Analysis of stratospheric ozone recovery
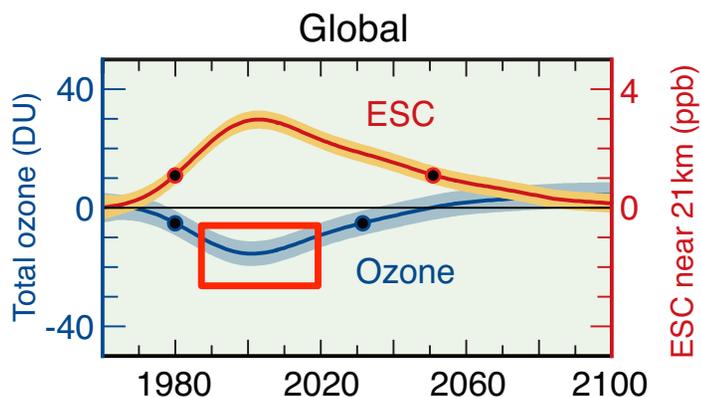## Birgit Hassler

Are we seeing signs of ozone recovery?

CSD role: **Major contributions to the WMO ozone assessment**

Construction of global ozone time series for model evaluations

Leading role in international initiatives looking at stratospheric ozone data

Increasing the fundamental understanding of ozone-climate interactions

Global

ESC: Ozone depleting substances

*(Fahey & Hegglin, WMO Ozone Assessment, 20 Questions, 2011)*

➢ **Ozone data for modeling**

➢ **Influence of dynamics on ozone recovery**

➢ **Changes in ozone depleting chemistry over time**

➢ **Searching for significant ozone increases globally**

OZONE DATA FOR MODELING

Global, zonal mean, monthly mean, gap-free ozone data set, based on observations

publicly available

- Used as boundary conditions for climate models

- Studies about ozone depletion – climate change interactions
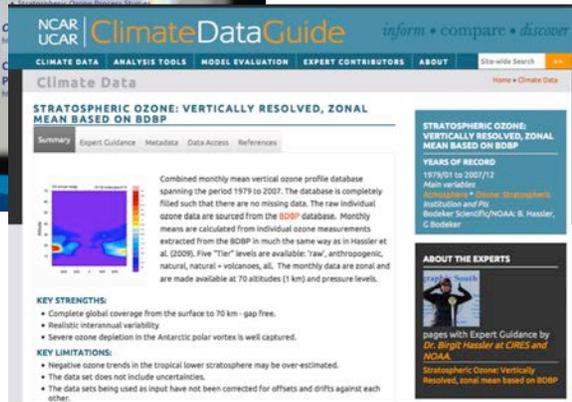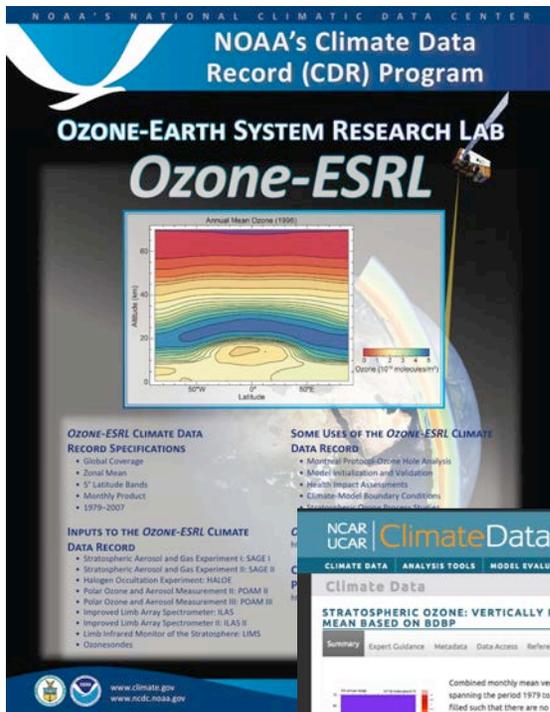
(Solomon et al., GRL, 2012)
(Bodeker et al., ESSD, 2013)
(Hassler et al., JGR, 2013)
(Young et al., GRL, 2014)

➢ **Expertise in providing global ozone data sets for different applications**
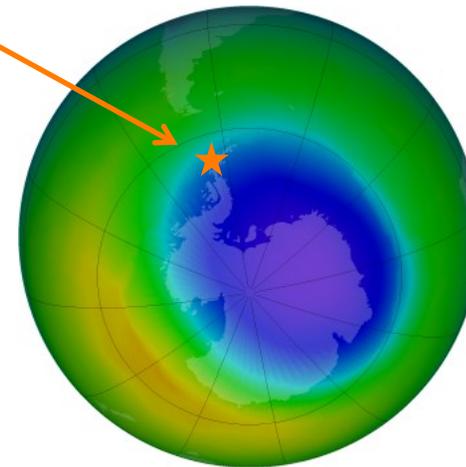
OZONE RECOVERY: DYNAMICS

How do atmospheric dynamics influence the detection of ozone recovery?

- Variability in ozone can be caused by atmospheric dynamics rather than chemistry
- Shift in polar vortex location over the last decades
- Total column ozone data from Antarctic stations

Total column ozone at Faraday station/Antarctica

Total column ozone October 1992
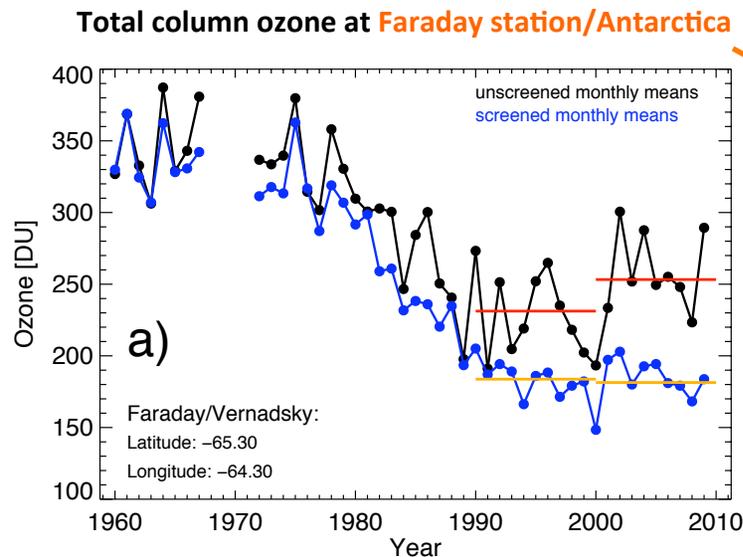
(Hassler et al., GRL, 2011, Figure 1a)

(NASA, Ozone Hole Watch)

➢ **Changes in atmospheric dynamics add a layer of complexity to the detection of ozone recovery**

OZONE RECOVERY: CHEMISTRY

Can we use knowledge about ozone depletion chemistry to predict ozone recovery?

- High quality ozone soundings from South Pole station
- Determining ozone loss rates for different time periods
- Statistically significant changes in chemically driven ozone loss rates can be expected in ≈2020s

Ozone mixing ratio at South Pole station
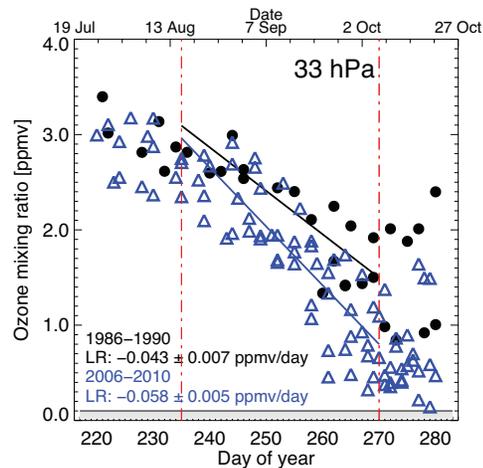
Estimated first sign of change in ozone loss rate
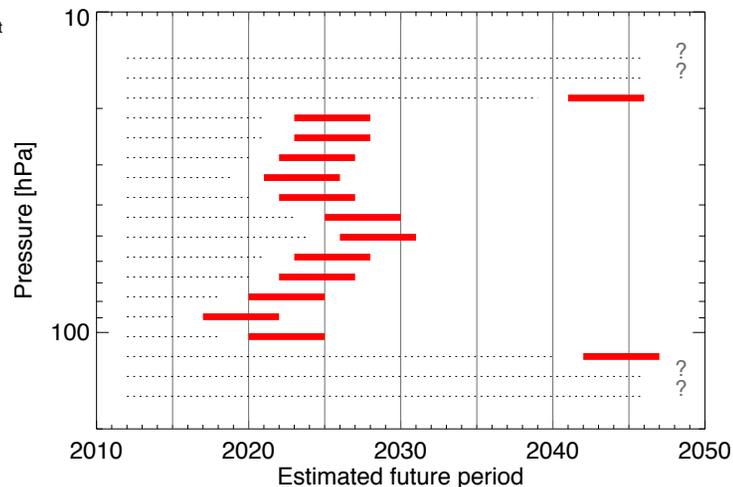

(Hassler et al., JGR, 2011, Figures 4 & Figure 8)

➤ First recovery prediction based on observations

GLOBAL OZONE RECOVERY

Is it possible to detect statistically significant ozone increases in global measurements?

- Analysis of different measurement systems for positive trends in the last decade
- Statistical methods still have limitations detecting ozone increase
- Results used to inform Ozone Research Managers at WMO in Geneva, 2014

Ozone trends [%/decade] for 35°N – 60°N
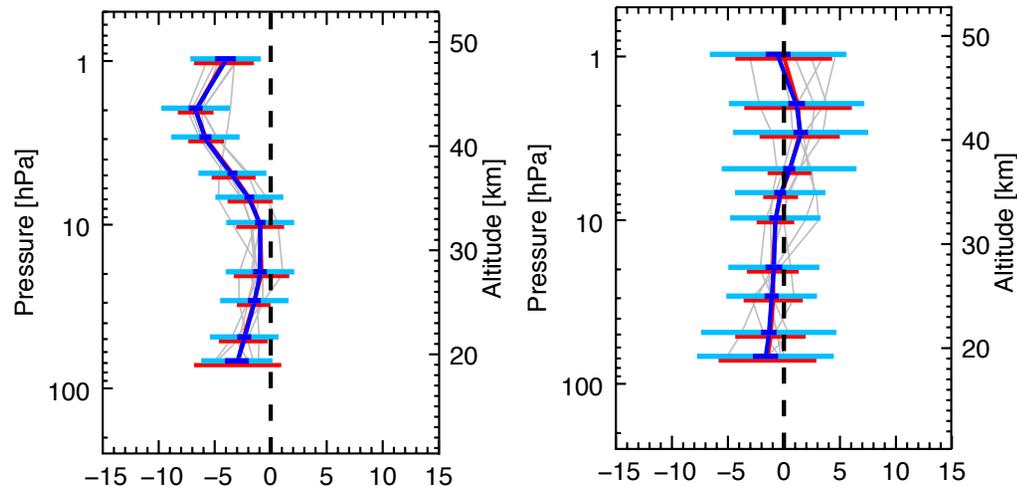
(Hassler et al., AMT, 2014)
(Tummon et al., ACP, 2015, accepted)
(Harris et al., submitted, 2015)

➤ **Detection of ozone increases still inconclusive**

Future plan: Continuing the analyses of ozone time series for the detection of ozone recovery