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Future projections of Benguela Coastal Low-Level Jet

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During the 21st century, it is expected that climate will continue to warm, essentially due to the increase of greenhouse gases emissions. Climate warming has several impacts in all regions, such as in the eastern boundary currents systems (EBCS) areas. In these regions, the feedbacks between atmosphere, land and ocean play an important role in defining regional climates. Some authors have studied the future projections on the EBCS focusing on the evolution of upwelling systems. The Benguela coastal low-level jet (CLLJ) is characterized by strong winds that occur around 500 m above sea level, within or at the top of the marine atmospheric boundary layer. The semi-permanent St. Helen high-pressure system over the South Atlantic Ocean and the inland thermal low-pressure system over the Namib Desert represent the synoptic forcing behind the Benguela CLLJ. The Benguela CLLJ is an important mesoscale feature in Namibia and Angola coastal areas. The feedback processes between CLLJs and upwelling play a decisive role in the regional climate. On the one hand, the decrease of the sea surface temperatures (SST) along the coast, due to upwelling lowers the evaporation over the ocean, and on the other hand, the strong coast parallel winds prevent the advection of marine air inshore decreasing water vapour transport. Moreover, upwelling has a strong economic impact in these areas through increased fish stocks due the transport of rich nutrient cold water from the deep ocean to the surface.
This study presents the climate change impacts on the Benguela CLLJ, from a coupled ocean (ROMS) and atmospheric (REMO) regional climate simulation and from an atmospheric (REMO) run. Both simulations have a 25 km horizontal resolution. A 20th century period (1976-2005) from present climate is used as control run. The projected changes on the Benguela CLLJ climate towards the end of the 21st century is analysed for the 2070 to 2099 period, for the RCP8.5 greenhouse gas emissions scenario. Overall, an increase in the frequency of CLLJ occurrence is expected to occur along the western coast in all seasons, with higher values in coupled simulation. There are shifts for higher occurrences of higher wind speeds. Additionally, the impact of the coastal jet changes on the Benguela upwelling system and Namib aridity is also studied. The pattern of SST for the future climate is quite different between the two simulations. The uncoupled run displays an increase in the SST near the coast, while in the coupled simulation, the SST shows little significant differences.

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