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## **The role of land surface fluxes in Saudi-KAU AGCM: Temperature climatology over the Arabian Peninsula for the period 1981-2010**

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### **Abstract**

A new version of the Community Land Model (CLM) was introduced to the Saudi King Abdulaziz University Atmospheric Global Climate Model (Saudi-KAU AGCM) for better land surface component representation, and so to enhance climate simulation. CLM replaced the original Land Surface Model (LSM) in Saudi-KAU AGCM, with the aim of simulating more accurate land surface fluxes globally, but especially over the Arabian Peninsula. To evaluate the performance of Saudi-KAU AGCM, simulations were completed with CLM and LSM for the period 1981-2010. In comparison with LSM, CLM generates surface air temperature values that are closer to National Centre for Environmental Prediction (NCEP) observations. The global annual averages of land surface air temperature are 9.51, 9.52, and 9.57 °C for NCEP, CLM, and LSM respectively, although the same atmospheric radiative and surface forcing from Saudi-KAU AGCM are provided to both LSM and CLM at every time step. The better temperature simulations when using CLM can be attributed to the more comprehensive plant functional type and hierarchical tile approach to the land cover type in CLM, along with better parameterization of upward land surface fluxes compared to LSM. At global scale, CLM exhibits smaller annual and seasonal mean biases of temperature with respect to NCEP data. Moreover, at regional scale, CLM demonstrates reasonable seasonal and annual mean temperature over the Arabian Peninsula as compared to the Climatic Research Unit (CRU) data. Finally, CLM generated better matches to single point-wise observations of surface air temperature and surface fluxes for some case studies.

**Keywords:** Land surface model, Community Land Model, Temperature simulation, Saudi-KAU AGCM

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