The Role of the CLM2 in the Surface Air Temperature and Precipitation of the FSU Climate Model

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The current Florida State University (FSU) climate model is upgraded by coupling the National Center for Atmospheric Research community land model (NCAR CLM2) as its land component in order to make a better simulation of surface air temperature and precipitation on seasonal time scale which are critical information for a crop model application. Climatological and seasonal simulations with the FSU climate model coupled to the CLM (hereafter, FSUCLM) are compared to those of the control (the FSU model with the original simple land surface treatment). The current version of the FSU model is known to have a cold bias in the temperature field and a wet bias in precipitation. The implementation of FSUCLM has reduced or eliminated this bias greatly due to reduced latent heat and increased sensible heat flux. The role of land model in seasonal simulations is shown to be more important during summer time than winter time. An assimilation experiment with atmospheric forcings (FSUCLMa) helps produce a better land model initial condition, which in turn, makes the biases become further smaller. The impact of various deep convective parameterizations is examined as well to further assess model performance.

Simulations of 10-yr length (1987-1996) were performed with each land model and four convective schemes (NCEP/SAS: moisture flux, only one cloud type, NCAR/ZM: similar to the AS but three significant assumptions, NRL/RAS: handing of detrainment, MIT/EMANUEL: buoyancy-sorting hypothesis, mixing hypothesis, and a stochastic coalescence model) coupled to the FSU climate model at a resolution of T63 (~ 1.86^{o}) with 17 vertical levels. The integrations commence on 1 January, 1987. Only the last 5 yr of the simulations (i.e., 1992-1996) were analyzed to allow a 5-yr spinup of soil water and temperature for the FSUCLM run.

In the near future, the coupled model (FSUCLM) will be used in our on-going project, downscaling for crop models. Since the current simulations were carried out using the FSU global climate model at a very low resolution (~200km), downscaling the parameters for a particular station may result in inaccurate results. In this connection, the CLM2 has to be coupled to the FSU regional climate model to allow more accurate representation of the station data. The regional model will be place over the southeast US and run at 20km resolution, roughly resolving the county level. To be precise, an attempt will be made to integrate outputs from the FSU regional model with agricultural models to forecast maize yield in southeast US using the CERES-maize (Crop Environment Resource Synthesis) crop model.

Computations were performed on the IBM SP4 at the FSU. COAPS receives its base support from the Applied Research Center, funded by NOAA Office of Global Programs awarded to Dr. James J. O'Brien.

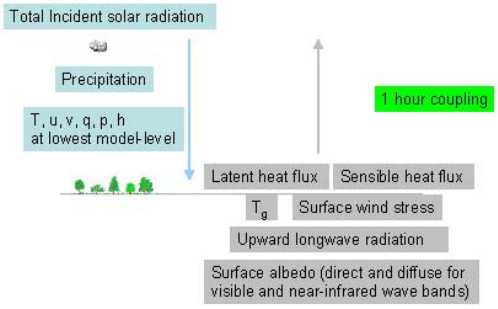

Fig. 1: Coupling Strategy

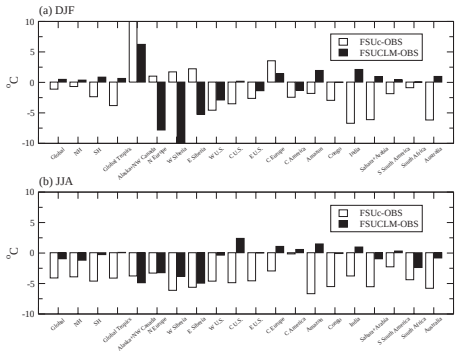

Fig.2: Surface (2m) air temperature bias over different geophysical locations for (a) DJF and (b) JJA.

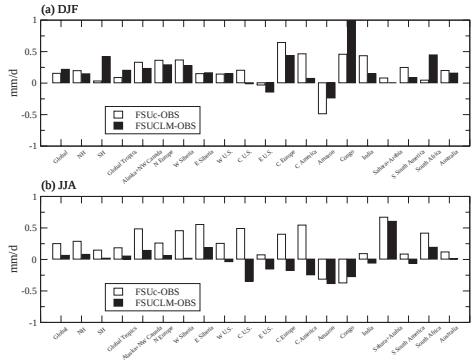

Fig.3: Same as Fig. 2 but for precipitation.

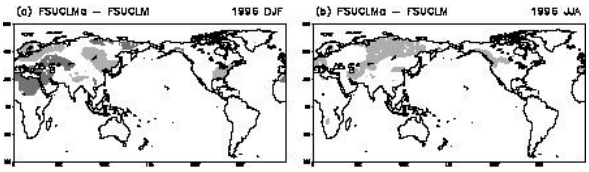

Fig.5: Seasonal surface (2m) air temperature difference between FSUCLMa and FSUCLM for (a) DJF and (b) JJA, 1996. Values greater than 2K are shaded light. Values smaller than -2K are shaded dark.

Table 1: Surface (2m) air temperature RMSE.

	DJF		JJA	
	FSUc	FSUCLM	FSUc	FSUCLM
NCEP	6.16	**4.08**	6.28	4.33
NCAR	5.98	4.12	6.12	**4.27**
NRL	5.70	4.34	5.93	4.51
MIT	5.38	4.77	5.59	4.73

Table 2: ETS (45N-45S over land) for 5-yr average (1992-1996) precipitation

		DJF		JJA	
		FSUc	FSUCLM	FSUc	FSUCLM
>0.25 mm/d	NCEP	0.246	**0.417**	0.051	0.251
	NCAR	0.258	0.397	0.030	0.271
	NRL	0.317	0.410	0.042	0.347
	MIT	0.196	0.356	0.035	0.221
> 2.5 mm/d	NCEP	0.495	0.528	0.364	0.464
	NCAR	0.494	**0.547**	0.368	0.501
	NRL	0.476	0.491	0.413	**0.545**
	MIT	0.402	0.430	0.423	0.527

References

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