

Kinetics of Free Radical Catalytic Photochemistry: Mapping the Molecular Scale to the Global Scale in the Context of Climate Change

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Abstract:

Given that the reaction rate constants for radical-molecule reactions involving HOx, NOx, ClO, BrOx and IOx range over some 20 orders of magnitude, this class of reactions is of particular interest from both (1) a theoretical perspective as well as in (2) the analysis of catalytic reaction pathways that directly impact the photochemical structure of the global atmosphere. Both of these topics will be addressed.

With rapid changes in the Earth's climate structure, the field of free radical kinetics must now confront an array of new mechanisms. Mechanisms that are central to our understanding of the coupling between (a) increased forcing of the climate by increasing concentrations of CO₂ and CH₄ from fossil fuel extraction and combustion in combination with the release of greenhouse species from melt zones in the Arctic, and (b) changes in the shortwave forcing of the climate, toxicity in tropospheric photochemistry, and increases in UV dosage at the Earth's surface from a new class of catalytic reactions in the stratosphere.