Lu and Sanche Reply: In our Letter [1], our findings suggest that "dissociation of chlorofluorocarbons (CFCs) by capture of electrons produced by cosmic rays and localized in polar stratospheric cloud ice may play a significant role in causing the ozone hole." In their Comment [2], Harris *et al.* have doubt on the importance of this mechanism in the stratosphere.

It is true that no laboratory measurements on the amount of CFCs adsorbed on or trapped in ice under exact polar stratospheric cloud (PSC) conditions have been reported. But, it is also premature to conclude that no sufficient CFCs are available in PSC ice for our mechanism to be significant. It is known that PSC ice particles are abundant in the winter lower polar stratosphere, where CFC levels are very high in the beginning of winter [cf. Fig. 1(a)]. CFCs may not appear to stick easily to ice, but dynamical and other properties of ice in PSCs can cause adsorption, diffusion, and trapping of molecules into ice [4].

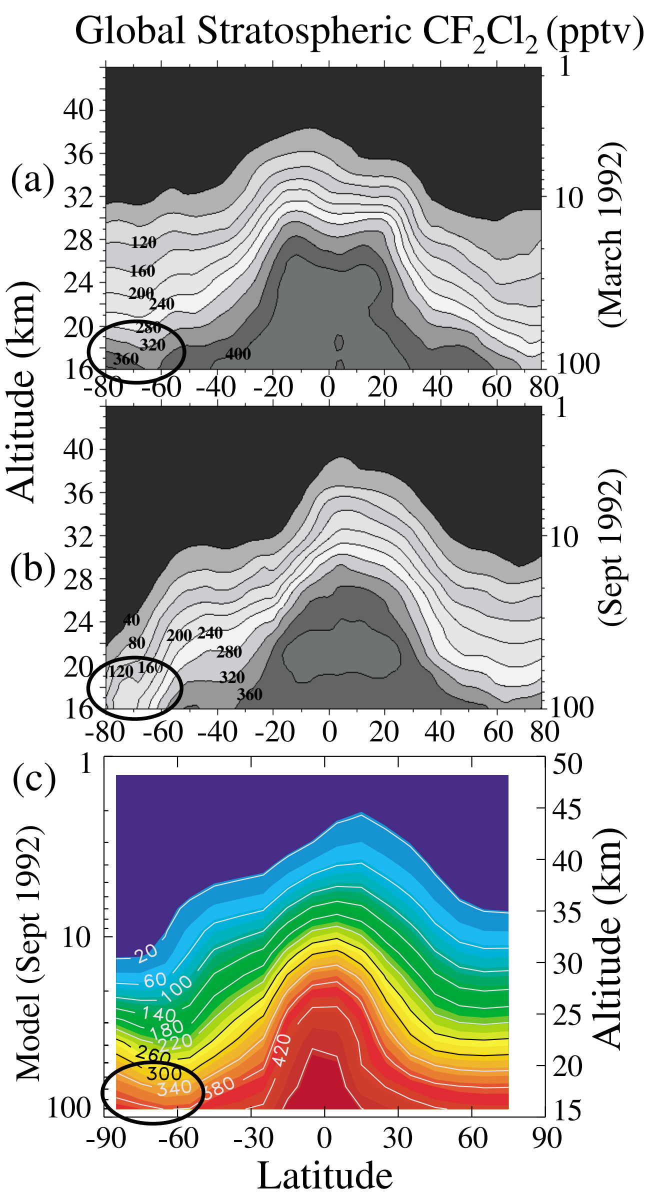

FIG. 1 (color online). (a) and (b) are the data measured by the UARS satellite (from NASA UARS database); (c) is the modeled result for September 1992 from the GSFC 2D photochemical model based on the photochemical mechanism and atmospheric transport processes [3]. The lower Antarctic stratosphere between 16 and 20 km is marked by a circle.

We do not agree with Harris *et al.*'s claim that our analysis of the UARS satellite data is incorrect. These data are shown in Fig. 1. The reader can see that the CFC-12 level in the polar stratosphere at altitudes between 16 and 20 km is higher (~ 360 pptv) during the Antarctic fall [Fig. 1(a)]; the opposite phenomenon appears in Fig. 1(b): the CFC-12 level decreases to about 100 pptv in the early spring. "These data indicate that *CFCs are strongly destroyed in the winter polar stratosphere at altitudes below 20 km*" [1]. Current atmospheric chemistry models attribute this destruction to more air transport downward in the winter polar stratosphere. However, the modeled result [Fig. 1(c)] [3] *that included both photochemical and air transport processes* deviates significantly from the satellite data [Fig. 1(b)], especially below 20 km. It should also be noted that the dissociative electron attachment process can occur for other trace molecules (e.g., N_2O). The latter can also react with the radicals resulting from the dissociation of CFCs.

We agree that our analysis of the global O_3 loss and the O_3 hole with the proposed pathway is not yet complete. If the CFC level is a limiting factor for the O_3 hole, then the reduction of CFC lifetimes would accelerate ozone recovery. However, if CFCs are in excess in the lower polar stratosphere, i.e., the availability of electrons is the limiting factor, then an increase of H_2O and thus cosmic-ray ionization events will delay O_3 recovery.

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