

ADAPTACLIMA - EPAL

Developing an Adaptation Strategy to Climate Change: the example of a Portuguese water supply company



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HYDROPREDICT 2012 – Vienna, 25th September 2012



1. Project framework

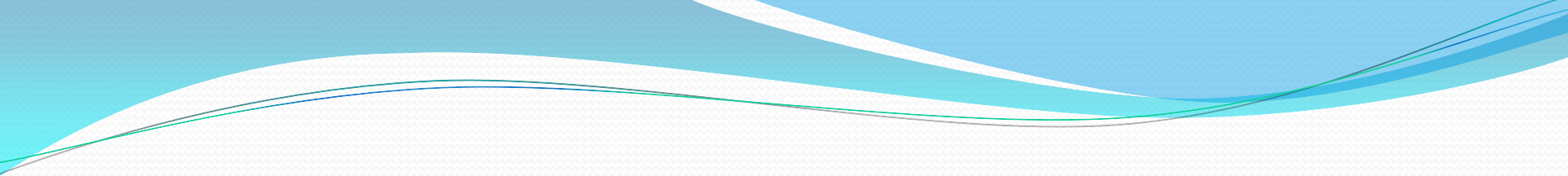
1. EPAL System
2. Motivation and objectives

2. Methodology

- A. Definition of an Adaptation Strategy

3. First Results

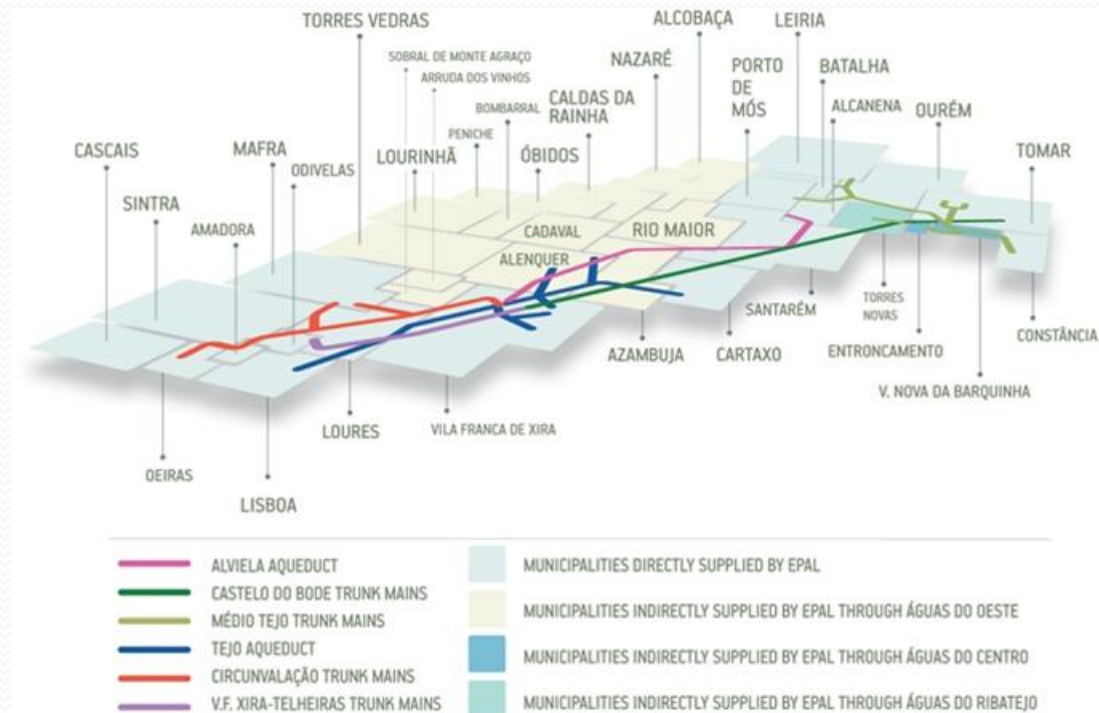
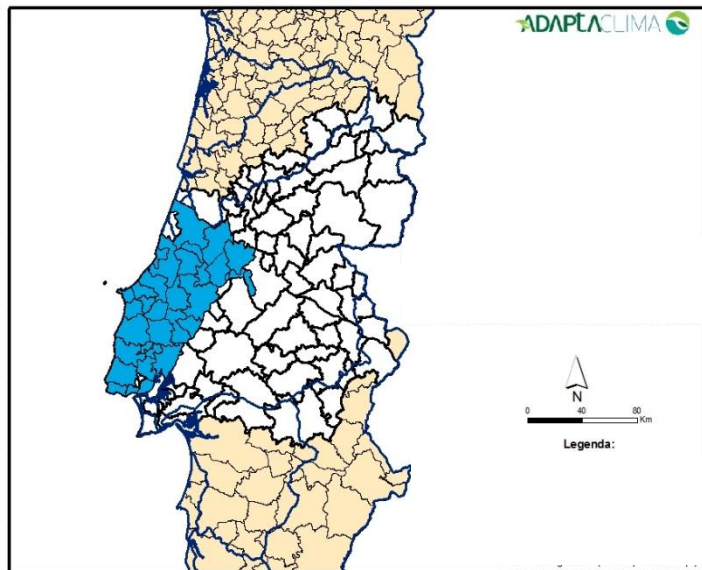
4. Main conclusions



P

roject Framework and Objectives

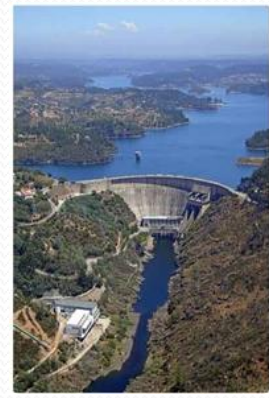
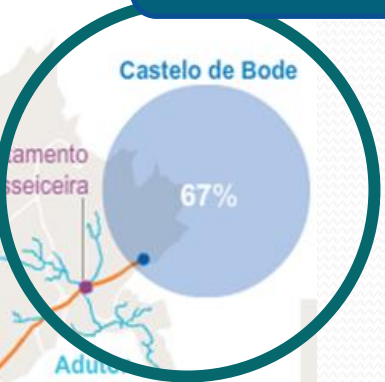
- ✓ **EPAL – Main Water Supply Utility in Portugal**
- ✓ Abstraction, treatment, transport and water supply
- ✓ Direct supplier Lisbon (500.000 upstream clients) & indirect supplier 33 Municipalities (clients serving population)
- ✓ Total population served \approx 2,8 million



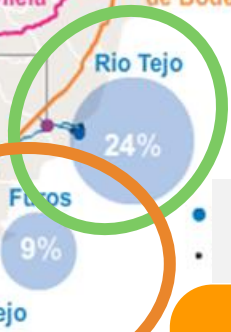
EPAL's System



Surface Water - dam reservoir [162,4 hm³ (2010)]
- CASTELO DE BODE



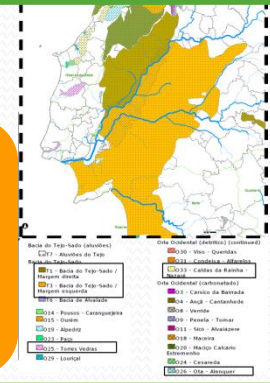
Surface Water - river abstraction [56,6 hm³ (2010)]
- VALADA TEJO



- Surface water
- Groundwater

Current Groundwater [23,4 hm³ (2010)]

- OTA
- ALENQUER
- LEZÍRIAS



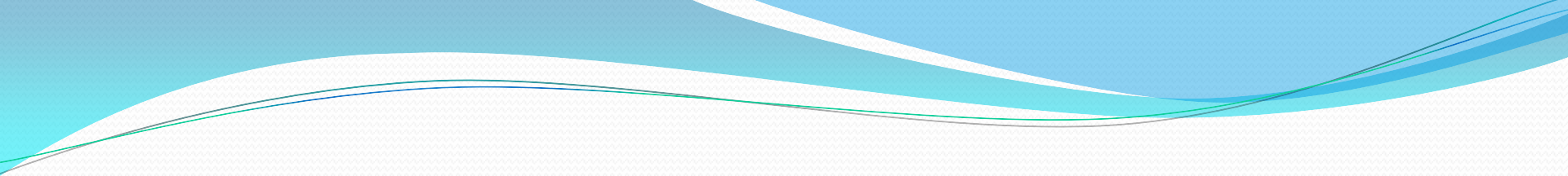
ed from: Público 2012

Project framework and objectives

- *How will water resources availability (quantity and quality) change under Climate Change?*
- *Is EPAL vulnerable to Climate Change?*
- *How should we respond in the short, medium and long term?*

ADAPTACLIMA aims to provide EPAL with an adaptation strategy in the medium and long term to identify and reduce the vulnerabilities of its activities to climate change

But how...?



Methodology



```
graph TD; A[1. Modeling future climate impacts] --> B[2. Defining adaptation options]; B --> C[3. Evaluating adaptation options]; C --> D[4. Build an adaptation strategy]; Stakeholders[Stakeholders] --> C; Stakeholders --> D;
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1. Modeling future climate impacts

2. Defining adaptation options

3. Evaluating adaptation options

4. Build an adaptation strategy

Stakeholders

Definition of an adaptation strategy



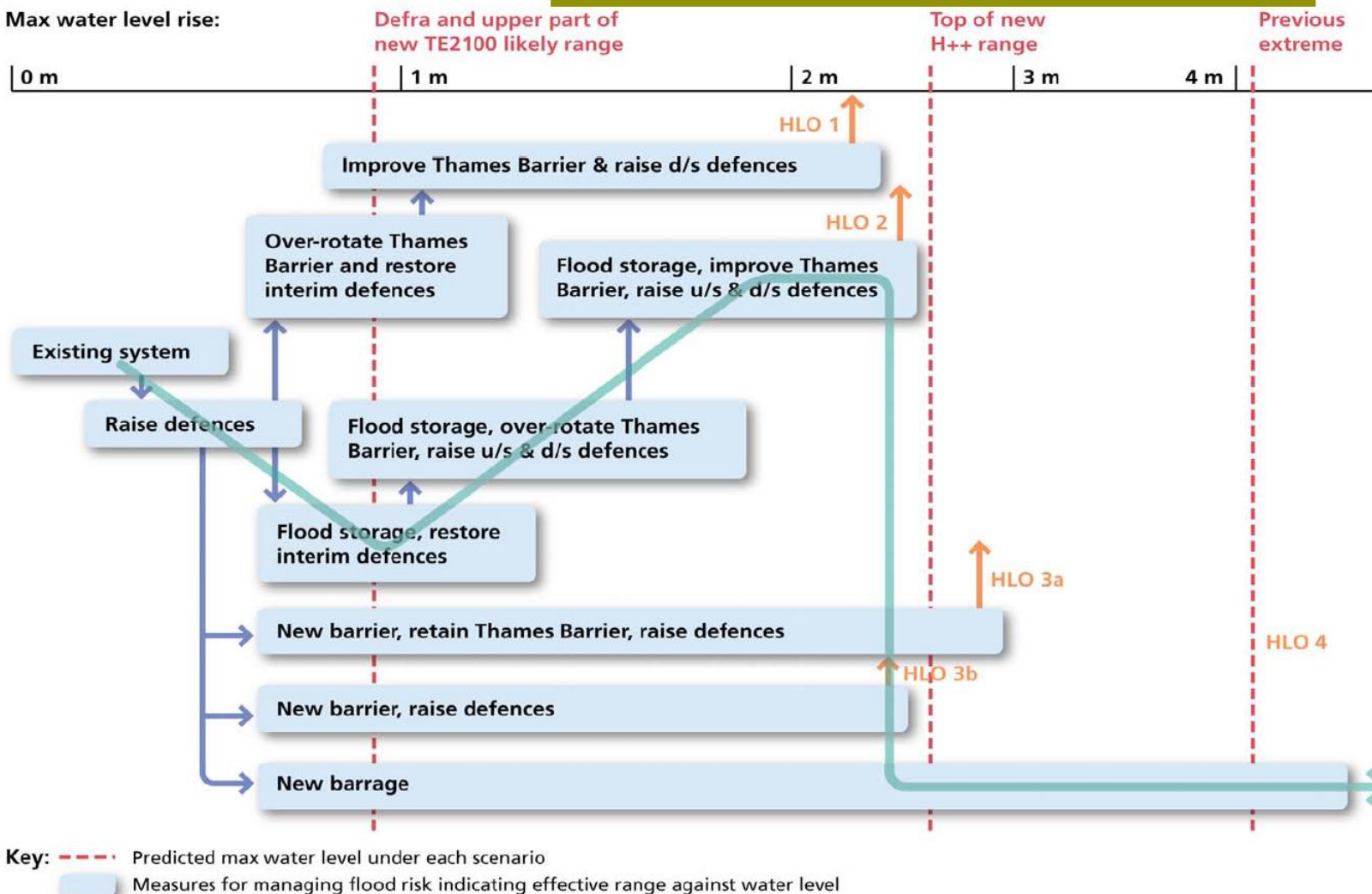
*Adapted from: Adaptation in the UK: a decision-making process N. Ranger, A. Millner, S. Dietz, S. Fankhauser, A. Lopez and G. Ruta. **The framework for adaptation decision-making.***

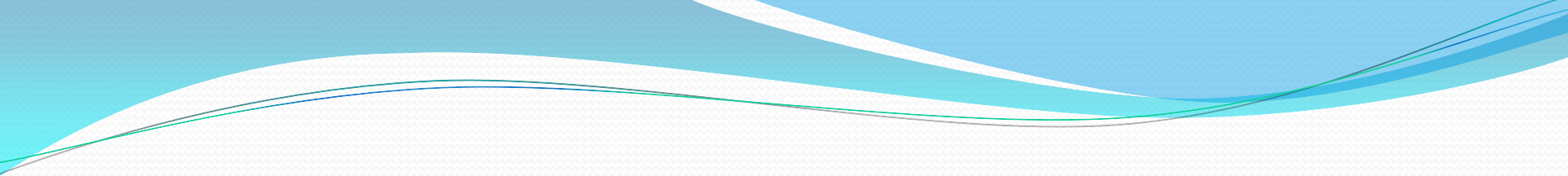
Definition of an adaptation strategy



CASE STUDIES (TE2100)

Max water level rise:

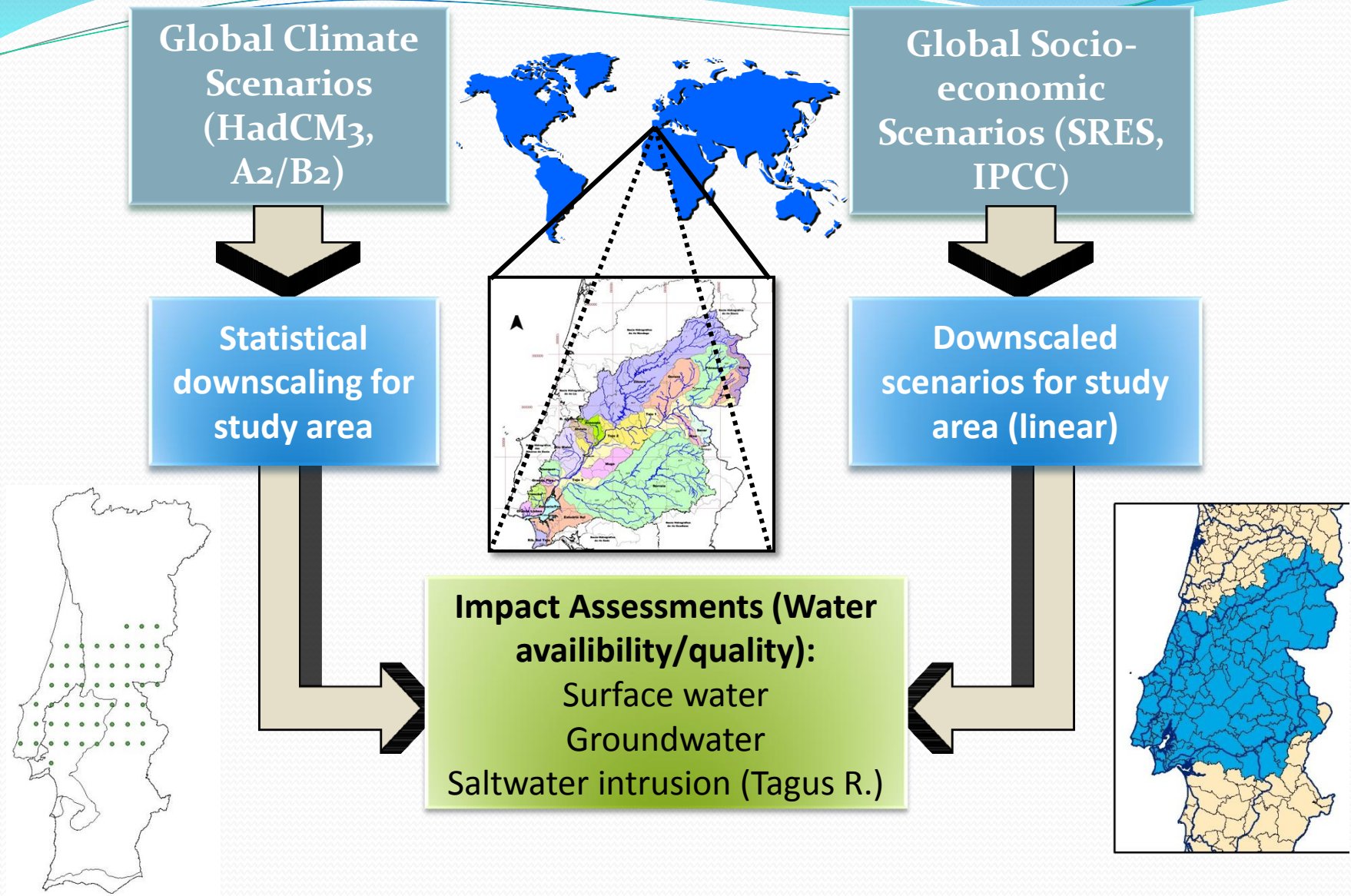




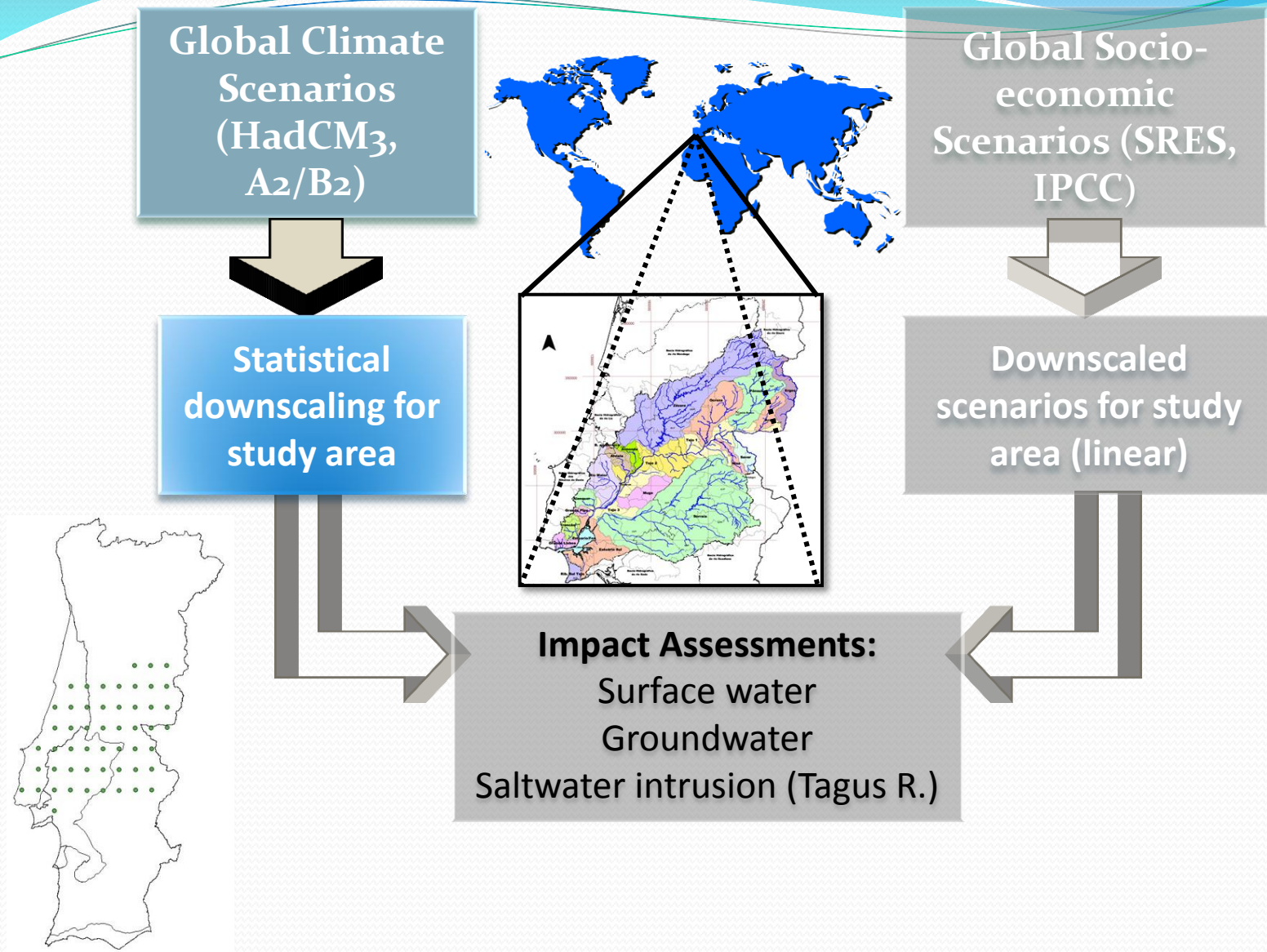
F

irst Results

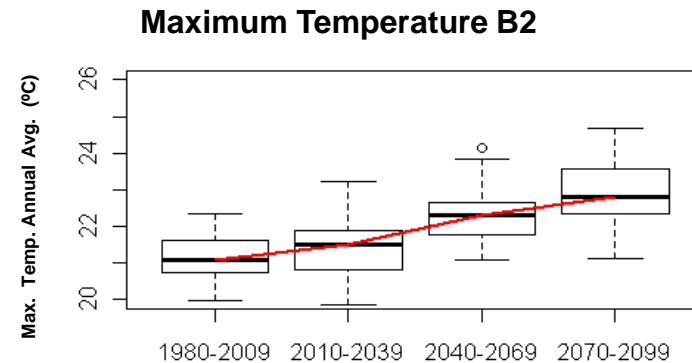
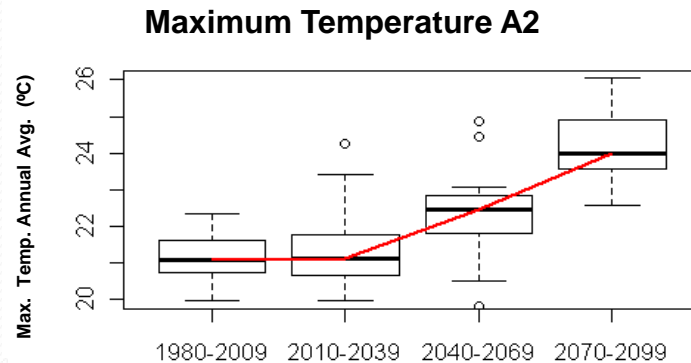
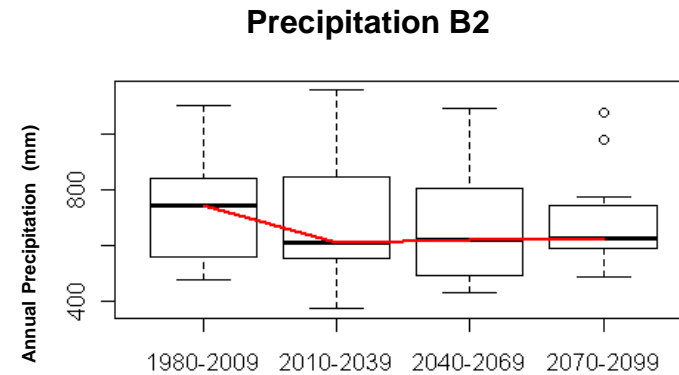
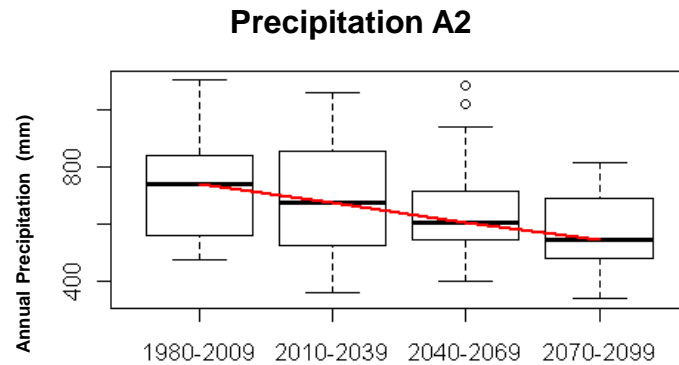
Future impact assessment



Results - Climate Scenarios

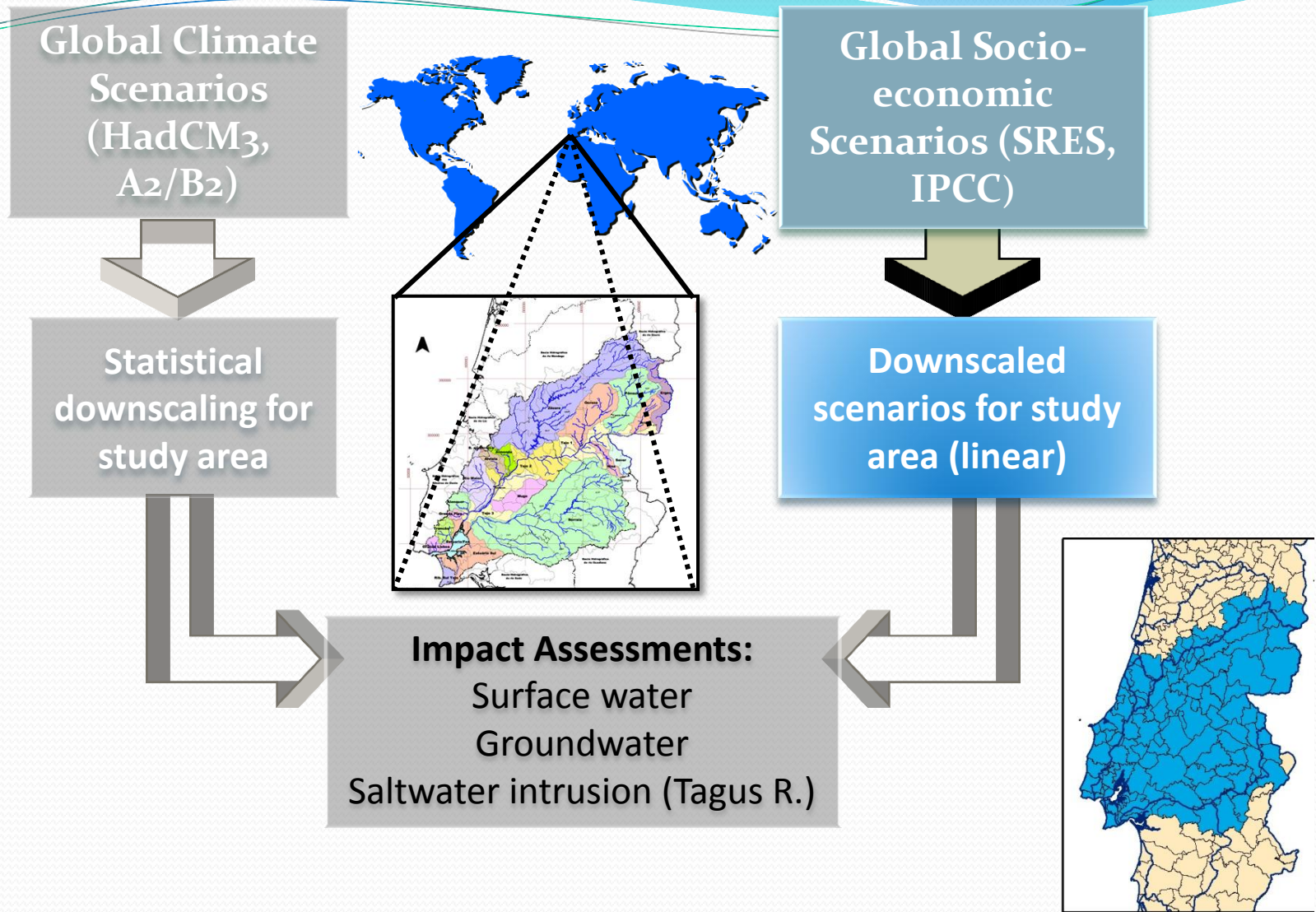


Results - Climate Scenarios

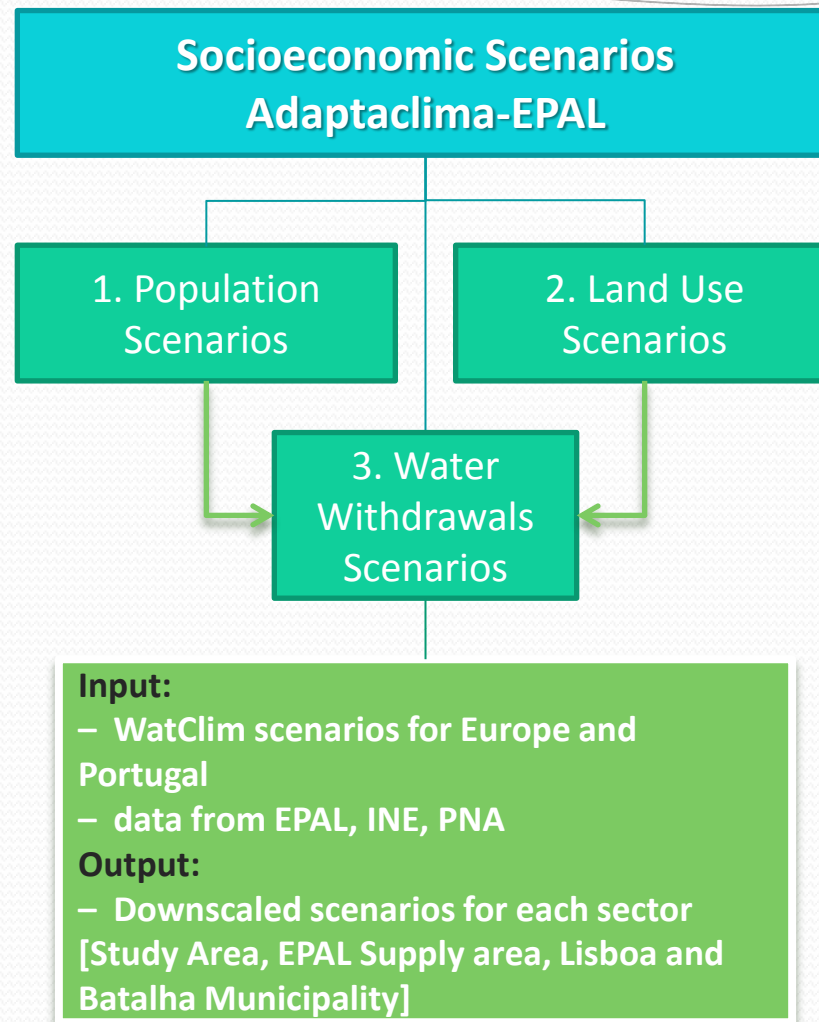


- Maximum temperature will increase 1.7 to 3° C in scenario B2 and A2, by the end of the century, when compared to the 1980-2009 period
- Average annual precipitation is expected to decrease about 55 (7.6%) and 151 mm (20.9%) by the end of century in scenarios A2 and B2 respectively, when compared to the 1980-2009 period

Results - Socio-economic Scenarios



Results - Socio-economic Scenarios

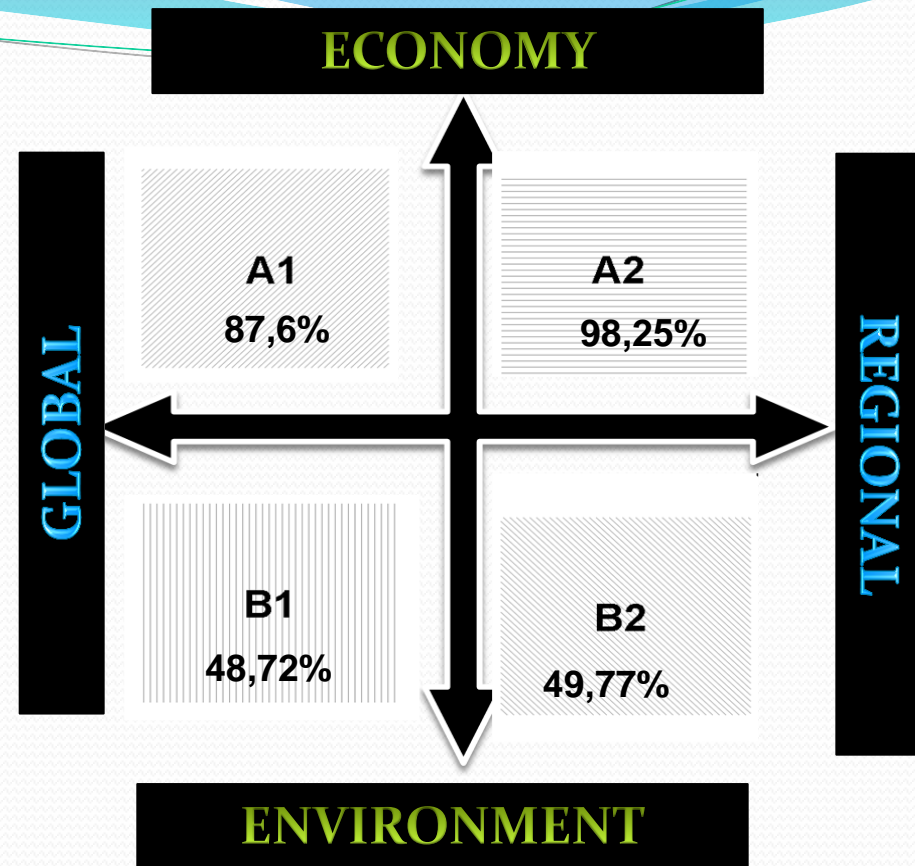


Jacinto et al., 2012. Water use scenarios as a tool for adaptation to climate change of a water supply company

Results - Socio-economic Scenarios

	Base year
Agriculture *1	1440000000 m ³
Industry *2	2194069 m ³
Domestic *2	237702531 m ³
Services *2	6466211 m ³

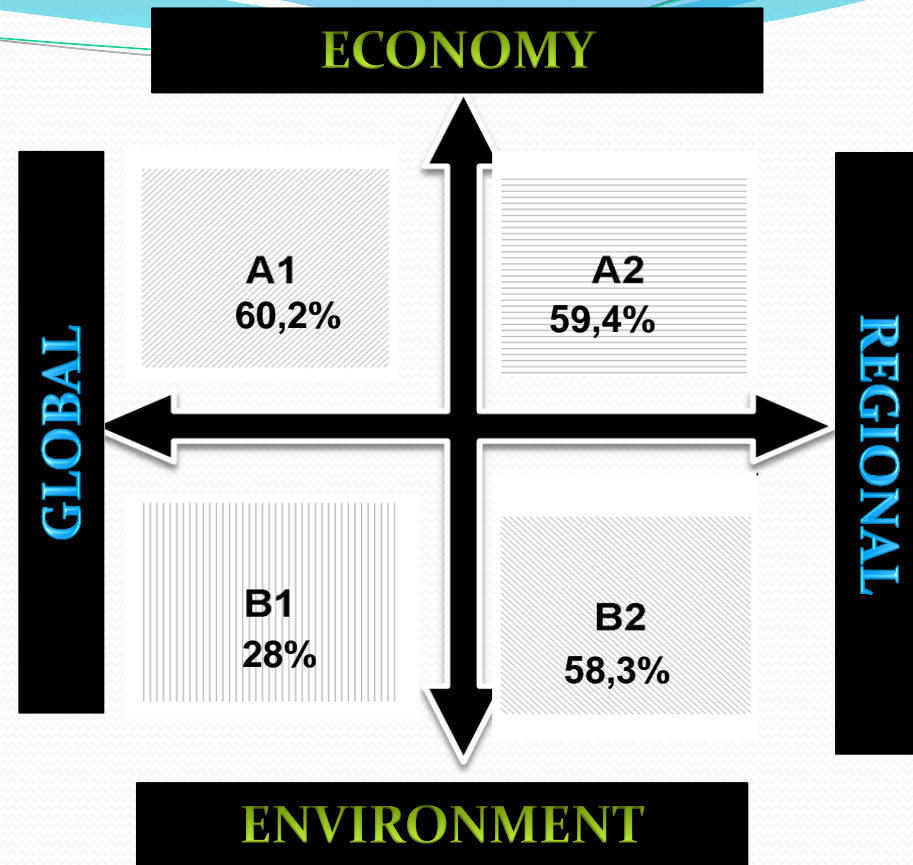
2080



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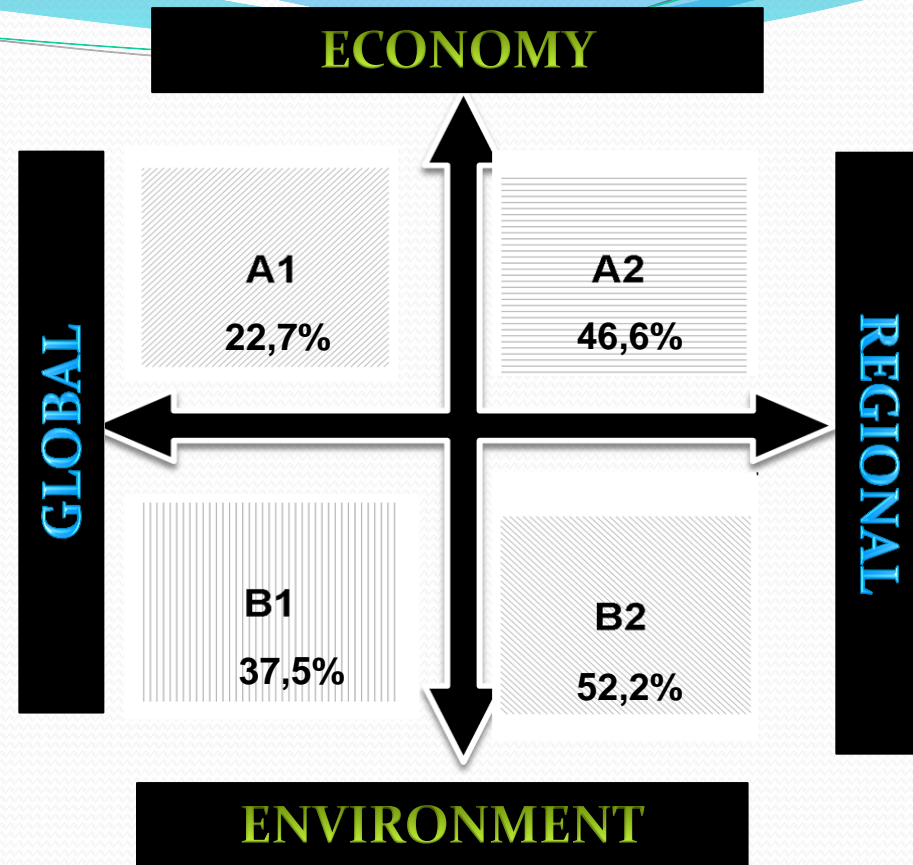
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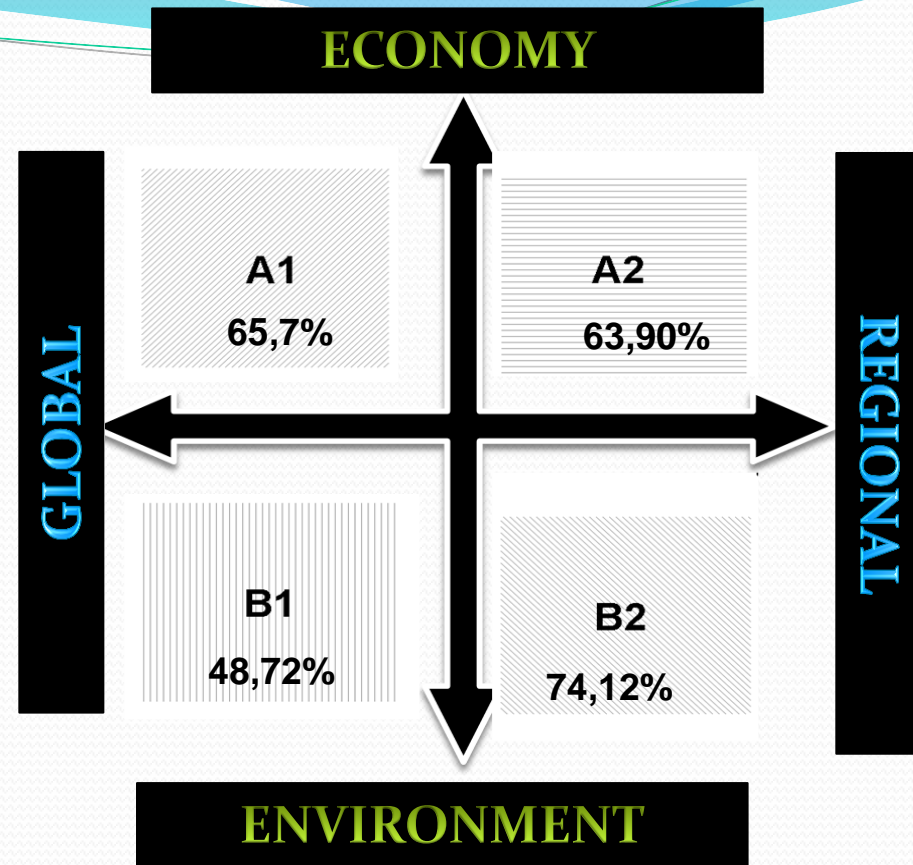
2080



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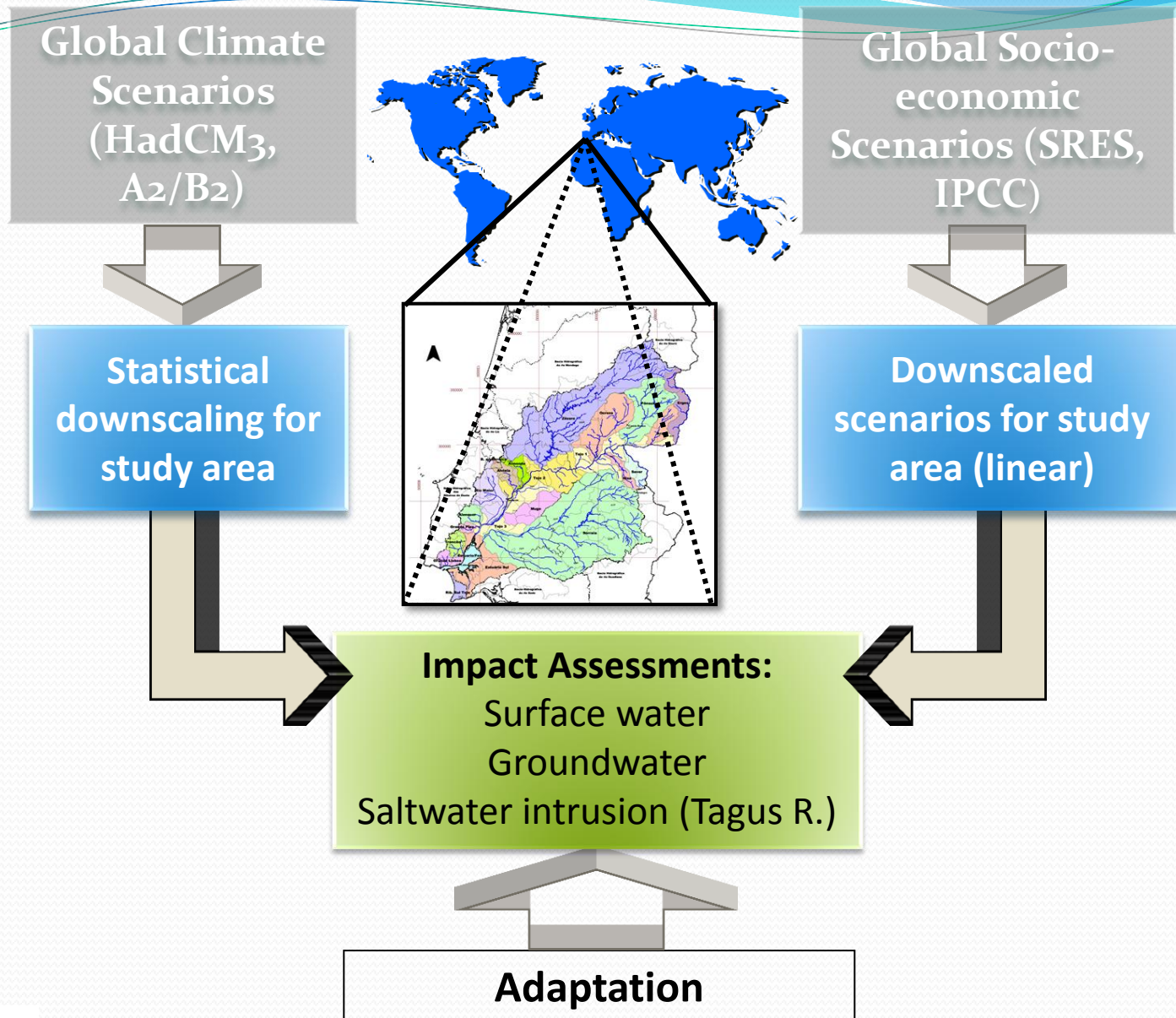
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2080



- different scenarios considered indicate **reductions in water use** in the study area driven mostly by a reduction in agricultural area and increases in water consumption efficiency;

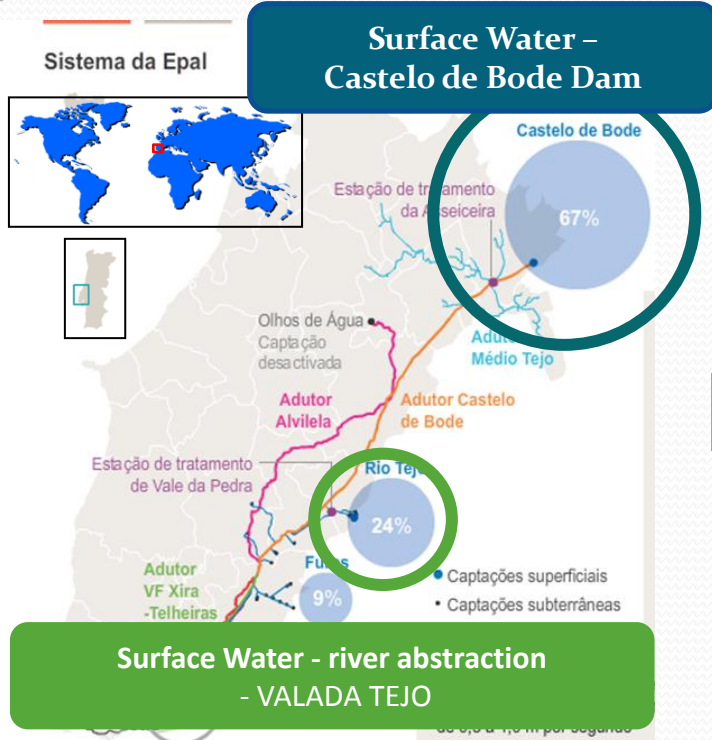
First results – Surface water availability



First results – Surface water availability

Preliminary results (not published - please do not cite)

Results from Nunes et al. (working drafts)



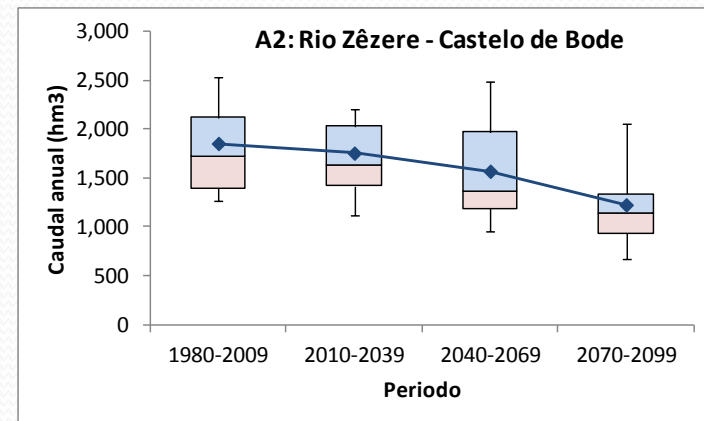
Aveiro University (Dr. João Pedro Nunes)

SWAT hydrological model

- For Climate scenarios A2 and B2:
- **Daily streamflow for the Zézere watersheds**
- **Daily streamflow for the Tagus watersheds**

Main results

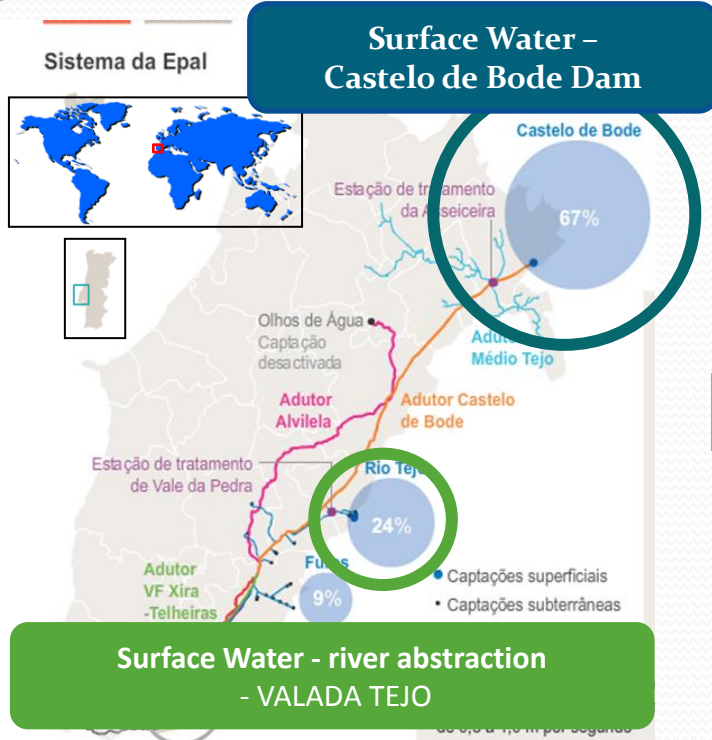
- When compared with the period of 1980-2009:
- **Avg. Annual Streamflow to Castelo de Bode decreases 20-34% (B2 and A2)**



First results – Surface water availability

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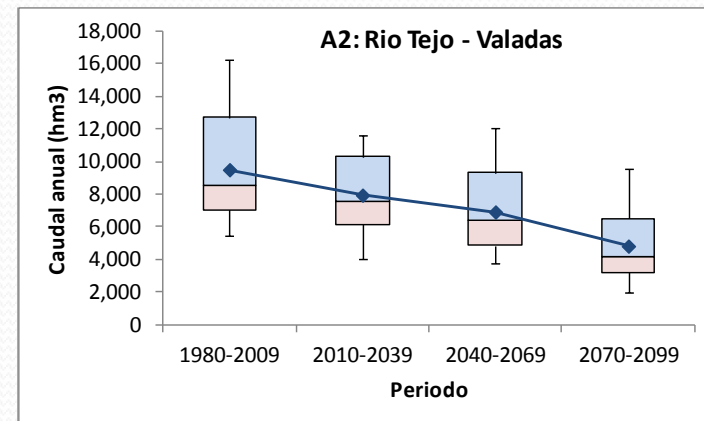
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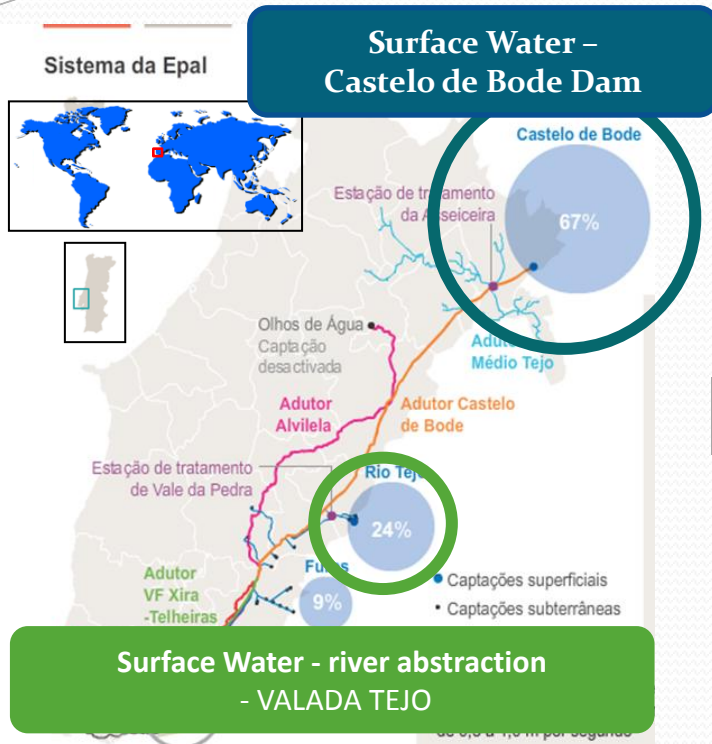
- When compared with the period of 1980-2009:
- **Avg. Annual Streamflow will decrease 31-49% (B2 and A2) in Valada**



First results – Surface water availability

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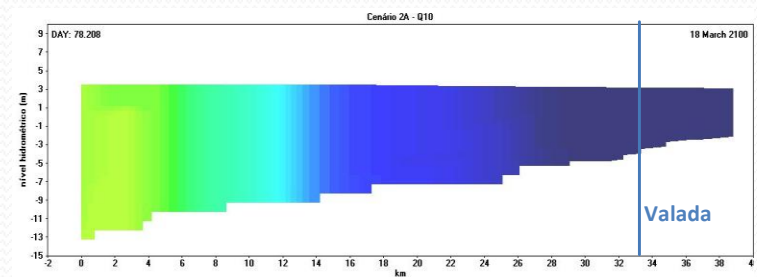
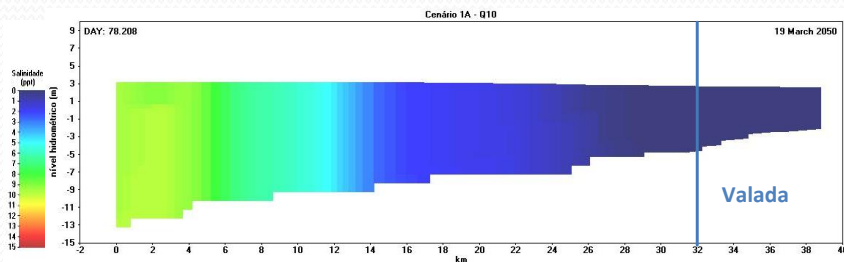
- When compared with the period of 1980-2009:
- **Avg. Annual Streamflow 20-34% (B2 and A2) in Castelo de Bode**
- **Avg. Annual Streamflow will decrease 31-49% (B2 and A2) in Valada**

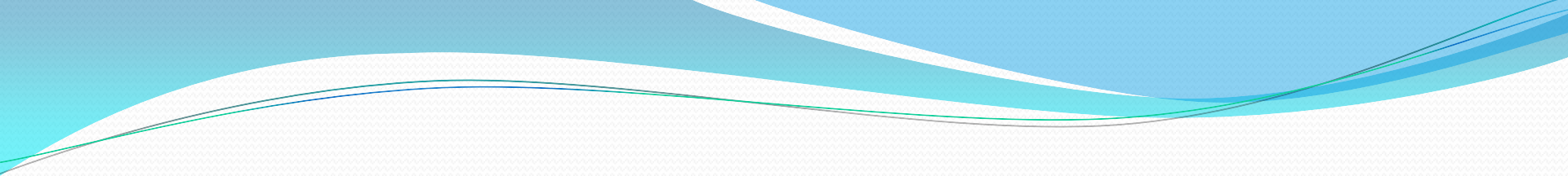
Main conclusions

- Significant decrease in the streamflow to Castelo de Bode and Valada Tejo but annual water availability is still much higher than current yearly water abstractions (162 hm³/year in Castelo de Bode and 57 hm³/year in Valada, according to EPAL data from 2001-2008 period)

Preliminary results (not published - please do not cite)

- **Surface water quality**
 - Relatively low increase in primary productivity driven by an increase in P concentrations
- **Groundwater**
 - Changes in piezometric levels until 2070 are not significant
 - After 2070 significant decreases are estimated, but a high level of associated uncertainty
- **Saline water intrusion**
 - No significant salinity impact for all tested scenarios





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ain Conclusions

Definition of an adaptation strategy

- Transition from a adaptation strategy driven by impacts to a strategy driven by decision-maker needs
- **Main advantages:**
 - Stakeholder engagement in all steps of the development of the adaptation strategy
 - Solutions more customized to the EPAL decision process
 - Easier integration with their operational planning
- **Main obstacles:**
 - Stakeholders interaction process is more time consuming
 - Researchers must adapt their methods to the stakeholder decision process

First Results

- Preliminary results – are still being improved
- Significant decreases in annual streamflow to surface water resources but water availability still exceeds current water abstraction needs
- Impact on other resources are relatively low or with a high level of uncertainty

Thank you!



Adaptar o Ciclo Urbano da Água a Cenários de Alterações Climáticas

[Início](#)[Projecto](#)[Documentos](#)[Equipa](#)[Notícias](#)[Contactos](#)

Notícias

No passado dia 6 de Julho de 2011 realizou-se o **primeiro Workshop ADAPTA CLIMA-EPAL** a nota de imprensa publicada na revista Águas Livres pode ser acedida através do seguinte link: [Primeira Workshop - Águas Livres](#)

**S I M****EPAL**

<http://siam.fc.ul.pt/adaptaclima-epal/>