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Development of a Weighted-Sum-of-Gray-Gases Model for Modeling Radiative Heat Transfer in Coal-Fired Oxy-Fuel Boilers

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ABSTRACT. The “multiplication” approach of Cassol et al. (2014) is introduced to gas-particle mixtures with coal/char and ash particles in the context of the Weighted-Sum-of-Gray-Gases (WSGG) model for modelling their radiative properties. Each radiating species is considered independent in this approach. The accuracy is assessed in a 2D square geometry representing the post-burner region of a coal-fired furnace with wet oxy-fuel conditions. The proposed non-gray gas-particle WSGG model predicts the radiative source terms and net wall heat fluxes with the mean relative errors less than 14 %. The use of Planck-mean values for particle absorption leads to higher errors. However, applying the non-gray WSGG gas parameter set of Bordbar et al. (2014) in conjunction with the proposed non-gray WSGG particle model significantly reduces the maximum errors, with the mean relative errors lower than 7 %, and the associated computational effort.