A review of climate change impacts in the Canary Islands

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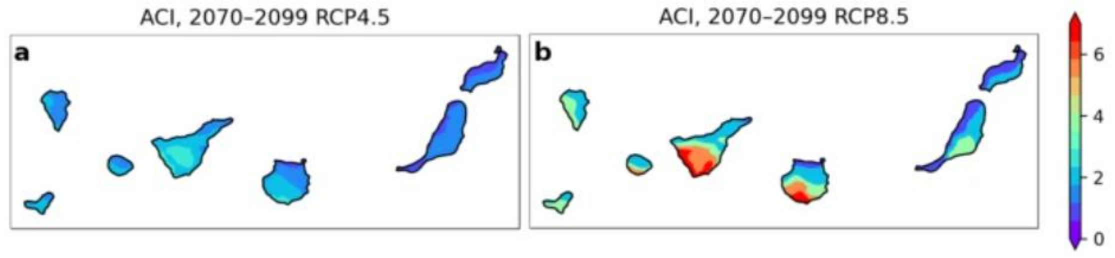
Environmental and socioeconomic factors increase small islands' exposure and vulnerability to climate change. This study reviews issues related to current and future climatic change and its impacts on the small island environments in the Canary Islands. Convection-permitting regionalized projections driven by data from three global climate models included in the Coupled Model Intercomparison Project (CMIP5) have been performed, covering the recent past (1980–2009) and future (2070–2099) periods, under two Representative Concentration Pathways, 4.5 and 8.5. The impact analysis includes water resources, energy, ecosystems and biodiversity, natural hazards, and health issues. We provide a succinct review of sectors that warrant particular attention, due to their weight in the gross domestic product, agriculture and tourism. The concluding section discusses adaptation and response strategies, and the portfolio of research that needs to be addressed.

Water resources

- According to the Clausius–Clapeyron, for each 1 °C of warming, saturated air contains 7% more water vapour, increasing evapotranspiration
- The Aridity Climate Index, defined as the ratio between the variation of evapotranspiration and that of precipitation (> 1 ≈ drought) could increase to a value of 6 in elevated areas, in the worst scenario, at the end of the century[1]

- This will imply hydrological drought with socioeconomic and landscape impacts that should lead to increased adaptation measures.



Aridity Change Index (ACI) for 2070–2099 RCP4.5 (**a**) and RCP8.5 (**b**). All three models coincide in a positive change of ACI at all gridpoints.

Energy

- 55% of water comes from desalination over the last decade. It accounts for nearly 12% of electricity consumption[2]

- During summer, future simulations indicate a decrease in solar photovoltaic (PV) potential because of the rise in temperature and, therefore, a reduction in panel efficiency. However, a generalized increase in PV is expected during the winter as a consequence of a reduction in cloud cover[3].

- During summer, the season of maximum wind energy production, a general Extractable Wind Power (EWP) reduction up to 15–20% at the end of this century, is predicted for in the highest elevation islands, except in the North-East coasts with a projected increase of 10–15%. During winter, projected changes in EWP are not significant[4].

Ecosystems and biodiversity

- Species assemblages in high-elevation areas on oceanic islands are disproportionately rich in endemic species. These are particularly vulnerable to both changing precipitation patterns and increasing temperatures[5].

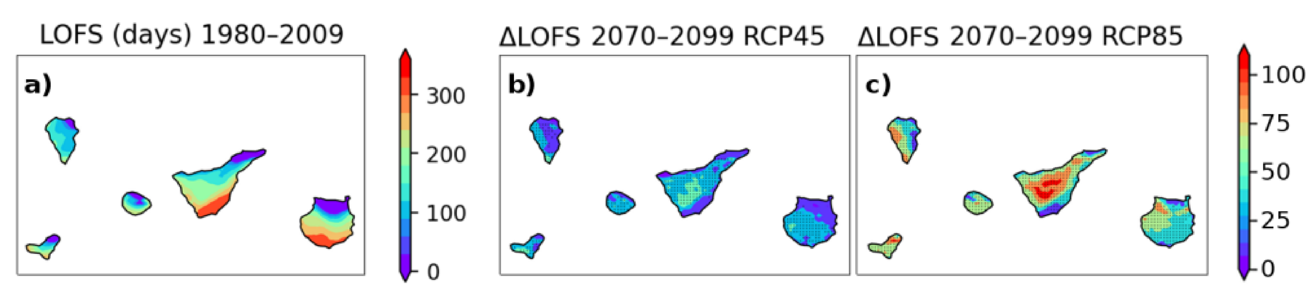
- The single-island endemic species that currently occur in predominantly arid regions would have the highest losses of climatically suitable area. Insular woody and succulent species face lower climate change-related reductions[6].

- Bioclimatic Indicators, including 53 biovariables derived from monthly temperature, precipitation, radiation, humidity, and wind speed over different recent-past and future periods have been calculated through regionalisation models[7]

- The future evolution of the height of the stratocumulus layer will have ecological consequences for cloud[8].

Extreme events

- Projections of average climate parameters have been performed for the future. The largest temperature changes are expected in the high mountains[9]. This, together with the expected decrease in rainfall, will increase the risk of fires[10].



The annual means of LOFS (extension in days of fire weather season) index

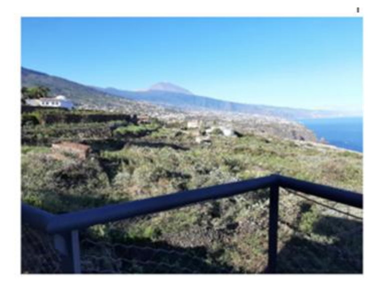
- Monthly absolute maximum and minimum temperature are expected to increase, for the end of the century and the business as usual scenario, 4.0 ± 0.5 °C and 4.4 ± 0.4 °C respectively. Warm days increases considerably (30 percentage points)[11].

- However, studies on extreme events are pending in the Canary Islands: heat waves, extreme precipitation, storms or combined events such as dust intrusions - heat waves - and wildfires.

Health issues

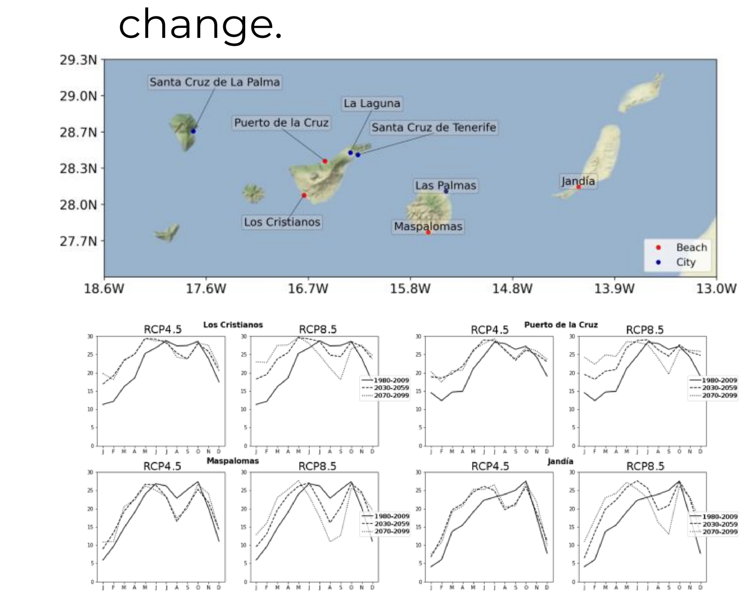
- Skin eruptions, fatigue, cramps, syncope, heat exhaustion, and heatstroke might occur as a consequence of heat exposure[12]. Heatwaves usually reach temperatures of 44–45 °C[13]; whereas night heat events are between 26 and 30°C[14].

- Dust intrusions are becoming more likely because of climate change[15] and have relevant impacts on human health. Respiratory pathologies, anxiety disorders, and atypical thoracic pain usually affect local population[16].



Agriculture and tourism

- The greatest water demand comes from agriculture. The average Water Footprint for bananas is 340 m3/t and for avocados 1740 m^3/t [17]. Water saving strategies must be carried out to adapt to climate change.



- In the business as usual scenario, "excellent" days for tourism are projected to increase in winter at the end of the century. Nevertheless, in the southern areas, where most of the hotel is located, significantly worsened conditions in summer[18].

"Excellent" days (HCIB80) for four beach tourism in the recent past and at mid- and end-century, for both emission scenarios (RCP4.5 and RCP8.5)

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