



Impact of non-uniform emission of reacting scalars on the chemical transformations in the atmospheric boundary layer: An LES study

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The reactivity of chemical species in the atmospheric boundary layer (ABL) is affected by the combined effects of atmospheric turbulence and non-uniform surface emissions of the reactants. For chemical species with a lifetime shorter than the characteristic turnover time of the largest turbulent eddies (typically 10-20 minutes for a convective boundary layer), the efficiency of turbulent mixing to bring the reactants together controls their chemical transformations. In addition to this process, non-uniform emissions of atmospheric pollutants increase the spatial variability and level of segregation of the reactants. This results in substantial differences in the reactivity pattern compared to the uniform emission situation. In this study, large-eddy simulation (LES) is used to study the effect of simple non-uniform surface emission patterns (with different emission areas but the same total emission) on the reactivity of two chemicals involved in a fast second-order reaction. Special attention is placed on studying the effect of the non-uniform emission on the intensity of the segregation and effective reaction rates.