We conclude this lecture with the discussion of chlorofluorocarbons, or CFCs.

CFCs are noteworthy for their ability to catalytically destroy stratospheric ozone. Chlorine species from CFCs dissociate in the stratosphere, and can be moved from reservoirs-- such as HCl and ClONO2-- to active forms-- such as molecular chlorine-- on the surface of polar stratospheric clouds or PSCs. Dissociation of chlorine leads to the catalytic ozone loss. Large losses at the poles-- where polar stratospheric clouds are present-- have been observed.

For this reason, CFCs have been regulated by the Montreal Protocol, and replaced by shorter-lived HCFCs-- or hydrochlorofluorocarbons. CFC concentrations have begun to drop, although HCFC concentrations are currently rising.

As shown in our discussion of global warming potential earlier in this lecture, CFCs are strong absorbers of infrared radiation, much more effective on a per molecule basis than is CO2. It is therefore a side benefit of the Montreal Protocol's regulation of CFCs that their global warming potential has been removed from the atmosphere. That is to say, if they had been emitted into the atmosphere-- if they were unregulated-- their radiative effect would have drastically increased the infrared absorption capacity of the atmosphere.

This can be visualized as an unrealized equivalent of carbon dioxide. This is portrayed by the shaded regions in this figure, and is equivalent to about 11 gigatons of carbon dioxide per year.

Analogous to CFCs, HCFCs are also strong absorbers of infrared energy. Although scheduled for reduction, an early phase-out of these species could have the side benefit of substantially reducing global warming.

To recap this lecture, we've discussed the greenhouse gases-- mainly those other than carbon dioxide. We've discussed why methane is special due to a hiatus in its rise. And we've discussed the concept of global warming potential, which is relative to carbon dioxide. Finally, we've discussed the role of CFC reduction on global warming.