

Changes in the polar vortex: effects on Antarctic total ozone observations at various stations and Antarctic surface climate characteristics

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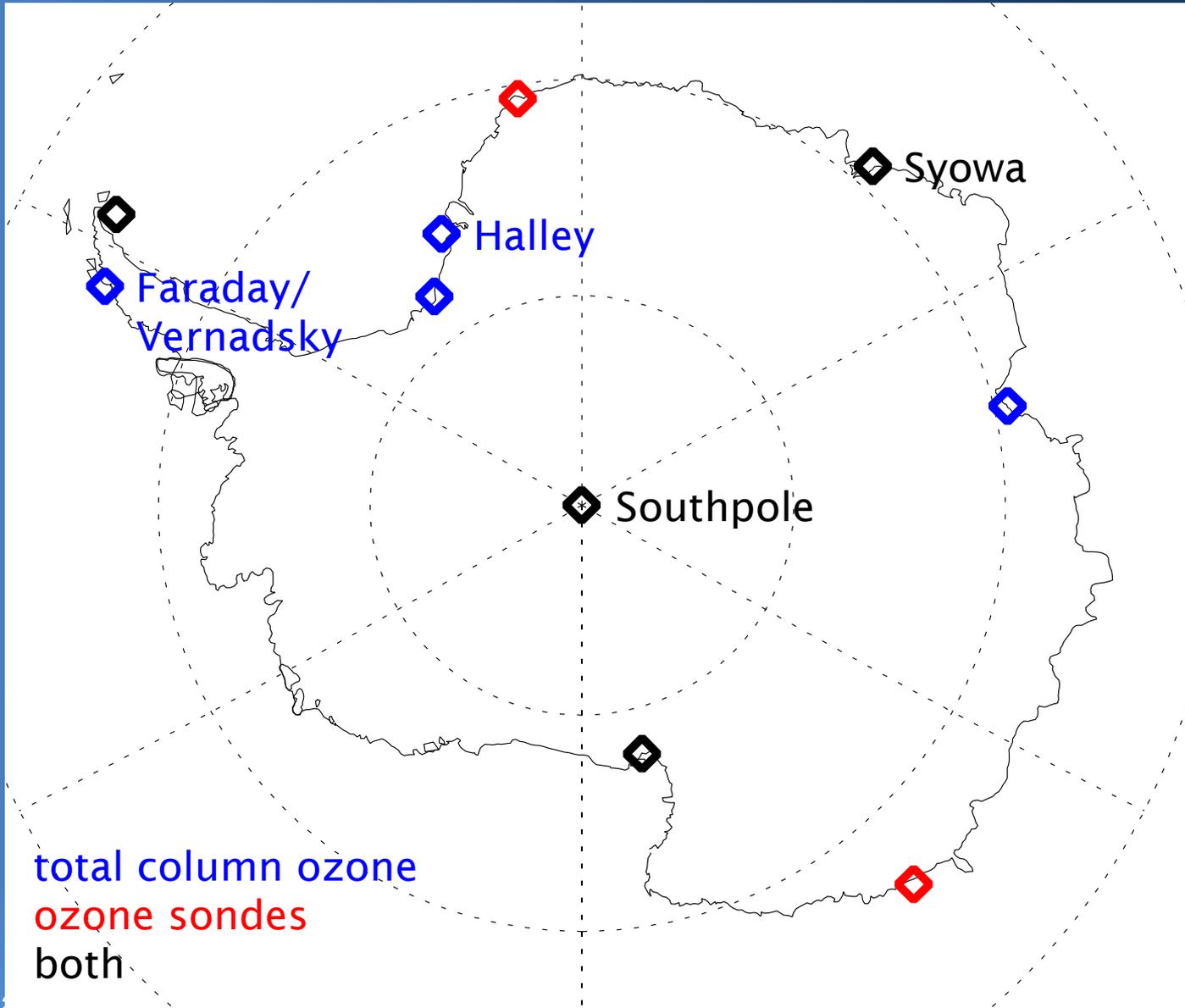
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Questions

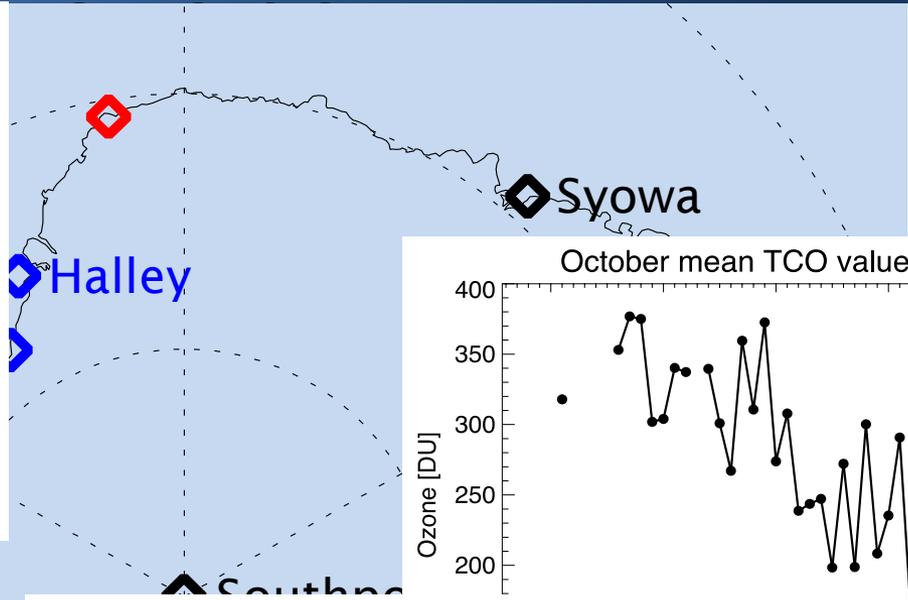
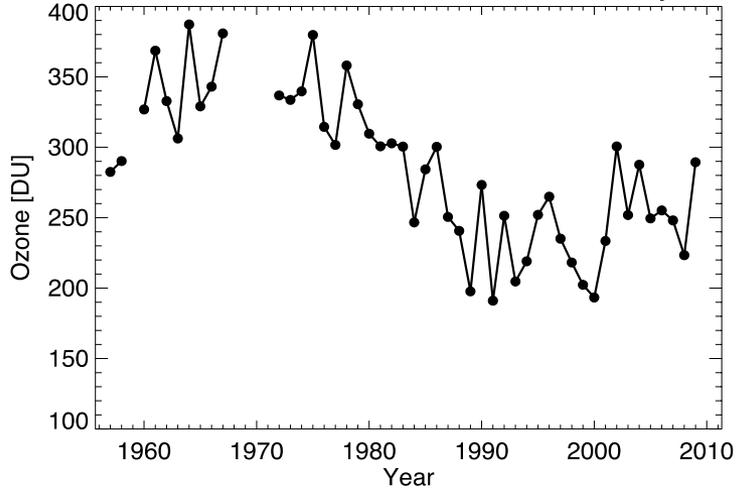
- With the peak of EESC concentrations reached in the late 1990s, can a recovery in ozone be detected over Antarctica already?
- Are there dynamical changes that affect ozone concentrations?
- If there are dynamical changes, do they also affect Antarctic surface characteristics, like sea ice extend?

Antarctica - stations

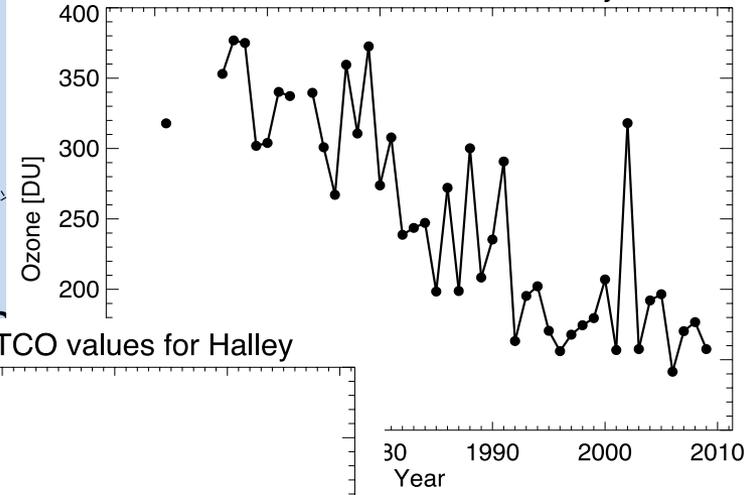


October mean total column

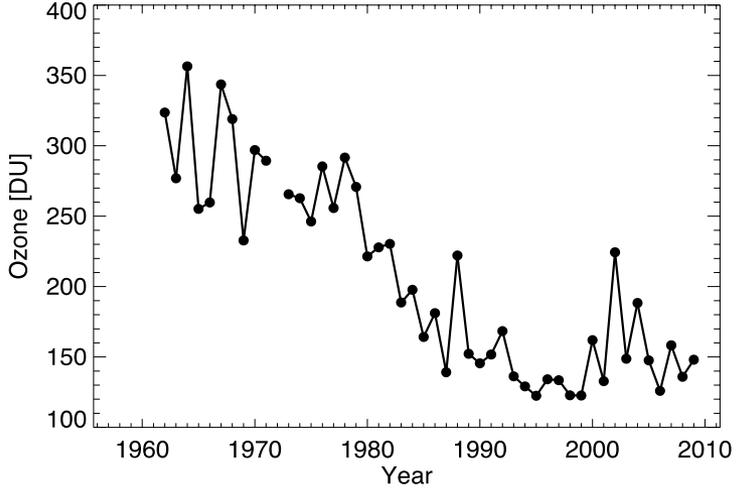
October mean TCO values for Faraday



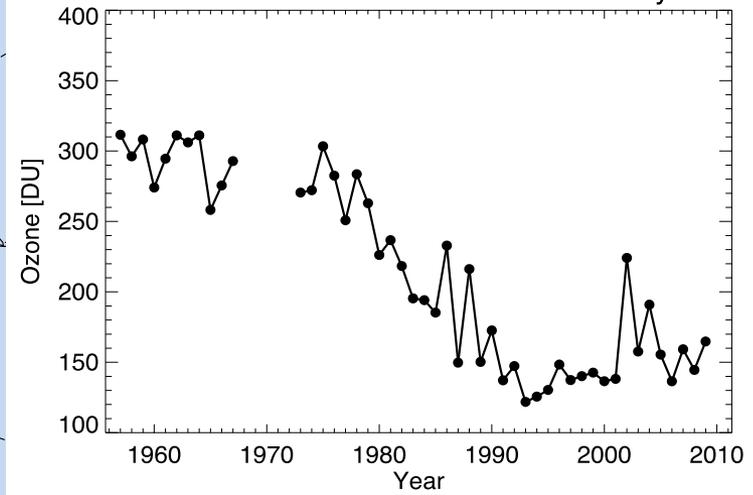
October mean TCO values for Syowa



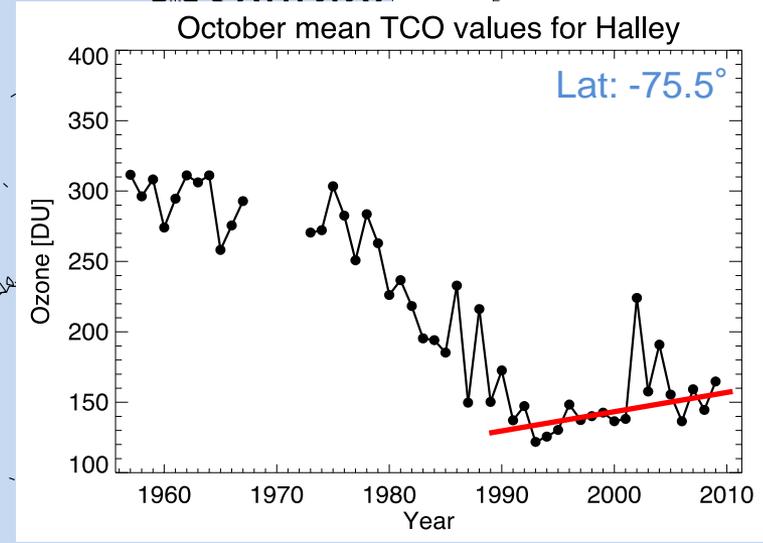
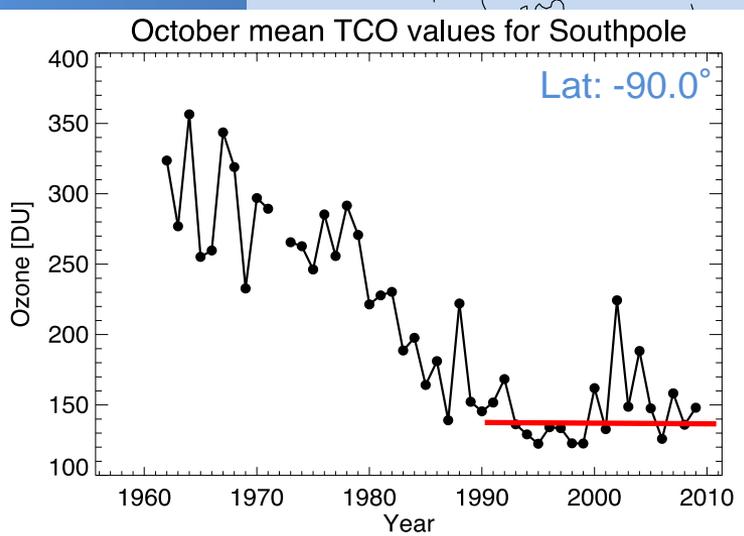
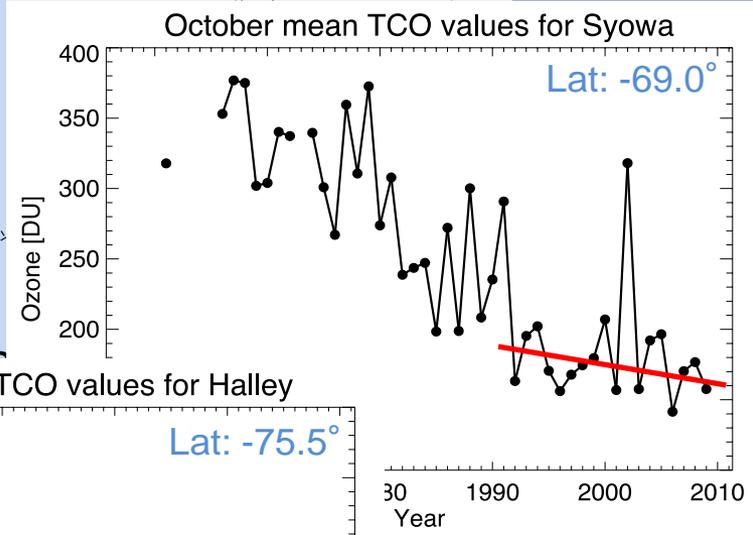
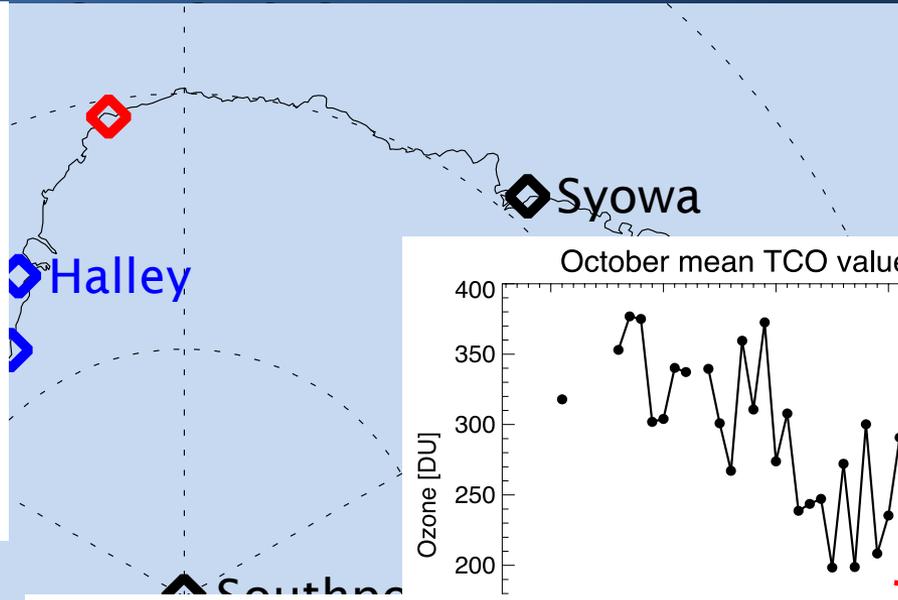
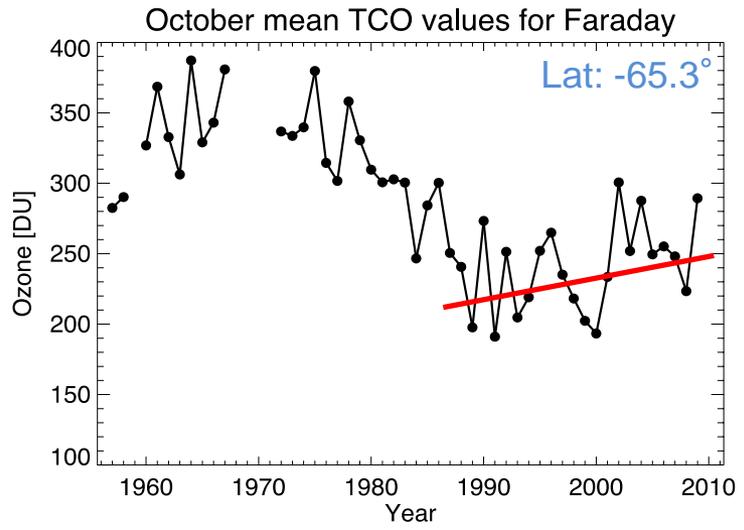
October mean TCO values for Southpole



October mean TCO values for Halley



October mean total column



Different TCO behavior:

1. Vortex breaks up earlier
2. Not as much ozone depletion due to lower concentrations of EESC
3. Vortex gets smaller
4. Change in vortex location

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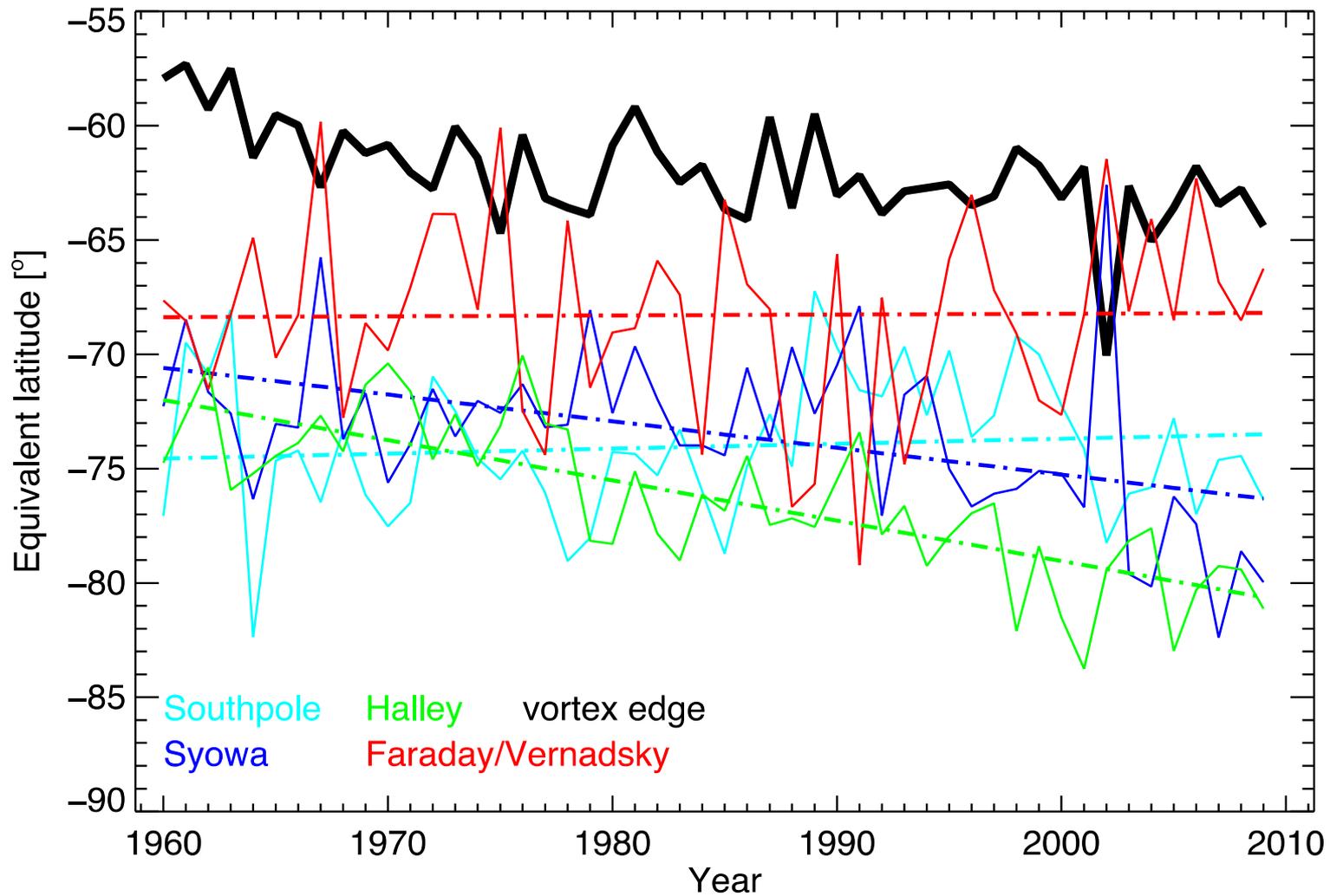
Vortex location I

- Change in equivalent latitude of vortex edge with time:
 - For 550 K
(*Equiv. Lat.*: area enclosed by same PV contour, placed circular around the pole → resulting latitude)

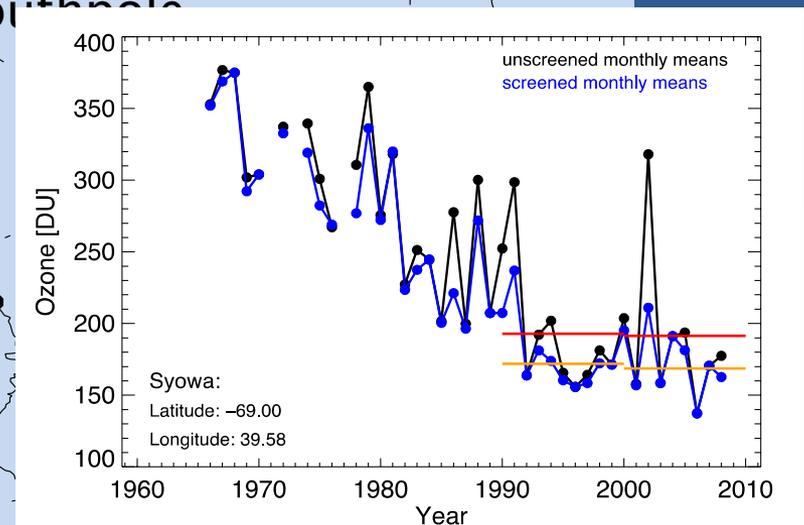
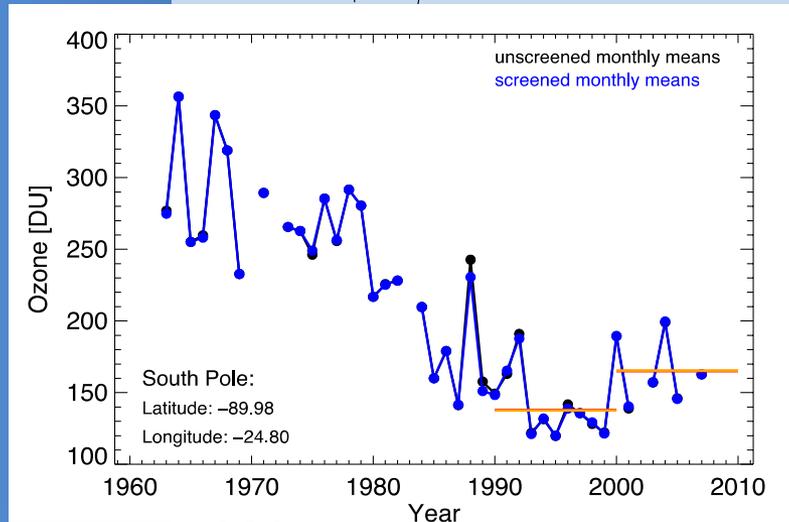
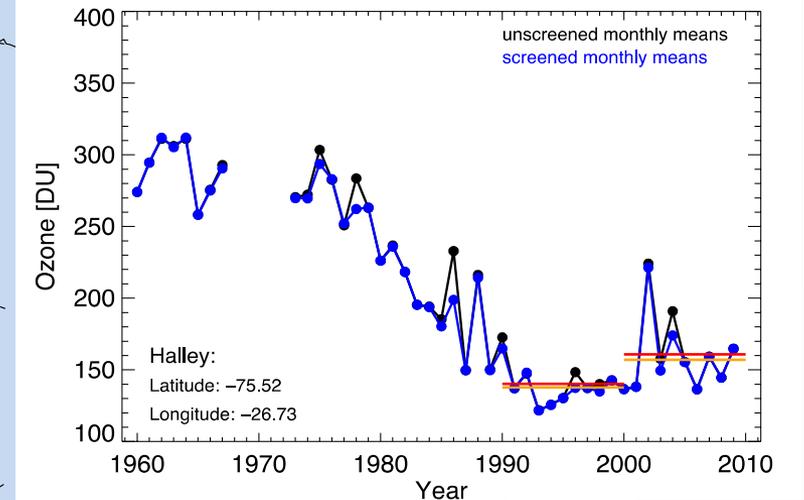
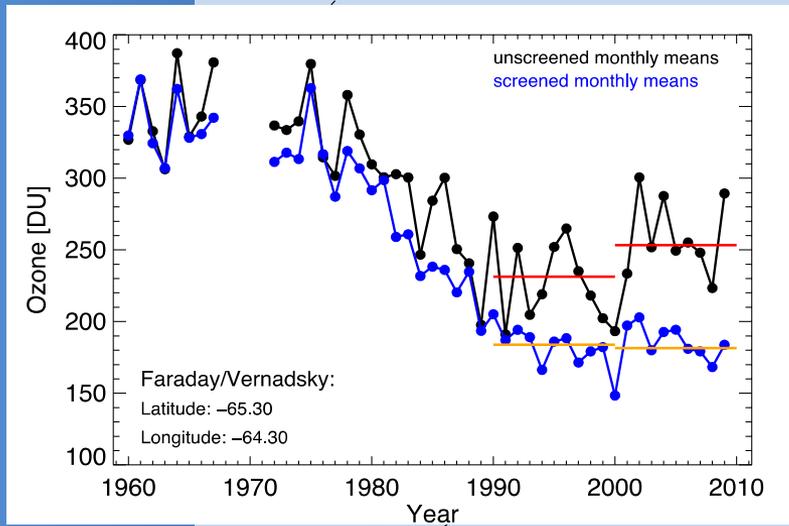
Data:

- NCEP/NCAR reanalysis (PV)

Vortex location II

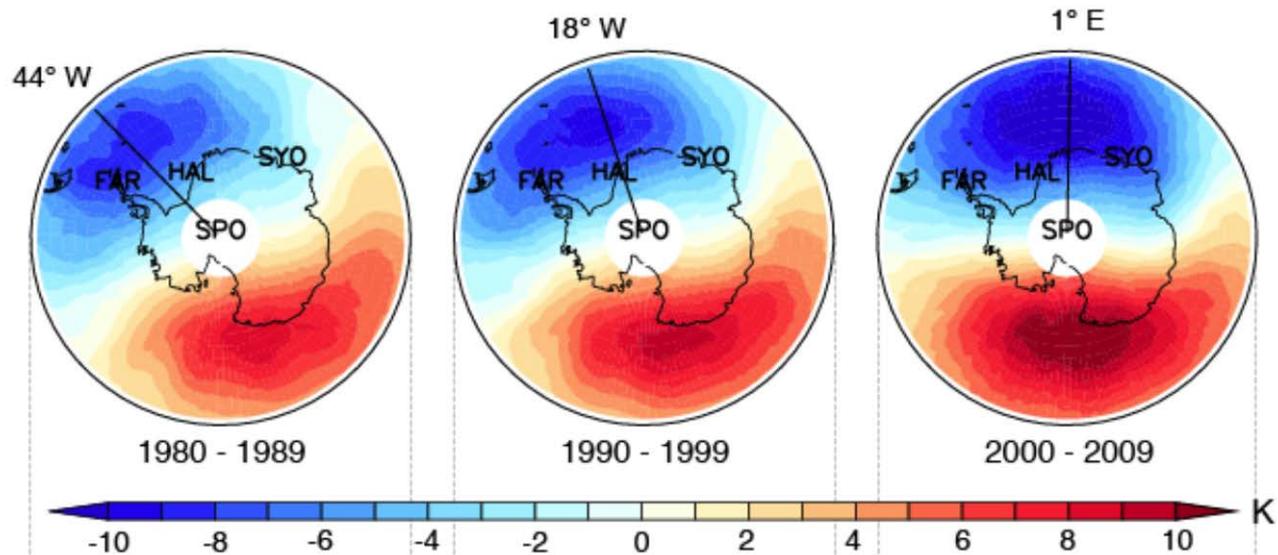


Applied screening

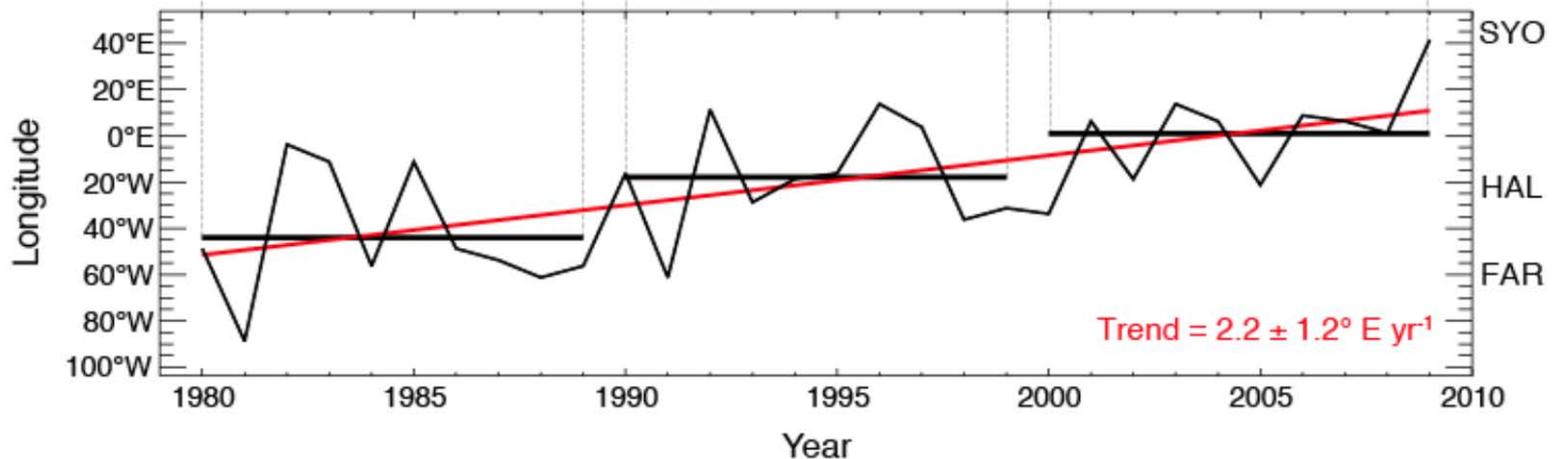


Lower stratospheric temperature

(a) T^* climatologies for October



(b) Longitude of T_{\min} (65° S - 75° S average), October



Summary I

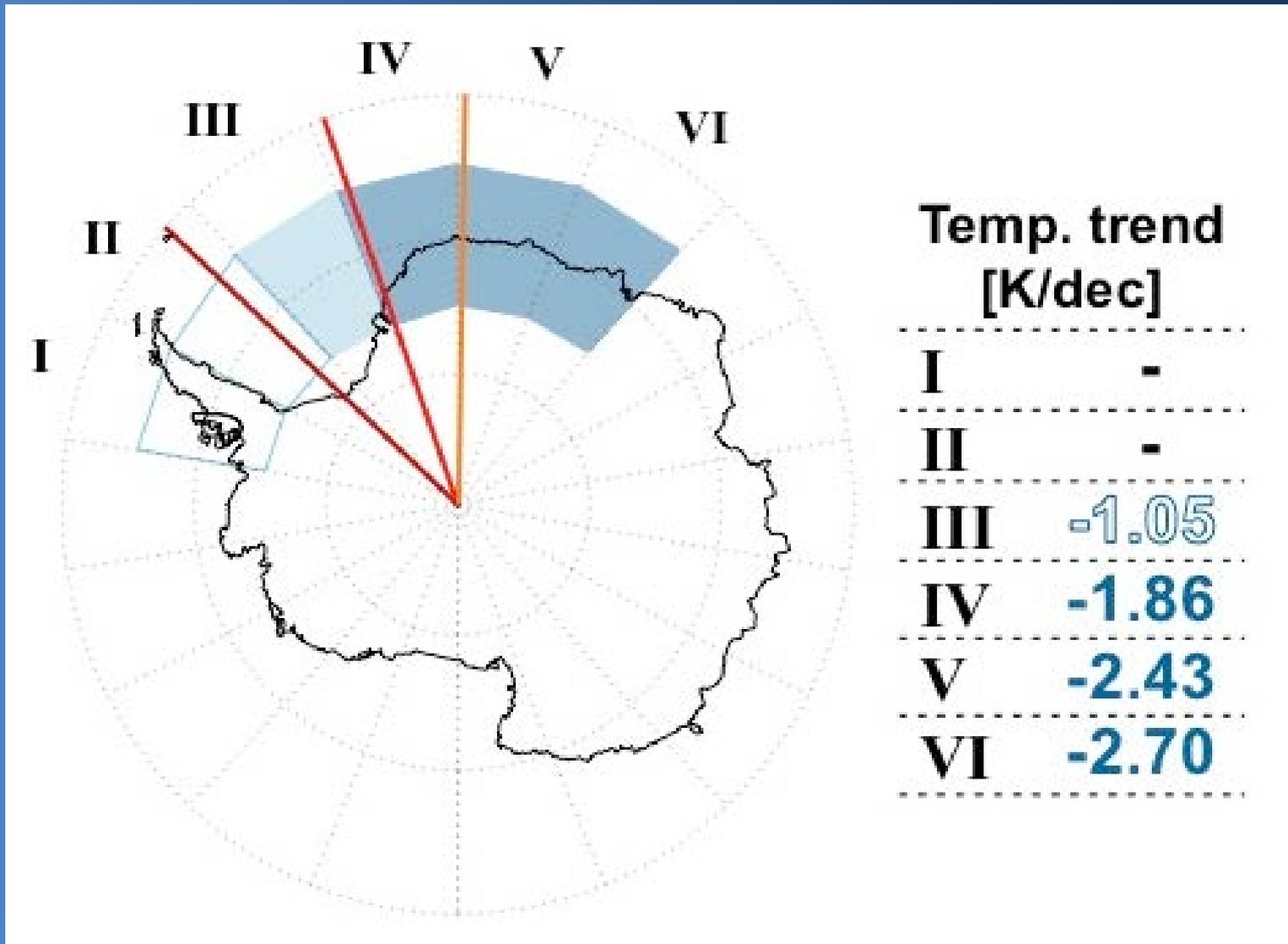
Location of vortex changed over time, moving eastward

- *Heterogeneous chemistry* still plays major role for Antarctic ozone concentrations in spring
- When looking for ozone recovery, it is important to clearly separate between *dynamically and non-dynamically* influenced ozone values

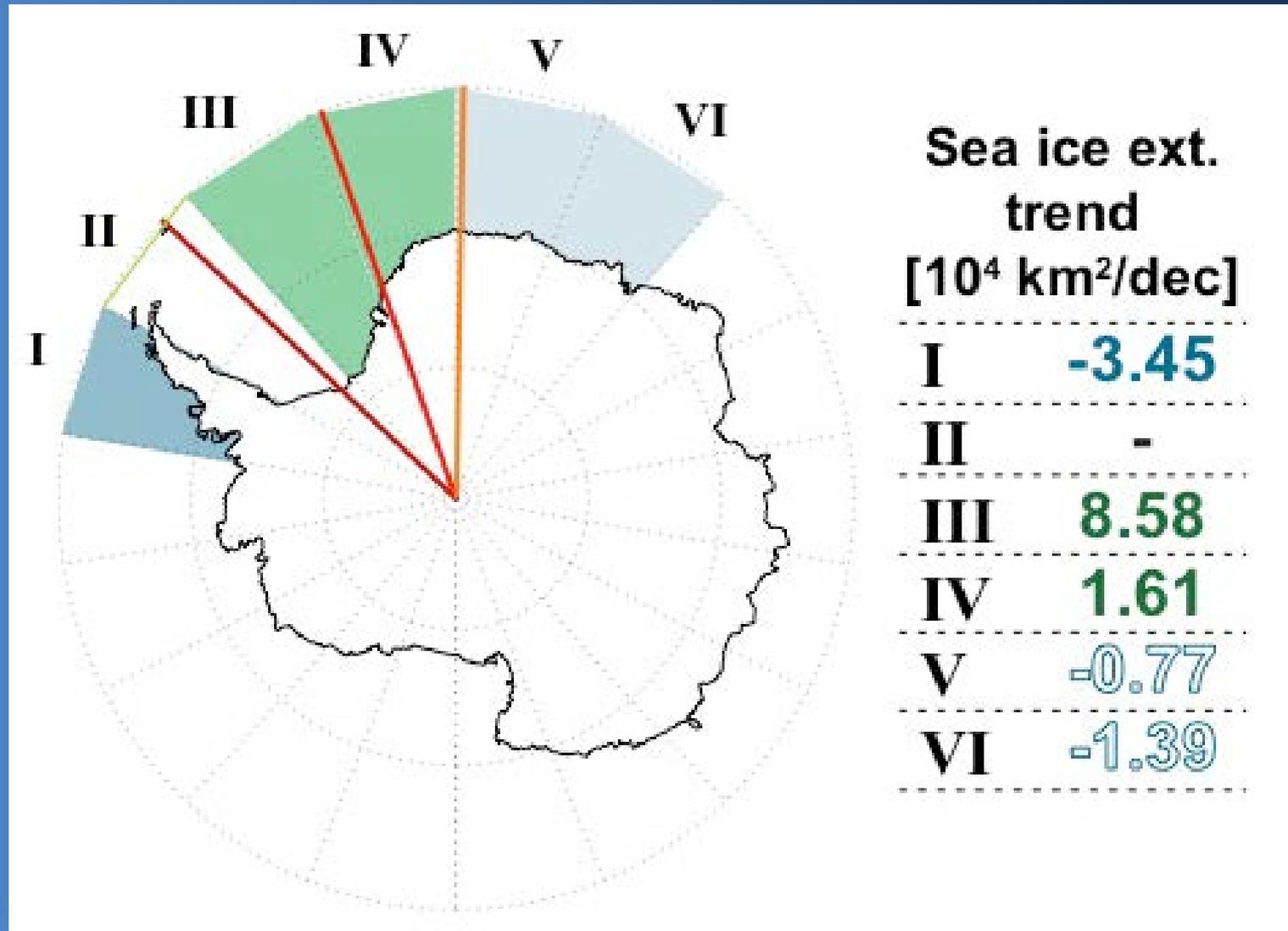
Influence on Antarctic climate?

- Is it possible to find impacts of this strong stratospheric temperature signal in Antarctic surface parameters, e.g. sea ice extent?
- What is cause and what is effect?

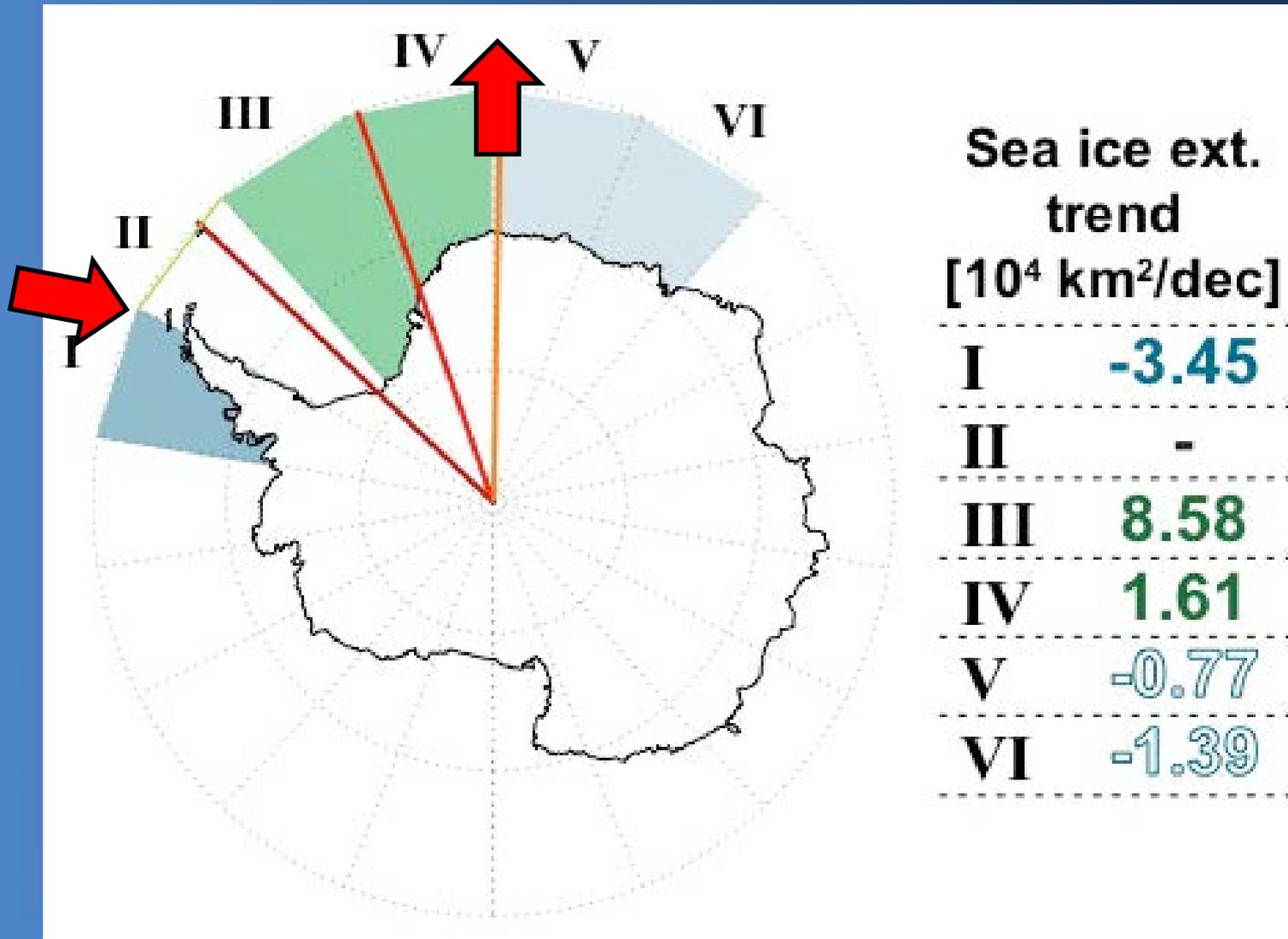
Lower strat. temp. trends (Oct.)



Sea ice extend trends (Feb.)



Sea ice extend trends (Feb.)



Possible implications

- A connection between Antarctic vortex temperatures and Antarctic sea ice extent *might* exist
- Shift in October vortex position *might* be reflected in summer/fall sea ice extent, however:
 - High uncertainties still on signal due to more influence factors on data
 - Cause and effect still unclear