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PARALLEL SESSION A : BENEFITS OF DOWNSCALING
A2: MODELS OF THE COUPLED REGIONAL CLIMATE SYSTEM

The Variable-resolution Earth System Model and its simulations of the Benguela upwelling system

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A new coupled climate model, the Variable-resolution Earth System Model (VRESM) is currently under development through collaborative research between the Council for Industrial Research (CSIR) in South Africa and the Commonwealth Scientific and Industrial Research Organisation (CSIRO) In Australia. The model employs ocean, atmosphere and land-surface models all cast on a cube-based grid and can be applied at quasi-uniform horizontal resolution to function as a global climate model, or in stretched-grid mode to function as a high-resolution regional climate model. The atmospheric model component is the Variable-cubic Atmospheric Model (VCAM) of CSIRO, which has evolved from the widely used Conformal-cubic Atmospheric Model (CCAM). The CSIRO Atmosphere Biosphere Land Exchange model (CABLE) provides VRESM with a dynamic land-surface, whilst the ocean is simulated by the newly developed Variable-cubic Ocean Model (VCOM) of the CSIR. VRESM development is taking place with the immediate objective of generating African-based projections of future global climate change as a contribution to CMIP6, whilst the stretched-grid version of the model is to be used to generate simulations of the coupled southern African climate system as part of the second phase of CORDEX.

Here we present the first VRESM simulations of the coupled regional southern African ocean-atmosphere system, through the application of the model in stretched-grid mode. Of interest is the state of the Benguela upwelling system along the southern African west coast under climate change. The coupled model was applied at a resolution of about 8 km over a domain of about 2000 x 2000 km2 over a domain stretching from the western parts of southern African into the Atlantic Ocean, covering the western coastal areas of South Africa, Namibia and Angola. The simulations were nudged in the 50 km resolution global CCAM CORDEX simulations, performed earlier for the period 1960-2100 (six ensemble members under RCP8.5, with forcing from different host GCMs). The 8 km resolution downscalings indicate that a southward shift in the prevailing south-easterly winds along the southern African west coast may lead to a weakening of upwelling zones along the Namibian coast. This may have implications for the frequency of occurrence and intensity of fog events, and on the distribution and abundance of fish species relying on the nutrient-rich water of the upwelling zones.

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