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# Influences of ClO dimer cycles on the polar stratospheric dynamics and their interactions

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1. Introduction
The photolysis of ClO dimer (ClOOCl) is a rate-limiting step for ozone loss cycles in the polar stratosphere. Therefore, ozone destruction rate has a large sensitivity to the photolysis rate. The JPL 2006 [Sander et al., 2006] provides the absorption cross section data as an average of multi laboratory measurements. Recently, Pope et al. [J. Phys. Chem. A, 2007] reported much lower values of the cross sections. The differences are especially large at the longer wavelengths, where the sunlight reaches the lower stratosphere at the end of the polar night (large zenith angles). However, their values are too small to explain the ozone destruction observed. Some studies have been done on not only laboratory measurements of the cross sections [e.g., Schofield et al., GRL, 2 008; Lien et al., J. Chem. Phys., 2007; Papanastasiou, J. Phys. Chem. A, 2007] but also a consistency of all the reactions associated with this ozone destruction cycle (a consistency between the ClO dimer absorption cross section, the coefficients of the other chemical reactions associated with the ozone destruction cycles, and observed ozone destruction rates) [e.g., Schofield et al., GRL, 2008]. Thus ozone destruction of this catalytic cycle is under discussion. This study investigates impacts of the differences in the ClO dimer cross section on the ozone destruction, using the CCSR/NIES chemistry-climate model. We particularly focus on a difference between both the hemispheres.

2. Method
The ClOOCl absorption cross sections from the JPL2006 recommendation are used for the control run. Those from Burkholder et al. [J. Phys. Chem. A 1990] and Pope et al. [J. Phys. Chem. A 200 7] are used for the sensitivity runs as a higher and lower value data, respectively. Another sensitivity run are performed with the cross sections set to zero at all wavelengths. Each run was integrated for 20 years following the scenario of the CCMVal-2 REF-B0, which is a time sliced experiment for the atmosphere condition for the year 2000. We also perform an assimilation run, in which the zonal winds, the meridional wind, and the temperature are nudged toward those of the control run. Differences between these runs are analyzed.

3. Results
In the Antarctic, the large/small ozone destructions correspond to the higher/lower ClO dimer cross section. The polar vortex breakup dates of the higher/lower cross section runs significantly delays/advances to that of control run. This implies an interaction between atmospheric dynamics and ozone. The correlation between the ozone and the cross sections in the sensitivity runs are slightly less significant in the nudging runs. This also implies the atmosphere-ozone interaction. On the other hand, in the Arctic, there is no significant relationship between ozone amounts and ClO dimer cross sections. Thus, the atmospheric dynamics is a dominant factor on the ozone amounts in the Arctic polar region, and hence ozone destruction is insensitive to the values of the cross sections there.

Keywords: Ozone Hole, ClO dimer cycle, Chemistry Climate Model