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Impact of global warming on tropical cyclone genesis in coupled and forced simulations: role of SST spatial anomalies

Jean-François Royer, Fabrice Chauvin, and Anne-Sophie Daloz
CNRM/GAME, Meteo-France/CNRS, Toulouse, France (jean-francois.royer@meteo.fr/ 33561079610)

The response of tropical cyclones (TC) activity to global warming has not yet reached a clear consensus in the Fourth Assessment Report (AR4) published by the Intergovernmental Panel on Climate Change (IPCC, 2007) or in the recent scientific literature. Observed series are neither long nor reliable enough for a statistically significant detection and attribution of past TC trends, and coupled climate models give widely divergent results for the future evolution of TC activity in the different ocean basins. The potential importance of the spatial structure of the future SST warming has been pointed out by Chauvin et al. (2006) in simulations performed at CNRM with the ARPEGE-Climat GCM. The current presentation describes a new set of simulations that have been performed with the ARPEGE-Climat model to try to understand the possible role of SST patterns in the TC cyclogenesis response in 15 CMIP3 coupled simulations analysed by Royer et al (2009). The new simulations have been performed with the atmospheric component of the ARPEGE-Climat GCM forced in 10 year simulations by the SST patterns from each of 15 CMIP3 simulations with different climate model at the end of the 21st century according to scenario A2. The TC analysis is based on the computation of a Convective Yearly Genesis Parameter (CYGP) and the Genesis Potential Index (GPI). The computed genesis indices for each of the ARPEGE-Climat forced simulations is compared with the indices computed directly from the initial coupled simulation. The influence of SST patterns can then be more easily assessed since all the ARPEGE-Climat simulations are performed with the same atmospheric model, whereas the original simulations used models with different parameterization and resolutions. The analysis shows that CYGP or GPI anomalies obtained with ARPEGE are as variable between each other as those obtained originally by the different IPCC models. The variety of SST patterns used to force ARPEGE explains a large part of the dispersion, though for a given SST pattern, ARPEGE does not necessarily reproduce the anomaly produced originally by the IPCC model which produced the SST anomaly. Many factors can contribute to this discrepancy, but the most prominent seems to be the absence of coupling between the forced atmospheric ARPEGE simulation and the underlying ocean. When the atmospheric model is forced by prescribed SST anomalies some retroactions between cyclogenesis and ocean are missing. There are however areas over the globe were models agree about the CYGP or GPI anomalies induced by global warming, such as the Indian Ocean that shows a better coherency in the coupled and forced responses. This could be an indication that interaction between ocean and atmosphere is not as strong there as in the other basins. Details of the results for all the other ocean basins will be presented.

References:
Chauvin F. and J.-F. Royer and M. Déqué , 2006: Response of hurricane-type vortices to global warming as simulated by ARPEGE-Climat at high resolution. Climate Dynamics 27(4), 377-399.
IPCC [Intergovernmental Panel for Climate Change], Climate change 2007: The physical science basis, in: S. Solomon et al. (eds.), Cambridge University Press.
Royer JF, F Chauvin, 2009: Response of tropical cyclogenesis to global warming in an IPCC AR-4 scenario assessed by a modified yearly genesis parameter. “Hurricanes and Climate Change”, J. B. Elsner and T. H. Jagger (Eds.), Springer, ISBN: 978-0-387-09409-0, pp 213-234.