Abstract

Land surface processes modulate the severity of heat waves, droughts, and other extreme events. However, models show contrasting effects of land surface changes on extreme temperatures. Here, we use an earth system model from the Geophysical Fluid Dynamics Laboratory to investigate regional impacts of land use and land cover change on combined extremes of temperature and humidity, namely aridity and moist enthalpy, quantities central to human physiological experience of near-surface climate. The model's near-surface temperature response to deforestation is consistent with recent observations, and conversion of mid-latitude natural forests to cropland and pastures is accompanied by an increase in the occurrence of hot-dry summers from once-in-a-decade to every 2–3 years. In the tropics, long time-scale oceanic variability precludes determination of how much of a small, but significant, increase in moist enthalpy throughout the year stems from the model's novel representation of historical patterns of wood harvesting, shifting cultivation, and regrowth of secondary vegetation and how much is forced by internal variability within the tropical oceans.

摘要

地表的進程調節了熱浪、乾旱、和其他劇烈天氣事件造成的嚴重影響，然而，模式表現出地表對極高氣溫的對比效果。在此，我們使用來自 GFDL 的地球系統模式，調查急遽的溫度和濕度下(又名乾旱和水氣熱含量，人類在近地表氣候體感的量值)，土地使用的區域影響和地表植披變化，模式的近地表溫度反映了近期觀察到的森林砍伐，且伴隨著乾熱的夏天發生次數增加，中尺度的自然林相變成的農田和牧場的變化，從每十年變成每 2~3 年。在熱帶地區，長時間尺度的海洋變化性移除了一些判斷依據，包括來自模式最新呈現的，植林、耕作改變、再生的植被等歷史模式中，整年的微小但顯著的水氣焓量；以及熱帶海洋的內部變化產生的影響。