The Influence of Heterogeneous Chemistry on Volcanic Sulfate Aerosols on Ozone Depletion and Recovery

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Anthropogenic emissions of CFCs introduce chlorine to the stratosphere, where heterogeneous chemical reactions on various surfaces convert stratospheric chlorine from reservoir species into reactive ones that go on to destroy ozone. Identification of stratospheric ozone changes attributable to ozone depleting substances and actions taken under the Montreal Protocol requires evaluation of confounding influences from volcanic eruptions due to the enhanced depletion caused by the greater surface areas available for heterogeneous reactions on volcanic sulfuric acid aerosols. A suite of recent simulations with the WACCM chemistry-climate model from 1979-2014 show that increased stratospheric aerosol loading from volcanic eruptions after 2004 impeded the rate of ozone recovery from 1999 to 2014. In contrast, eruptions increased ozone loss rates over the depletion era from 1980 to 1998. These findings reinforce the need for accurate information regarding stratospheric aerosol loading when modeling ozone changes, particularly for the challenging task of accurately identifying the early signs of ozone healing distinct from other sources of variability.

Key words: ozone depletion, stratosphere, heterogeneous chemistry, volcanic aerosols