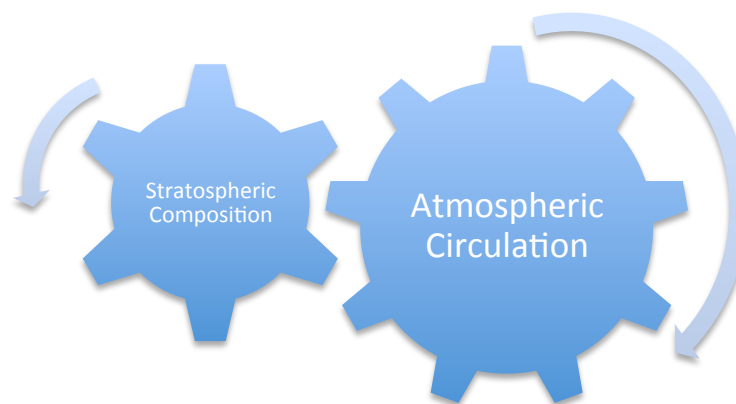




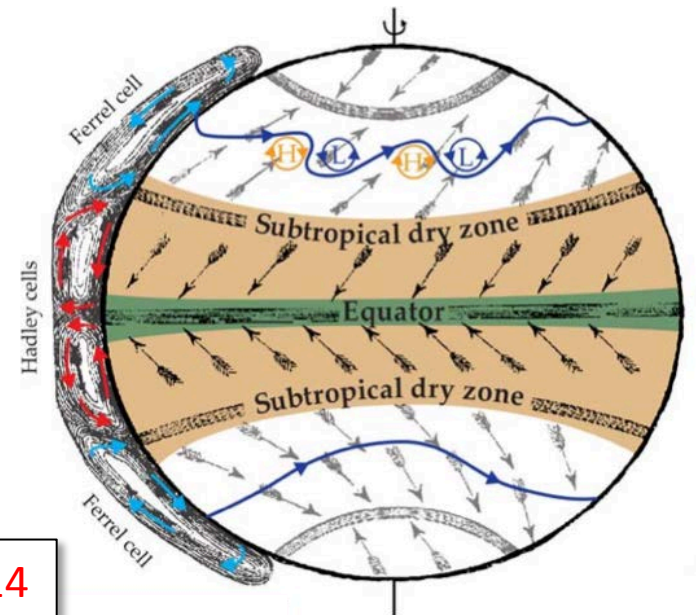
TAKEAWAY: CSD researchers are experts in...

- ... developing stratospheric composition datasets.
- ...analyzing observationally-based atmospheric circulation and tropical width changes.
- ... studying relationships between changes in stratospheric composition and atmospheric circulation.



Motivation

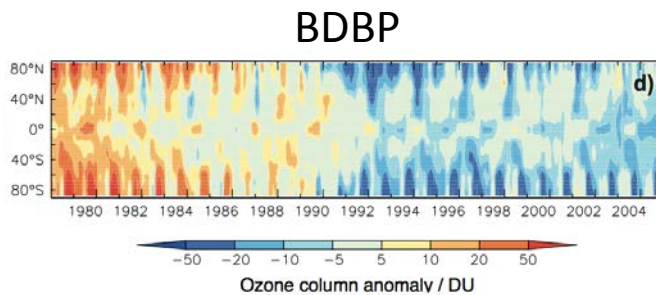
- Circulation changes have been observed and are predicted for the future (“tropical widening”).
 - Potentially large regional surface climate changes.
- Atmospheric composition changes can drive circulation changes, and vice versa.
- Observational and model estimates of past change disagree, and are highly uncertain.
 - Modeled change < observed change



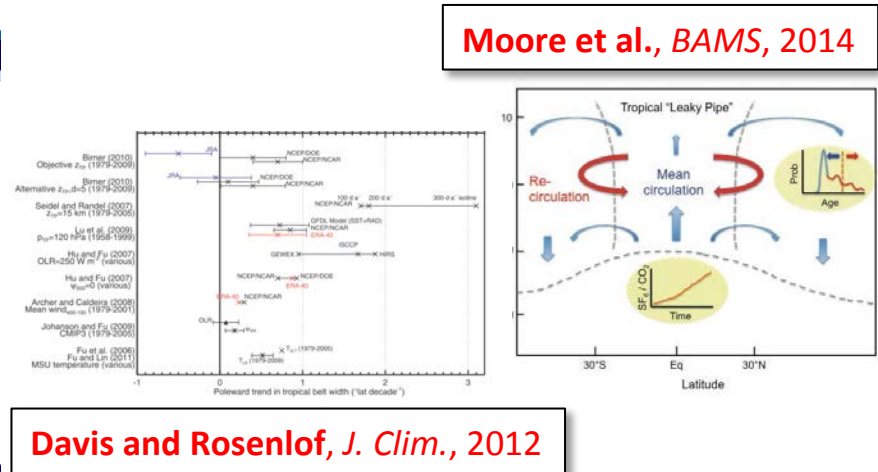
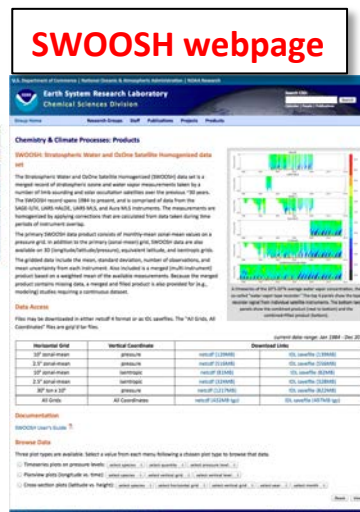
Birner, Davis, Seidel, Physics Today, 2014

Quantifying composition and circulation change

- CSD produces merged satellite data records of O₃ (BDBP) and H₂O (SWOOSH).
 - SI²N 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.

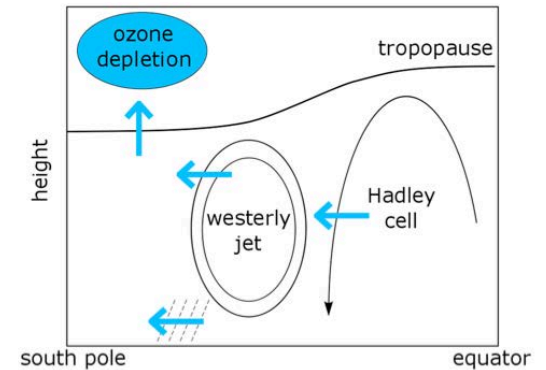


Hassler et al., ACP, 2013

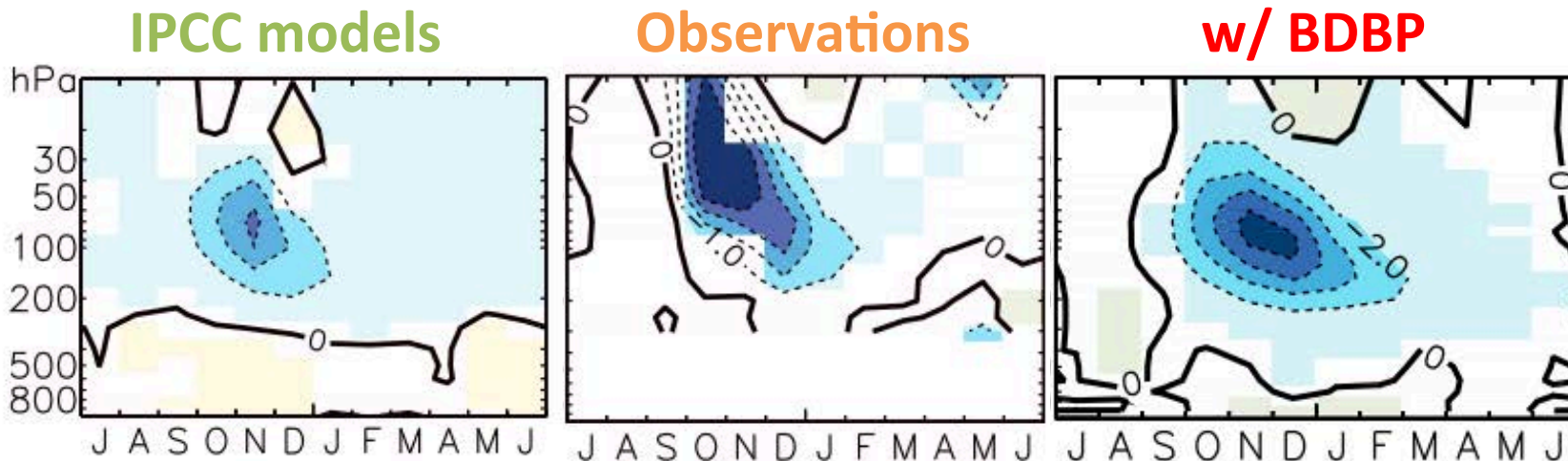


Circulation sensitivity to composition change

- 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)