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Modelling of Turbulent Scalar Fluxes in the Broken Reaction Zones Regime.[1] HONG G. IM, King Abdullah Univ of Sci Tech (KAUST), NILANJAN CHAKRABORTY, University of Newcastle, MARKUS KLEIN, CHRISTIAN KASTEN, Universitt der Bundeswehr Mnchen, PAUL ARIAS, University of Michigan — The LES filtered species transport equation in turbulent reacting flow simulations contains the unclosed turbulent scalar flux that needs to be modelled. It is well known that the statistical behavior of this term and its alignment characteristics with resolved scalar gradient depend on the relative importance of heat release and turbulent velocity fluctuations. Counter-gradient transport has been reported in several earlier studies where the flames under investigation were located either in the corrugated flamelets or thin reaction zones regime of premixed turbulent combustion. Therefore it is useful to understand the statistical behavior of turbulent scalar fluxes if the flame represents the broken reaction zones regime (BRZR). The present analysis aims to provide improved understanding on this subject through an a-priori analysis of a detailed chemistry database consisting of three freely-propagating statistically planar turbulent H2-air premixed flames representing three different regimes of combustion. Results indicate that heat release effects weaken with increasing Karlovitz number, but that counter-gradient transport can still occur for large LES filter size in the BRZR. Furthermore the behaviour of the flux and in particular its sign are different for reactant and product species.

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