High Resolution Ensemble West Atlantic Basin Seasonal Hurricane Simulations

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Introduction

This paper will examine the use of an ensemble of seasonal integrations using a global spectral model at a high horizontal resolution (T126L27) in hindcasting the June-November Atlantic tropical storm activity for the seasons 1986-2005. This horizontal resolution is generally higher than existing seasonal tropical system studies, although there are a few studies of note which are of even higher horizontal resolution (e.g., Bengtsson et al. 2006). We will examine whether the use of a high horizontal resolution improves the seasonal hindcasts in terms of interannual variability and intensity.

Model and Experiments

The Florida State University/Center for Ocean Atmospheric Prediction Studies model (Cocke and LaRow 2000) with a relaxed Arakawa-Schubert deep convection scheme was used. Four ensemble members for each of the 20 years (1986-2005) were calculated. Time lagged initial conditions for the atmospheric model were obtained from the ECMWF re-analysis and were centered on 1 June of the respective year. Observed weekly SSTs were obtained from the Reynolds and Smith ((1994). The detection algorithm is the same as that used in Vitart et al. (2003) and modified slightly for our model resolution. In this paper, the observed tropical storms are identified by the National Hurricane Center Best Track data set, HURDAT (available at http://www.nhc.noaa.gov/pastall.shtml).

Interannual Variability

The number of storms for each year from each ensemble is calculated from the detection algorithm and the ensemble mean is plotted along with the observed as a function of time in Figure (1). The observed number of storms is shown with the solid black line while the ensemble mean is the dotted line. The spread of the ensembles is shown by the two squares. Overall the ensemble mean does well in simulating the interannual variations in the storm numbers except during the cold ENSO event years of 1998 and 1999 when the ensemble mean was much higher than the observed. The pattern of reduced number of storms during a warm event and increased numbers during a cold event is clearly seen in the ensemble mean. The model did well in simulating the record number of storms during 1995 and 2005. The temporal correlation of the ensemble mean with the observed was 0.78. The observed variance was 25.25 while the ensemble mean variance was slightly lower at 12.55. The high correlation and variances noted are most likely related to the use of weekly observed SSTs and the choice of the convection scheme.

Intensity

For each of the four ensembles the storm's lowest surface pressure was identified and shown in Figure (2). Out of the four ensembles, the lowest surface pressure found was 936hPa, indicating that even at this high horizontal resolution the model was able to generate only one category 4 storm on the Saffir-Simpson scale. Similar difficulties in producing intense storms using a even

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higher resolution model than used in this study were noted by Bengtsson et al. (2006). Indicating that model resolution (and perhaps model physics) are still insufficient.

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