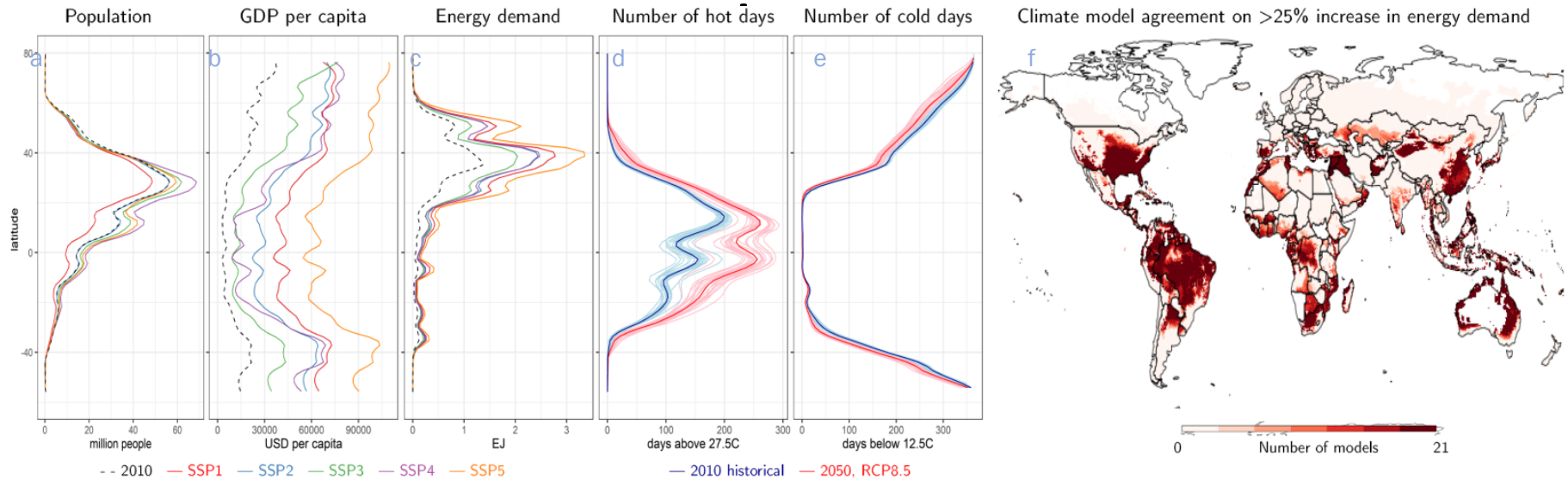


Amplification of future energy demand growth due to climate



Latitudinal (a) population, (b) per capita income and (c) energy demand for 5 shared socioeconomic pathway scenarios, (d) hot days and (e) cold days for 21 climate model simulations of current and RCP 8.5 climate scenarios, and (f) model agreement on increases in total energy demand exceeding 25% under RCP 8.5.

Objective

Energy is critical for human wellbeing and continued economic development, and is also one of the human systems most directly influenced by changes in climate. Previous studies have tended to focus on a single country, world region or economic sector (e.g., households), and rely on projections from a small number of climate models. This study provides the first comprehensive estimates of the way in which anticipated mid-century climate change will affect the demand for energy across the world.

Approach

Using historical data on income, population, energy use, and temperature exposures for many countries over several decades, we estimate a statistical model of the response of demand for three fuels (petroleum, natural gas, electricity) in four sectors (agriculture, industry, commerce and households) to hot and cold days (avg. temperatures $> 27.5^{\circ}\text{C}$ and $< 12.5^{\circ}\text{C}$). The model is coupled with gridded daily temperatures from 21 climate model simulations of the current period and the decade of the 2050s under scenarios of modest (RCP 4.5) and vigorous (RCP 8.5) warming.

Impact

Compared to baseline scenarios in which demand is driven by population and income growth alone, climate change increases 2050 global energy use by 11-27% with modest warming, and 25-58% with vigorous warming. Large areas of the tropics, southern Europe, China, and the USA, experience the largest increases. A key driver of rising demand is electricity for cooling, especially in industry and commerce. Uncertainties include the future path of GHG emissions, differences in climate models' spatial projections of temperature extremes, and countries' baseline patterns of energy consumption.



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