In situ and ground-based remote sensing measurements of atmospheric CO_2 in New Zealand

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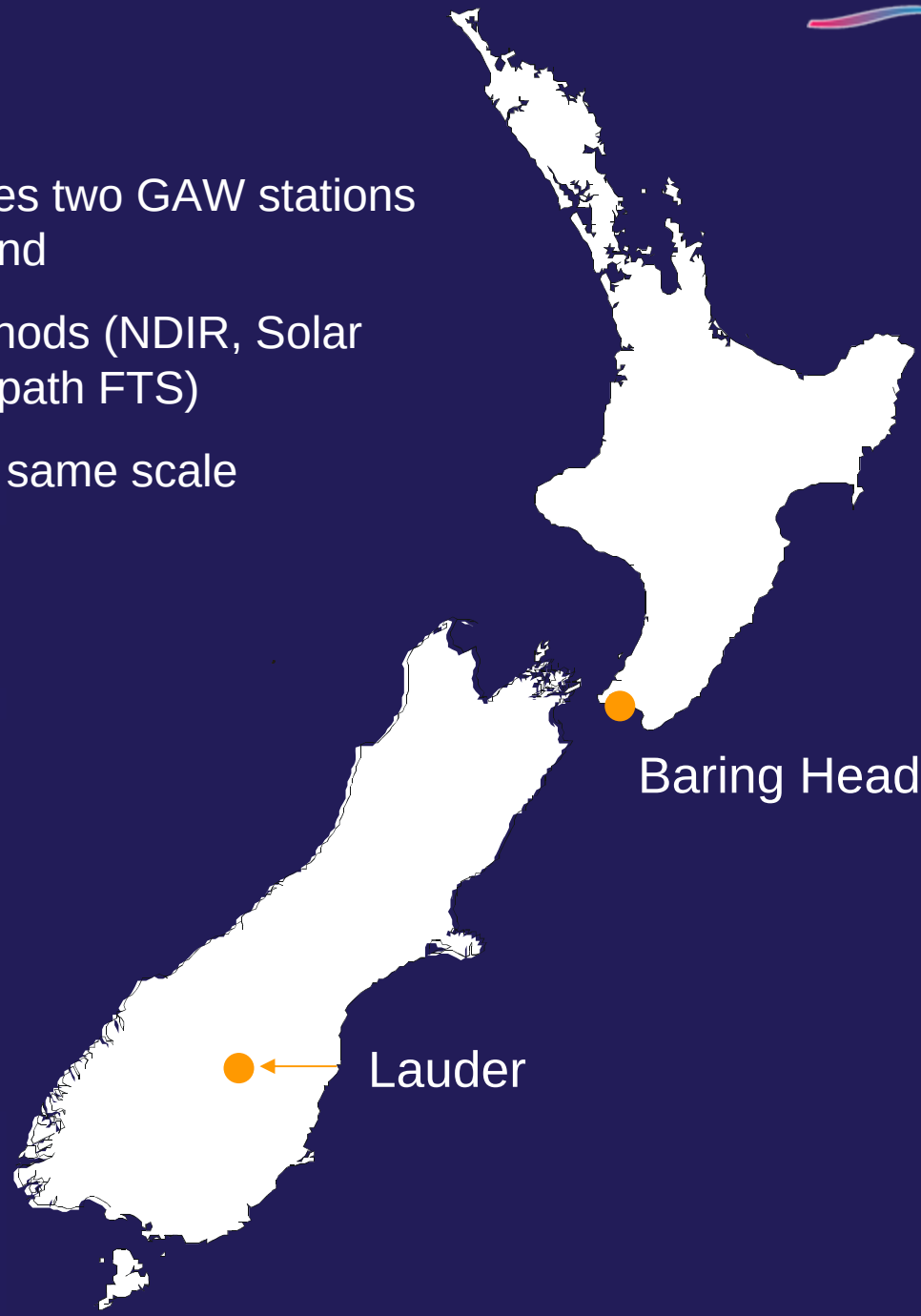
15th Experts 7th-10th Sept 2009, Jena

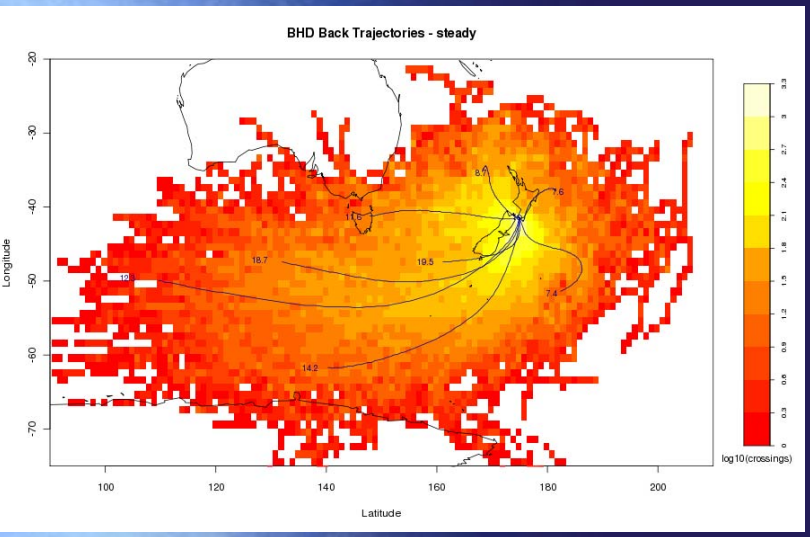
NIWA operates two GAW stations in New Zealand

Different methods (NDIR, Solar FTS, Closed path FTS)

Operating on same scale

Comparisons





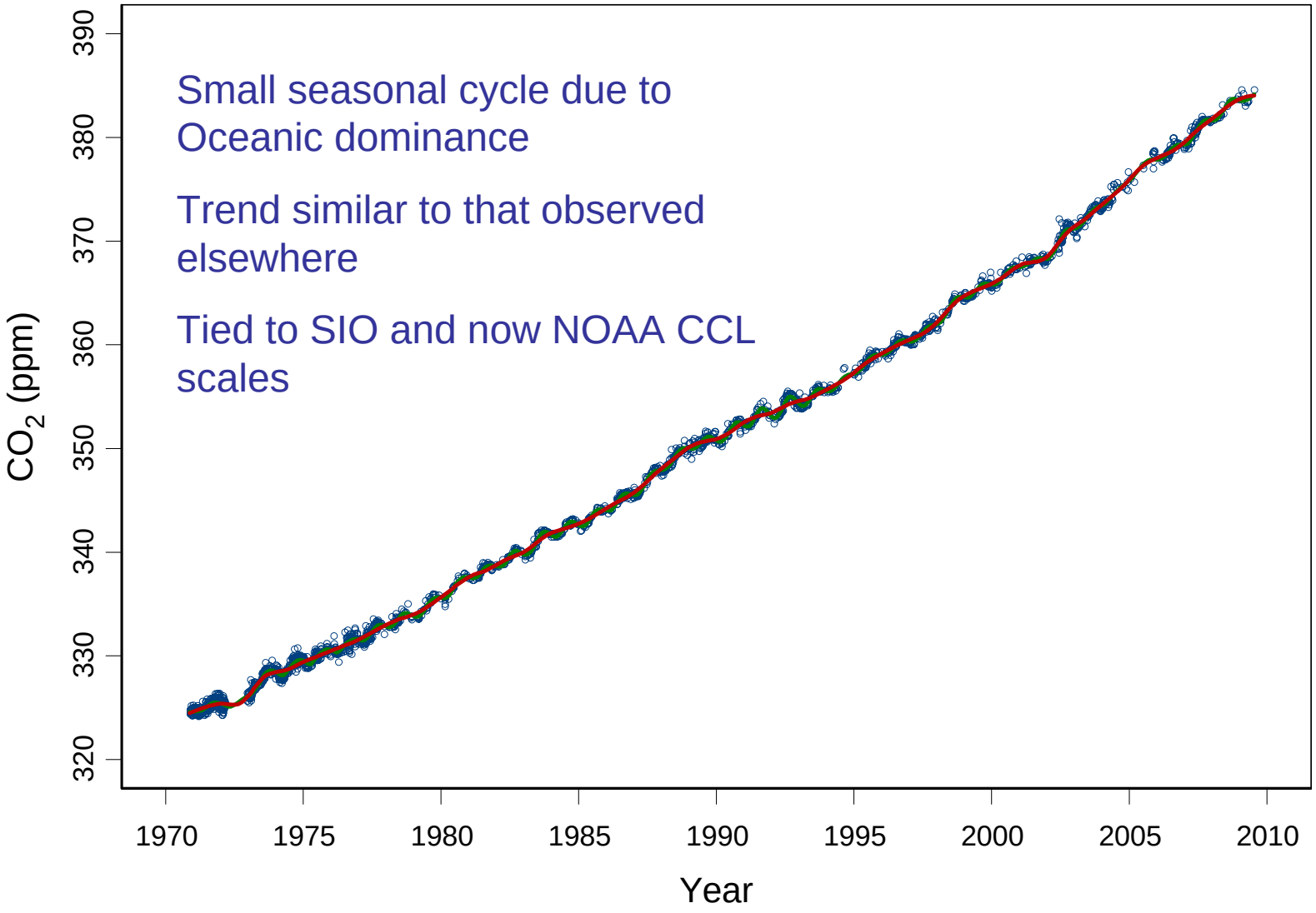
BARING HEAD

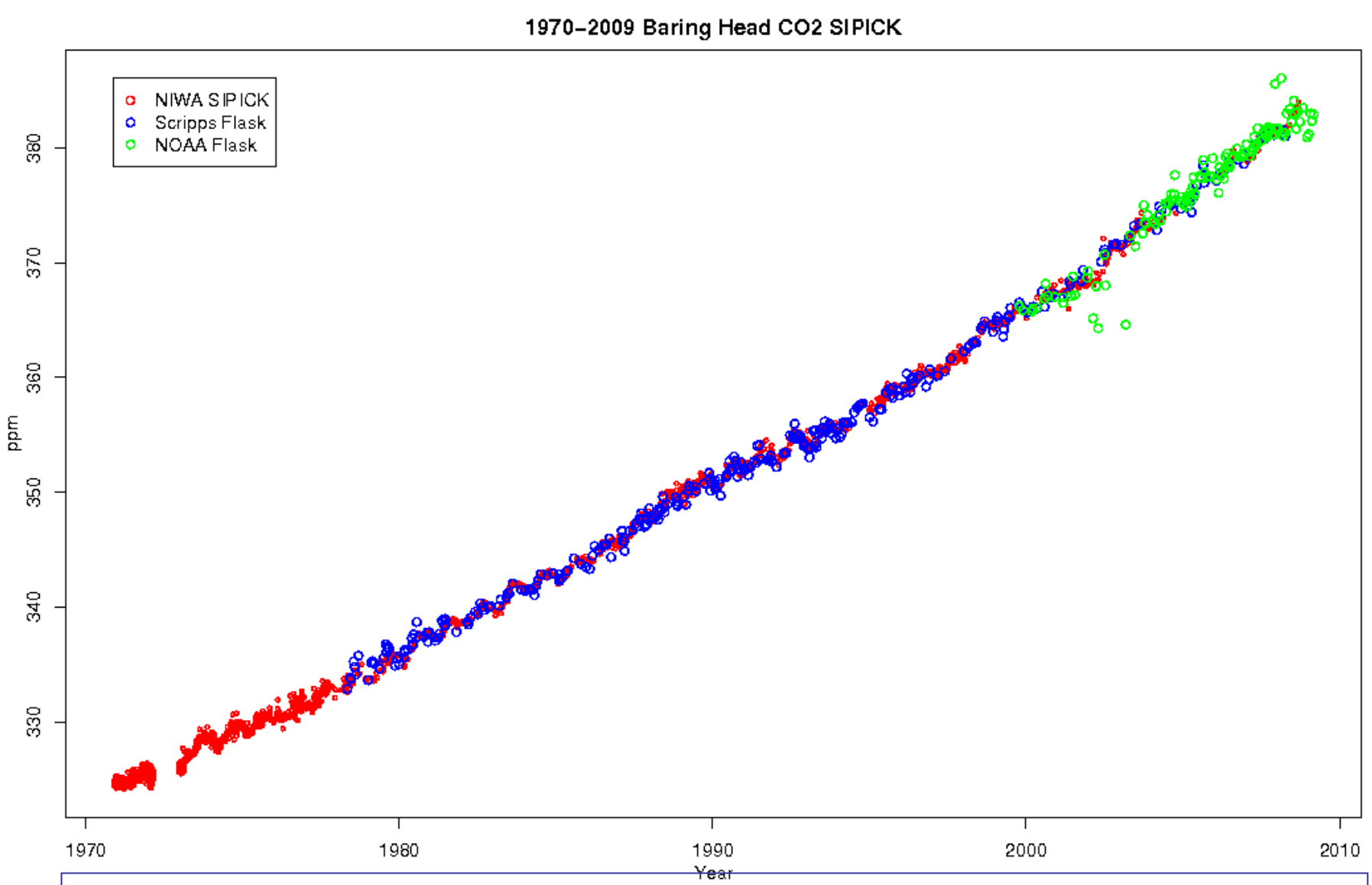
Site exposed to generally high wind speeds (7 to 40 ms^{-1}) from two direction (S or N)

Traditionally observing Steady Intervals (SI) with less than 0.2 ppm variability in 4 hours

4 day back trajectories during SI indicate air originating from a large area of Southern Ocean, mostly to the west.

Baring Head SI timeseries

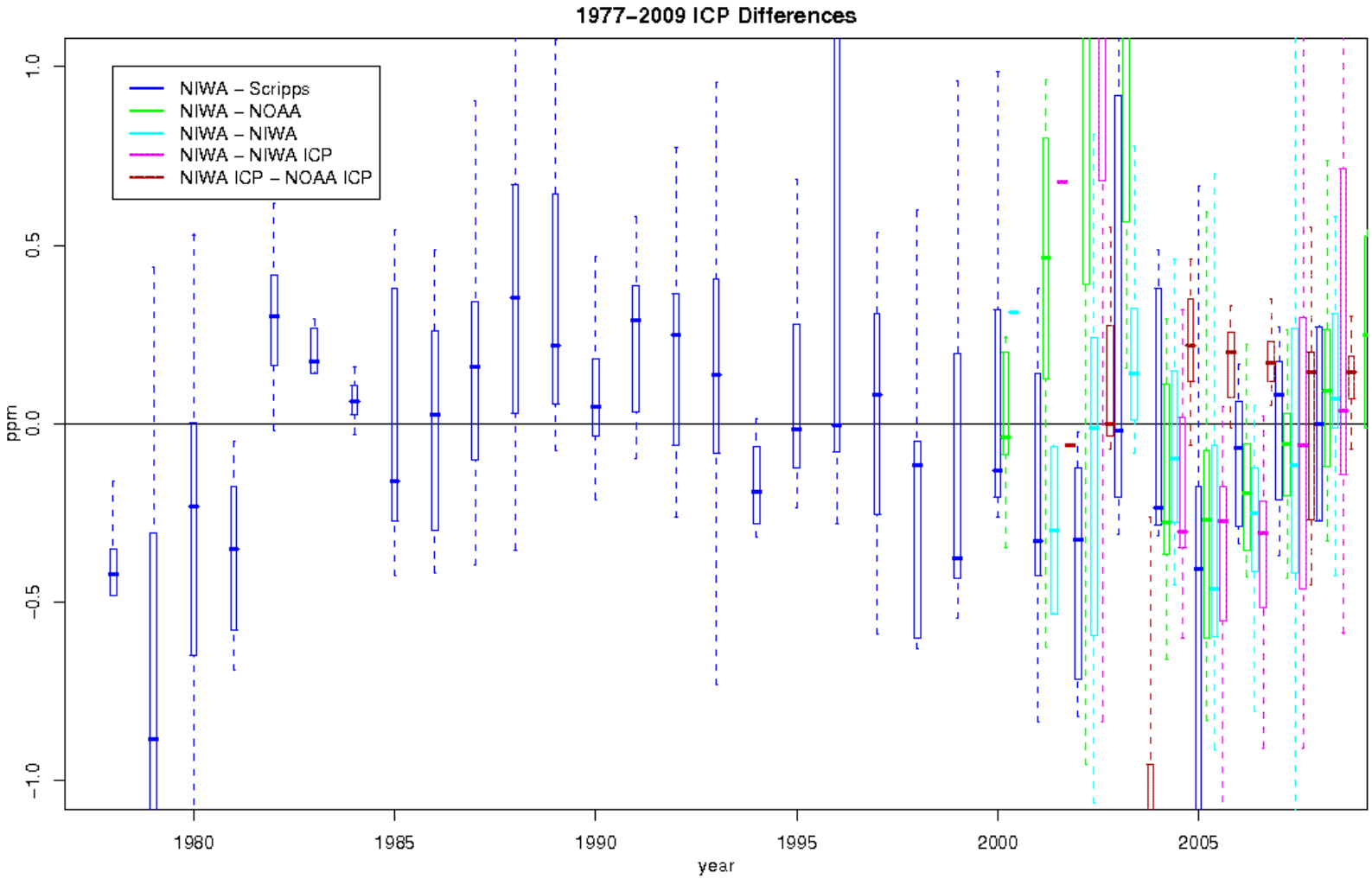




Baring Head steady intervals

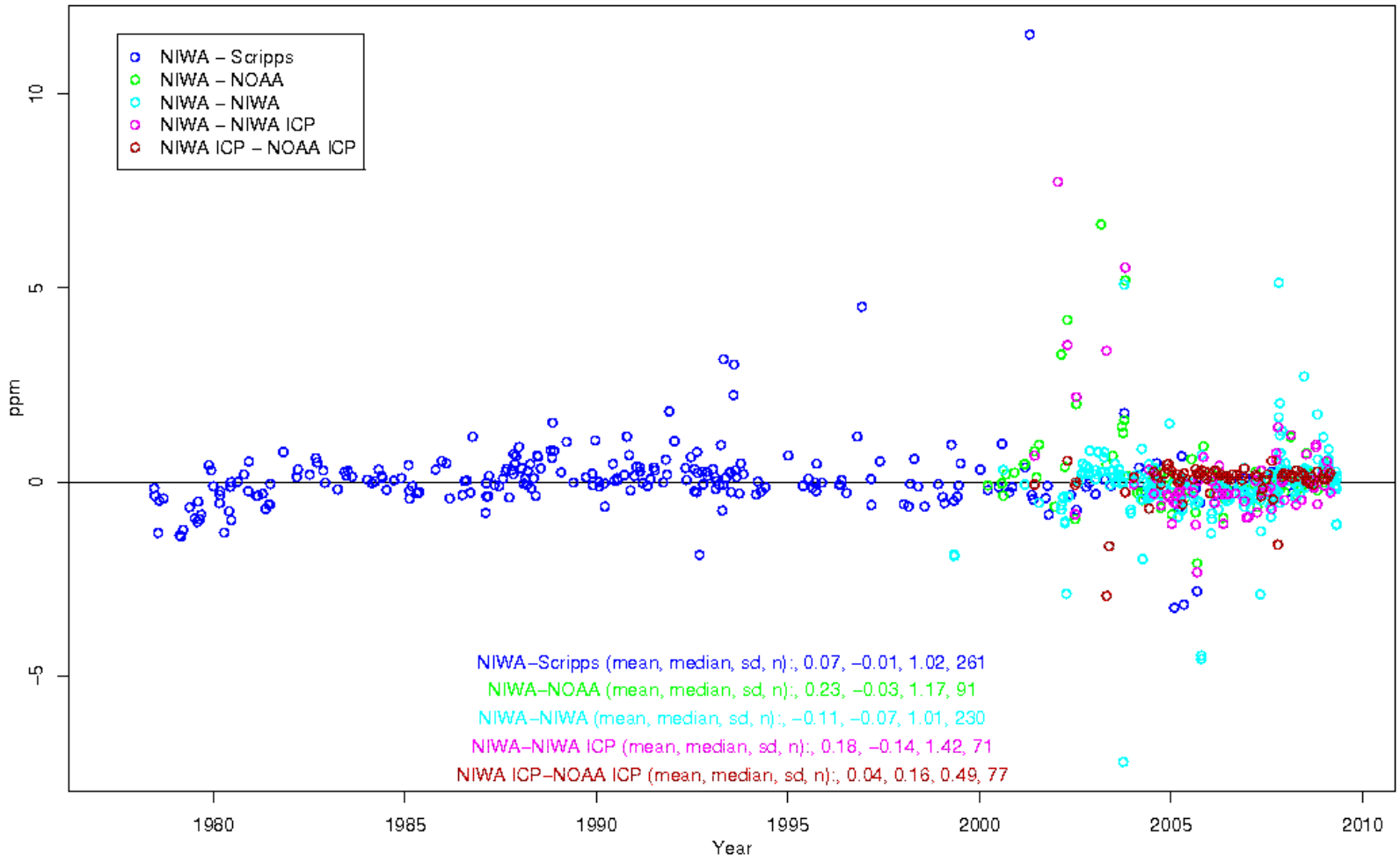
SIO flasks comparison since 1978, evacuated flasks collected during SI.

NOAA Flasks comparison since 1999, auto-sampler collects during SI.

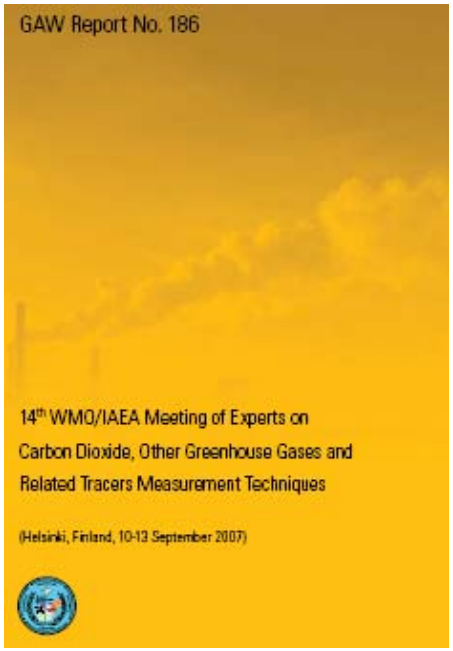


Annual mean differences between Baring Head SI and comparison flasks

Differences between SI and Flasks



- Working gas correction applied to early record for ref gases in N2 not air
- Note



R13. SUMMARY OF RECENT INTERNATIONAL PLANNING OF ATMOSPHERIC TRACE GAS MEASUREMENT STRATEGIES.

d) Develop and implement long-term measurements of total column Greenhouse Gases at a number of sites in WMO-GAW and its partner stratospheric network NDACC recognising the need for satellite calibration/validation and modelling.

Lauder

History of spectroscopic column measurement

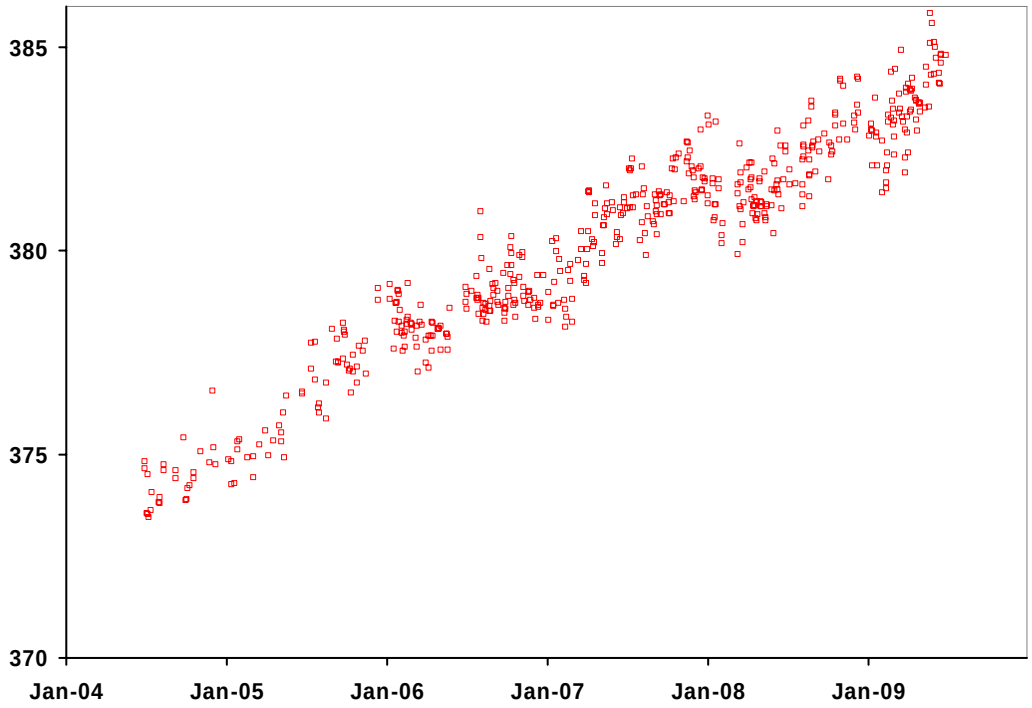
Significant Cloud free periods

Total Carbon Column Observing Network (TCCON)

Ground based Solar absorption FTS (Bruker 120)

In situ closed path FTS (Dave Griffith, Wollongong)

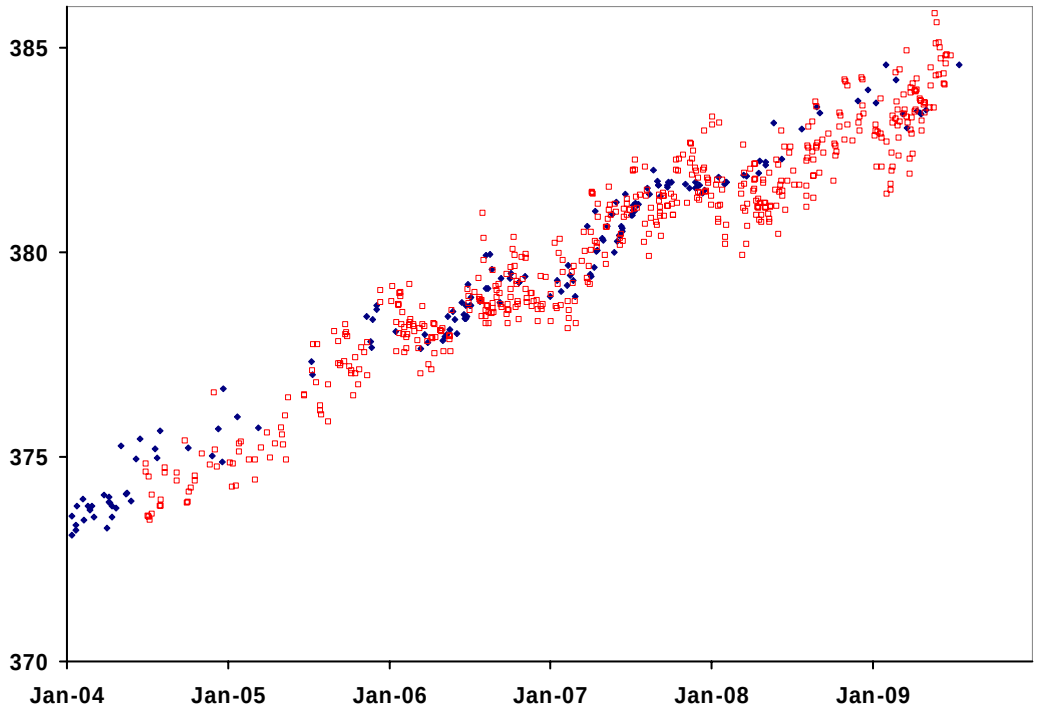
Solar absorption FTS at Lauder



- O_2 1.27 micron band used for dry air mole fraction
- HIPPO overflights used to calibrate to mole fraction CO_2 scale
- Local Network of TCCON includes Wollongong and Darwin
- To be used as primary validation data for GOSAT CO_2 retrievals

FTS airmass corrected column average dry air VMR, *preliminary calibration C=1.012*

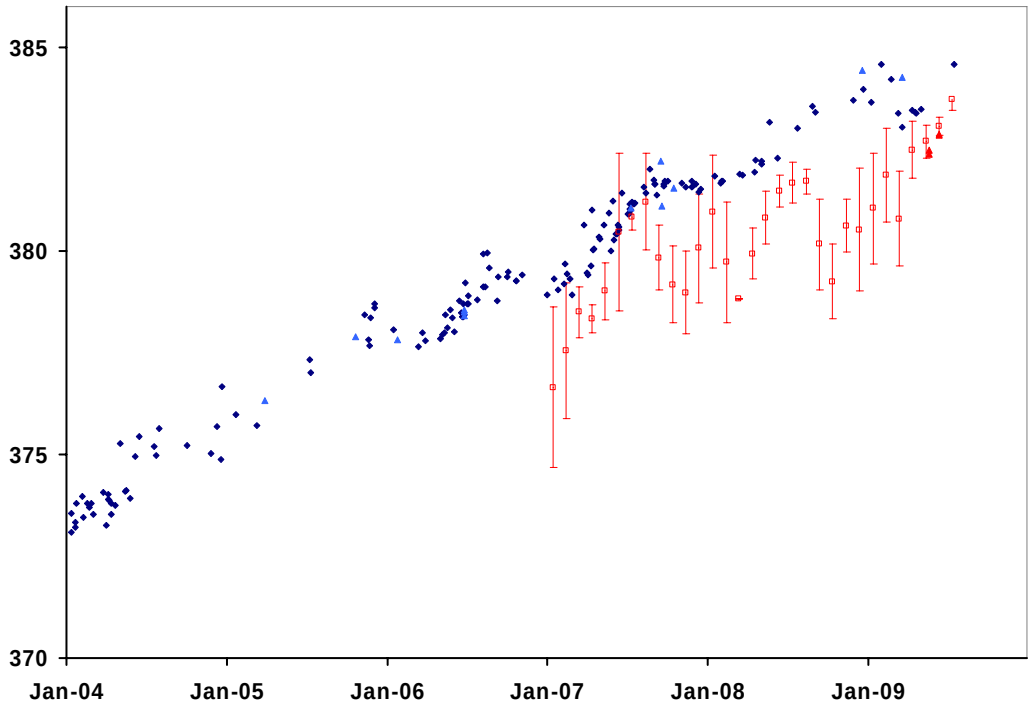
Comparison of Solar FTS and Baring Head SI



- Similar secular trends
- Seasonal cycles are comparable
- Some phase difference
- Both methods appear to representing larger spatial scales
- Not necessarily seeing the same fooprint

FTS airmass corrected column average dry air VMR, *preliminary calibration C=1.012*

In Situ FTS at Lauder and Baring Head SI



Closed cell Fourier Transform Spectrometer (David Griffith, Wollongong, Aust)

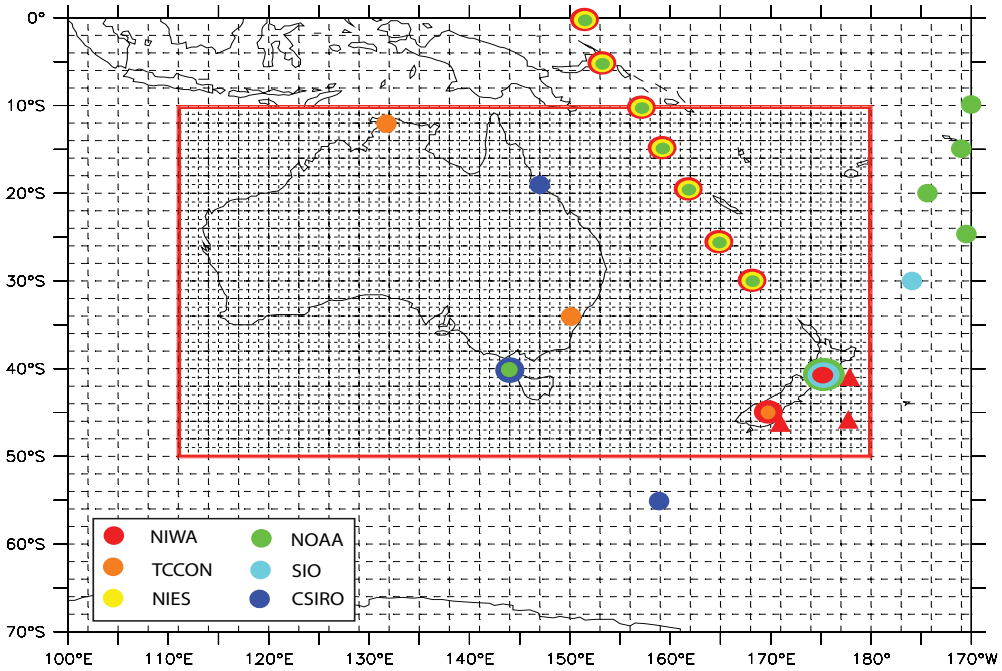
Uses Reference gas on WMO mole fraction scale

Intake at 10m

To avoid local influences data plotted as monthly mean (and stdev) of hourly means (15:00-16:00) at winds over 5 ms^{-1}

IFTS has regional influences not visible in BHD data
Higher variability in summer/spring
Lower By ~1ppm in winter
Flask data measured by GC validate each in situ timeseries

Regional Carbon Modelling



Establish CarbonTracker Australasia

- Local grid 1x1 degree
- Global grid 3 x 2 degrees
- Input to come from
  - In situ measurement sites
  - TCCON sites
  - Ship and event sampling (CO_2 and pCO2)

Summary

- Good agreement at this stage between solar FTS and SI Baring Head CO_2
- Indirect calibration with aircraft (maybe use Aircore in future?)
- In Situ FTIR easier to calibrate with known ref scales
- Multi species
- Low on user time and consumables
- Flasks integrated over measurement period seem initially to be useful for comparison.