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Islands Climatology at Local Scale. Downscaling with CIELO model

Eduardo Azevedo (1), Francisco Reis (1), Ricardo Tomé (2), and Conceição Rodrigues (1)

(1) University of the Azores, Research Center for Climate, Meteorolgy and Global Change, Portugal., (2) IDL, Lisbon University, Portugal

Islands with horizontal scales of the order of tens of km, as is the case of the Atlantic Islands of Macaronesia, are subscale orographic features for Global Climate Models (GCMs) since the horizontal scales of these models are too coarse to give a detailed representation of the islands' topography. Even the Regional Climate Models (RCMs) reveals limitations when they are forced to reproduce the climate of small islands mainly by the way they flat and lowers the elevation of the islands, reducing the capacity of the model to reproduce important local mechanisms that lead to a very deep local climate differentiation. Important local thermodynamics mechanisms like Foehn effect, or the influence of topography on radiation balance, have a prominent role in the climatic spatial differentiation. Advective transport of air - and the consequent induced adiabatic cooling due to orography - lead to transformations of the state parameters of the air that leads to the spatial configuration of the fields of pressure, temperature and humidity. The same mechanism is in the origin of the orographic clouds cover that, besides the direct role as water source by the reinforcement of precipitation, act like a filter to direct solar radiation and as a source of long-wave radiation that affect the local balance of energy. Also, the saturation (or near saturation) conditions that they provide constitute a barrier to water vapour diffusion in the mechanisms of evapotranspiration. Topographic factors like slope, aspect and orographic mask have also significant importance in the local energy balance.
Therefore, the simulation of the local scale climate (past, present and future) in these archipelagos requires the use of downscaling techniques to adjust locally outputs obtained at upper scales.
This presentation will discuss and analyse the evolution of the CIELO model (acronym for Clima Insular à Escala LOcal) a statistical/dynamical technique developed at the University of the Azores, which has been improved since its original version, constituting currently a downscaling tool widely applied with success in different islands of Macaronesia. Recently the CIELO model has been tested against data from the Eastern North Atlantic (ENA), Graciosa Island ARM facility programme (established and supported by the U.S. Department of Energy with the collaboration of the local government and the University of the Azores).