Seasonal Climate Signatures in the FSU Climate Model Coupled to the CLM2

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The recently released community land model (CLM2) is coupled to the Florida State University (FSU) climate model (Cocke and LaRow, 2000) to improve land surface properties and investigate its role in the seasonal climate studies. The previously used FSU simplified land surface scheme includes a 3 layer soil temperature model based on the force-restore method. Surface characteristics are determined from the USGS 24 category land use/land cover survey. Seasonally varying climatological values for soil moisture, land albedo and surface roughness are prescribed based on the USGS data. Meanwhile, the CLM2 is a new and advanced land surface model (Bonan et. al, 2002 and Zeng et. al, 2002). With improved physical parameterizations, it uses five primary subgrid land cover types (glacier, lake, wetland, urban, vegetated) in each grid. The vegetated portion of a grid is further divided into patches of plant functional types obtained from satellite data.

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 °) 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.

Simulations with the atmospheric model coupled to the CLM2 (hereafter, CLM) are compared to the control (the original FSU model, FSUc). In Fig. 1, surface (2 m) air temperatures (°K) of FSUc and FSUCLM are compared to the Willmott and Matsuura (2002) observations for the DJF (upper left 3 panels) and JJA (bottom left 3 panels). Meanwhile, precipitation (mm/d) of FSUc and FSUCLM are compared to the Willmott and Matsuura observations for the same season in the right panel. Results from the NCEP scheme are only shown here. As evident from the figure, the FSUCLM experiment improves the seasonal simulation of both surface air temperature and precipitation compared to the control. The FSUCLM reduced much of the surface temperature cold bias noted in the FSUc run. The wet bias in the FSUc was reduced as well especially over the Eurasia during the JJA. Figure 2 shows skill scores in terms of RMSE for surface air temperature in the upper panel and precipitation in the bottom panel. Each of two versions of land models and four versions of convective schemes are compared. Noticeable improvements are evident in the simulation of both variables.

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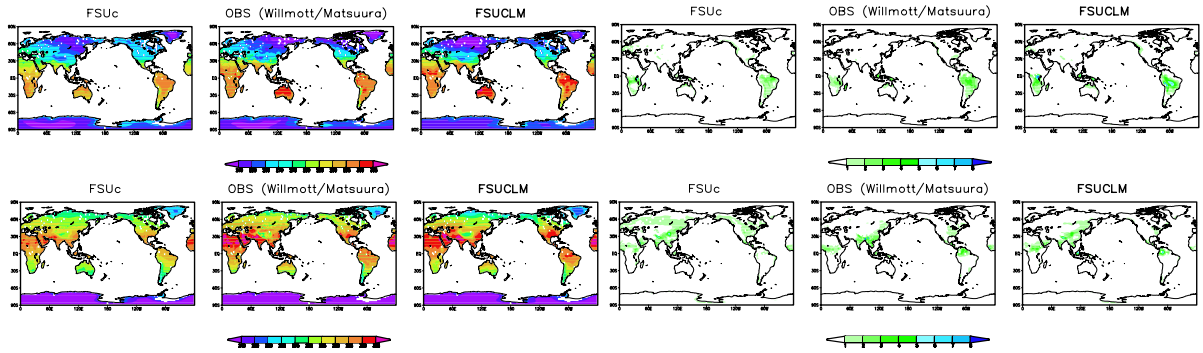

Figure 1:

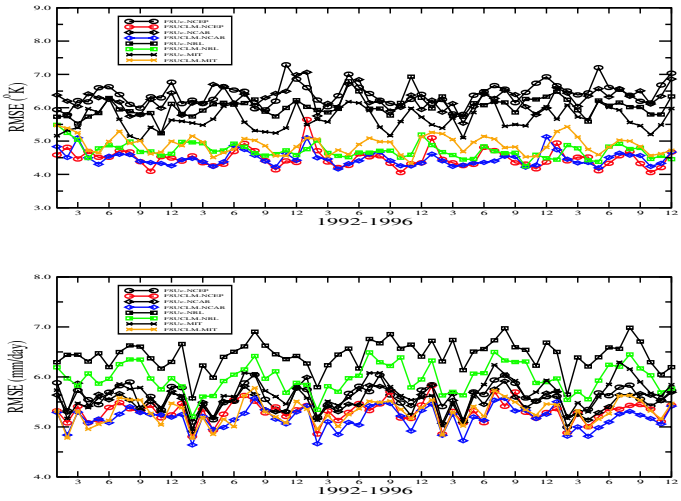

Figure 2:

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