Atmospheric oxygen observations from New Zealand

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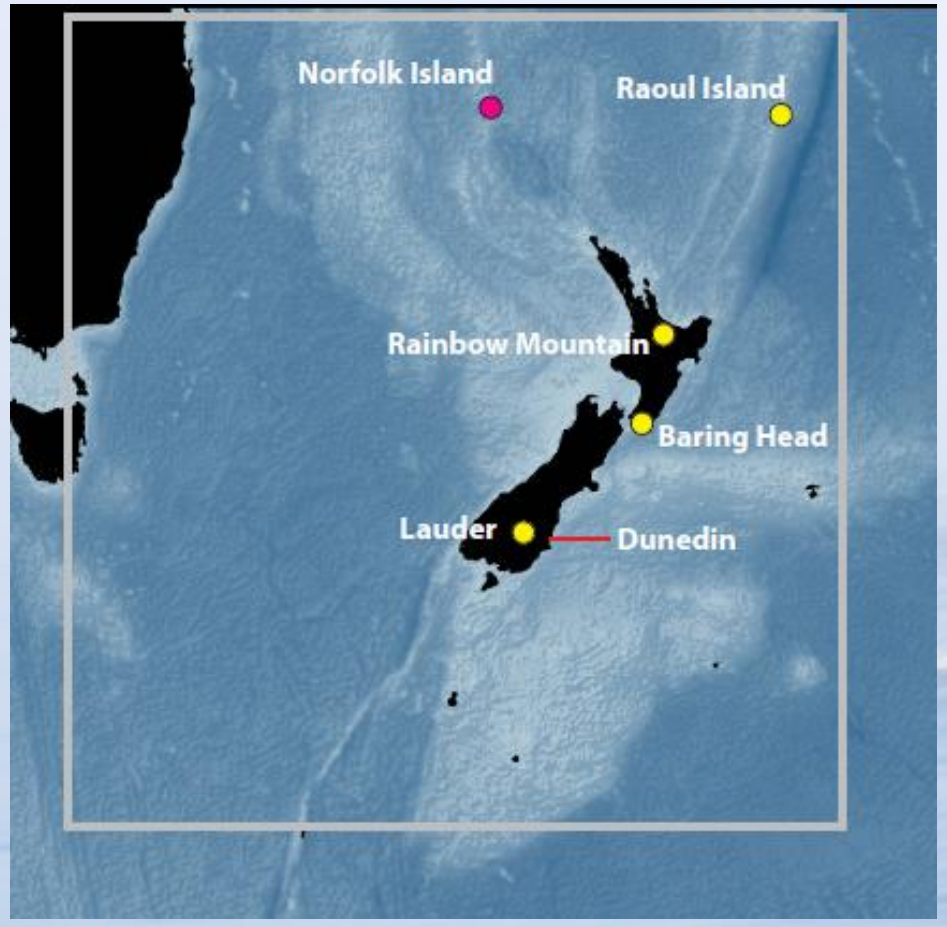
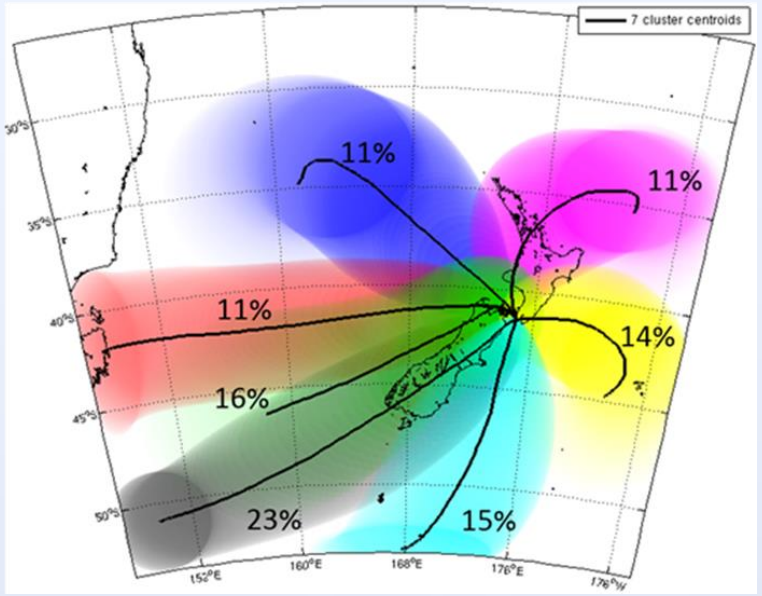
APO – La Jolla – 18th -20th Sept 2015

Baring Head



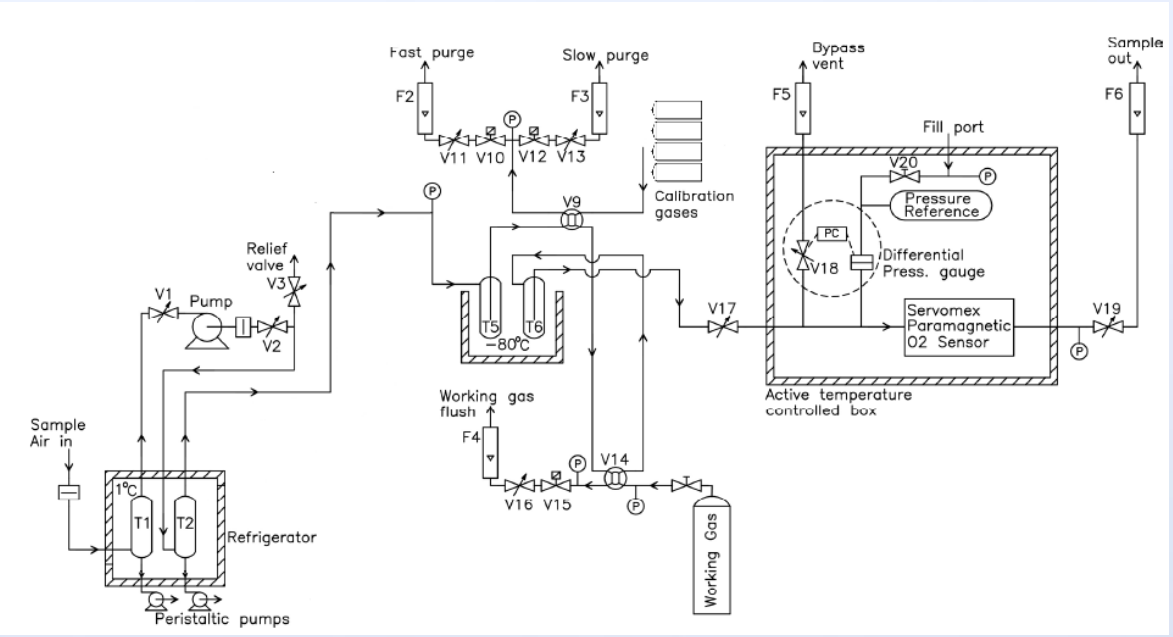


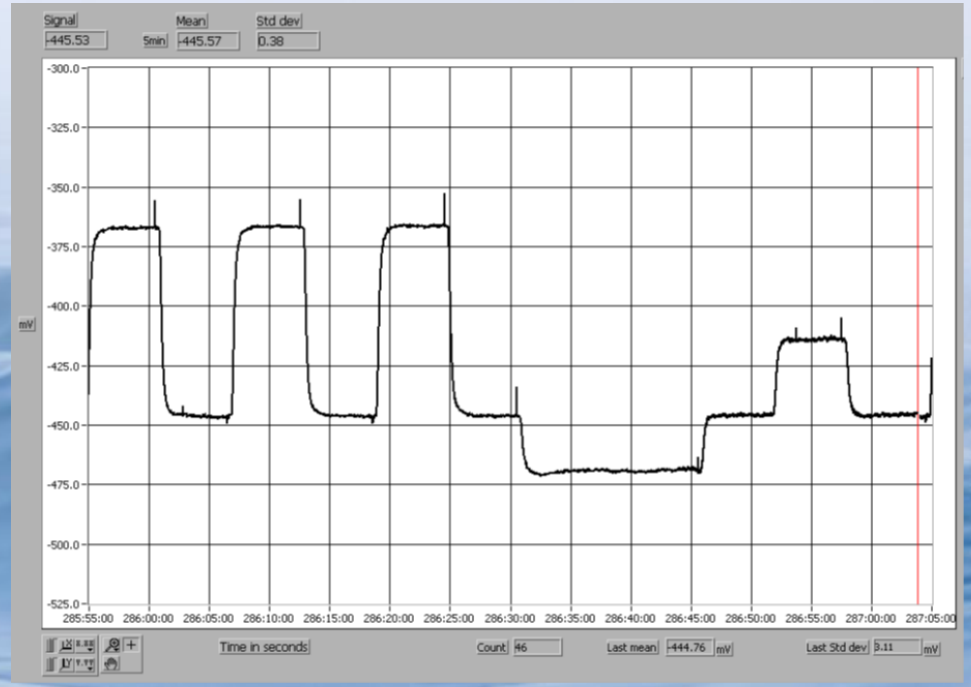
- Located on the southern tip of the North Island, New Zealand
- Two dominate wind directions at the site (N and S)
- The back trajectories can be clustered into seven groups
- Southerly sector (~15%) is background oceanic air

BHD-O_2

- Paramagnetic oxygen analyser
  - Paramax 101, Columbus Instruments)
  - Servomex PM1155B oxygen sensor
  - Single cell, switching reference gas and
  - Multiple stage drying (2x 3°C, 2x -80 °C)
  - Active pressure and temperature control within the cell
  - 6 minute jogs

- CO_2
  - NDIR, Siemens Ultramat 3
  - Same intake point but separate airlines
  - Matched data combined with O2/N2

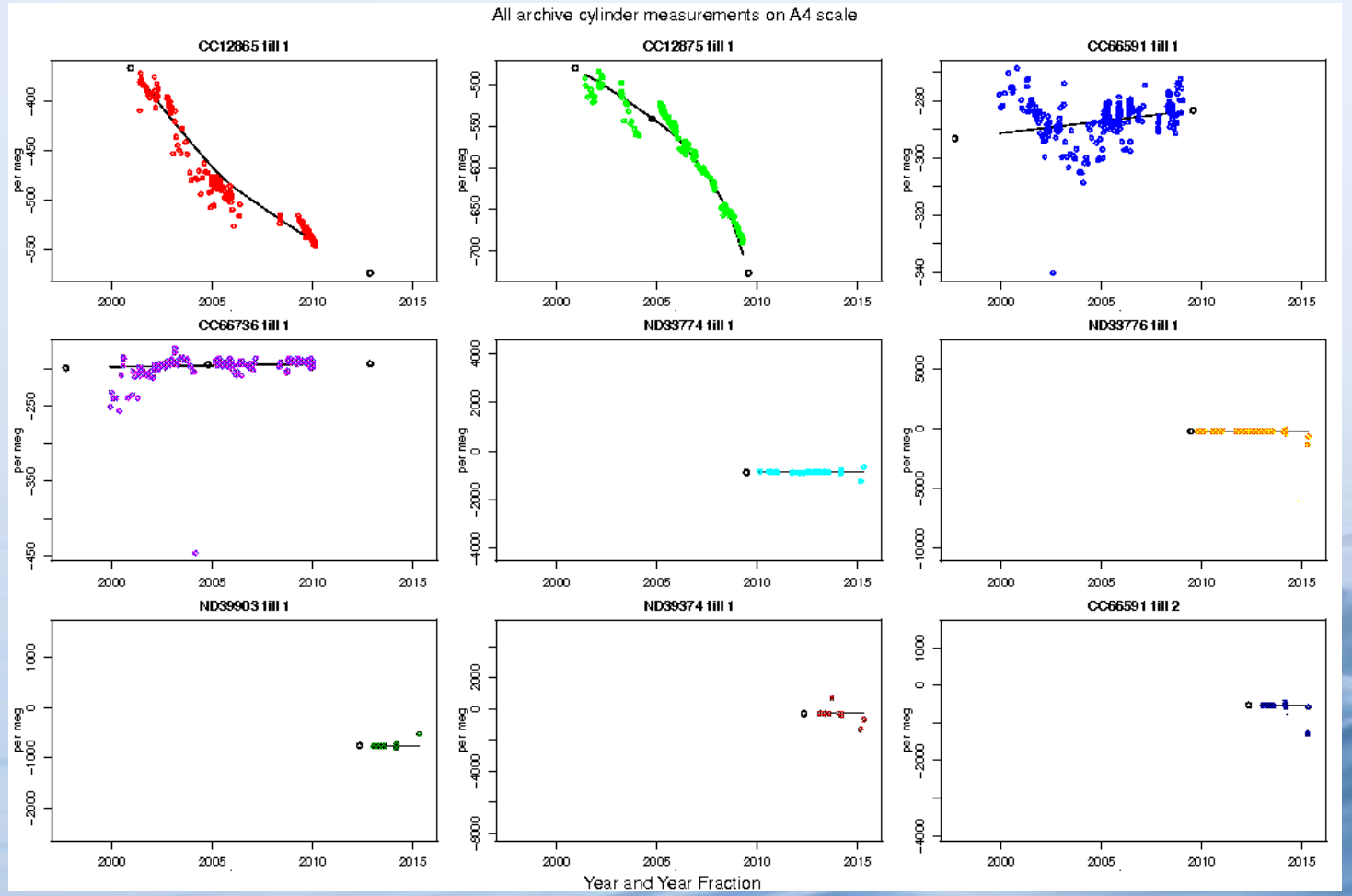




BHD-O2

- Calibration on SIO scale
  - Initially defined observations vs Span gases then moved to an Archive suite
  - Archive gases (AR)
    - Gases last ~ 10 years
    - Long-term reference gases defined at SIO
    - Between 4 and 6 gases in suite
    - Used to transfer SIO scale to HS and LS every 4-6 weeks
  - Span gases (HS and LS)
    - Gases last ~ 2 years
    - Define the day to day instrument response

Calibration



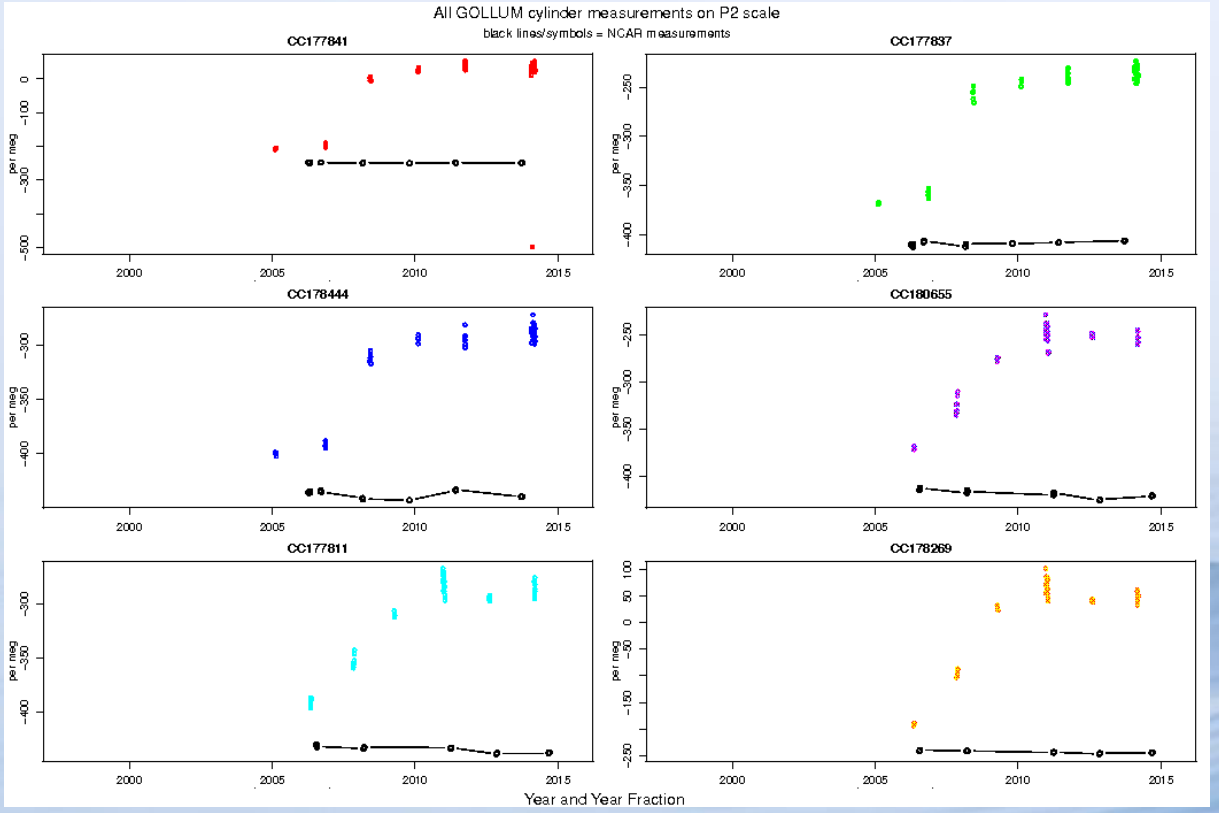
Several early cylinders showed significant drift

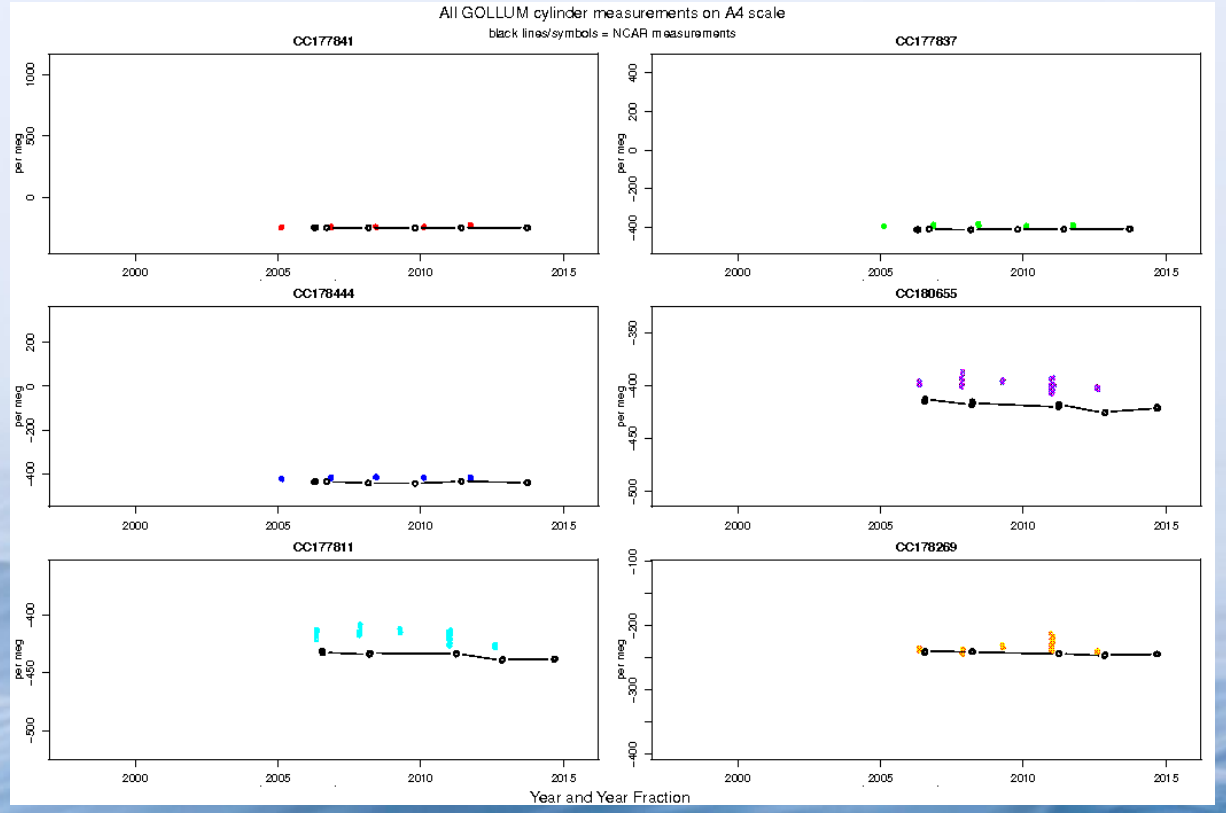
- Some pressure dependence
- Some inverse pressure dependence
- H2O content at time of filling was measured at 5-6 ppm

A4 method used to transfer SIO scale for calibration

- 4-6 gases assigned by SIO
- In early record some have corrections applied

Gas stability

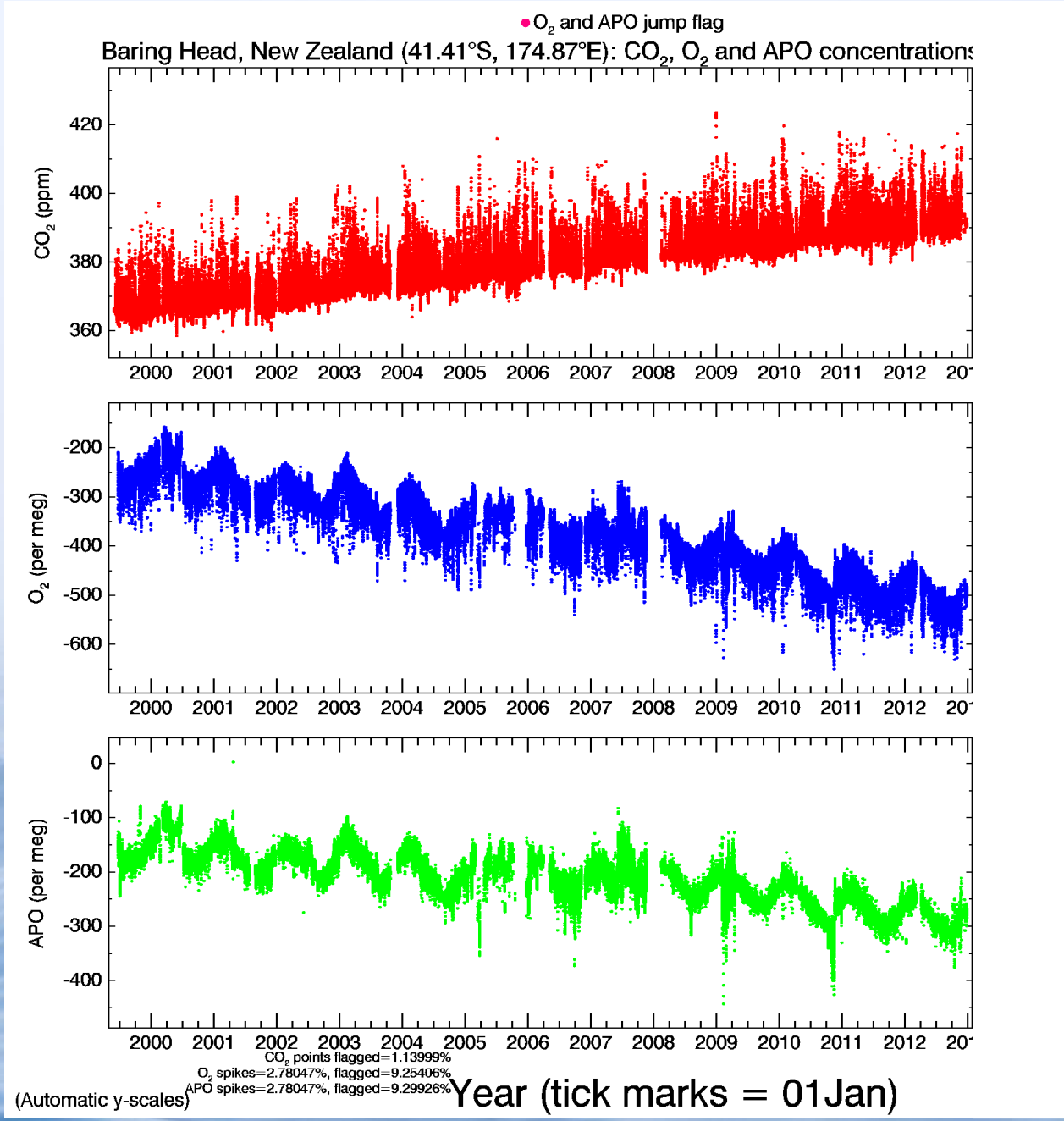




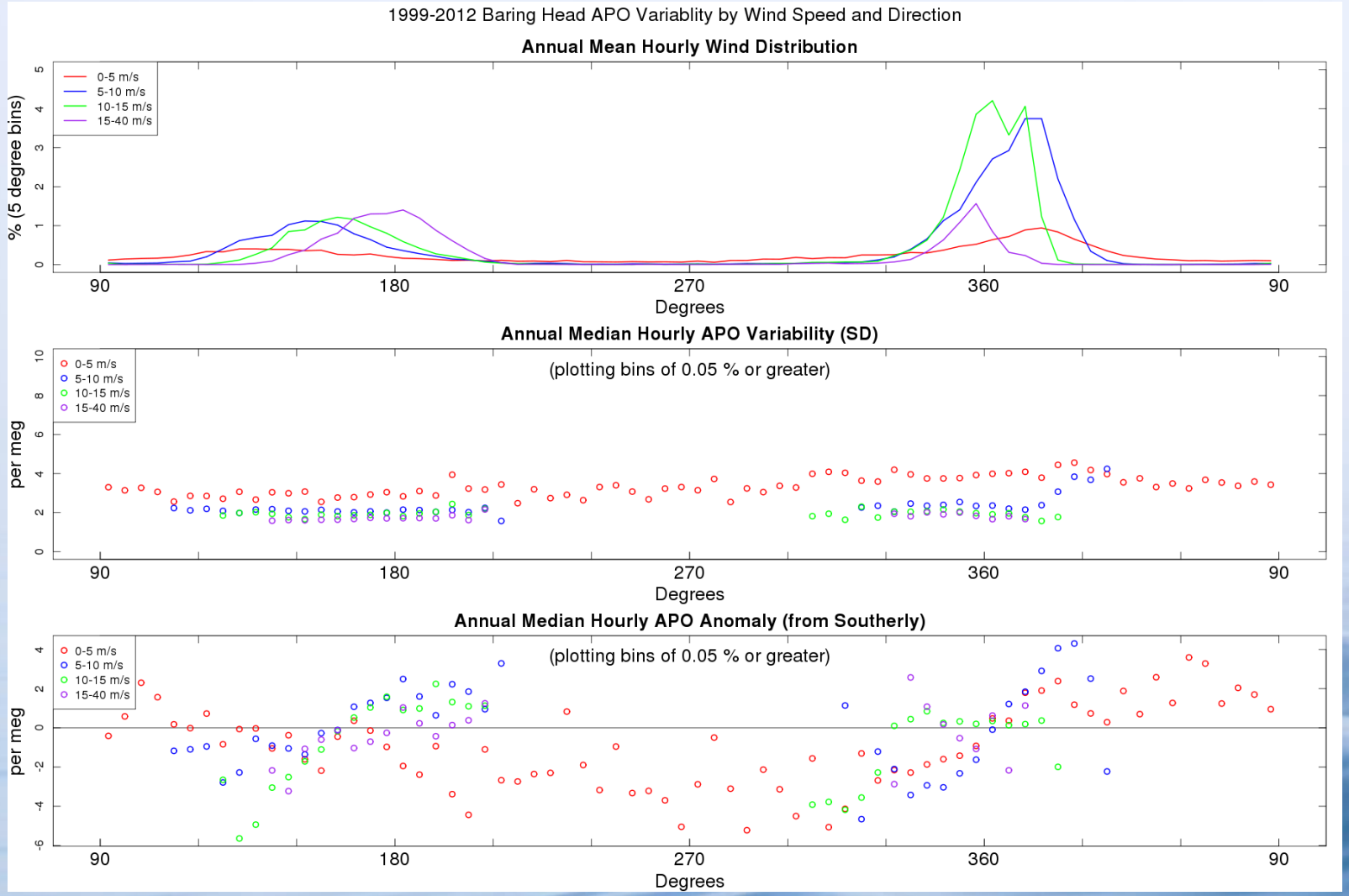
BHD-O2 Time-series

Amplitude of seasonal cycle

- Steady interval CO_2 ~ 0.9 ppm
- APO ~ 54 perMeg

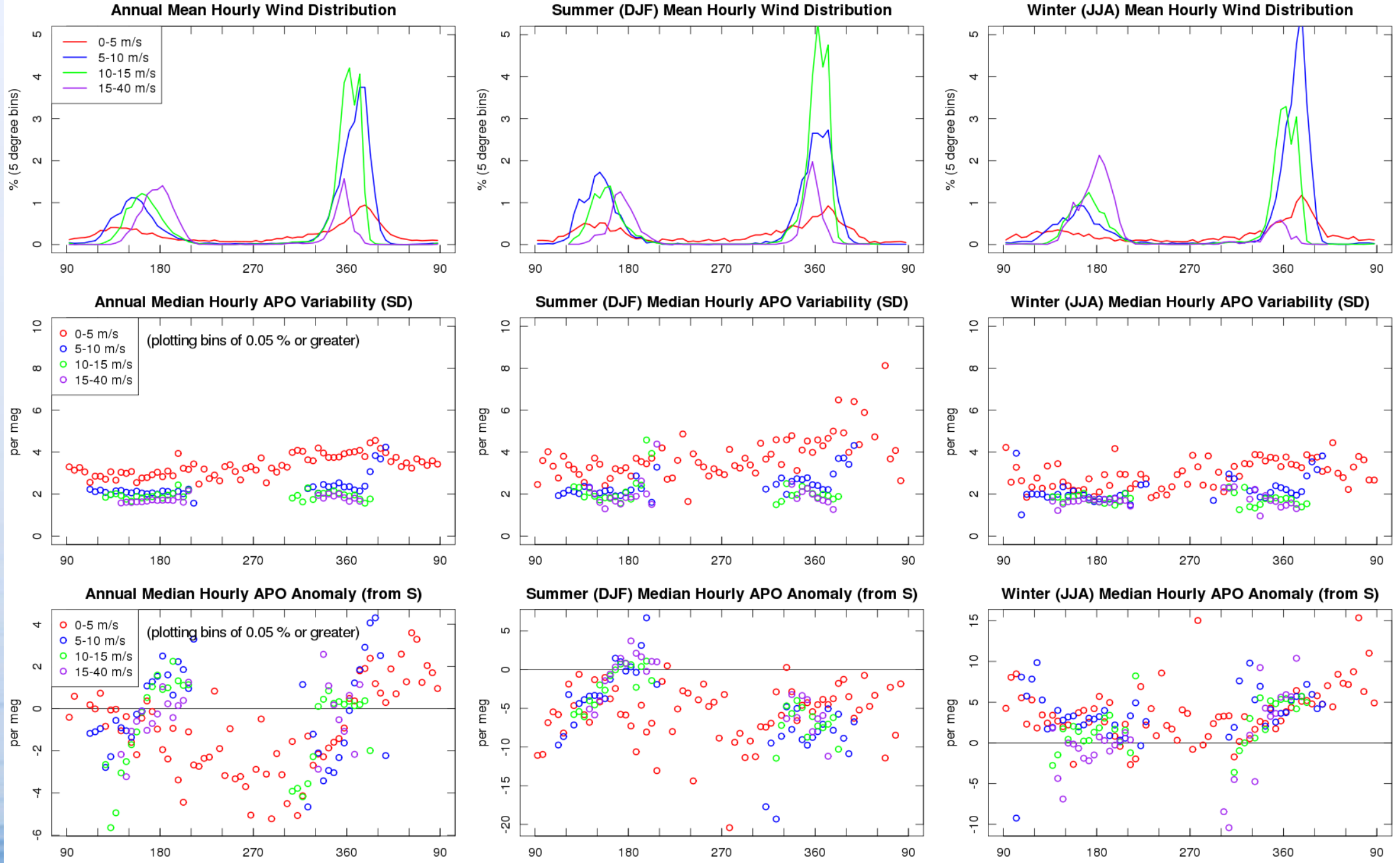


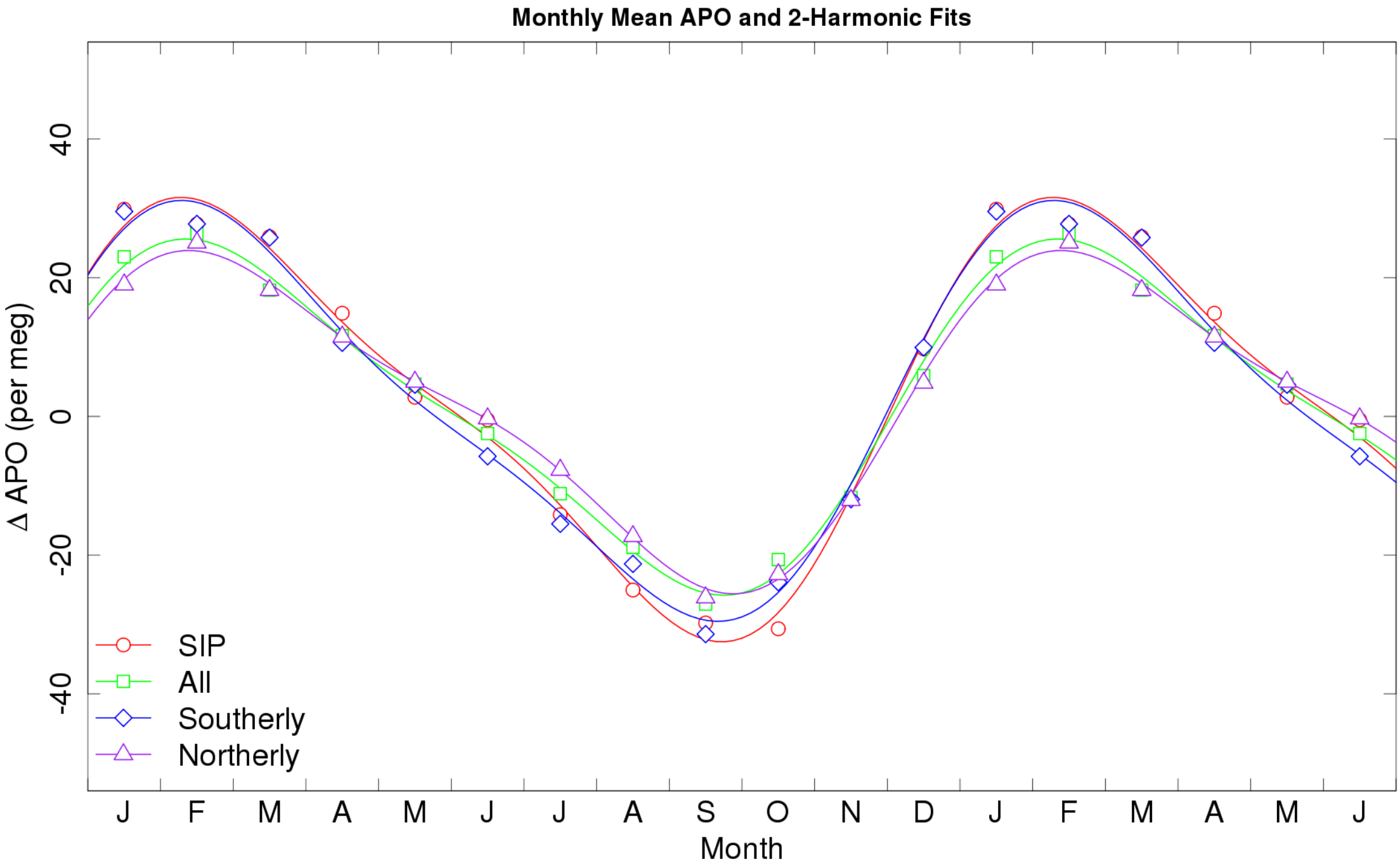
Wind effects

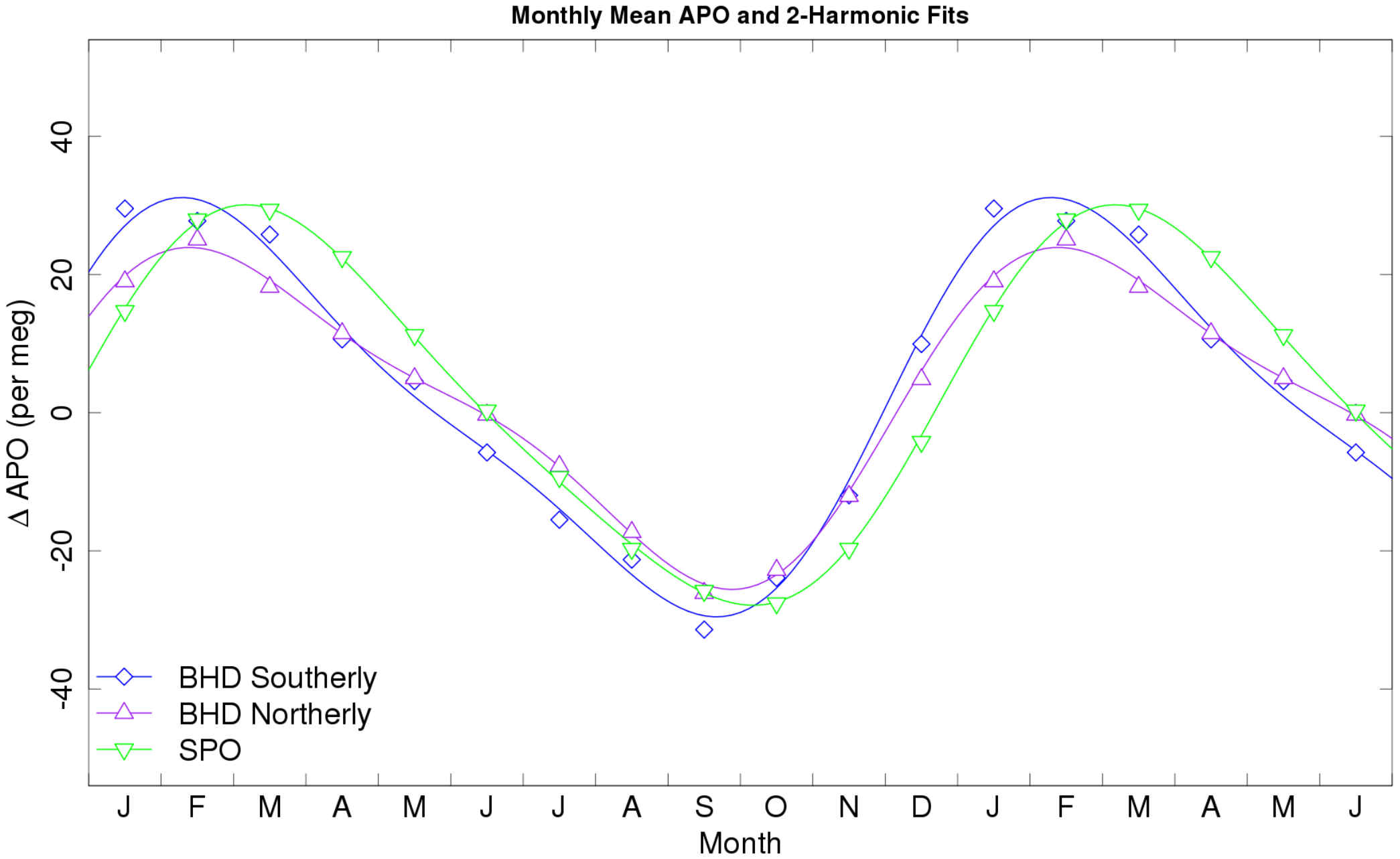


- Two main wind directions northerly and soutehrly
- 5-15 m/s are dominant speeds
- APO variability lowest over 5 m/s

1999-2012 Baring Head APO Variability by Wind Speed and Direction




Monthly Mean APO and 2-Harmonic Fits
Δ APO (per meg)
40
20
0
-20
-40
SIP
All
Southerly
Northerly
J
F
M
A
M
J
J
A
S
O
N
D
J
F
M
A
M
J
Month


Monthly Mean APO and 2-Harmonic Fits
Δ APO (per meg)
40
20
0
-20
-40
BHD Southerly
BHD Northerly
SPO
J
F
M
A
M
J
J
A
S
O
N
D
J
F
M
A
M
J
Month

Summary

- Continuous record for 16 years
- Lineage to SIO scale
- Calibrations now stabilised
- APO seasonality greater for southerly than northerly conditions
- BHD leads SPO APO