Geophysical Research Abstracts
Vol. 21, EGU2019-1333-1, 2019
EGU General Assembly 2019

Impact of Climate Change on the Atmosphere-Land-Ocean Feedbacks in the Benguela Eastern Boundary Upwelling System

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During the 21st century it is expected that climate will continue to warm essentially due to the enhancement of greenhouse gases concentration in the atmosphere. Global warming is associated to several impacts in all regions of the world, particularly in the eastern boundary upwelling systems (EBUS) areas, which are considered as one of the most vulnerable to climate. The feedbacks between the atmosphere, land and ocean play an important role in defining the regional climate areas. A small change in the variability or in the dynamics of the EBUS may have large impacts on ecosystems and even on local socio-economics. This study presents the climate change impacts on the feedbacks between the Benguela coastal low-level jet (BCLLJ), upwelling and Namib aridity along the Benguela EBUS. The present work uses four regional climate ROM simulations in uncoupled and coupled mode for two periods: historical (1976-2005) and future (2070-2099), following the RCP8.5 greenhouse gas emissions scenario. The future BCLLJ frequency of occurrence is projected to increase all year round between 22-35oS. These anomalies are more pronounced in the coupled run than in uncoupled one. A slight strengthening of the flow along offshore South Africa is a result of the southerly displacement and intensification of the St. Helen's anticyclone. Moreover, a north-south latitudinal warming of the SST is expected in a future climate, larger in uncoupled run than in coupled run. The projected increase of the along-shore wind will lower the SST, due to an intensification of the upwelling. The stronger radiative heating over land relative to the ocean, will boost the land-ocean thermal contrast, leading to an intensification of the zonal advection of warmer air from inland. Stronger thermal and pressure gradients will lead to stronger baroclinicity, resulting in a thermal wind structure that will increase the BCLLJ wind speed. Also, there is a reduction of the water vapour content in the atmosphere over land due to a "barrier effect" along the coast, produced by the CLLJ. Hence a reinforcement in the positive feedback between the BCLLJ occurrence, upwelling and aridity is expected in this region.

Acknowledgements. Daniela Lima is supported by FCT through a doctoral grant PD/BD/106008/2014, within the EarthSystems Doctoral Program of the Faculty of Sciences of the University of Lisbon. The authors wish to acknowledge SOLAR (PTDC/GEOMET/7078/2014) and FCT UID/GEO/50019/ 2013 (Instituto Dom Luiz) projects.