**TAKEAWAY:** CSD researchers are experts in...

... developing stratospheric composition datasets.

... analyzing observationally-based atmospheric circulation and tropical width changes.

... studying relationships between changes in stratospheric composition and atmospheric circulation.
Motivation

• Circulation changes have been observed and are predicted for the future ("tropical widening").
  ➢ Potentially large regional surface climate changes.

• Atmospheric composition changes can drive circulation changes, and vice versa.

• Observational and model estimates of past change disagree, and are highly uncertain.
  ➢ Modeled change < observed change

Birner, Davis, Seidel, Physics Today, 2014
Quantifying composition and circulation change

• CSD produces merged satellite data records of O\(_3\) (BDBP) and H\(_2\)O (SWOOSH).
  - SI\(^2\)N Initiative on past changes in the vertical distribution of ozone, Chemistry Climate Model Initiative (CCMI)
• CSD research uncovered major inconsistencies in tropical widening estimates related to definitional and dataset sensitivities, and has provided more robust estimates.
  - S-RIP Chapter leads, IPCC contributing authorship, and conveners of an AGU Chapman Conference on the topic in summer 2015.
• CSD research has helped resolve apparent discrepancies between modeled and observed trends in stratospheric age of air.

Hassler et al., ACP, 2013
SWOOSH webpage
Moore et al., BAMS, 2014
Davis and Rosenlof, J. Clim., 2012
Circulation sensitivity to composition change

- Ozone depletion: the dominant driver of recent SH change
- Ozone-caused cooling and circulation change is weaker in IPCC models than in observations, due to poor representation of ozone depletion.
- The BDBP database better represents ozone depletion, and better captures observed cooling and circulation changes.

Young et al., GRL, 2014
The Future

• Understanding atmospheric composition – circulation interactions is likely a generational scientific problem

• Our future work will focus on
  – Continued maintenance and development of composition datasets for climate research
  – Developing robust and novel observational metrics of circulation change
  – Fundamental research into mechanisms affecting the strength of the Brewer-Dobson circulation and width of tropics
  – Coordinated international research activities/assessments related to these topics (e.g., S-RIP, CCMI)