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Supporting Information for

Chemistry contribution on stratospheric ozone depletion after the unprecedented water rich Hunga Tonga eruption

Authors: Jun Zhang[1*], Douglas Kinnison[1], Yunqian Zhu[2,3], Xinyue Wang[1], Simone Tilmes[1], Kimberlee Dube[4], William Randel[1]

Affiliations:

[1]Atmospheric Chemistry Observations & Modeling Laboratory, National Center for Atmospheric Research, Boulder, CO, USA

[2] Cooperative Institute for Research in Environmental Sciences, University of Colorado Boulder, Boulder, CO, USA, 80309

[3]Chemical Sciences Laboratory, National Oceanic and Atmospheric Administration, Boulder, CO, USA, 80305

[4]Institute of Space and Atmospheric Studies, University of Saskatchewan, Saskatoon, SK, Canada

[*]Corresponding author: Jun Zhang (jzhan166@ucar.edu)

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Introduction

Supporting information includes text and figures to support the discussion in the main article.

Text S1. Odd oxygen definition and reactions included in each odd-oxygen loss mechanism.

Odd oxygen definition Ox = O_3 + $O(^3P)$ + O(1D) + NO_2 + $2NO_3$ + HNO_3 + HO_2NO_2 + $2N_2O_5$ + ClO + $2Cl_2O_2$ + 2OClO + $2ClONO_2$ + BrO + $2BrONO_2$, which is approximately equal to O_3 + $O(^3P)$

Chapman mechanism self-loss cycle, plus O1D_H2O (Ox-Ox):
OddOx_Ox_Loss = 2.*(O+O_3) + ($O(^1D)$+H_2O)

NOx involved Ox loss cycle (NOx-Ox):
OddOx_NOx_Loss = 2*(NO_2+O) + 2*(NO_3+hv)

HOx involved Ox loss cycle (HOx-Ox):
OddOx_HOx_Loss = (HO_2+O) + (HO_2+O_3) + (OH+O) + (OH+O_3) + (H+O_3)

ClOx/BrOx involved Ox loss cycle (ClOx/BrOx-Ox):
OddOx_CLOxBROx_Loss = 2*(ClO+O) + 2*(2*(ClOOCl + hv) + 2*(ClO+ClO=> 2Cl + O_2) + 2*(ClO+ClO => Cl_2 + O_2) + 2*(BrO+ClO => Br + Cl + O_2) + 2*(BrO+ClO => BrCl + O_2) + 2*(BrO+BrO) + 2*(BrO+O) + (ClO+HO_2) + (BrO+HO_2)

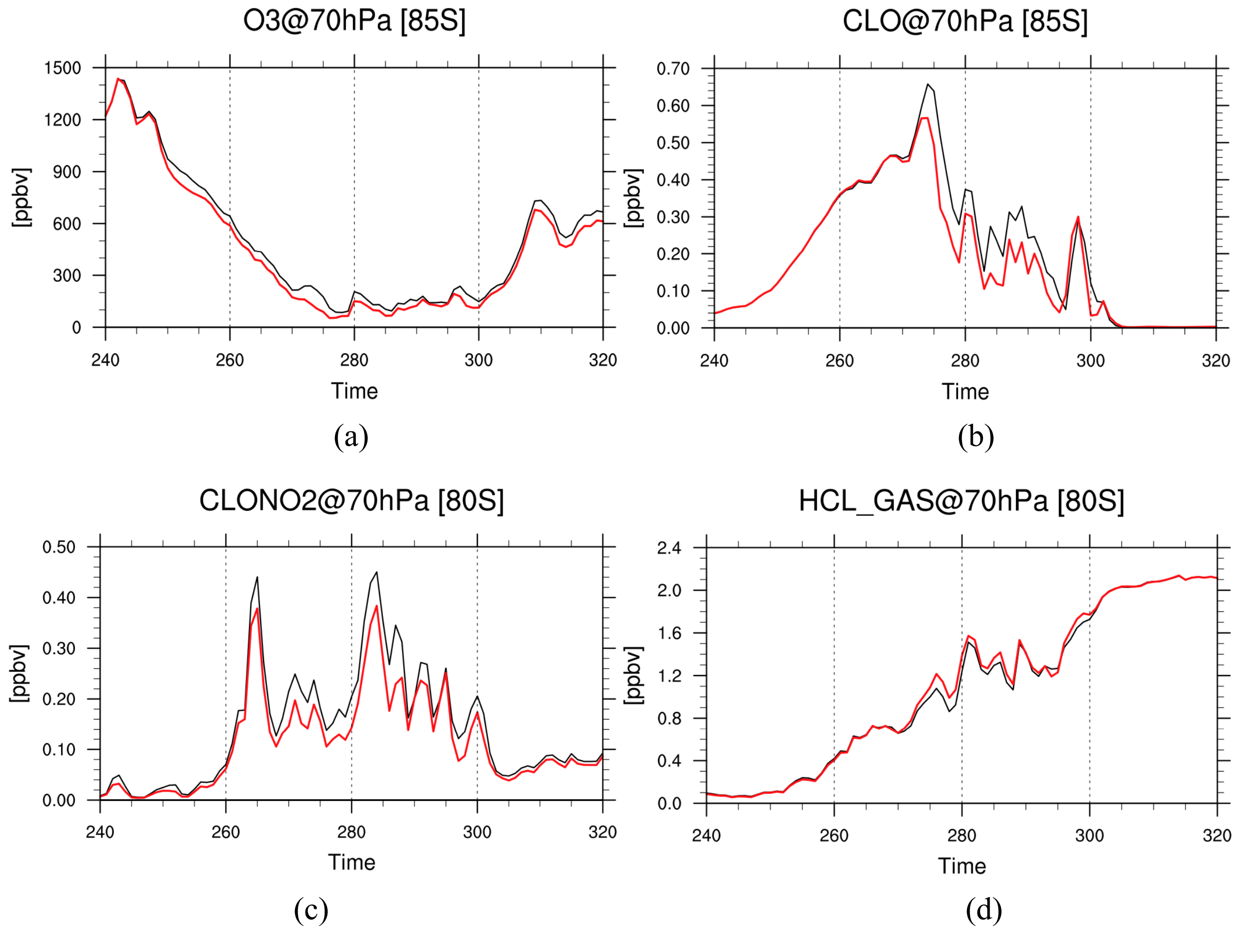

Figure S1. Calculated perturbations from full-forcing (SO_2+H_2O) experiment run (red lines) compared to no-forcing control runs (black lines) for (a) O_3 (b) ClO (c) $ClONO_2$ and (d) HCl at 70 hPa 80°S. Shown day 240 to 320 in 2022.

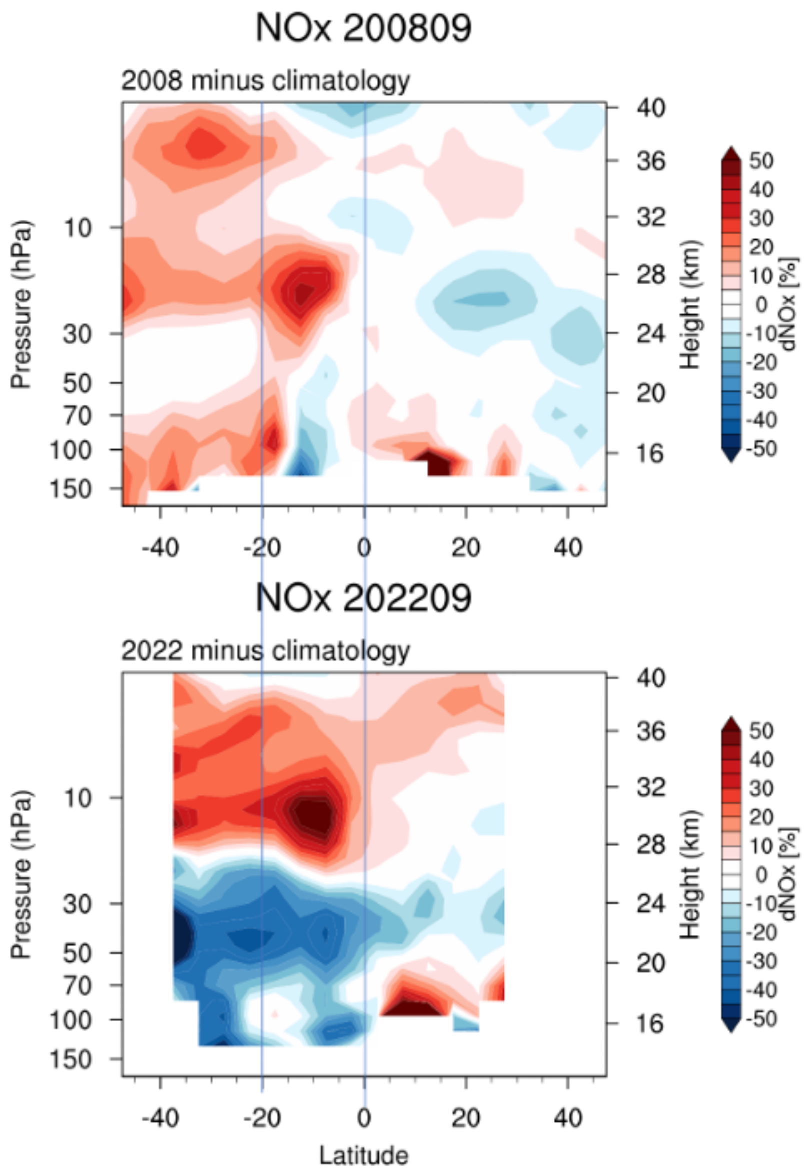

Figure S2. Calculated NOx anomaly (%) relative to climatology (2007 to 2021) from OSIRIS in September 2008 (top) and 2022 (bottom).