In situ Measurements of Stratospheric Ozone during Concordiasi

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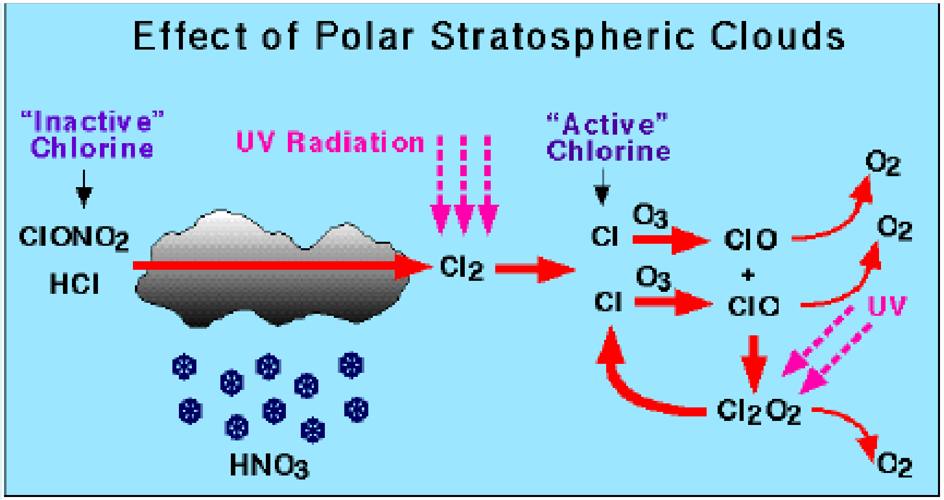
Outline

- Outstanding questions about stratospheric ozone depletion
- Ozone measurement requirements
- Instrumentation
- Analysis plans

Polar Stratospheric Ozone Loss

- Linked to catalytic reactions of chlorine and bromine oxides
  - Source of halogens is CFCs and Halons
  - Critical role of PSCs in halogen activation
  - Details of photochemistry determine extent of ozone loss

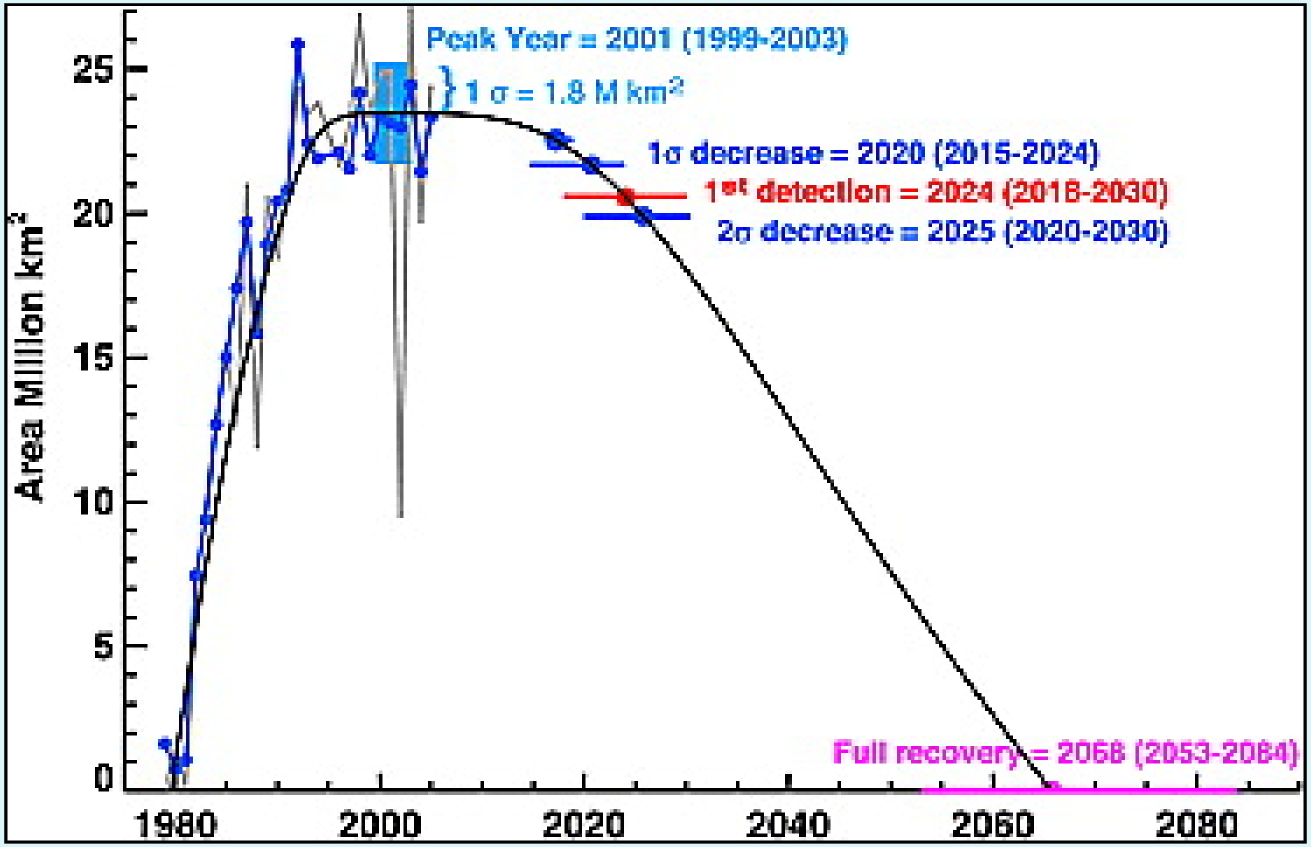


Outstanding Questions

- When will the Antarctic “ozone hole” disappear?
  - Nominally, when chlorine levels drop below a threshold of about ~2 ppb
  - But, details of temperature and water vapor, PSC formation and chemical reactions matter

Outstanding Questions

When will the Antarctic "ozone hole" disappear?



Newman et al., GRL, 2006

Outstanding Questions

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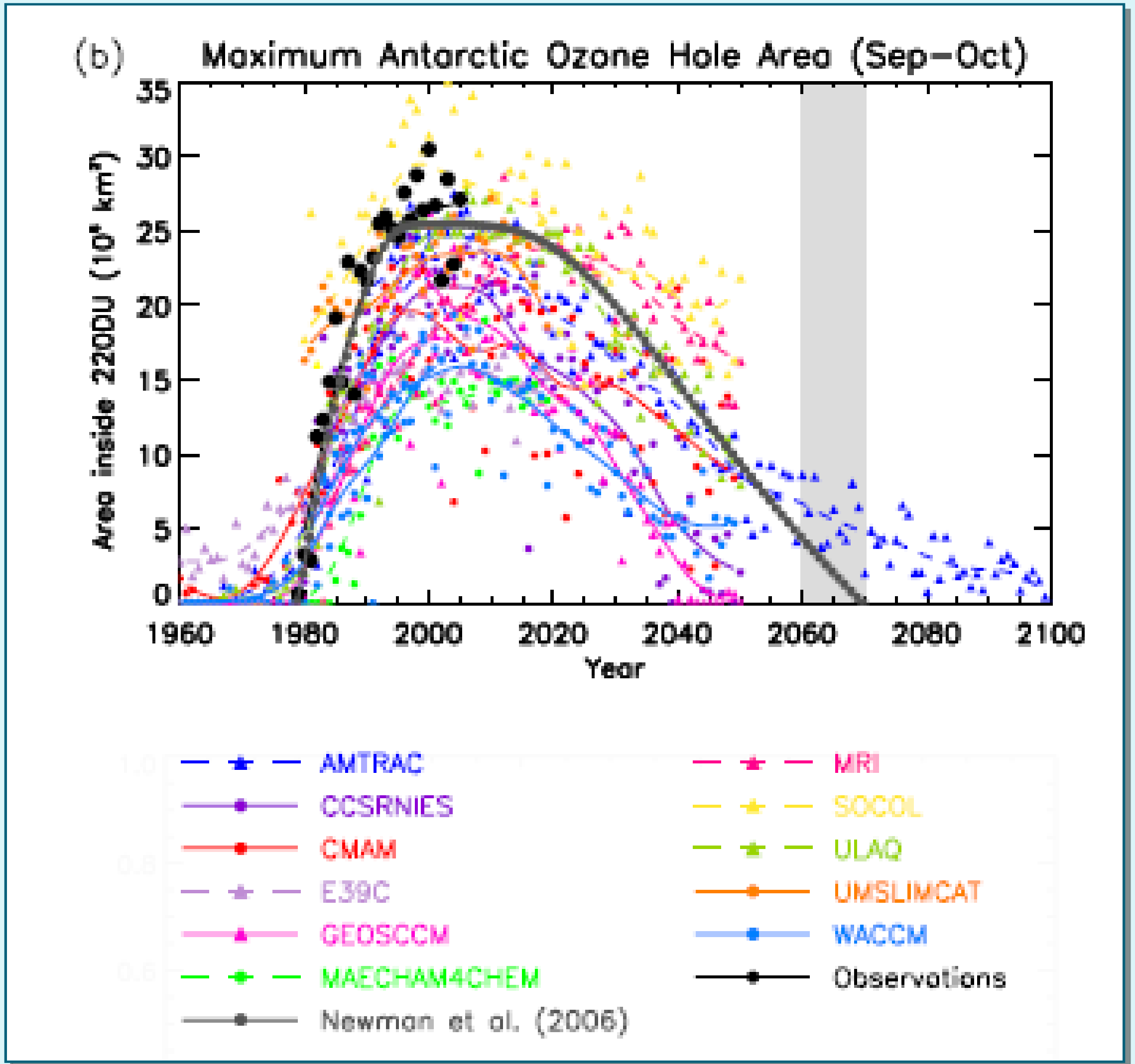


WMO, 2006

Outstanding Questions

- What causes interannual variations in ozone loss within the Antarctic polar vortex?
- What is happening to ozone in the “collar” region along the edge of the Antarctic polar vortex?
- Will ozone in the Arctic “recover” in the same way as in the Antarctic?

→ *Complexities of interaction between chemistry and dynamics*

How well do we need to measure O_3?

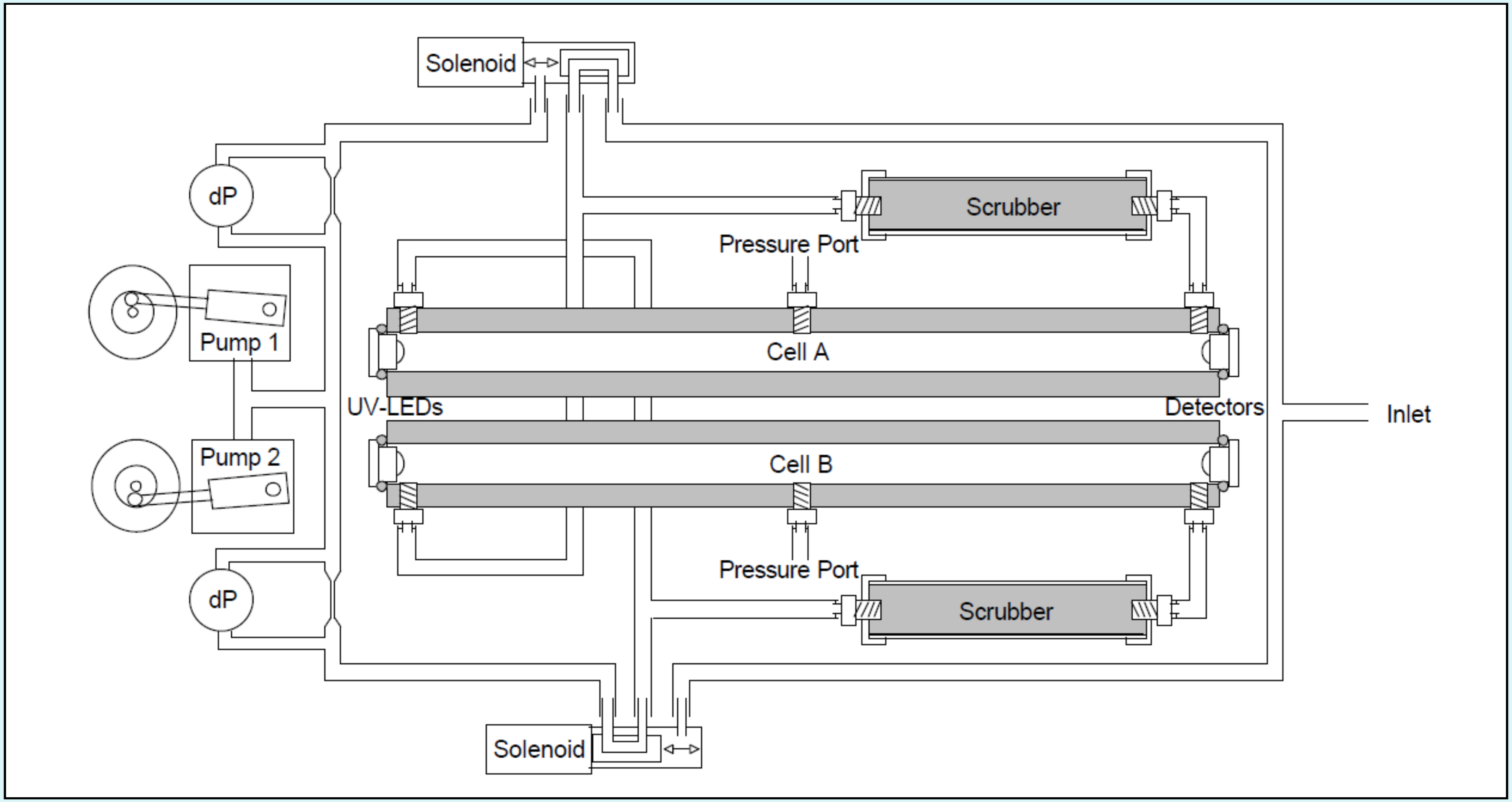
- Model calculations suggest that ozone loss rates in the Antarctic during the austral spring range from **1 – 10 ppb** per sunlit hour [e.g. Hoppel et al., 2005]

- To resolve these changes, need to have an instrument precision of better than 1 ppb per hour-long measurement

Instrument Design Requirements

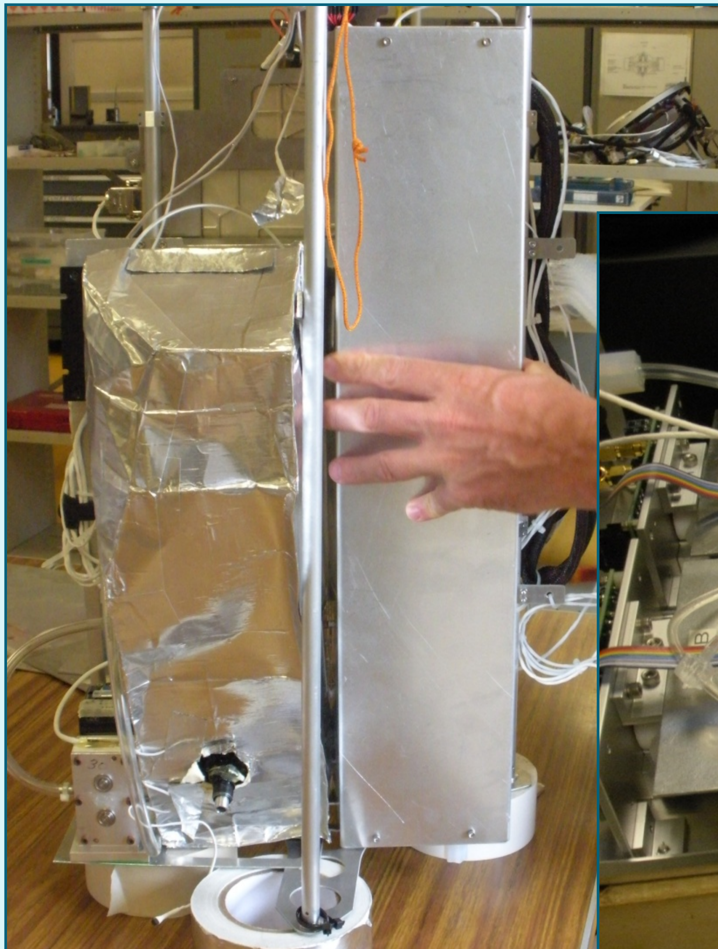
- Adequate precision and accuracy to resolve anticipated ozone changes
- Lowest power consumption possible
- High reliability for operation on long flight
- Redundancy in case of equipment failure
- Low cost

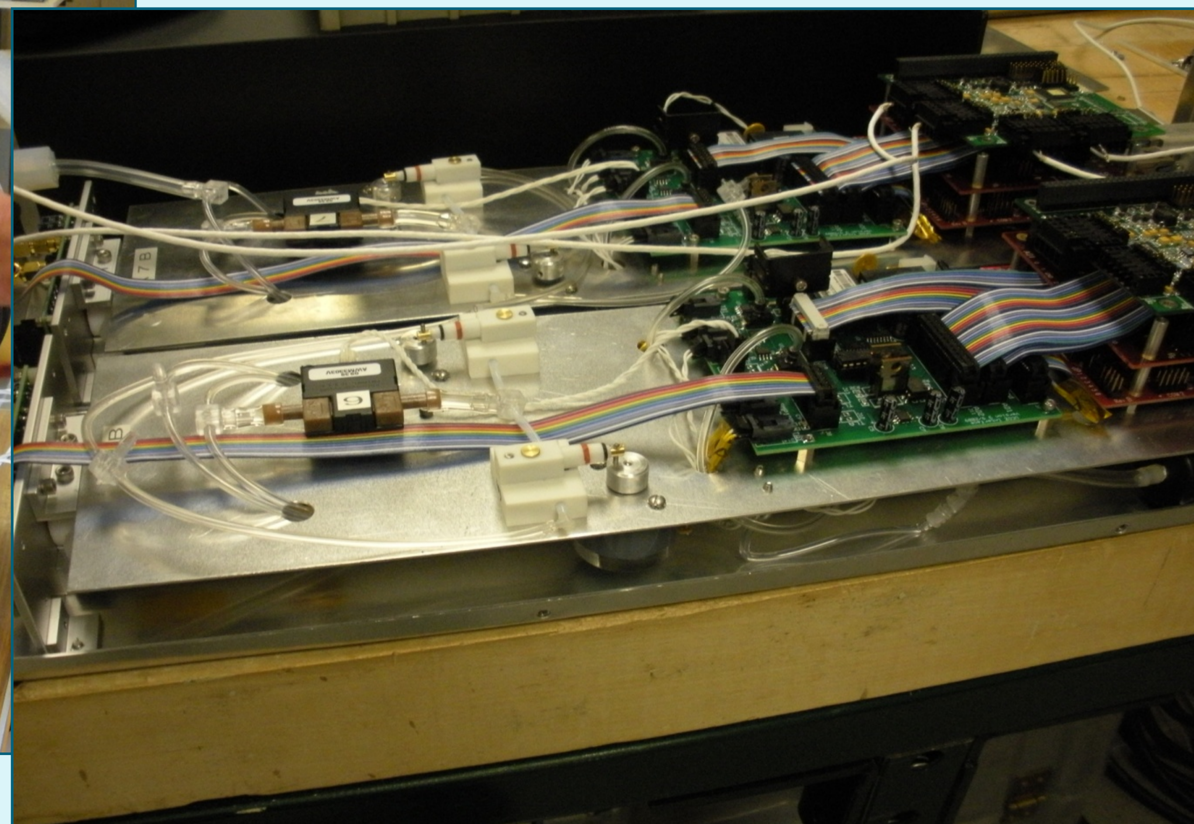
Instrument Design



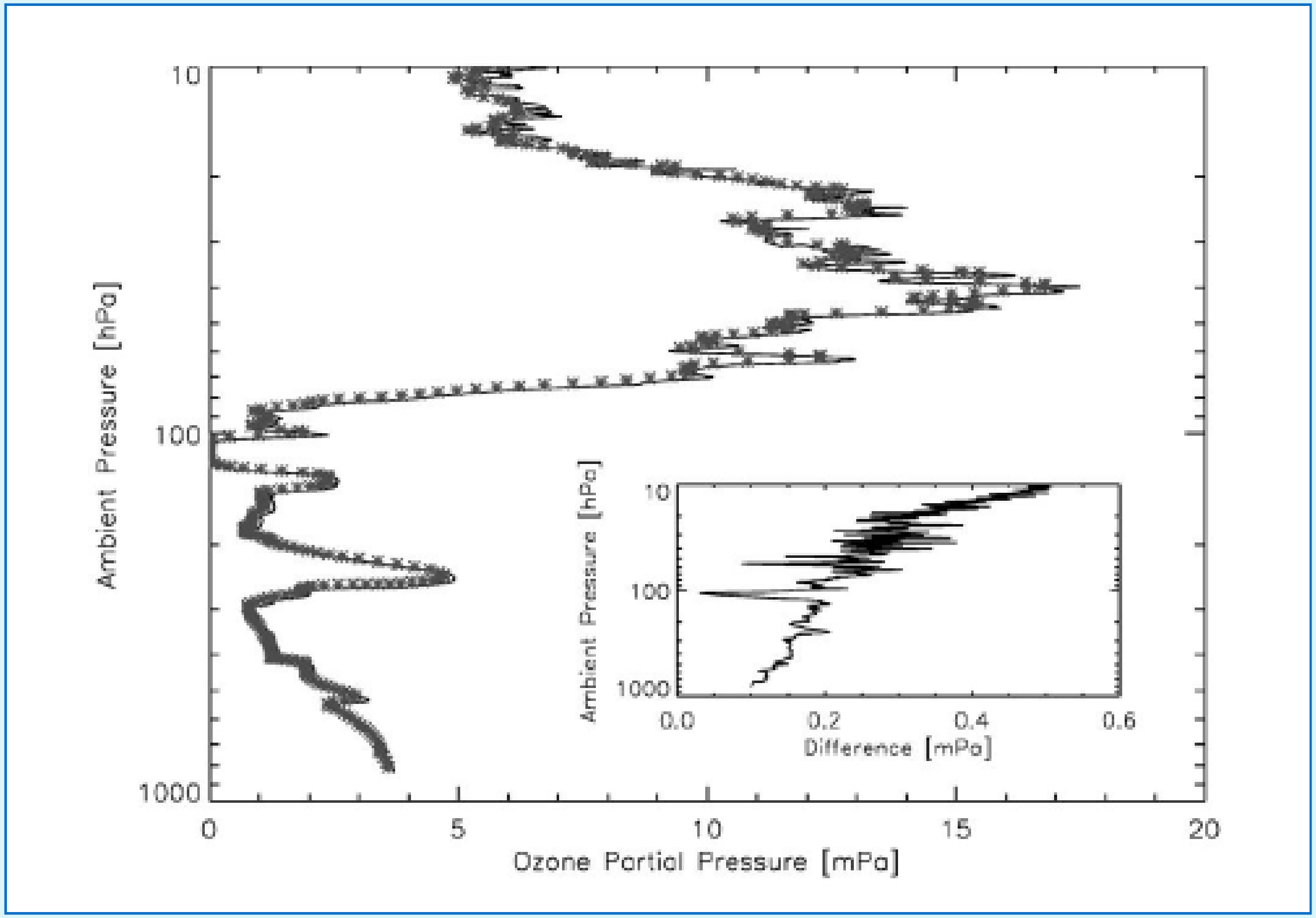
- UV absorption at 254 nm – Beer-Lambert Law
- UV-LED light source – low power
- Fully redundant detection and flow system components

UCOz on Gondola and in Lab





Instrument Performance



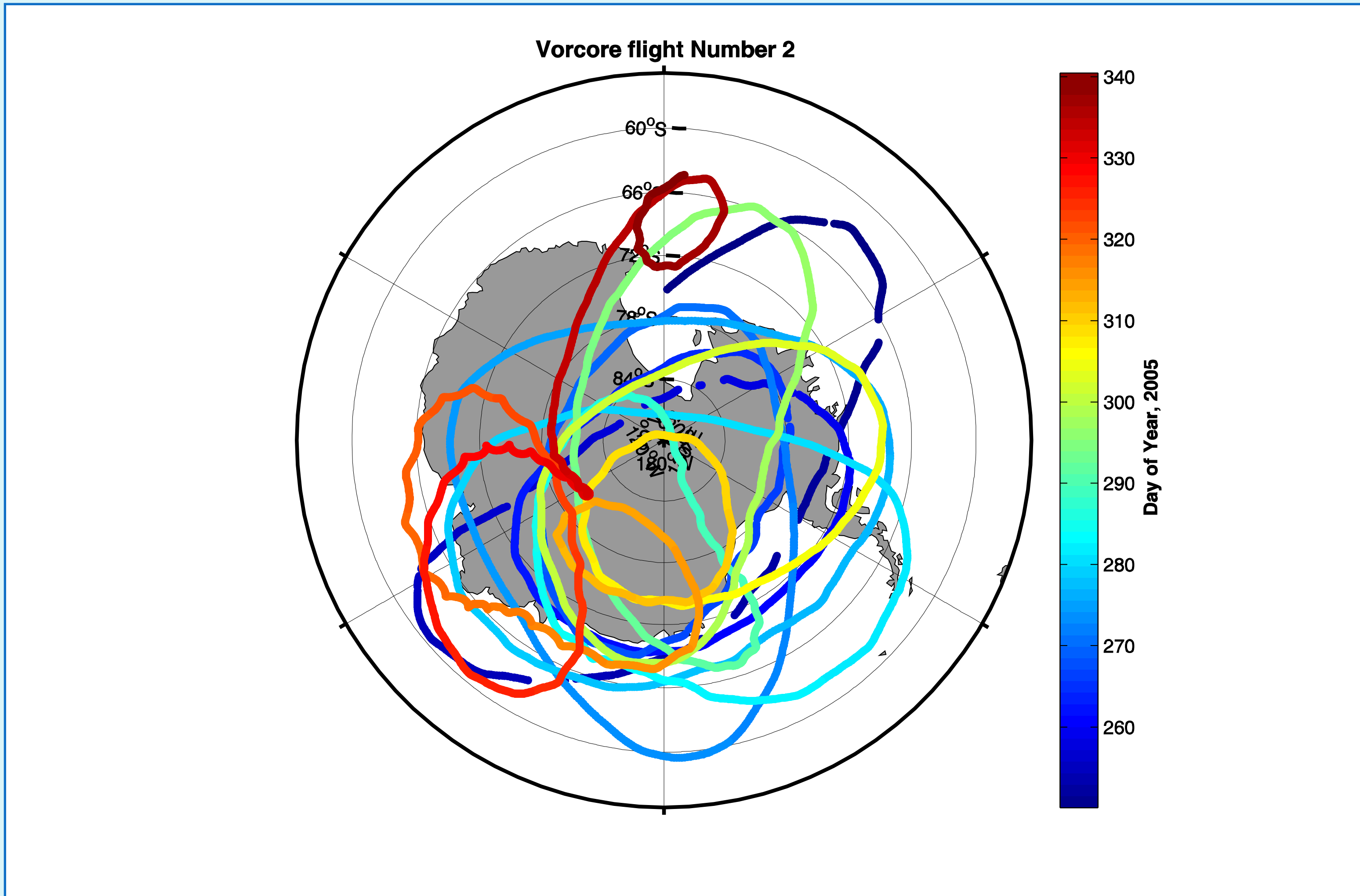
Accuracy: 7 – 10 %

Precision: 0.7 ppb
@ 10 sec

Data Analysis Plans

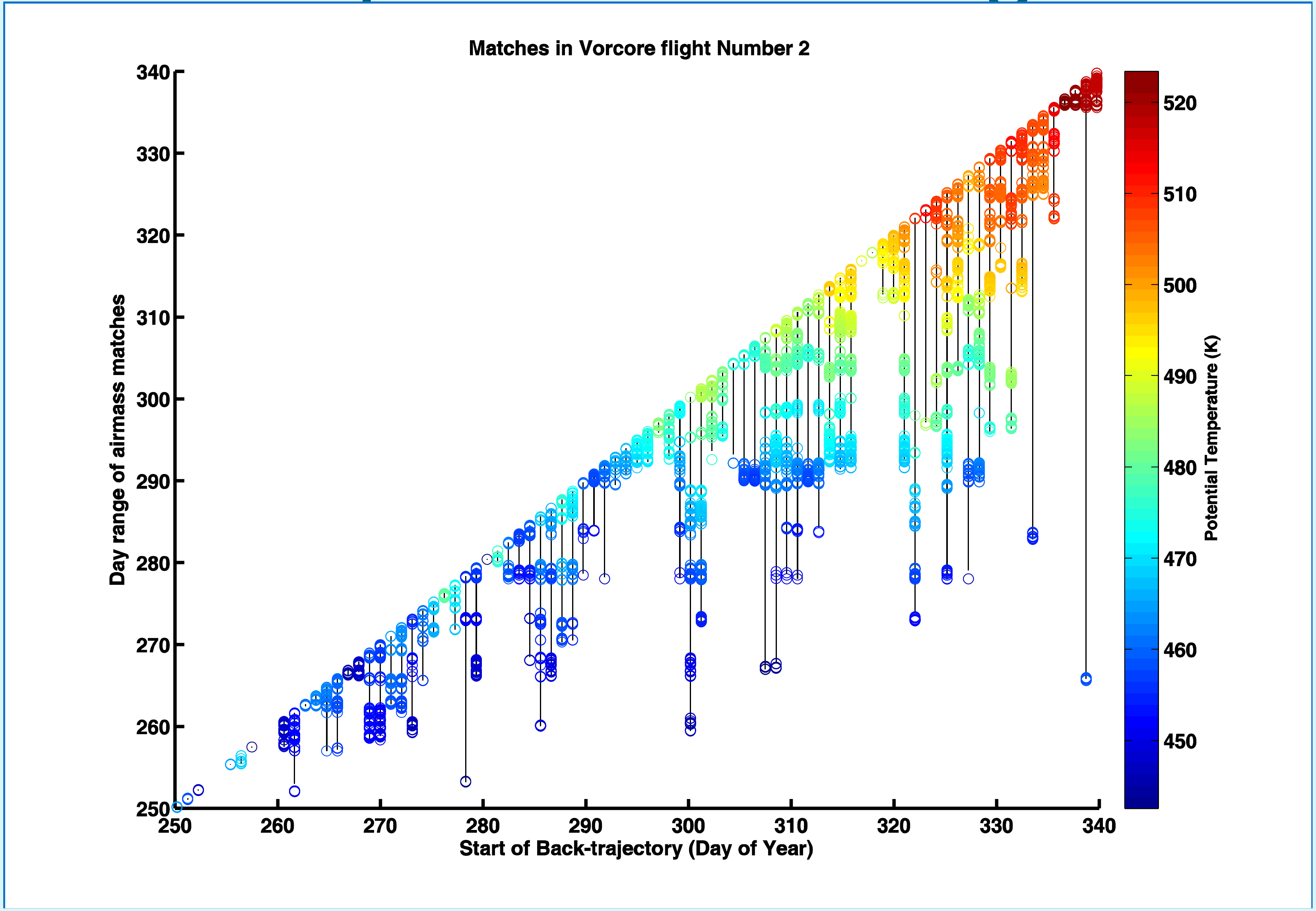
- Collaboration with R. Schofield and M. Rex of Alfred Wegener Institute (Potsdam)
- Modeling of ozone loss along balloon trajectories
- Incorporate methodologies used in MATCH technique

Example: Vorcore Flight 2



Position of balloon: Day 260 – Day 340

Example: Vorcore Flight 2



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