EMS7/ECAM8 Abstracts,
Vol. 4, EMS2007-A-00551, 2007
7th EMS Annual Meeting / 8th ECAM

SST impact on the cyclogeneses simulated by RegCM3 over the South Atlantic

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Studies have shown that part west of the South Atlantic near the South America east coast is an active cyclogenetic region throughout the year. The present study has as its main objective to evaluate the impact of the different SST prescriptions in these systems climate simulations. Five simulations were undertaken for 1990 with the Regional Climate Model (RegCM3) using the reanalysis of the project R-2 from the National Center for Environmental Prediction (NCEP) as model initial and boundary conditions. The SST monthly climatology by was used to simulations, being altered in each numeric experiment, except in control (ExpCTRL). The sensitivity experiments differ from the ExpCTRL only in relation to the SST: in two experiments the SST horizontal gradients were intensified in 10 and 30% of their climatological value (ExpGrad1 and ExpGrad3, respectively) and in the other two a SST homogeneous field was considered over all domain which differed on average 1.5^{o}C. To the cold homegenous experiment (ExpSSTc), in each month, the SST mean was calculated in the region between 63.5^o – 58.5^o W and 48.5^o – 38.5^{o}E, which corresponds to the Malvinas Current, and to the warm homogeneous experiment (ExpSSTw) the mean was calculated in the region between 56.5^o – 51.5^o W and 46.5^o – 36.5^o E, which corresponds to the Brazil Current. To identify and track the extratropical cyclones an objective method considering the systems with relative vorticity lower or equal to -1.5 s^{-1} and a lifetime longer or equal to 24 hours was applied. In the ExpCTRL three regions with the maximum cyclogeneses on the South America east coast are observed: between the south and southeast coast of Brazil, in the Prata River discharge in Uruguay and in south coast of Argentina ($\sim$48^o). Although these results are in accordance with those obtained by the R-2, they present an underestimate in the systems

number. Concerning the sensitivity experiments, both the ExpSSTc and the ExpSSTw concentrate the cyclogeneses occurrence in the domain inferior boundary showing a overestimate in relation to ExpCTRL, suppress their occurrence in the central part of the South Atlantic and in the south/southeast of Brazil and reduce it in the Argentina coast. These characteristics are associated to the SST spatial configuration employed in these experiments, i.e., in the central part of the South Atlantic as well as on the Brazilian coast, the prescribed SST is colder than that used in the ExpCTRL, which reduces the latent and sensible heat fluxes from the sea to atmosphere. On the other hand, in the south of the South Atlantic the prescribed SST is warmer than the climatology intensifying the turbulent fluxes in relation to ExpCTRL and contributing to the increase of the cyclogeneses in this area. It is also observed, in ExpSSTw, a higher intensity of the systems near the South America east coast, except in the Prata river discharge which, in this experiment, is slightly underestimate, while in the ExpSSTc it is similar to that in the ExpCTRL. In the ExpGrad1 and ExpGrad3 experiments it can be noticed that to the east of 40^oW, the cyclogenetic density area appears more concentrated in the regions with SST horizontal gradients differing to that in the ExpCTRL. Both experiments intensify the ciclogenetic activity on the South America east coast between 38^o-43^oS and on the south/southeast of Brazil. This can be associated with the increase of the sea-air latent and sensible heat fluxes compared to ExpCTRL. On the other hand, there is a cyclogenetic density reduction on the Argentina south coast and a small reduction at the Prata river discharge. Although the latent heat fluxes are about $\sim$20 W m^{-2}more intense in these regions than in the ExpCTRL, the cyclones sector where the they are acting must be considered, because, if it is in a cold sector, they may reduce the baroclinic instability – hypothesis for further investigation. In conclusion, in the four sensitivity experiments, the cyclogeneses tend to developed in regions where latent and sensible heat fluxes are from sea-air. In the ExpSSTc and ExpSSTw these fluxes are coincident with the region of maximum atmospheric baroclinicity. These results also indicate that the south and southeast coast of Brazil and the south of Argentina are sensitive to the SST field configuration due to the fact that it influences the latent and sensitivity heat fluxes. On the other hand, the systems developed on the Uruguay coast are less influenced with the SST modification which indicates that cyclogeneses in this region may be due to other mechanisms.