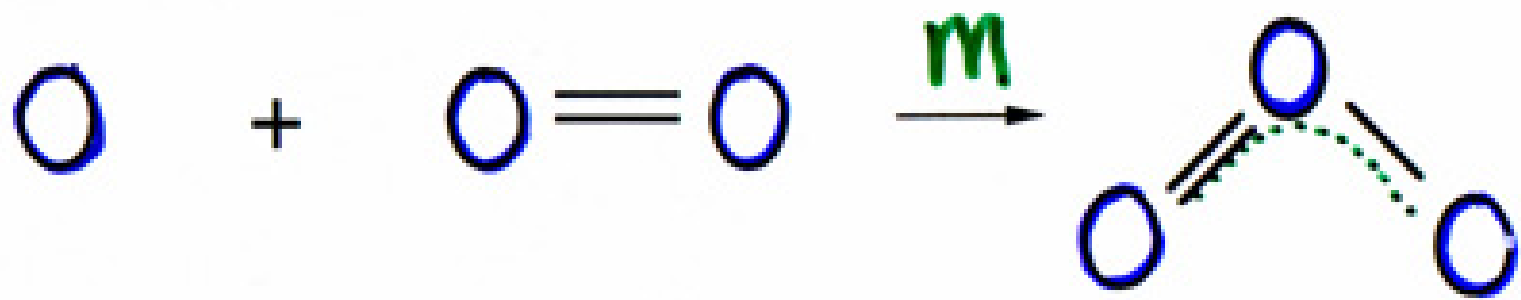


The Antarctic Ozone Hole

What do Clouds
Have to do with it?

Sharon Anthony
The Evergreen State College

What is Ozone?



Atomic Oxygen

Molecular Oxygen

Ozone

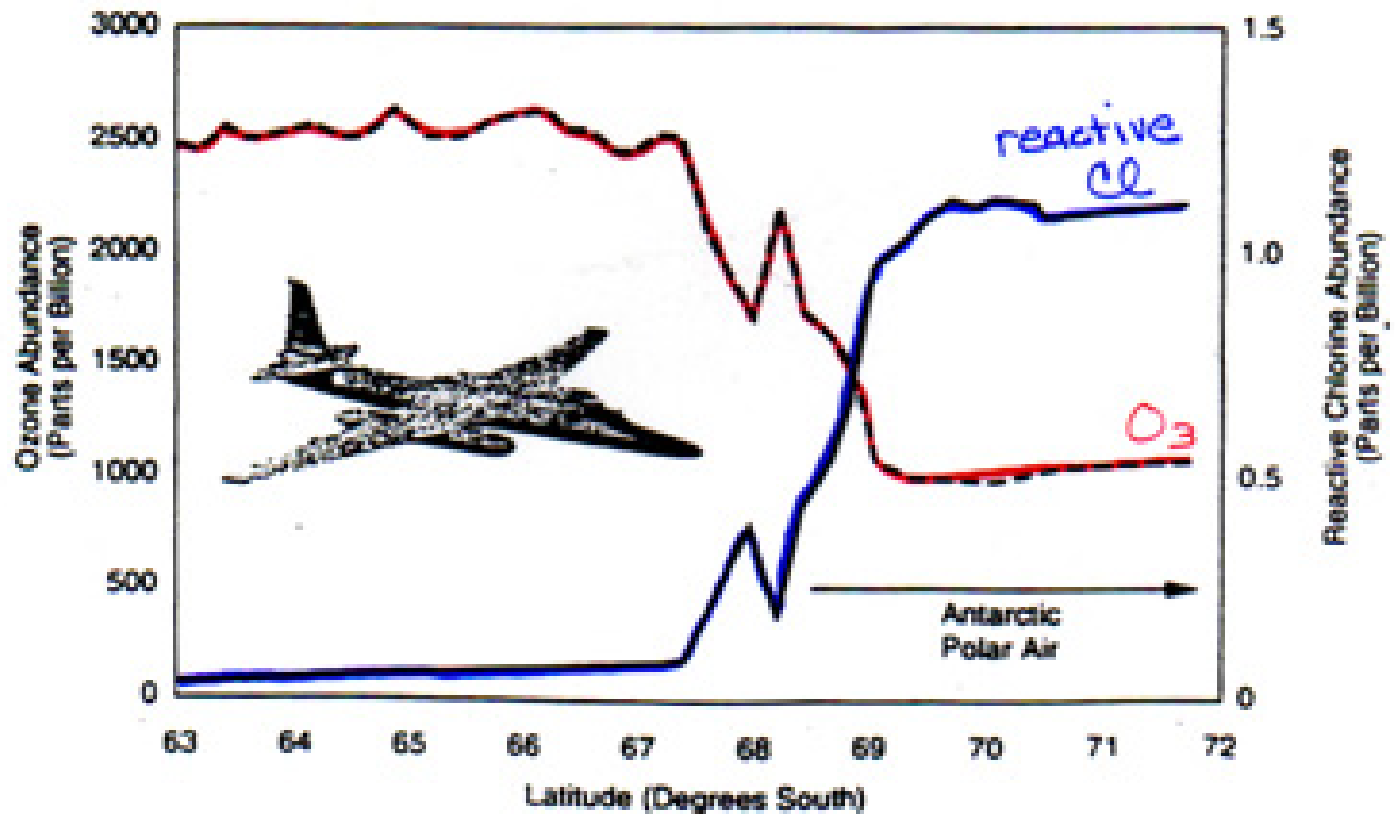
Outline

- 1) General ozone
- 2) Antarctic ozone hole
- 3) Slide show
- 4) Polar stratospheric cloud formation



POLAR NOSTALGIA

Measurements of Ozone and Reactive Chlorine from a Flight into the Antarctic Ozone Hole



Highly elevated ClO when O3 low

chlorine implicated in ozone loss

Catalytic O₃ destruction by chlorine over Antarctica



✳️ Catalytic cycle: chlorine is not destroyed

✳️ Each Chlorine atom can destroy 100,000 ozone molecules

Chlorine Partitioning

1% Active Chlorine

Cl

destroys ozone

ClO



99% Inactive Chlorine

HCl

doesn't destroy ozone

ClONO₂

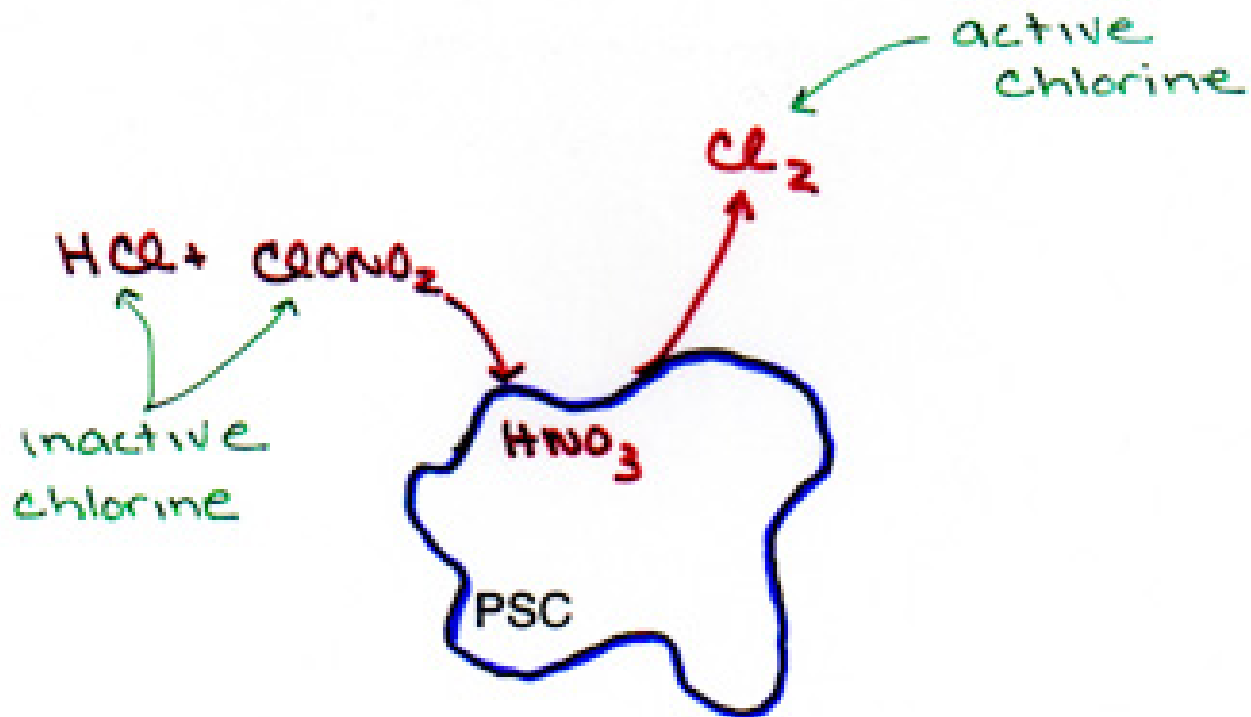
Chlorine Activation



* Chlorine activation reactions don't take place in the gas phase

Why Antarctica?

- 1) Cold temperatures allow Polar Stratospheric Clouds (PSCs) to form



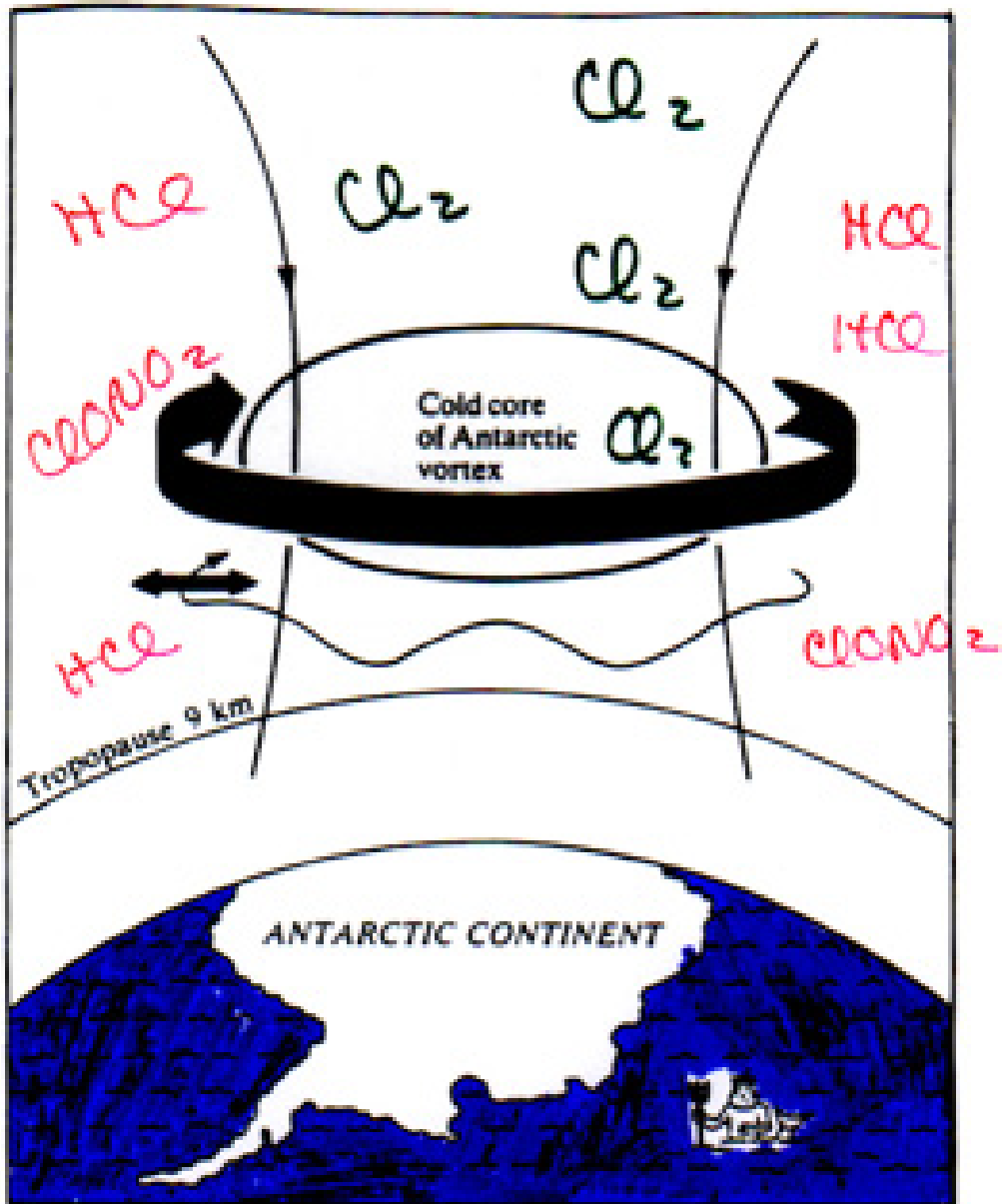
gas phase



- ☛ Reactions on polar stratospheric clouds convert inactive chlorine to active chlorine

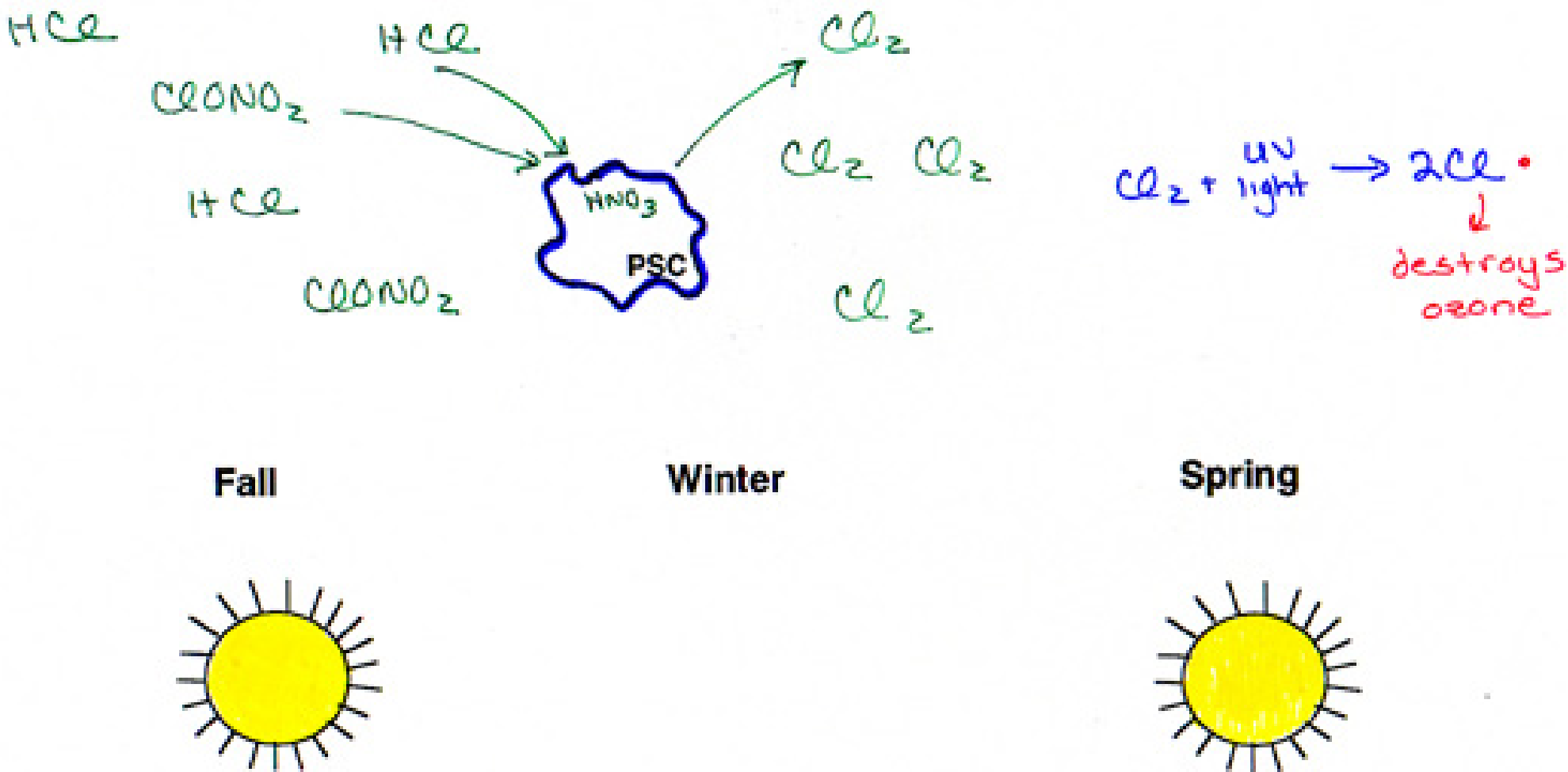
Why Antarctica?

2) Polar vortex forms in winter

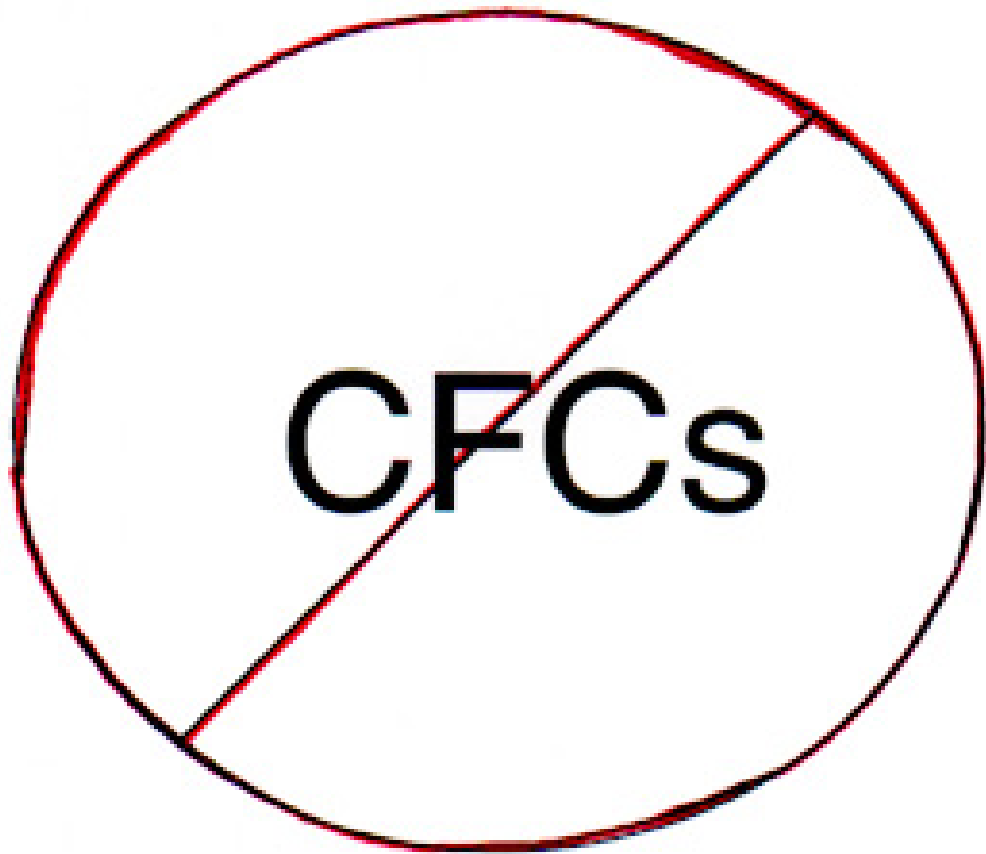


Vortex separates polar air from mid-latitude air

Why does the ozone hole form in the spring?



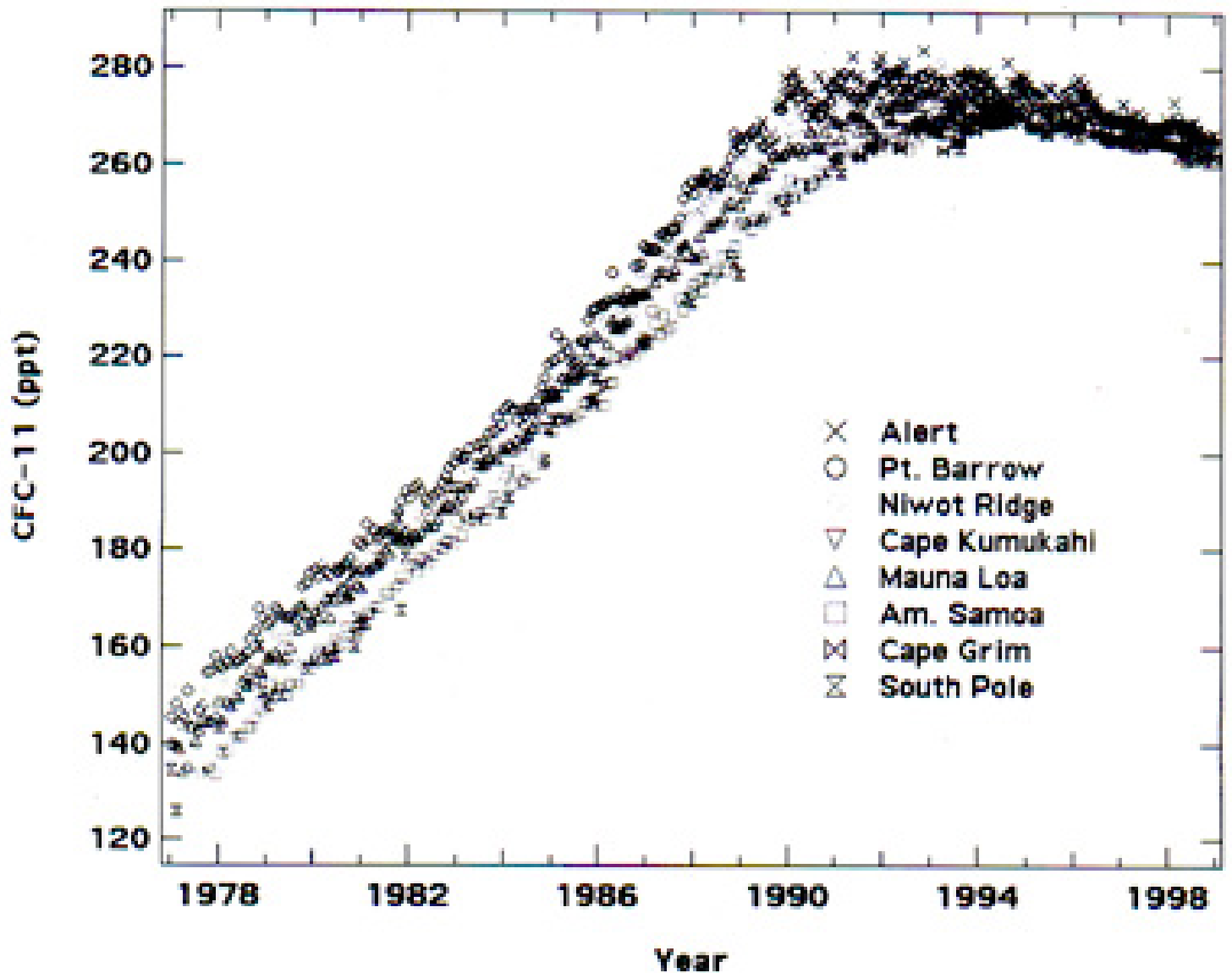
What are we doing to plug the "hole"?



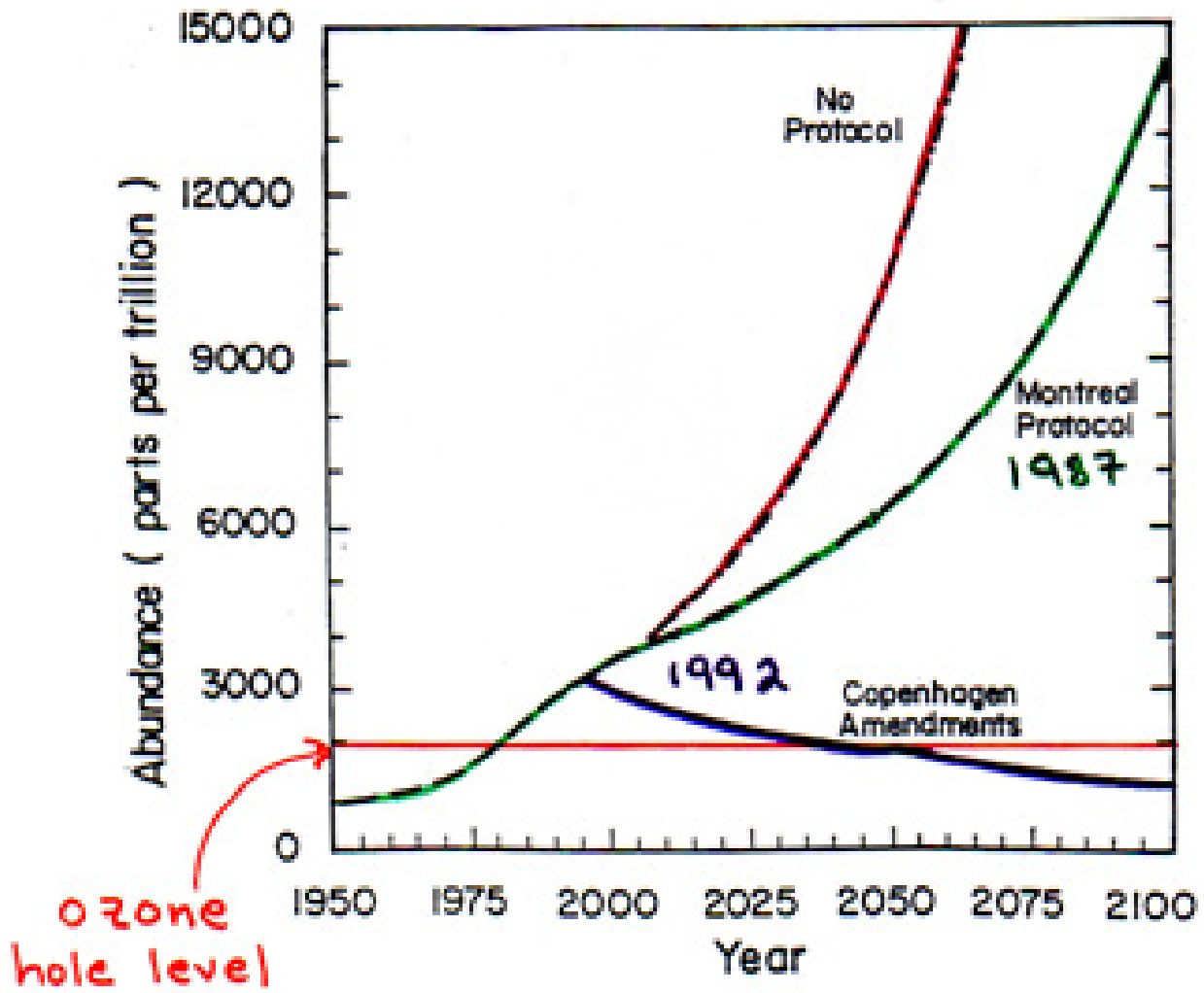
* 1985 - Ozone hole reported

* 1987 - Montreal protocol signed to phase out CFCs

CFC-11 Concentrations



Future Chlorine Loading



Best case: Will still have an O₃ hole until 2050