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Sensitivity studies of oxidative changes in the troposphere in 2100 using the GISS GCM

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Abstract. We examine the relative importance of chemical precursor emissions affecting ozone (O_3) and hydroxyl (OH) for the year 2100. Runs were developed from the Comparison of Tropospheric Oxidants (Ox_Comp) modeling workshop year 2100 A2p emissions scenario, part of the Intergovernmental Panel on Climate Change (IPCC) third assessment report (TAR). While TAR examined only cumulative change, we examine individual components (NO_x, CH_4, CO, etc.). Also, since there will be climate changes in 2100 (not accounted for by TAR), we investigate the effect of changing our fixed SSTs/ocean ice from present day to 2100 conditions, as projected by a coupled ocean-atmosphere model with doubled CO_2. Unlike TAR we perform multiannual integrations and we include interactive lightning. Largest changes arose from the run with 2100 industrial NO_x (O_3=+16.9%, OH=+29.4% in July) and the run with 2100 methane (O_3=+17.4%, OH= -19.1% in July). In the latter run, large ozone increases in the NH upper troposphere appeared to repartition HO_2 into OH to such an extent that the lowering in OH associated with increased methane was overwhelmed in that region. Incorporating all changes collectively led to the July tropospheric ozone burden increasing from 426 to 601 Tg (+41.1%) and the July OH concentration increasing from 13.6 to 15.2x10^5 molecules/cm^3 (+11.8%).

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