Hybrid combustion model for dust-containing hydrogen-air mixtures in the CABARET-COMBUSTION code

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The CABARET-COMBUSTION code implements the CABARET algorithm for multicomponent reacting gas mixtures, including an approach to resolving sonic points. The code includes a large-scale combustion model for mixed combustible mixtures based on a turbulent flame closure model, a detonation model based on single-stage irreversible chemical kinetics, and a jet combustion model based on a vortex dissipation model. The code has been validated on a number of problems related to the combustion and detonation of hydrogen-air mixtures in open spaces and cluttered channels of various configurations. At the current stage of the work, the code incorporates a hybrid combustion model for dust-containing hydrogen-air mixtures. Within this model, hydrogen combustion is described by a large-scale combustion model, and dust combustion is described by the single-stage chemical kinetics of surface reactions involving oxidation of dust by oxygen and steam. Additionally, the computational model accounts for radiative heat transfer between the gas and dust fractions. This paper discusses the main results of the validation of the presented hybrid combustion model using experiments involving the combustion of graphite dust in hydrogen-air mixtures with varying hydrogen contents.