

Cenários e Impactos das Alterações Climáticas em Portugal

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Equipa: Pedro Matos Soares, Rita M. Cardoso, Daniela Lima

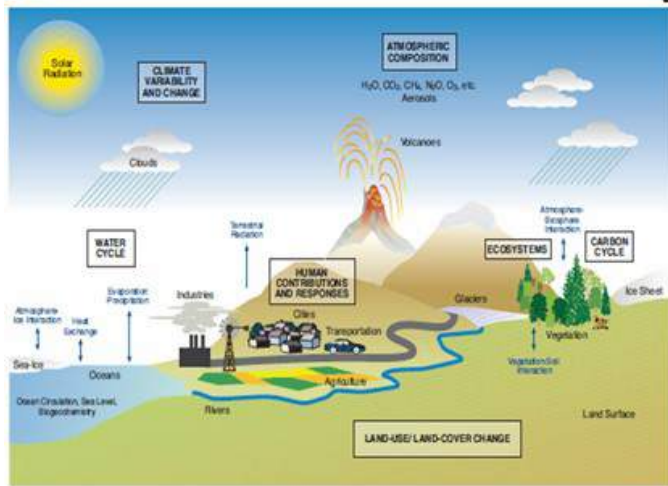
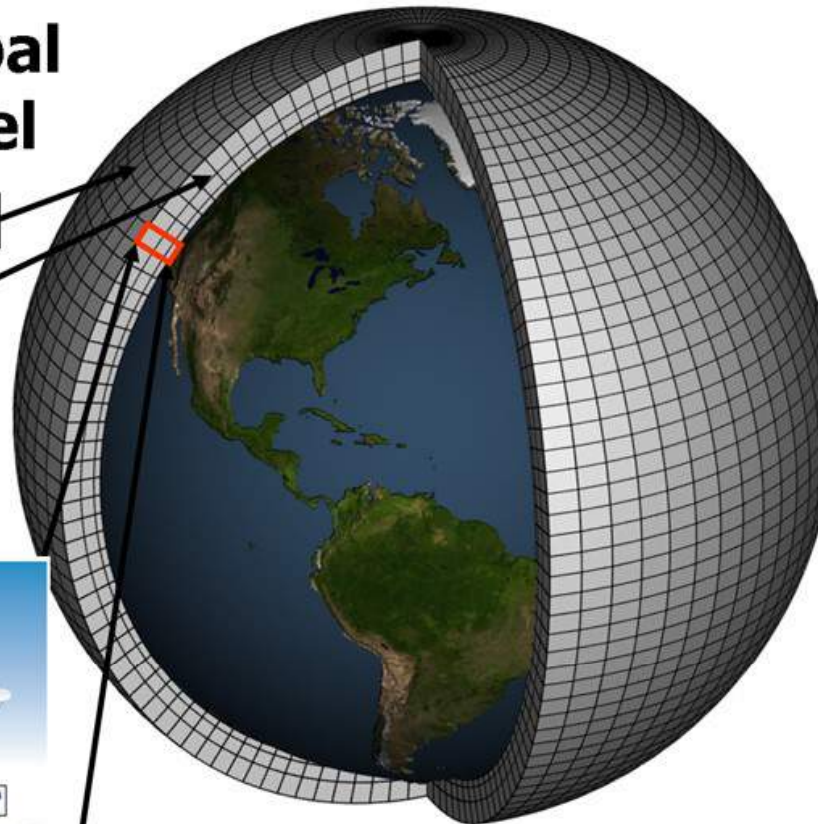
Colaboradores: Álvaro Semedo, Miguel Nogueira, Ricardo Tomé e Pedro Miranda

Trabalho realizado no âmbito do projecto
SOLAR earth System mOdeLLing of the eAsteRn atlantic Region
(PTDC/GEOMET/7078/2014, Modelação do Sistema Terra no Atlântico Este)

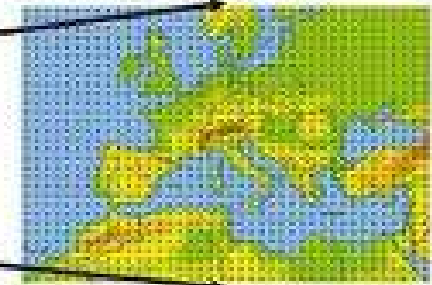
Schematic for Global Atmospheric Model

Horizontal Grid (Latitude-Longitude)

Vertical Grid (Height or Pressure)



RCM



Qual é a performance dos GCMs ?

Forçamentos Antropogénicos e Naturais

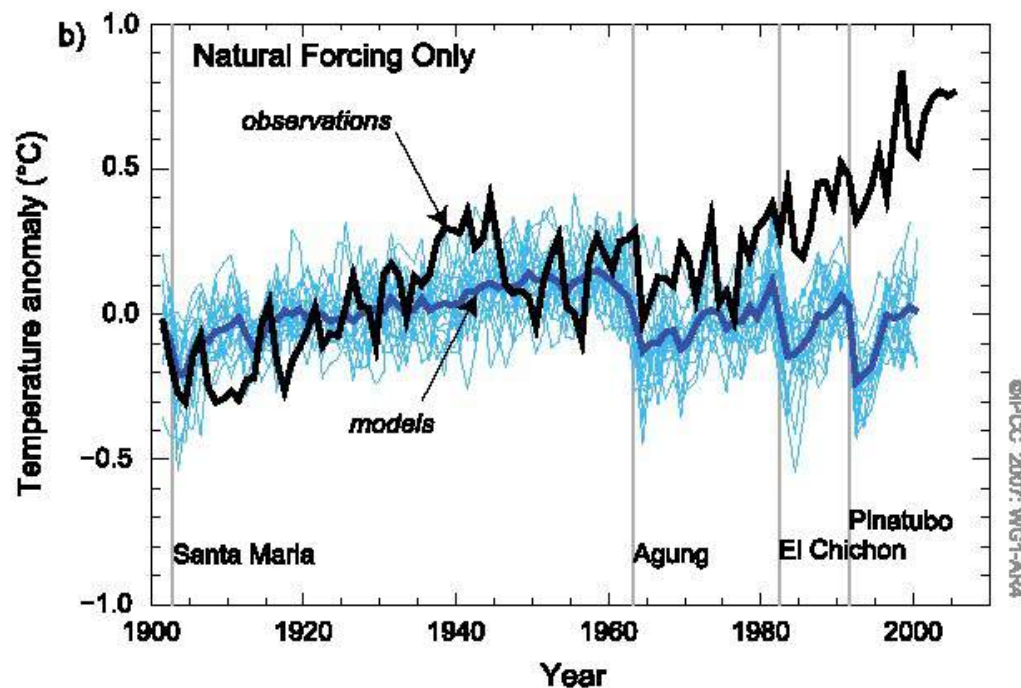
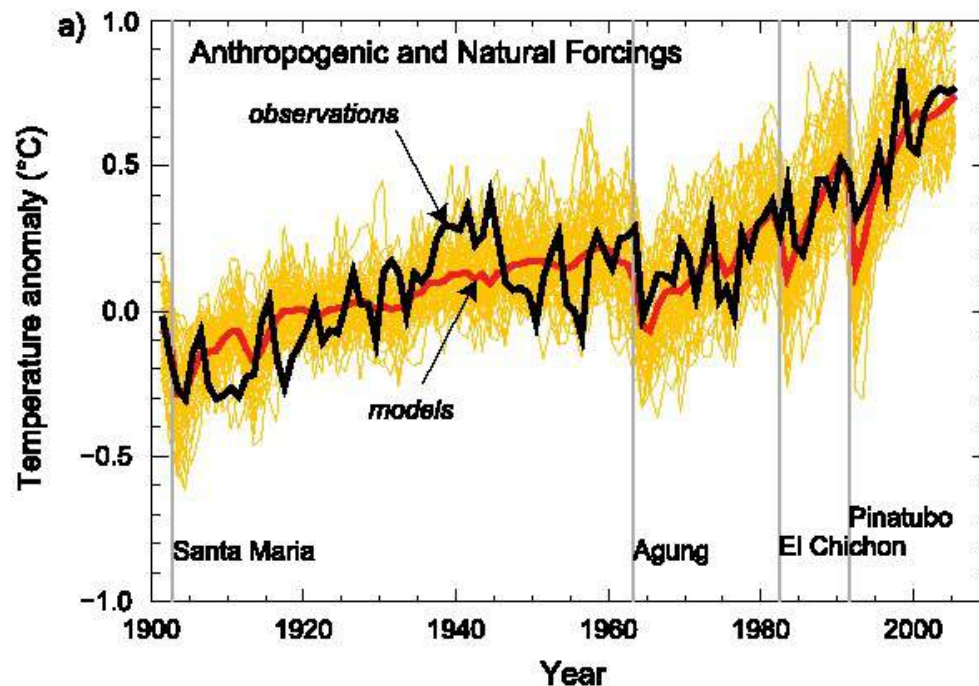
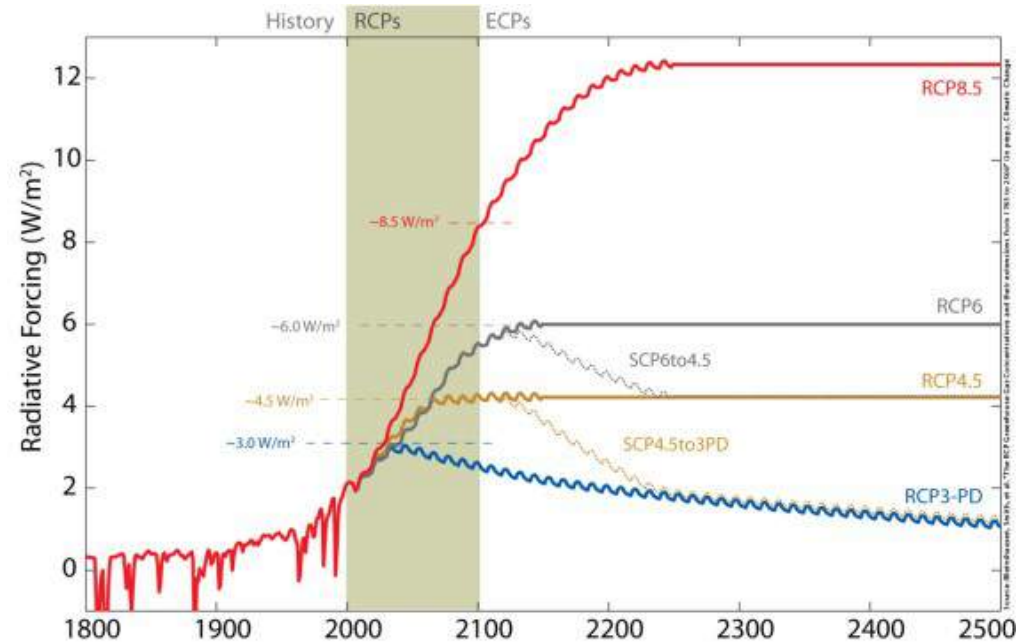


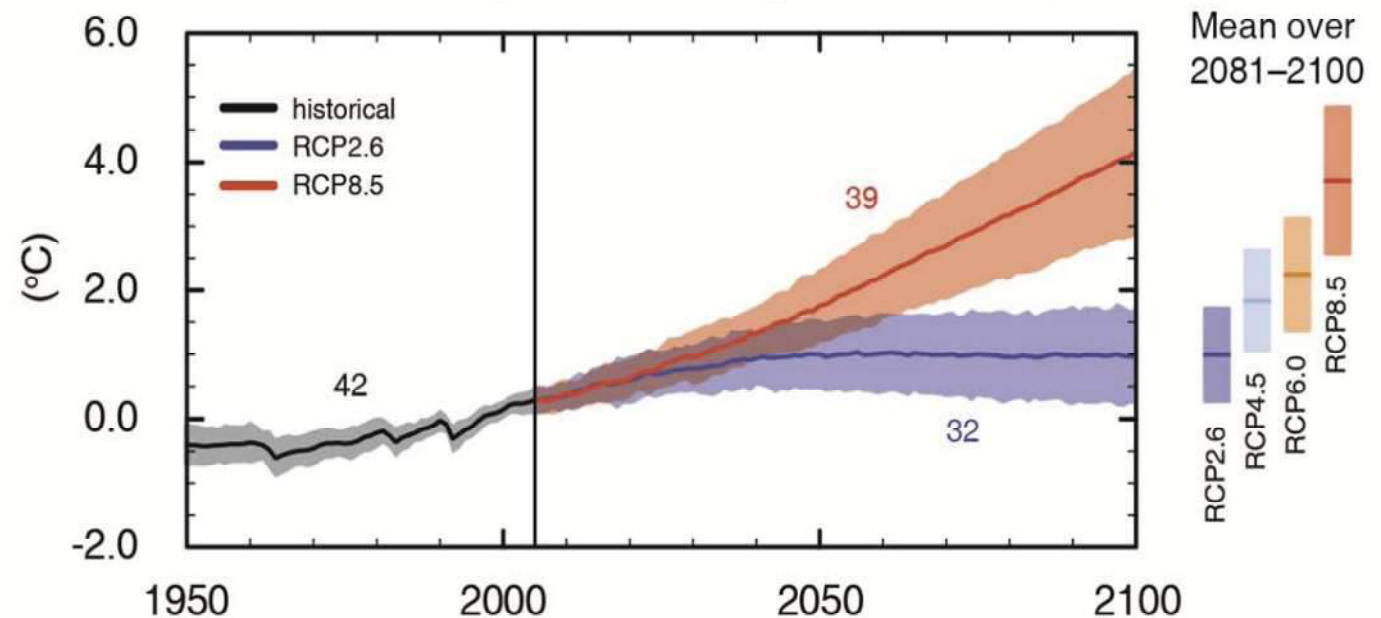
Figure TS.23. (a) Global mean surface temperature anomalies relative to the period 1901 to 1950, as observed (black line) and as obtained from simulations with both anthropogenic and natural forcings. The thick red curve shows the multi-model ensemble mean and the thin lighter red curves show the individual simulations. Vertical grey lines indicate the timing of major volcanic events. (b) As in (a), except that the simulated global mean temperature anomalies are for natural forcings only. The thick blue curve shows the multi-model ensemble mean and the thin lighter blue curves show individual simulations. Each simulation was sampled so that coverage corresponds to that of the observations. [Figure 9.5]

Source: IPCC 2007a (WG I TSp.62)

Representative Concentration Pathways (RCPs)



Anomalia da temperatura relativamente a 1986-2005.
Ensemble multi-modelo, CMIP5.



Previsões
para o
Futuro

IPCC - 2013

Objectivos

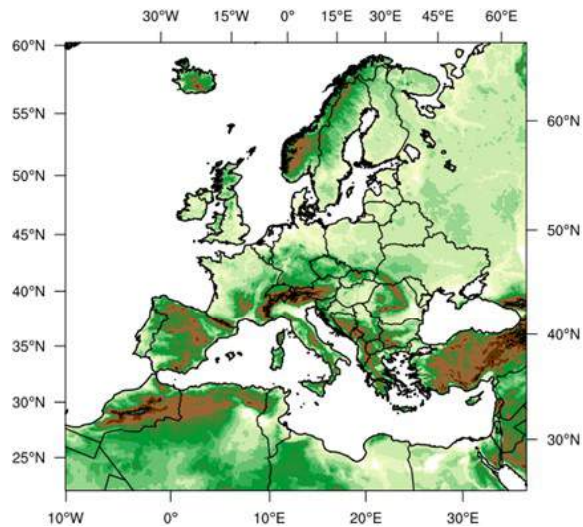
Caracterizar o impacto das alterações climáticas na precipitação, temperatura e vento em Portugal

Metodologia

- Avaliar os resultados das mais recentes simulações de alta resolução, comparando-os com observações (EURO-CORDEX);
- Estabelecer um ranking de modelos baseado na sua performance;
- Conceber ensembles multi-modelo usando diferentes metodologias – total, seleccionado, pesado;
- Avaliar o sinal das alterações climáticas.

Domínios dos RCMs

EURO-CORDEX (7 institutos)



EURO-CORDEX

Resoluções:

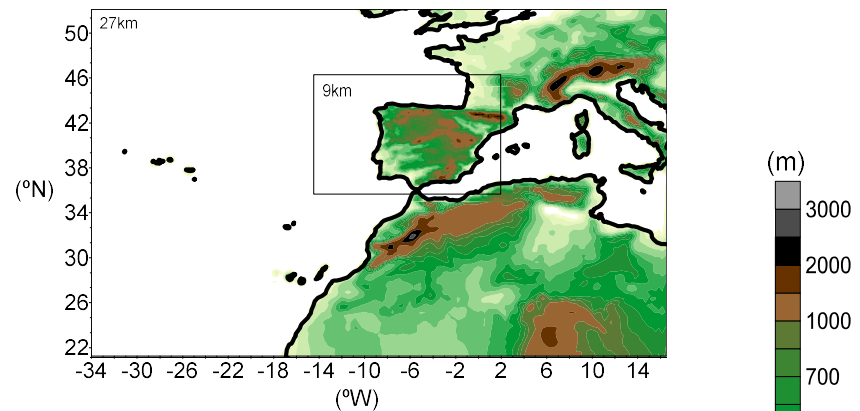
0.11° ~ 12km (11 modelos)

0.44° ~ 50km (18 modelos)

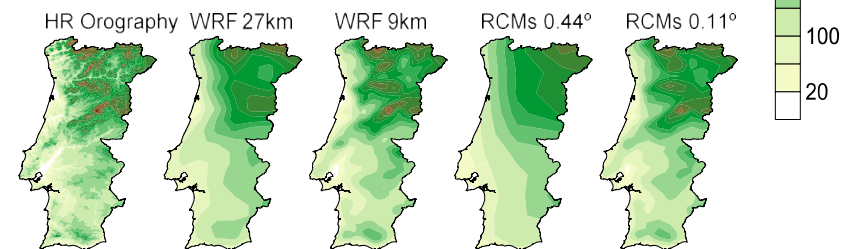
WRF-IDL

Resolução: 9km

(a)



(b)



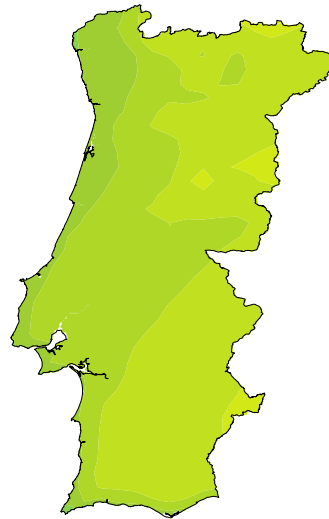
Anomalias de Temperatura máxima para o clima futuro

**2071-2100
RCP8.5 (cenário)**

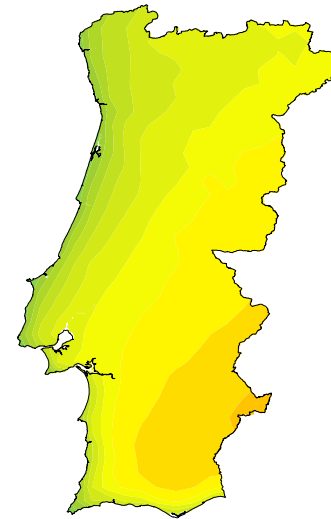
**2071-2100
menos
1971-2000**

Cardoso et al. (2018)

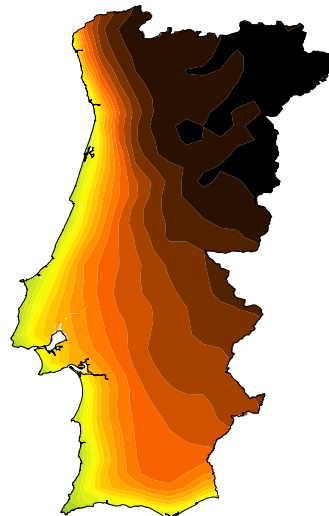
Inverno



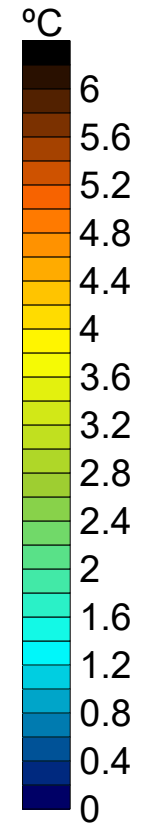
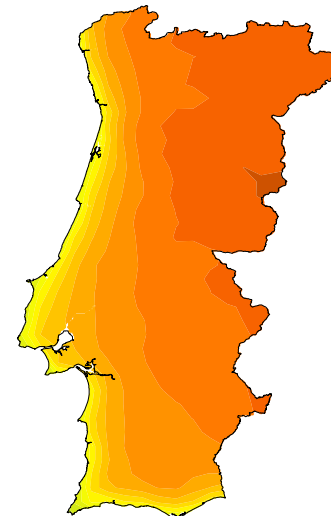
Primavera



Verão



Outono



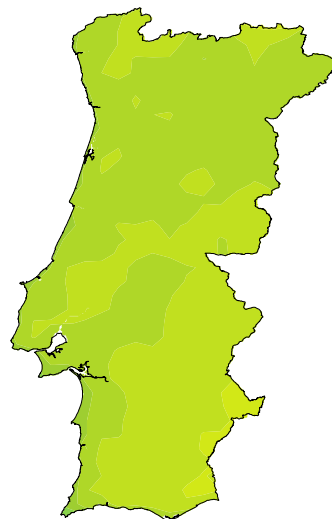
**Anomalias de
Temperatura
mínima
para o clima
futuro**

**2071-2100
RCP8.5 (cenário)**

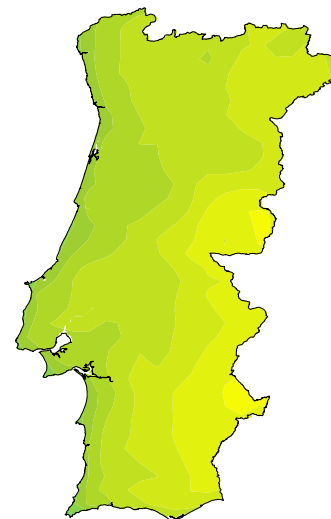
**2071-2100
menos
1971-2000**

Cardoso et al. (2018)

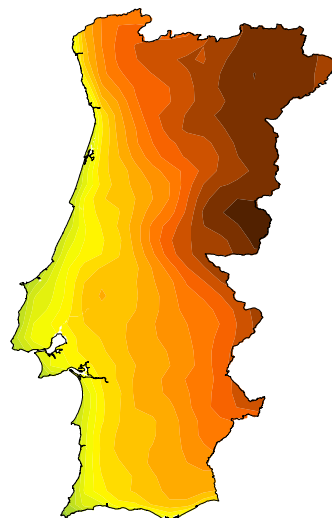
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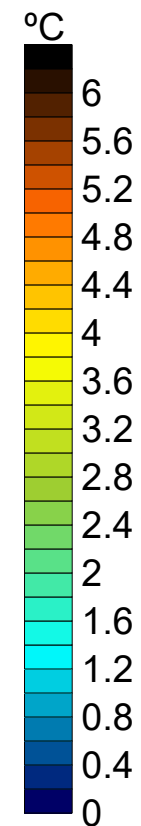
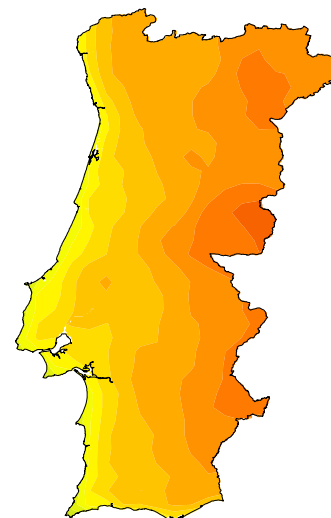
Primavera



Verão



Outono

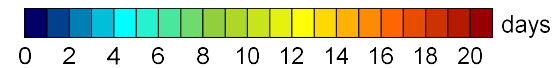
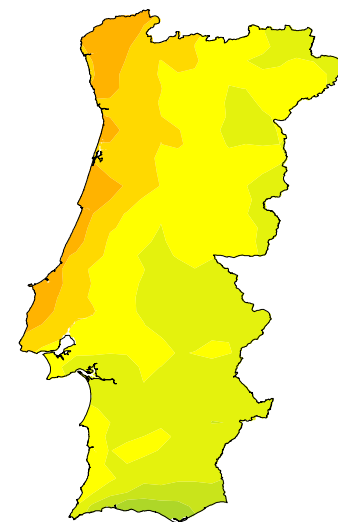
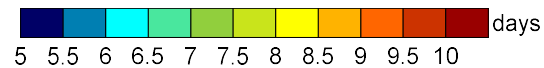
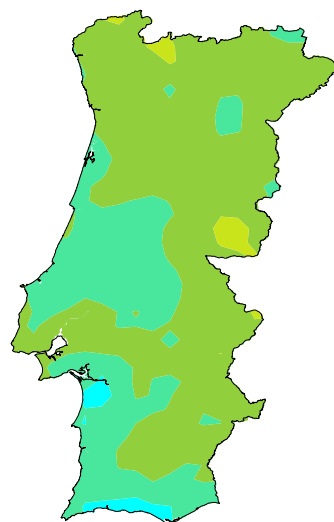
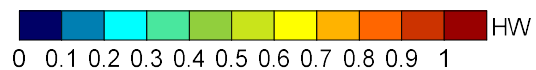
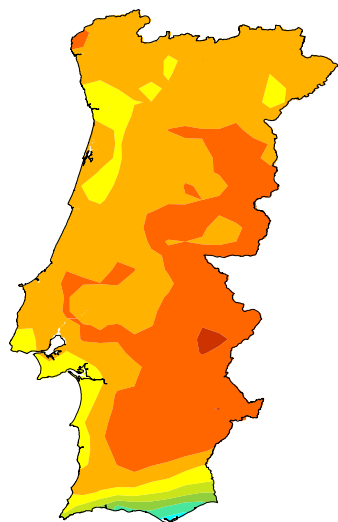


Nº de ondas de calor

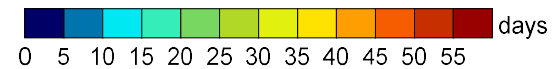
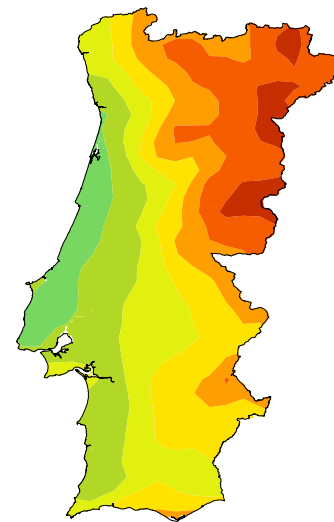
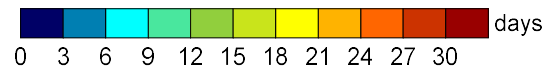
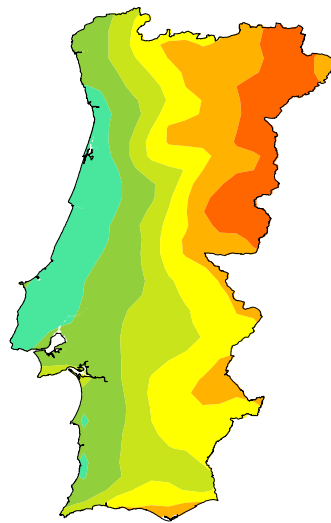
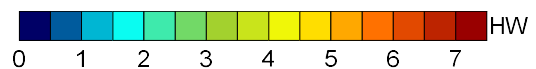
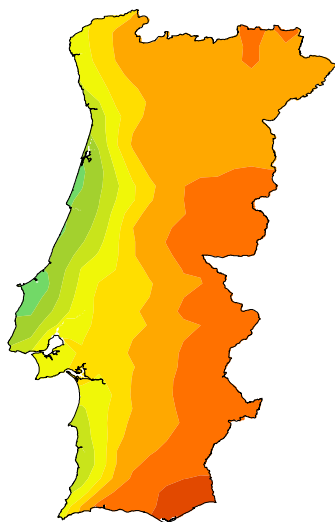
Duração média HW

Duração máxima HW

1971-2000



2071-2100 (RCP8.5)



Precipitação Anual

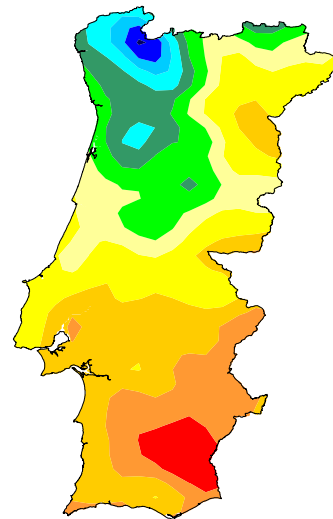
Presente,
Futuro e
Anomalias
relativas
anuais

RCP8.5

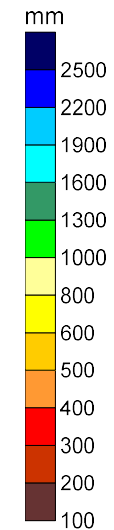
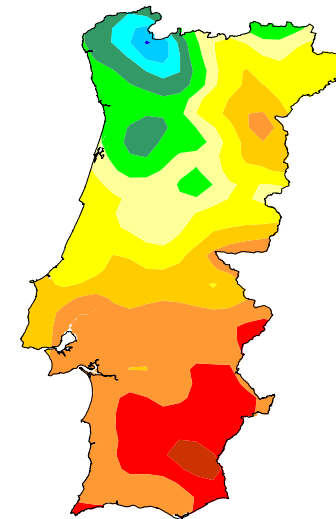
(2071-2100 menos
1971-2000)/1971-
2000

Soares et al. (2017)

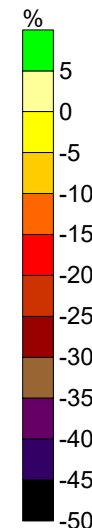
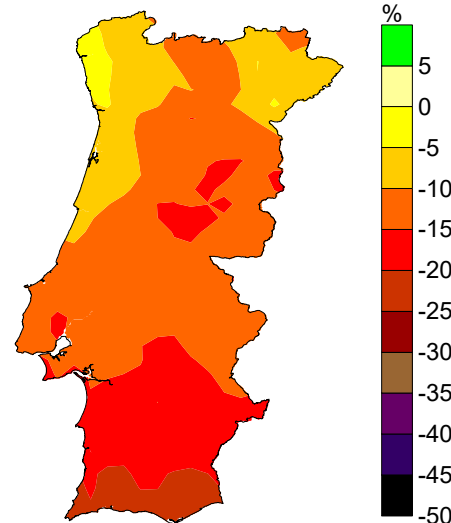
Presente



RCP8.5



Anomalia Relativa

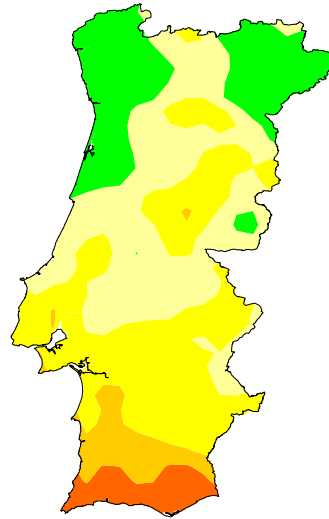


Precipitação

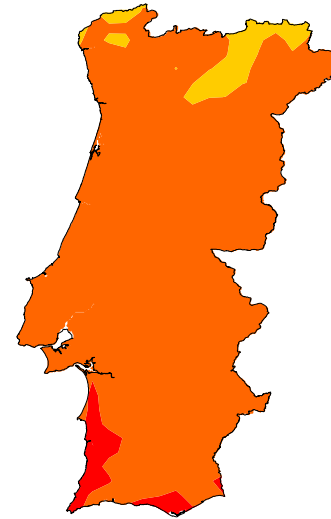
Anomalias Sazonais relativas

(2071-2100 menos
1971-2000)/1971-2000

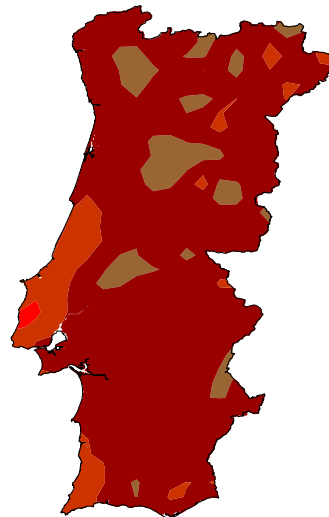
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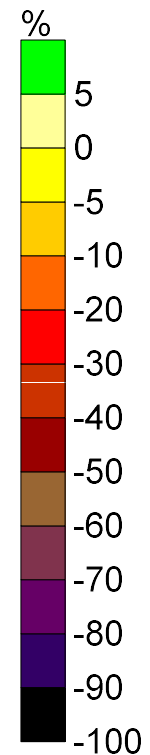
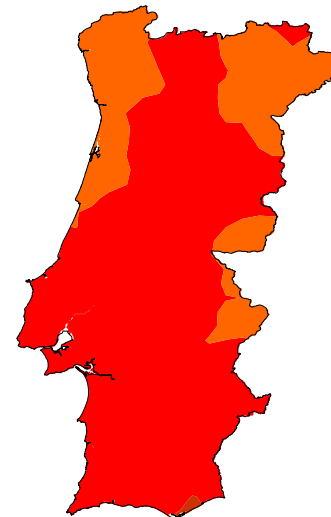
Primavera



Verão



Outono

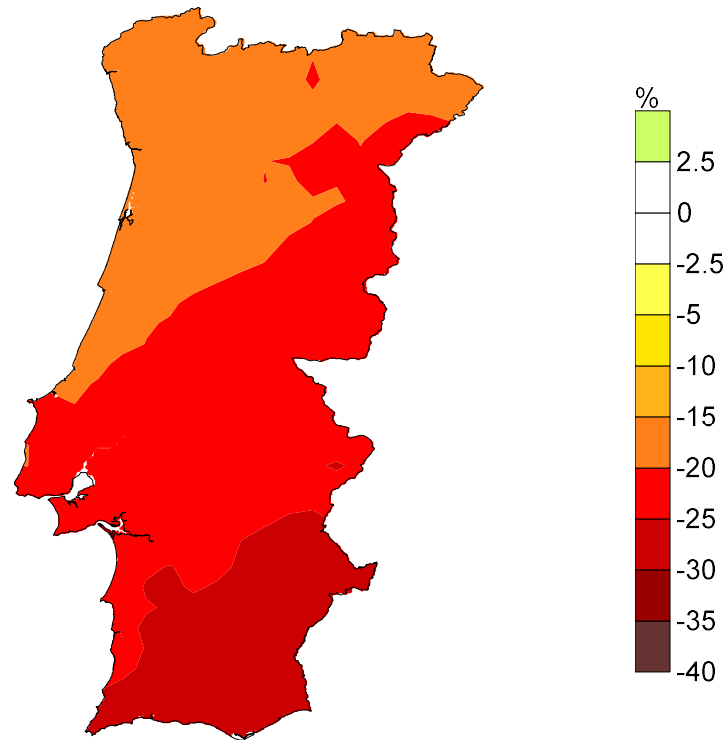


Precipitação

**Anomalia
anual
relativa do
número de dias
com
precipitação**

**(2071-2100 menos
1971-2000)/1971-2000**

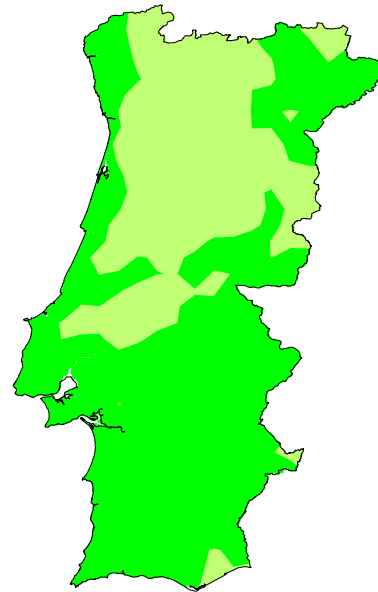
Soares et al. (2017)



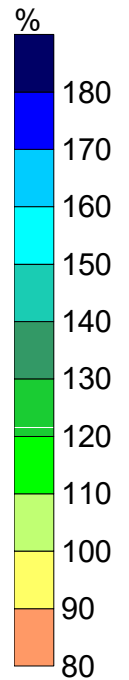
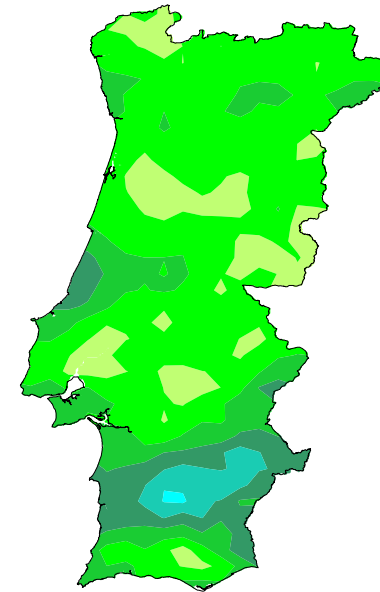
Precipitação Extrema

Anomalia
anual
relativa

p95



p99



(2071-2100 menos
1971-2000)/1971-2000

Soares et al. (2017)

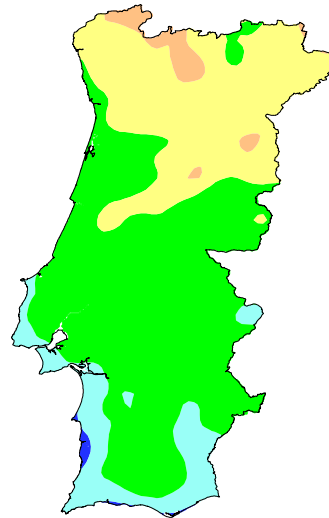
Recurso eólico (densidade de energia) - Onshore

Anomalias
relativas

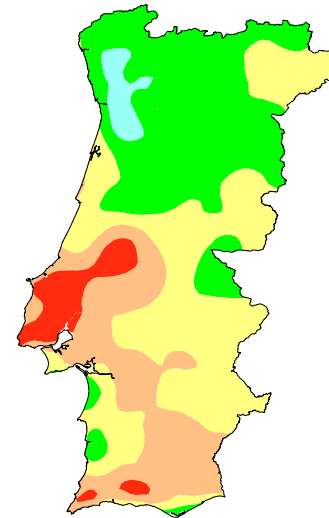
RCP8.5

(2071-2100
menos 1971-2000)
/1971-2000

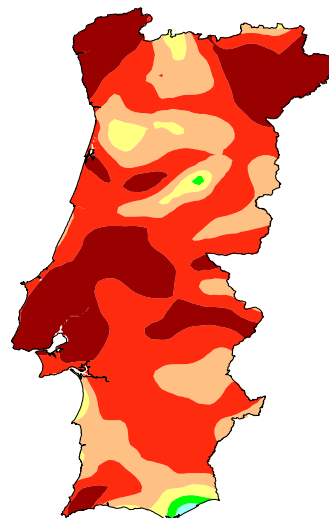
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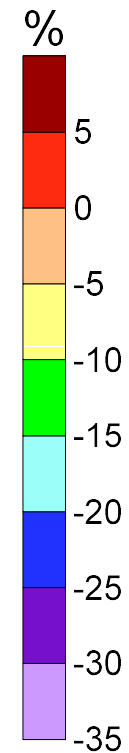
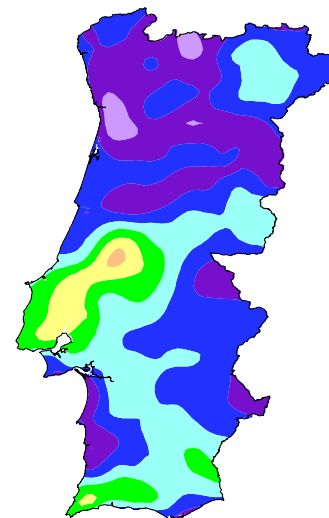
Primavera



Verão



Outono



Sumário

As projecções do clima para final do século apontam para:

- Um aumento médio da temperatura que pode chegar aos 8°C no interior do país e entre 2°C e 4°C nas zonas costeiras;
- O número de ondas de calor aumenta 7 vezes no interior do país e triplica no litoral;
- A duração média das ondas de calor duplica no litoral e triplica no interior. Enquanto que a duração máxima aumenta de 10-15 dias para 25-55 dias;
- Uma redução da precipitação anual de 10 a 35%, com reduções de 20 a 30% de precipitação na primavera e outono;
- Redução de 15 a 25% do número de dias com chuva;
- Aumento da precipitação extrema, entre 10 a 50%;
- Redução da densidade de energia eólica entre 5 a 20% no inverno e primavera e 5 a 35% no outono;
- Aumentos máximos de 5% de densidade de energia eólica no verão.

Muito obrigada pela atenção

Cardoso RM, Soares PMM, Lima DCA, Miranda PMA (2018) *Mean and extreme temperatures in a warming climate: EURO CORDEX and WRF regional climate high-resolution projections for Portugal*. Climate Dynamics DOI: 10.1007/s00382-018-4124-4

Soares PMM, Cardoso RM, Lima DCA, Miranda PMA (2017): *Future precipitation in Portugal: high-resolution projections using WRF model and EURO-CORDEX multi-model ensembles*. Climate Dynamics, 49, 2503-2530. DOI 10.1007/s00382-016-3455-2