A computer model for predicting natural ventilation in buildings by solar chimney alone is presented. The simulations are based on the solution of the 3-D steady laminar conservation equations of mass, momentum and thermal energy with an appropriate set of boundary conditions. The equations are discretized using a finite difference formulation and solved by the Marker and Cell (MAC) scheme. Indoor airflow fields and temperature distributions are discussed with respect to human comfort at the living level, 1 m above floor. The simulation results show that solar chimney alone can induce a sufficient ventilation rate for ensuring residents' thermal comfort, when the outdoor temperature is moderate (below 37°C).