数学与系统科学研究院

计算数学所学术报告

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报告题目：

A high-resolution land model with the groundwater lateral flow, human water regulation and the changes in soil freeze–thaw fronts for CAS-ESM model

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报告地点： 科技综合楼三层

311 报告厅

Abstract:

Human water regulation (HWR), groundwater lateral flow (GLF) and the movement of frost and thaw fronts (FTFs) affect soil water and thermal processes, as well as energy and water exchanges between the land surface and atmosphere. Reasonable representation of these processes in land surface models is very important to improving the understanding of land-atmosphere interactions. In this study, mathematical descriptions of GLF, HWR and FTFs were synchronously incorporated into a high-resolution community land model named the Land Surface Model for Chinese Academy of Sciences (CAS-LSM). With a series of atmospheric forcings and high-resolution land surface data from the Heihe Watershed Allied Telemetry Experimental Research (HiWATER) program, numerical simulations of the period 1981–2013 using CAS-LSM with 1-km resolution were conducted for an endorheic basin, the Heihe River Basin in China. Compared with observations, CAS-LSM reproduced the distributions of groundwater, evapotranspiration and permafrost reasonably, and well matched the temporal changes in ground temperature, heat fluxes and FTFs. Results illuminate the temporal and spatial characteristics of frozen soil and the changes in the land-atmosphere exchange of carbon, water and energy. The permafrost and seasonally frozen soil were distinguished. In the seasonally frozen areas, the maximum soil frost depth increased by 0.65 mm/year within natural areas and decreased by 2.12 mm/year in human-dominated areas. The active layer thickness increased 8.63 mm/year for permafrost. In the permafrost zone evapotranspiration and latent heat flux increased, and the sensible heat flux declined. In the human-dominated areas water use raised the latent heat flux and reduced the sensible heat flux, net ecosystem exchange and streamflow recharging to the eco-fragile region in the lower reaches. Results suggested that the land surface model CAS-LSM is a potential tool for studying land surface processes, especially in cold and arid regions experiencing human interventions.

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