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Global climate change impact on the electrical energy cost of buildings: Madrid case study

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This paper studies how global climate change impacts on the electrical energy consumption (total electricity, fans electricity and cooling electricity) and their respective economic cost using buildings covering an area of 1 km by 1 km of Madrid city. The energy demand calculations use meteorological information with 50 meters of spatial resolution, considering the 3D shape of the buildings and land use properties around the buildings. Climatic variables are dynamically downscaled from 1º to 50 m using a nesting approach. Building energy simulations are implemented with the EnergyPlus model. To determinate the cost of impacts, future distribution of the energy source in the two climate scenarios are considered and the corresponding 2012 prices from the Spanish Commission of the Energy. The impacts at energy demand of the area are calculated for years 2030, 2050 and 2100 versus 2011 under two IPCC global climate projections: RCP 4.5 (stabilization emission scenario) and RCP 8.5 (little effort to reduce emissions). It is assumed that the buildings don´t change for the future simulations to isolate effects of the global climate on the energy demand of the buildings. The electrical consumption changes in the 2100 are very important. In the RCP 8.5 we can observe a very strong increment on the electricity demand for cooling the buildings. In the RCP 4.5 decreases of electrical consumption (-14.37%) are observed because due to very important decreases of the temperature. On average, the global climate for year 2100 will have an impact on a typical Madrid buildings block of 117918 euros per year following the RCP 8.5 and the RCP 4.5 will save 110537 euros/per year.

Biography

Roberto San Jose is a Professor in Technical University of Madrid and Director of Environmental Software and Modelling Group in the Computer Science School of UPM. He has more than 300 scientific publications in relevant Journal Citation Index Journal. He completed his PhD in 1982 related to the unstable surface turbulent boundary layer parameterization. He has been involved in air pollution modelling mainly using three-dimensional mesoscale models, such as MM5 and CMAQ. He has been a Full Professor since 2001

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