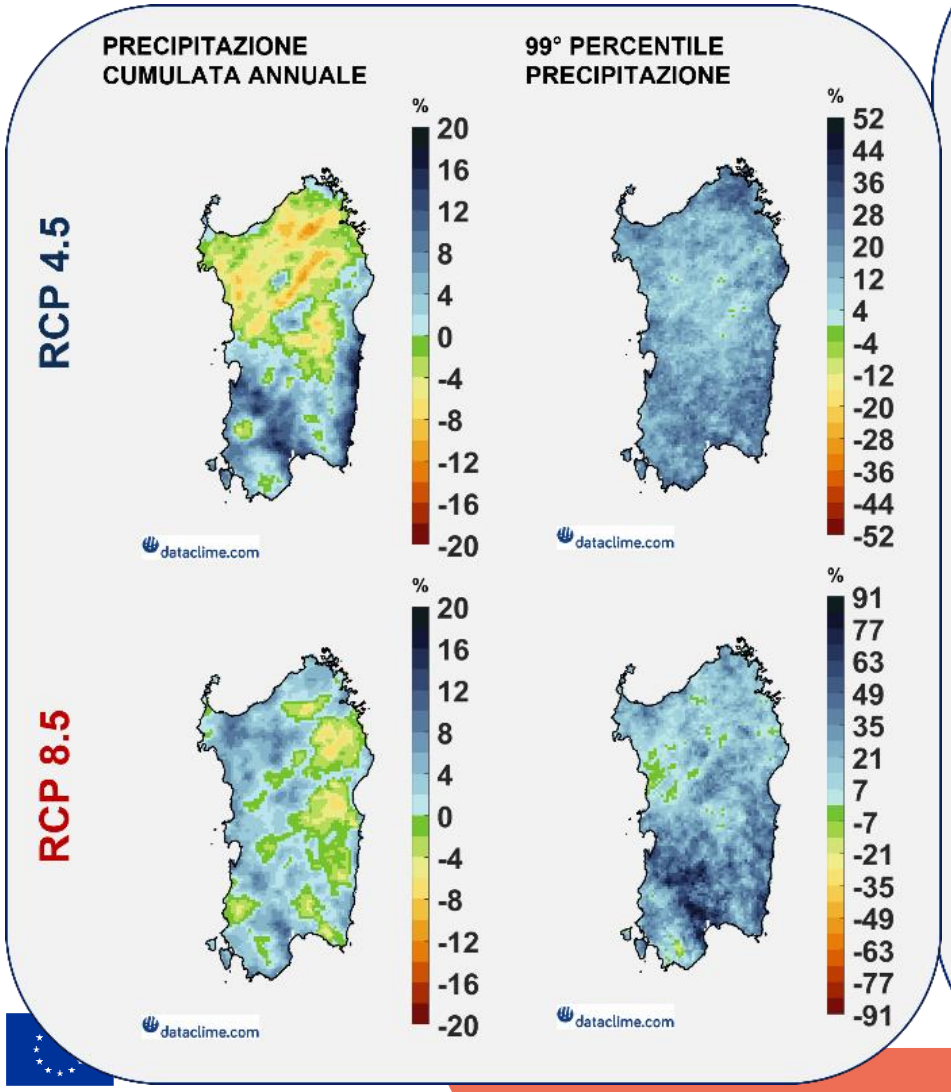
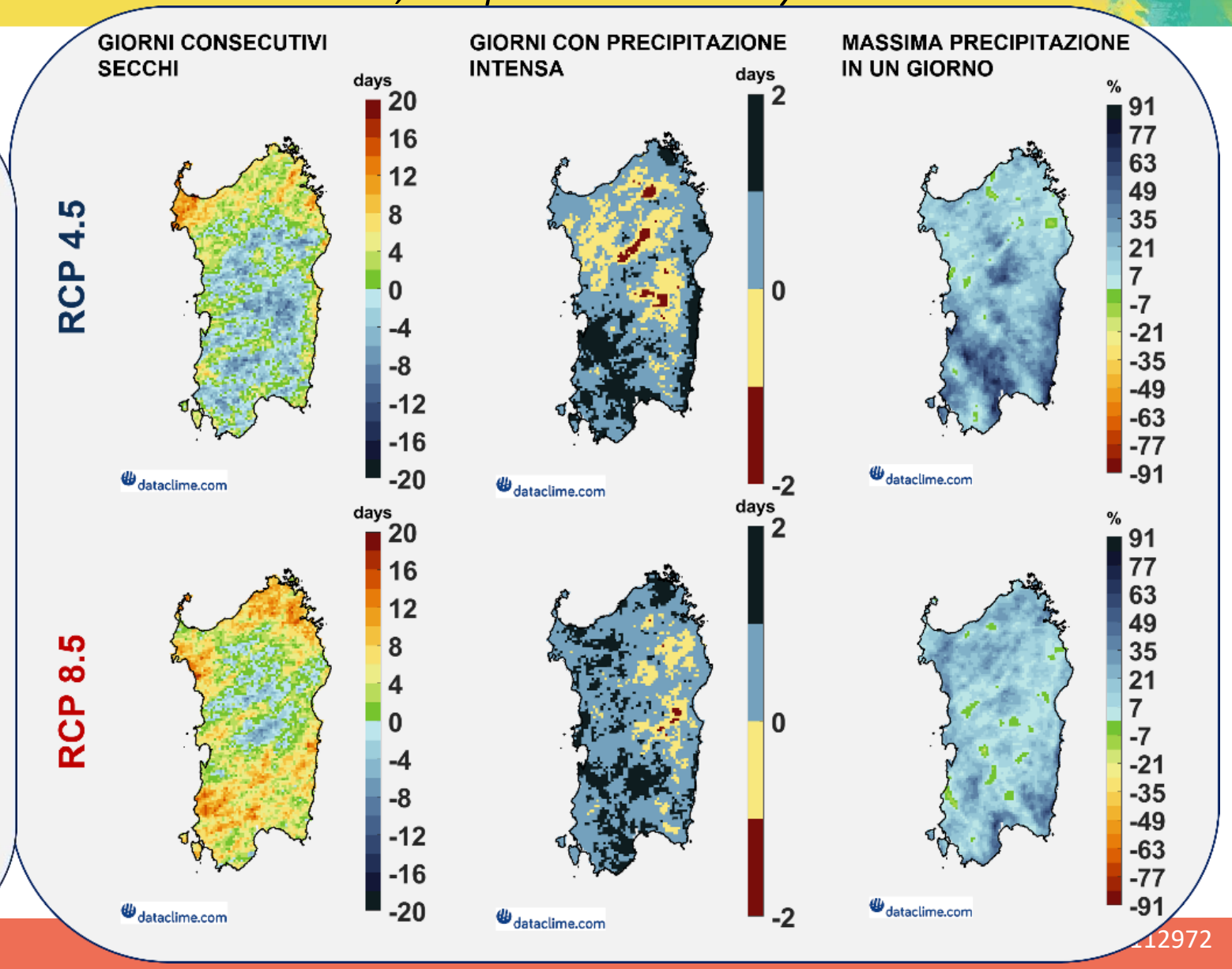
Precipitation

Expected changes in the 2021-2050 thirty-year period compared to the 1981-2010 reference period (RCP4.5 and RCP8.5 scenarios)
Spatial scale: about 2 km; temporal scale: hourly





Summurizing

General increase in average temperature and in maximum and minimum temperature extremes, in periods of high temperatures, in the **frequency of extremely hot events and tropical nights.**

The RCP4.5 scenario returns a reduction in **cumulated annual precipitation** in the north and an increase in the south

The RCP8.5 scenario shows a general increase in annual precipitation over the entire region, with the exception of a slight reduction in some areas located in the north-eastern and southern part of Sardinia.

For both scenarios, in most of the study area is expected an **increase** in the values of maximum Pcp in 1-day and of **precipitation extremes**

In terms of **number of consecutive dry days** with Pcp lower than 1 mm, the RCP4.5 scenario shows an increase in annual values in the norther part of the region and a reduction in the central and southern parts.

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Concluding remarks

1. The **added value of scientific research.** It is essential to have tools capable of analyzing the expected risks to identify appropriate adaptation measures at different scales. **High-resolution models**

2. **More options to understand risk**. Having more methods to reduce uncertainty of risk indexes, more advanced research for **extreme climatic indicators**

3. **Riduce local vulnerability** means to identify **local adaptation solutions** due to the diverse impacts, local characteristics and different development pathways

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CHALLENGES

4

Mainstreaming adaptation at different levels in public policies when planning objectives are decided, financial programs are elaborated or investing projects are developed. To **integrate adaptation with the sustainable development of the territory**

5

Use economic resources with competence and innovation, through **new models for production and business** and new ways **towards sustainable development of the territory** must became familiar for private and public bodies both at local and national level

6

Invest in sustainable development, the only development model for the future, an opportunity to not lose or postpone

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Thank you!

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