RESPUESTA DEL ATLÁNTICO TROPICAL NORTE A ENSO: INFLUENCIA DE LA RESOLUCIÓN ESPACIAL DE LOS MODELOS

TROPICAL NORTH ATLANTIC RESPONSE TO ENSO: SENSITIVITY TO MODEL SPATIAL RESOLUTION

Jorge López-Parages[(1)], Laurent Terray[(1)]
[(1)] CECI, Université de Toulouse, CERFACS/CNRS, Toulouse, France, parages@uma.es

SUMMARY

Although the ENSO teleconnection with the tropical North Atlantic (TNA) sea surface temperatures (SSTs) is one of the most robust ENSO teleconnections, the processes behind the genesis of the initial SST anomalies over the eastern TNA are not completely understood. This study points to the coastal upwelling off northwest Africa as a major contribution of these initial ENSO-related SST anomalies. This role of the upwelling is, however, reproduced differently in ocean–atmosphere coupled models with different spatial resolutions. As a consequence, the choice of a model significantly affects the scope and predictability of the ENSO impact on the TNA. This novel result should be taken into account in future analyses before making categorical statements regarding this teleconnection.

In this study, the ENSO teleconnection with the tropical North Atlantic (TNA) sea surface temperatures (SSTs) in boreal spring is analyzed in ocean–atmosphere coupled global circulation models. To assess the role played by horizontal resolution of models on this teleconnection, we used a multimodel dataset that is the first to combine models with both low and high resolution. The TNA response to ENSO projects onto the most significant SST mode of the tropical Atlantic at interannual time scales, the Atlantic meridional mode (AMM). Its evolution is primarily driven by the wind– evaporation–SST (WES) feedback, which in turn is based on the development of an initial SST gradient. This study examines and quantifies the relative contribution of a dynamic-related (upwelling) and a thermodynamic-related (evaporation) process in triggering this gradient in the case of the ENSO–TNA teleconnection. While no major contribution is found with the evaporation, a consistent contribution from the coastal upwelling off northwest Africa is identified. This contribution is enhanced in high-resolution models and highlights the close link between the upwelling in winter and the development of the AMM in spring. It is further shown that high-resolution models present a thinner and more realistic ocean mixed layer within the upwelling area, which enhances the effect of surface winds on upwelling and SSTs. As a consequence, high-resolution models are more sensitive than low-resolution models to surface wind errors, thereby they do not ensure improved reliability or predictability of the TNA SST response to ENSO.

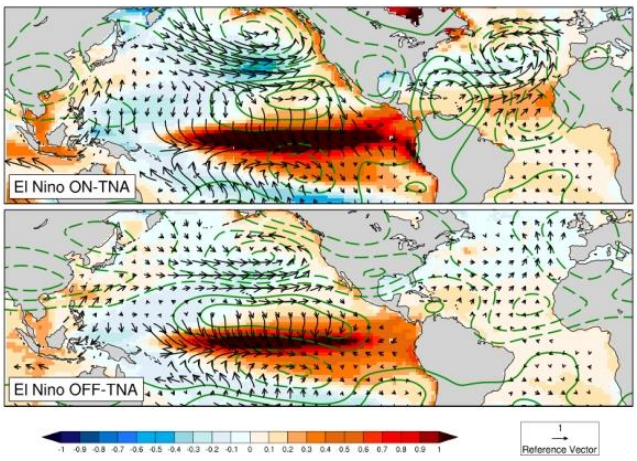

Figure 1 – SST (shaded), surface winds (vector) and streamfuncion at 300 hPa (contours) in January-February when the TNA SST response to ENSO is overestimated (top panel) and underestimated (bottom panel) in CGCMs.