EFFECT OF GAS RADIATION ON RADIATIVE HEAT TRANSFER BETWEEN HUMAN BODY AND URBAN STREET CANYON

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ABSTRACT. This paper describes the numerical simulation results of radiative heat transfer between the human body and an urban street canyon (building walls, pavement, and the sky) in the presence of participating non-gray gas mixtures such as H_2O, CO_2, and CO. The ambient temperature corresponding to typical summer conditions and the concentration of each gas in the Tokyo metropolitan area were assumed. The geometry of a simple street canyon was modeled for variable horizontal and vertical scales. The simulation results demonstrated that the participating gas significantly affects the infrared radiation field in the urban street canyon. The fraction of radiation that is absorbed and emitted via gas is approximately 30% of the total incident radiation to the human body surface. This causes a homogenization of the infrared radiation field surrounding the human body. In addition, the maximum difference between the radiative heat flux to the human body surface of the present simulation and that of the conventional vacuum simulation is approximately 20 W/m^2. These results indicate that non-gray gas mixtures play an important role in the characteristics of human thermal comfort in an urban street canyon under hot and humid summer condition.