**Long-Term Winter Rainfall Predictions Over the Southeast U.S.
Using the FSU Global Spectral Model**

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1. Introduction

The prediction of El Niño-Southern Oscillation (ENSO) teleconnection patterns by global models is important for regional climate simulations. In an effort to improve ENSO predictions using improved model physics, the skill of the Florida State University Global Spectral Model (FSUGSM) is assessed focusing on seasonal rainfall over the Southeast U.S. since precipitation patterns over the region have been found to be connected to ENSO (Ropelewski and Halpert, 1986).

2. Data and Methodology

The FSUGSM is a global spectral model with a T63 horizontal resolution (approximately 1.875°) and 17 unevenly spaced vertical levels. Details of this model can be found in Cocke and LaRow (2000). The experiment utilizes two runs using the Naval Research Laboratory (NRL) RAS convection scheme and two runs using the National Centers for Environmental Prediction (NCEP) SAS convection scheme to comprise the ensemble. The two convection schemes are slightly different in how they calculate cumulus cloud cover and convert that into precipitation. The simulation was done for 49 years, from 1950 to 1999. Reynolds and Smith monthly mean sea surface temperatures (SSTs) from 1950-1999 provide the lower boundary condition. Atmospheric and land conditions from 1 January 1987 and 1 January 1995 were used as the initial starting conditions. The observational precipitation data being used as the basis for comparison is a gridded global dataset from Willmott and Matsuura (2005). Monthly precipitation data for the boreal winter season (DJF) were averaged to create seasonal averages. A model ensemble was created using an equal-weight average of the four model runs. Temporal correlations between the observations and model data and between the average SST over the tropical Pacific and Southeast precipitation were calculated.

3. Results

Model ensemble correlations yield an insight into the overall skill of the models. Figure 1 shows the ensemble correlations to the observations for the ENSO signal, El Niño, and La Niña. The ENSO signal correlation (Figure 1a) is a combination of the warm and cold years as classified by the JMA ENSO index (JMA 1991). This particular correlation gives a general idea of how well the models represent the overall ENSO signal. The ENSO signal is then broken down into El Niño (Figure 1b) and La Niña (Figure 1c). The ensemble correlates well in the sensitive coastal areas, especially in the overall ENSO signal and El Niño. Since La Niña lacks a coherent pattern,

(a) (b) (c)

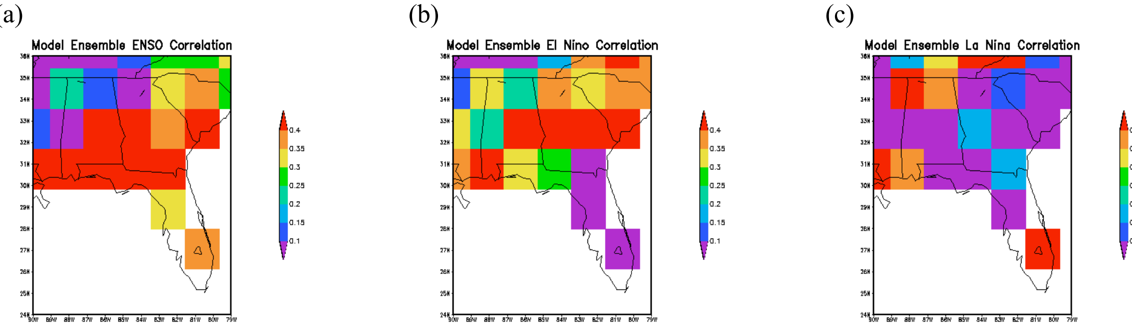

Figure 1: Temporal correlations showing areal patterns of the model ensemble for a) the overall ENSO signal, b) El Niño, and c) La Niña.

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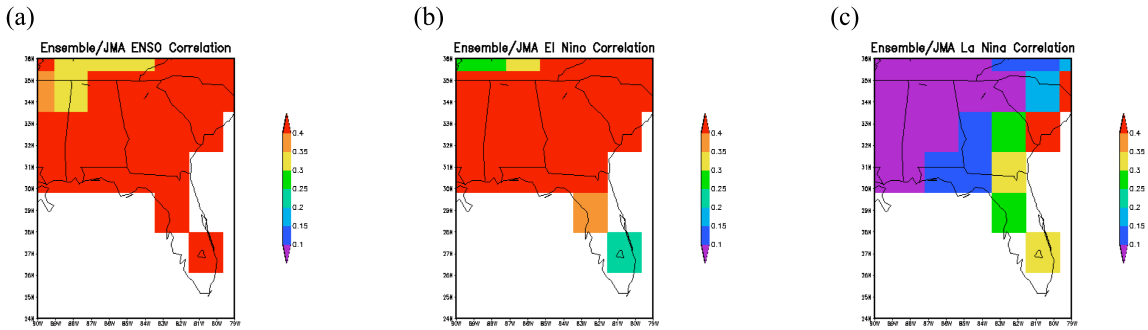

Figure 2: Temporal correlations of JMA box-averaged SSTs and observed precipitation for a) the overall ENSO signal, b) El Niño, and c) La Niña.

the ensemble ENSO signal correlations can be mostly attributed to El Niño. These correlations, particularly the ENSO signal and El Niño, show that the models are capable of recreating the spatial patterns of precipitation over the Southeast.

The Southeast is connected to the tropical Pacific through the upper level jet stream. The position of the jet stream over the Southeast changes with each ENSO phase. During El Niño, the jet stream shifts south over the warm waters of the tropical eastern Pacific and moves over the Gulf of Mexico. This allows for the moisture over the tropical eastern Pacific to reach the Southeast. During La Niña, the jet stream is more amplified over the western U.S. due to the shift in the warm pool westward over the tropical Pacific and thus takes a more northern track over the Southeast, shifting the maximum precipitation northward. Figure 2 shows the connection of the tropical Pacific SSTs to Southeast precipitation in the model ensemble for the overall ENSO signal, El Niño, and La Niña. As in Figure 1, El Niño appears to have a much stronger signal than La Niña in the models and thus influences the overall ENSO signal more. The problems with La Niña appear to lie in the model's ability to skillfully predict the SSTs over the tropical Pacific and therefore the jet stream.

4. Summary and Conclusions

Efforts to use models to predict Southeast precipitation patterns have emerged due to the connection of these patterns to ENSO. Using the FSUGSM, precipitation patterns are compared to observations to assess the skill of the model in predicting ENSO-related atmospheric phenomena. The model ensemble shows correlation values greater than 0.4 for the overall ENSO signal in coastal areas in the comparison to the observations and tropical Pacific SSTs. The model appears to have more skill in forecasting El Niño than La Niña, since both sets of correlations show lower values for La Niña than El Niño. This could be due to the model having problems with the position of the jet stream, particularly in La Niña. Future work consists of using a statistical test to verify the significance of the correlations.

Acknowledgements. We would like to thank D. W. Shin for the use of some of his data sorting codes and computer programming assistance. We would also like to thank Melissa Griffin for her assistance in the ongoing statistical test programming. This research is supported by the NOAA Office of Global Programs as an Applied Research Center to Dr. James J. O'Brien.

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